# DIETARY INTAKE AND EATING PRACTICES OF UNIVERSITY STUDENTS IN THE UK

By

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## ABSTRACT

**Background:** University represents a key event in the transition from youth to adulthood for a substantial proportion of young adults in the UK. There is evidence that UK university students consume poor quality diets, with potential long-term health implications. However, contemporary studies are scarce and limited in scope.

**Aim:** This research aimed to explore the food choices of university students in the UK. Objectives were to: assess dietary adequacy and patterns among UK university students and associated socio-demographic and lifestyle characteristics; explore students' experiences and values in relation to dietary patterns; and to identify students' eating behaviours associated with body weight gain.

**Methods:** A multi-methods research design comprising three phases of data collection was employed. An online food frequency questionnaire was administered to undergraduate students at five UK universities to assess dietary adequacy and patterns, with subsequent principal components analysis. Semi-structured qualitative interviews were conducted with a purposive sample of 25 undergraduate students and analysed thematically. An online survey among student members of a national weight loss programme was also undertaken with subsequent analysis.

**Findings:** Dietary analyses revealed intake of several key nutrients and food groups outside of recommendations and four major dietary patterns: 'vegetarian'; 'snacking'; 'health-conscious'; and 'convenience, red meat & alcohol'. Several socio-demographic and lifestyle characteristics were associated with these patterns. Food choice experiences were complex and involved four substantive themes. Themes encompassed students' relationships with peers and their dietary decisions at university, the impact of the unique university experience on food choice, aspirations of – and threats to – making healthful choices at university, and students becoming autonomous consumers. Cooking ability and consumption of fruit and vegetables, convenience/fast food and alcohol were significantly associated with body weight gain at university.

**Conclusions:** There is heterogeneity in food intake and dietary practices amongst university students, with implications for enhancements to university food and welfare policies.

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## DEDICATION

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# LIST OF ABBREVIATIONS

| | |
|---|---|
| ANOVA | Analysis of Variance |
| BMI | Body Mass Index |
| BMR | Basal Metabolic Rate |
| CA | Cluster Analysis |
| DLW | Doubly Labeled Water |
| DoH | Department of Health |
| DRV | Dietary Reference Value |
| EAR | Estimated Average Requirement |
| Erep | Reported energy intake |
| EU | European Union |
| FFQ | Food Frequency Questionnaire |
| GB | Great Britain |
| GLM | General Linear Model |
| HESA | Higher Education Statistics Agency |
| HPFS | Health Professional's Follow-up Study |
| KCL | King's College London |
| LDL | Low Density Lipoprotein |
| LRNI | Lower Reference Nutrient Intake |
| MJ | Mega Joules |
| NDNS | National Diet and Nutrition Survey |
| NHS | Nurse's Health Study |
| NMES | Non-milk Extrinsic Sugars |
| NSP | Non-starch Polysaccharides |
| PAL | Physical activity level |
| PCA | Principal Components Analysis |
| pTEE | Predicted Total Energy Expenditure |
| RNI | Reference Nutrient Intake |
| RNS | Rather Not Say |
| SACN | Scientific Advisory Committee on Nutrition |
| SES | Socioeconomic Status |
| SPSS | Statistical Package for the Social Sciences |
| UK | United Kingdom |
| WCRF | World Cancer Research Fund |

# CHAPTER 1.
# INTRODUCTION

## 1.1 Rationale for research

The relationship between diet and optimal physical health is well defined. Obesity, diabetes, some cancers and coronary heart disease have strong dietary links, and obesity is furthermore associated with chronic disease risk (1–8). The incidence of overweight and obesity remains unprecedentedly high, however, affecting in excess of 65% of men and 55% of women in the UK in 2013 (9), and cardiovascular disease represents the nation's single largest killer (10,11). This burden of chronic disease has substantial long-term costs to both the individual and society, resulting in a projected loss of up to six million quality-adjusted life-years and a £2 billion rise in health care costs by 2030 if current trends continue (8,12). Understanding – and ultimately improving - the dietary intake and food choices of the UK population is therefore imperative and remains a public health priority (13–16).

There has been intense research interest regarding the dietary intake and eating behaviours of the UK population. The rolling National Diet and Nutrition Survey (NDNS) provides regular surveillance information on food and nutrient intakes of British children, adolescents and adults alike, and indicates that intakes of key food groups and nutrients are deviant from recommendations (17,18). The last two decades have additionally witnessed a proliferation in researchers investigating whole dietary patterns, and dietary patterns among UK children, adolescents, working aged adults and the elderly have now been investigated (19–24). This latter approach is particularly pertinent to public health practitioners, since its whole-diet nature is more representative of natural eating behaviour and may allow direct translation of findings into dietary advice (25).

The young adult population represents the country's future workforce and eating patterns established during these formative adult years may represent a template for long-term consumption habits and thus disease risk (26). However, there has been little UK scrutiny of the dietary adequacy and consumption patterns of the young adult population specifically (17,18,27–29) and there has additionally been scant research interest in the diets of university students (30–35). The high number of individuals now embarking upon higher educational study, however, means such students comprise a substantial proportion (50%) of the young adult population, with in excess of two million individuals studying at university in 2014/15 (36,37). Widening participation initiatives additionally mean that an increasing number of young adults from a diverse range of socioeconomic backgrounds are now attending university (38). University thus represents a key event in the transition from youth to adulthood for many young people.

The university student population may furthermore embody a group of young adults with a set of unique factors driving dietary intake: for many young people, the transition to university life may be associated with increased autonomy over food choice, smaller food budgets, and exposure to new social groups and food cultures, which may influence food intake and interfere with healthful dietary practices. Although there is some evidence that dietary behaviours track from adolescence to adulthood (39–41), the transition from home to university life has been associated with unfavourable changes to food intake: increases in alcohol and sugar intake, and decreases in fruit and vegetable consumption have been reported (35,42). Universities may thus represent a setting in which dietary behaviours are open to change and large groups of young adults can be reached, representing an appropriate target for health promotion efforts.

A limited body of cross-sectional data indicates that the dietary behaviours of UK university students are not conducive to long-term health: alcohol consumption among students has received most recent research attention and there is evidence that binge drinking is endemic (31,32,43–47). There are also indications that high intakes of confectionery and fast foods, and low consumption of fruit and vegetables are defining features of students' diets (30–34) and such behaviours have implications for chronic disease risk if adopted in the long term. Additionally, the first year of university life has been identified as a period associated with body weight gain in both North American (48) and now UK students (34,49,50). Overweight during young adulthood has been identified as a significant predictor of obesity later in life (51,52) and body weight gain during this period thus has clinical significance. Alongside such weight gain, high rates of body dissatisfaction, dieting among healthy weight individuals and engagement in extreme weight loss behaviours have also been noted, particularly among female students (33,53–60). Such engagement in dieting behaviour and dysfunctional relationships with food not only implicate dietary adequacy (58,61,62), but may also create tension and conflict for young people at university when needing to live, eat and socialise with new peer groups during this time.

University students therefore represent a population of interest for dietary research. However, existing UK studies are few, often limited by lack of detailed food intake data and/or focus only on first year students. There is additionally no data on the whole dietary patterns consumed by this population, whilst understanding of drivers of food choice and the dietary experiences of students is partial. This research project therefore aims to further explore the food choices of university students in the UK.

## 1.2 Outline of thesis

This thesis comprises this chapter and eight further chapters. Chapter two provides a focused narrative review of the literature relevant to this research project, concluding with a statement of the specific research objectives that this project will address. Chapter three presents the project's methodology – an overview of the research design of the project and reflection on the use of multiple methods is first provided, followed by a detailed account of the methods employed. Chapters four to seven comprise the four results chapters, and discussion of the findings presented in these chapters is provided in chapter eight. Finally, chapter nine provides a summary of the project's major findings and outlines recommendations for both policy and future research.

# CHAPTER 2.
# LITERATURE REVIEW

## 2.1 Introduction

This chapter summarises the existing literature on dietary patterns, food and nutrient intake, body weight change, and influences on - and meanings of - food choices amongst university students, out of which the current research objectives were formulated (section 2.9). This review will focus in particular on the UK setting, and more specifically on university students, but due to the relatively small body of literature on this topic, general UK and non-British student populations are also included to enhance contextualisation and provide relevant insights. Longitudinal studies examining tracking of dietary intake from adolescence to adulthood are also reviewed. The possible detrimental health consequences of university students' dietary behaviours and decision-making, as identified in the literature, are also shown. A small number of non-peer reviewed publications on various aspects of dietary intake among UK students, which have been published or sponsored by commercial organisations, have additionally been conducted (63–65), however, these reports have not been specifically reviewed or used for comparison in this project. This chapter concludes by highlighting current omissions in knowledge and statement of the specific research objectives of the current project.

## 2.2 Dietary intake and patterns among UK populations

The National Diet and Nutrition Survey (NDNS) provides regular information on the food intake and dietary adequacy of GB and Northern Ireland populations. This review focuses on data from the GB survey, although Northern Ireland data are also highlighted; data for 11-18 and 19-64 year olds are reviewed. Intakes are generally comparable between surveys, although there is a general indication that people in Northern Ireland consume a diet of slightly poorer quality than their mainland counterparts (17,18).

Most recent data from the 2008/09-2011/12 rolling surveys indicate that adults aged 19-64 years and adolescents aged 11-18 years are not achieving the recommended levels of consumption of key food groups (17,18). Indeed, only

30% of working-age adults and 9% of 11-18 year olds in the UK survey reported achieving the recommended ‘5-a-day’ consumption of fruit and vegetables; daily consumption was estimated at approximately four portions for adults, and three portions among those aged 11-18 years. Consumption of oily fish was also below the recommended one portion (140 g) per week for all age and sex groups, whilst working-age men exceeded the red meat consumption guidelines (86 g/day compared to the recommended 70 g/day) (17). Adults and adolescents in Northern Ireland generally report less favourable intakes of these food groups (18).

In the GB survey (17), energy intake was substantially below estimated average requirements (EAR) in both age and sex groups (11-18 year old females - 6.60 MJ/day; 11-18 year old males - 8.30 MJ/day; females 19-64 years - 6.78 MJ/day; males 19-64 years - 8.14 MJ/day), although under-reporting was evident: employment of the DLW method indicated that 16-64 year olds underestimated energy intakes by approximately one third. Both age groups met the DRV for total fat, but exceeded recommended intakes of saturated fat and NMES; intakes of the latter were highest amongst those aged 11-18 years (15.4% of total energy intake).

Whilst the majority of males reported consumption of micronutrient-replete diets, there was evidence of inadequacy among working-age women and girls aged 11-18 years for a range of vitamins and minerals. In excess of 10% of adolescent girls reported intakes below the LRNI for vitamin A, riboflavin, iron, calcium, magnesium, potassium, selenium, zinc and iodine. A notable proportion (>10%) of working-age women also reported intakes of riboflavin, iron, magnesium, potassium and selenium below the level of the LRNI. A similar pattern of energy and nutrient intakes was reported among the Northern Irish population, although greater proportions of both adults and adolescents reported inadequate micronutrient intakes; of particular concern, at least 50% of adolescent females failed to meet the LRNI for iron, zinc and magnesium (18). Biochemical analyses indicated risk of vitamin D deficiency in both age and gender groups across Northern Ireland and UK populations: new dietary recommendations ($10\mu g\ day^{-1}$) recently published will enable assessment of dietary intake adequacy in future surveys (66). Salt intakes - estimated from 24-hour urinary excretion – of both age and sex groups exceeded daily intake recommendations in GB and Northern

Ireland populations. Salt intakes were particularly high among adult men aged 19-64 in Northern Ireland (9.2 g/day) (67,68).

Sub-division of adults into those aged 16-24 and 25-49 years provides some information on dietary adequacy of young adults, although the range of foods and nutrients reported is limited. Consumption data on fruit and vegetables, red meat and oily fish indicates deviation from recommendations, particularly among those aged 16-24. In this age group, only 18% of males and 10% of females achieved the '5-a-day' recommendation for fruit and vegetable consumption, whilst oily fish consumption was estimated at 21 g/week, substantially below the recommended 140 g. Males aged 16-24 and 25-49 consumed over the recommended daily intake of red meat (92 g/day and 86 g/day respectively) (69). Generally, deviation from recommendations was greater among those aged 16-24 years in Northern Ireland compared to this age group in the GB survey (70).

In addition, both age and sex groups in the GB survey exceeded the DRVs for saturated fat and NMES; females aged 16-24 years had greatest intakes of NMES (15.1% of total energy intake). Intakes were slightly greater among young adults in Northern Ireland (70). Consumption of NSP was substantially below the DRV at less than 14 g/day in both age and sex groups. For micronutrient intakes, there was little evidence of nutrient inadequacy in men of either age group and among women aged 25-49, with the exception of iron (30% of women did not meet requirements for iron intake at the LRNI level). However, among females aged 16-24, over one-third of respondents in both the GB and Northern Ireland samples failed to meet the LRNI for iron, and up to 16% had similarly inadequate intakes of calcium and folate (69,70). Intakes of only four micronutrients were assessed in this age-specific analysis, however, and further evaluation of the extent of nutrient inadequacy is therefore not possible.

The recent proliferation of studies exploring dietary patterns has enabled greater insight into the eating patterns of UK populations and identification of sub-groups who tend towards more (or less) healthful dietary habits. 'Health-conscious', 'vegetarian', and 'processed', 'convenience' and 'traditional' patterns have been consistently identified as the dietary patterns predominating among children, adolescents, and working-age and older adults alike (19,21–24,28,71–74). The author is aware of only two studies that have focused specifically on young adults (28,29). These studies examined dietary patterns among women aged 20-34 years living in Southampton (28), and among a representative sample of Northern Irish young adults aged 20-25 years (29). Multiple dietary patterns were identified in both samples, indicating heterogeneity in eating habits among this young adult sub-group. Two dietary patterns predominated among the sample of young adult women, which were labeled a 'prudent' and 'high energy' diet (28). The first pattern had high factor loadings on foods typically deemed good for health (e.g. fruit, vegetables, wholemeal bread) and negative factor loadings for foods such as chips, sugar, red and processed meat and soft drinks, whilst the second pattern had high factor loadings for puddings, meat and fish, eggs, cakes, biscuits and potatoes, as well as fruit and vegetables (28). Among the Northern Irish sample, four major dietary patterns were identified: 'drinker/social', 'healthy', 'western', and 'sweet tooth' (29). The predominant 'drinker/social' pattern was characterised by consumption of white bread, alcohol, fats and meat dishes, whilst the 'western' diet was rich in soft drinks, crisps and chips (29).

There has been greater interest in the drinking habits of young British adults. Most recent data on alcohol intake indicates that consumption levels are decreasing, particularly among those aged 16-24 years (75). However, in 2013, 79% of all adults reported drinking alcohol in the week prior to data collection, with 15% fulfilling the criteria for binge drinking (defined as consuming in excess of eight units (men) or six units (women) of alcohol in a single drinking session) during this period. In all age groups, alcohol consumption and binge drinking was greater among men than women (75). The proportion of young adults engaging in binge drinking decreased substantially between 2005 (29%) and 2013 (18%), although those aged 16-25 and 25-44 years are still more likely to binge drink than any other age group. Additionally, more detailed national dietary data indicates that average alcohol intake among young adult consumers (16-24 years of age) exceeds the recommendation that energy from alcohol intake should contribute no more than 5% of total energy intake (76); alcohol energy contributed 6.9% and 8.3% of total energy intake for men and women aged 16-24 years respectively (69). Among those aged 25-49 years, an opposite gender pattern is evident, with male consumers drinking more than females: alcohol contributed 9.1% to total energy intake among men and 7.7% among women (69). Alcohol intake in both age groups in Northern Ireland was slightly greater (9% of total energy intake); gender-specific intake figures were not provided (70).

### 2.2.1 Demographic factors associated with dietary patterns among the general adult population

National dietary data and studies examining dietary patterns have additionally provided information on the socio-demographic factors underpinning dietary choices. Associations between dietary patterns and age, gender and socioeconomic status (SES) are frequently reported. Generally, studies among the working-age population have reported a positive association between age and tendency to consume more healthful dietary patterns. Younger adults have consistently been found to score more highly on a 'convenience' or 'processed' type diet - characterised by high intakes of refined cereals, confectionery, prepared meats and high fat foods, alongside low consumption of vegetables, fruits, fish and whole grains (19,22,23,28,71,72).

Markers of socioeconomic status (SES) vary between studies (e.g. household income; maternal education; manual/non-manual classes), but there is consistent evidence that individuals with higher SES consume more healthful diets characterised by fruits, vegetables, fish and whole grains, than their counterparts with lower such status (17–19,22–24,71–73). National survey data congruently indicates that both adults and children in higher income groups have more adequate nutrient intakes than those from more deprived backgrounds (77,78).

In terms of gender, more recent studies investigating dietary patterns among UK adults have conducted separate analyses for men and women (22,23), but there is evidence that females tend towards more healthful or vegetarian diets (22,23,71). Adolescent females are also reported to score more highly on health-conscious/prudent and vegetarian dietary patterns than their male counterparts, who favour processed or snack-oriented diets rich in food items including processed meats, desserts, pizza, confectionery and fizzy drinks (24).

Some studies have also provided information on ethnic differences in diet preferences. These findings are somewhat mixed: early dietary patterns studies on nationally representative data reported that non-white adults favour ‘convenience’ diets over their white British counterparts (19), whilst another indicated that adults from ethnic minorities were more likely to score highly on both a ‘healthy’ and ‘high fat’ pattern (72). Other studies indicate that non-white men favour a ‘processed’ and ‘semi-vegetarian’ diet (23), whilst women tend towards a ‘confectionery’ diet pattern (22). Among the younger population, white adolescents have been reported to favour a ‘snacks/sugared drinks’ pattern; in contrast, non-white teenagers tended towards a ‘vegetarian’ diet (24).

Data on differences in diet quality by geographical region are scarce and limited to national datasets or studies sampling from more than one region. However, existing data generally report that adults in the south of England favour healthier diets than their northern counterparts (19,72). Most recent NDNS data indicates that adults from Northern Ireland consume diets of poorer quality than the UK as a whole (17).

These dietary patterns studies have also provided evidence for a clustering of lifestyle behaviours: adults favouring more healthful diets are consistently reported to practice additional health-promoting lifestyle behaviours, including sensible drinking habits, greater engagement in physical activity and abstention from smoking (19,23,71–73). Identification of such clustering is important, because the negative health outcomes associated with multiple lifestyle risk factors have been reported as greater than the sum of individual health risk behaviours (79).

### 2.3 Tracking of dietary intake and eating behaviours from adolescence to adulthood

A small number of studies conducted in the UK, Europe and North America have examined longitudinal dietary change and tracking of food intake from adolescence into young and middle adulthood. This research is necessary to understand the importance of dietary habits established during adolescence and young adulthood in determining long-term consumption patterns and thus chronic disease risk. Findings to date are inconsistent: some studies indicate tracking of diet from adolescence to adulthood (39,41,80,81), whilst others report young adulthood as a period of notable dietary change (82–84). In these studies, dietary tracking has generally been assessed using at least one of two methods: first, by examination of food or nutrient intakes by percentile distribution (e.g. quartiles) and subsequent examination of relative ranking of intake over a number of years; and second, by calculation of a tracking coefficient, ranging from a coefficient of zero (complete absence of tracking over time) to one (perfect tracking over time).

In the UK, Lake et al (2006) (39) have assessed longitudinal dietary change and tracking of food intake between adolescence (11-12 years) and adulthood (32-33 years) among a modest sample of young people (n=200) in Northern England. A general tendency towards dietary improvement in adulthood was reported: as individuals aged they reported lesser consumption of foods high in fat and sugar, and increased intake of fruit and vegetables (39). Dietary tracking was also evident: intakes of several food groups (fruit & vegetables; bread, other cereals & potatoes; meat, fish & alternatives) were significantly correlated at both timepoints, suggesting that dietary behaviours practised in adolescence do track forwards into middle adulthood. In contrast, no tracking was evident for consumption of milk and dairy foods, or foods high in fat or sugar. However, this study did not assess dietary intake during young adulthood (20-25 years), and any dietary changes taking place during this period were therefore not reported.

In contrast, Gallagher and colleagues (82) have assessed tracking of energy and nutrient intakes among a larger sample of young people in Northern Ireland (n=476), between adolescence (15 years) and young adulthood (20-25 years). With the exception of protein intake among female subjects, tracking of both macro- and micro-nutrient intake in this study was low. Diet at 15 years thus appeared unpredictive of diet during young adulthood, highlighting young adulthood as a potentially important window for the establishment of new, longer-term dietary patterns. However, this study did not continue to assess diet into later adult life: it is possible that food consumption habits may rebound to adolescent patterns by middle adulthood (39).

Outside of the UK, a large study in Finland has assessed tracking of nutrient intakes and whole dietary patterns over a 21-year period among participants between the ages of three and 18 years at study outset (41,80). Two similar dietary patterns (traditional Finnish and health-conscious) were identified at baseline and 21 years later, and strong tracking in dietary pattern adherence was reported; this was particularly the case for older subjects and those with extreme pattern scores (41). Similarly, childhood fat intake and fruit and vegetable consumption was shown to be associated with diet quality 21 years later (80). In contrast, data from the Amsterdam Growth and Health Study reported that adolescent dietary intake was a poor predictor of adult diet: tracking coefficients for energy and nutrient intake across a 20 year period (13-33 years of age) were low to moderate at best (83). Generally, the diets of male participants appeared to track more strongly across the measurement period. However, the authors note that dietary measurement error may have weakened tracking coefficients and thus underestimated the true degree of dietary tracking (83). In the same sample, low tracking of fruit and vegetable intake (assessed using tracking coefficients) was also reported (84). However, participants who consumed the recommended fruit and vegetable intake during adolescence were between two and six times more likely to consume the recommended levels of these food items at follow-up, highlighting some degree of dietary tracking (84). In Norway, examination of dietary change among young people between the ages of 14 and 21 revealed an overall deterioration in food intake during the measurement period; howerver, dietary tracking was evident, through relative stability in consumption of typical 'junk' foods (i.e. sugar-sweetened bevegarages; chocolate and sweets) (85).

Longitudinal dietary change between adolescence (9-18 years) and young adulthood (19-28) has also been examined among a sample of young people (n = approximately 250) in North America (86). Greater mean consumption of fruit/juice, mixed meats, milk, desserts and candy were reported during childhood and adolescence, whilst consumption of poultry, cheese, seafood, salty snack, beed and sugar sweetened beverages was greater among young adults. However, this study did not assess the degree of dietary tracking, and used a single 24-hour recall for the measurement of diet, which may not be representative of habitual intake, thus limiting conclusions. More recently, Sijitsma and colleagues (87) have reported changes in diet and diet quality over a 20-year period among a large (n = 2652) North-American sample from young adulthood (18-30 years) to middle adulthood (38-55 years). Generally, diet quality increased over the 20-year assessment period, and these increases was particularly marked in individuals with intitial lower scores (87). Increases in the consumption of food groups such as seeds and nuts, green vegetables and soy products, alongside reductions in consumption of foods such as whole fat dairy, butter and soft drinks were specifically noted. However, dietary change was not always linear: generally, more positive dietary change occurred after, rather than during, the young adulthood period (87).

Finally, Laska and colleagues (26) have measured the association of involvement in food preparation behaviours during adolescence and emerging adulthood (18 years – early twenties) with food preparation behaviours and diet quality in mid-late twenties, providing an additional layer of insight into the tracking of dietary behaviours during this period. In this study, although food preparation during adolesence was positively associated with food preparation behaviours in emerging adulthood, it was not associated with meal frequency or diet quality when participants were in their late twenties (39). In contrast, food preparation during emerging adulthood was positively associated with reduced frequency of missed meals and diet quality in mid to late twenties (specifically, reduced fast food and sugar sweetened beverage consumption and greater fruit and vegetable intake). In somewhat contrast to the British study of Lake and colleagues (39), this study therefore suggested that dietary behaviours estbalished in young adulthood, when individuals become increasingly autonomous for their food intake, may be more important for long term consumption habits than those behaviours practised during adolescence. However, it should be noted that this North American study did not report absolute dietary intake during adolesence.

In summary, therefore, studies examining tracking of diet across the transition from adolescence to young and middle adulthood are scarce, and findings are mixed. Some studies report significant tracking of dietary behaviours (39,41,80,85), whilst others reported limited dietary tracking (82,83). There is some evidence that tracking of diet may be food group and/or nutrient specific

(39,80), as well as the possibility of a ‘bounce back’ phenomenon, i.e. diet during young adult years may diverge from adolescent dietary behaviours, but then return to more closely to adolescent habits by middle adulthood (39,82,87). However, differences in length of follow-up period between studies limits study comparisons. More research is required in this area, particularly to examine the extent to which young adult dietary patterns represent a template for longer-term consumption habits and thus disease risk; such information may have important implications for the design of targeted dietary messages or interventions to improve long-term food intake. Indeed, efforts to promote the establishment of healthful dietary behaviours during the university years is particularly relevant if dietary behaviours adopted during this period represent a blueprint for long-term consumption patterns.

## 2.4 Dietary intake and eating behaviours of university students

A small body of literature on the dietary intake and eating behaviours of university students specifically has also been published. The following section reviews this literature - UK research is the focus, but pertinent non-British research is also included.

### 2.4.1 Current knowledge on dietary adequacy and eating behaviours of university students in the UK

The small body of existing student-specific dietary research has tended to focus on alcohol consumption, and early research (1990s) consistently reported undergraduate students to exceed sensible drinking limits (43). Contemporary data is congruent with early reports, indicating that over 50% of students regularly binge drink or consume alcohol at hazardous levels (31,32,44–46,88). In a multi-centre study of approximately 3500 undergraduate students, for example, 65% of women and 75% of men reported binge drinking (defined here as consuming more than five drinks in a row) during the two weeks prior to the survey (32). This figure is higher than corresponding information among the general young adult population, which suggests fewer than one in five are regularly engaging in such behaviour (75). Among students at a single British university, approximately one in two students reported hazardous levels of alcohol consumption in the week prior to survey participation (46).

Data on the eating habits of British university students is scant, although studies report high consumption of convenience foods and low consumption of fruit and vegetables (30–34). A survey investigating the food attitudes and behaviours among students from two universities in Northern Ireland concluded that students tended towards diets high in convenience (67% of the sample 'regularly' consumed ready-made meals or other convenience foods) and fried (28% consumed fried food 2-3 times weekly) food, alongside infrequent consumption of home-cooked meals (over 30% of students prepared their main meals from raw ingredients less than twice weekly) (33). Approximately two thirds of all students reported 'regular' consumption of fruit and vegetables, however detail regarding amount consumed was not obtained. Vegetarianism was common with approximately 1 in 4 women and 1 in 10 men excluding meat from their habitual diet; this is greater than the 1% reported among the general working age Northern Ireland adult population (89). However, lack of detailed dietary data in this study limits interpretation, particularly as to whether students' diets were nutritionally adequate and how dietary behaviour might relate to socio-demographic and other lifestyle factors.

A recent lifestyle survey involving over 3500 undergraduate students across seven British university populations (32) has also provided some insight into student eating patterns, reporting high alcohol, high confectionery and low fruit and vegetable consumption as contemporary and defining features of students' diets. Despite around 70% of students claiming that nutrition was 'important' or 'very important', only approximately 16% of female and 11% of male students achieved the '5-a-day' fruit and vegetable intake recommendation, and approximately one quarter of all respondents consumed sweets at least daily (32). A smaller-scale survey among students at a single university reported comparable findings, with over 60% of students in this study failing to meet daily fruit and vegetable intake recommendations (31). Dodd and colleagues (31) additionally reported clustering of unhealthful lifestyle behaviours: individuals who did not meet fruits and vegetable intake recommendations also tended to engage in inadequate physical activity, exhibited high psychological stress and were more likely to smoke. Once again, however, detailed dietary data was not obtained in these studies and information on dietary adequacy is lacking.

Insight into energy and nutrient adequacy among British university students is particularly scarce. Early data (1940s - 1990s) indicated low intakes of energy and some micronutrients, particularly among female students (90–93). A more contemporary study reported similarly inadequate energy intakes alongside excessive contribution of saturated fat to total energy (94). However, this recent study had a small sample, assessed food intake using a single 24-hour recall and did not assess micronutrient intake; under-reporting of energy intake is also possible. In contrast, in a study assessing changes in food, energy and macronutrient intake among first year university students via FFQ, energy intakes of both male and female students significantly exceeded recommendations at the start of the academic year (35). However, reported frequencies of consumption of most food groups decreased significantly throughout the first year of university life and by four months follow-up, energy intakes were comparable to recommendations; the percentage contribution of macronutrients to energy intake did not differ significantly from recommended intakes throughout the first year (35). It should be noted that most recent studies that have examined eating behaviours among student populations have omitted any form of detailed dietary assessment (30–34).

There is additionally indication that body dissatisfaction and dieting is prevalent among British university students, particularly females. In the Northern Ireland student survey, dieting was commonly reported: approximately one in three women and one in ten men reported currently following a strict or casual weight loss diet (33). Frequent breakfast skipping was also reported, with around only half of the sample consuming breakfast daily. These figures are lower than those reported in an earlier study among an English tertiary college population (mean age 17.9 years): approximately 50% of female students reported attempting weight loss in the past year, compared to just under 20% of men (60). Of these college students, 35% of females reported missing meals, 17% reported crash dieting and 19% reported engaging in self-induced vomiting as a means to lose weight; prevalence of these behaviours was generally lower among men (60). A more recent survey specifically examining body image concerns among students from seven universities reported at least mild concerns in almost 60% of female students; the corresponding figure for male students was 20% (95). However, this study did not investigate concurrent engagement in dieting behaviour. These observations are important, since engagement in dieting behaviour has implications for nutritional adequacy (section 2.5).

### 2.4.2 Dietary intake among university students in other westernised countries

Researchers in Europe, Australia, Canada, and in particular the United States have also investigated the dietary intake of university students and report findings similar to those in the UK. Low intakes of fruits and vegetables (96–101), frequent breakfast omission (102,103), frequent fast food consumption (97,98,102,104,105), and high – albeit variable - rates of alcohol consumption (106) are consistent and defining features of students' diets. In a study involving around 250 North American university students, for example, over 90% of students from all years of undergraduate study reported frequenting a fast food restaurant 6-8 times weekly (104).

International studies also note high prevalence of dieting and weight control behaviours, poor body image and weight dissatisfaction, particularly among women (54,58,59,98,107–111). Disparity between perceived and actual body weight among female students is consistently reported, with high rates of engagement in dieting for weight loss (40-50%) despite relatively low prevalence of overweight (54,58,108–111). For up to 15% of female students, weight loss was pursued via extreme weight control behaviours (e.g. self-induced vomiting, diet pills and laxatives) (108,111), whilst dieting among underweight women has also been noted (54,58). These studies indicate that female students in particular may have dysfunctional relationships with food.

Some studies have additionally included detailed nutritional evaluation. These report that university students fail to achieve nutrient intake recommendations: excessive contribution of both total and saturated fat to energy intake, above-recommended consumption of sodium, and inadequate intakes of a range of micronutrients (101,112–115) have been noted. Female students appear more likely to report a poor nutrient intake profile.

### 2.4.3 Heterogeneity of eating behaviours among university students

Despite the cross-cultural convergence of dietary habits (i.e. high consumption of fast and convenience foods, low consumption of fruits and vegetables, frequent meal skipping and dieting) amongst university students, there is evidence to suggest that eating habits are not homogenous within this group.

A small number of recent studies, which have employed data reduction techniques to analyse diet, indicate that certain groups of students tend towards the adoption of more (or less) healthful diets at university than others (30,116–119). A recent cluster analysis of eating behaviours (frequency of consumption of fast food, convenience food, fruit and vegetables, and snacking) among British undergraduate university students revealed four eating patterns (30): ‘risky eating behaviours’, ‘mixed eating behaviours’, ‘moderate eating behaviours’, and ‘favourable eating behaviours’. Students adopting ‘risky eating behaviours’ - characterised by frequent snacking, high consumption of fast and convenience foods, and low fruit and vegetable intake - were more likely to be living on campus and of Christian faith compared to their counterparts adopting contrasting ‘favourable eating behaviours’. No significant associations between dietary clusters were identified for gender, BMI, age or year of study (30). It should be noted that examination of such relationships was cursory because of a lack of detailed dietary assessment and limited statistical power (sample size of 345). Elsewhere, higher proportions of non-white students were found to favour less healthful behaviours (low physical activity; low fruit and vegetable consumption) than their white counterparts in a sample of UK students (31). Higher proportions of white students were also more likely to meet dietary recommendations for fruit and vegetables, dairy and grains than their African-American counterparts in a US study (102).

Principal components analysis of more detailed dietary data of North American university students revealed three major dietary patterns, explaining approximately one quarter of the variance in food intake of the sample: ‘prudent’, ‘western’ and ‘alcohol’ patterns were identified (119). This study focused on the relationship between dietary pattern adherence and disease risk, and identified strong associations between the ‘western’ dietary pattern (characterised by consumption of red and processed meat, French fries and refined grains) and markers of cardiovascular disease risk (serum triglycerides and LDL cholesterol), particularly among men. In contrast, the ‘prudent’ and ‘alcohol’ dietary patterns (the latter being characterised by less than one alcoholic drink per day) were favourably associated with anthropometric measurements and blood lipid profile respectively (119). However, socio-demographic characteristics of students favouring these dietary patterns were not examined. Elsewhere, studies in China and Lebanon have reported several demographic factors to be associated with dietary patterns adopted by university students, including gender, social class, BMI and living place (116–118). In the Lebanon study, female students and those with high incomes and high BMI gravitated towards a ‘vegetarian/low calorie’ diet, whilst males favoured a ‘western’ style diet (118).

Outside of the dietary patterns literature, evidence from North America also suggests that dietary intake may differ according to living arrangements: among students living away from home, those residing on campus have been reported as more likely to adopt healthful eating habits, such as greater fruit and vegetable consumption, than their off-campus counterparts (120–122). The authors speculated that this may be due to increased availability and variety of foods served in on-campus canteens, which may promote dietary diversity, as well as difficulties in negotiating the purchase and preparation of healthful meals for those living in shared off-campus accommodation.

In the UK, Devine and colleagues (33) also tentatively pointed towards a relationship between living-residence and dietary intake, albeit in an opposite direction to the North American literature (120–122). Poor dietary habits were particularly apparent among students residing in university accommodation: only 59% of students living in university residences reported regular consumption of fresh vegetables and salads, compared to 77% and 82% of students living with family or alone respectively (33). A gradient in consumption of ready meals was also noted, with more students in their first year of university life (35%) reporting regular consumption of these meals than students from any other year of study. However, analytical statistics were not employed to assess these differences.

Gender differences in food-related behaviours of this population have also been reported. Female students are reported to exhibit higher prevalence of dieting and weight control behaviours than their male counterparts (33,109,123) whilst males are reported to engage in significantly greater use of fast food restaurants than their female peers (104,105). These gender differences are in line with research conducted among the non-university UK adult population, which has reported men to favour dietary patterns characterised by foods high in fat and convenience foods (71,72). Dieting among the teenage population has also been more commonly reported among female students: approximately 50% of 250 UK female college students reported dieting during the preceding year, compared to less than 20% of their male counterparts (60).

Drinking behaviour among university students also appears heterogeneous. Age and gender differences have been identified, with greater proportions of younger students reporting alcohol consumption than their older counterparts; gender differences are less clear and vary between studies (46,88,106). Cluster analysis of alcohol consumption data classified UK university students into four distinct typologies of drinking behaviour, highlighting that not all students consume alcohol excessively: non or light drinkers (26%), less frequent drinkers who binge (44%), habitual drinkers who binge infrequently (12%), and habitual drinkers who binge frequently (19%) (88). Students in cluster two (less frequent drinkers who binge) were more likely to be younger and female, whilst more males were identified as habitual drinkers (88).

### 2.5 Dietary influences and meanings for university students

If an holistic understanding of student dietary behaviour is to be achieved, understanding why students adopt such dietary practices is also imperative. In addition to the survey literature on dietary intake, a small body of research - predominantly qualitative in nature - has addressed the factors driving students' eating – and drinking - behaviours. These studies provide insight into the multiple influences on - and meanings of - dietary choices at university; these understandings are important for the design of targeted dietary interventions or communication strategies for dietary change.

### 2.5.1 Insights into students' alcohol consumption at university

In the UK, research in this area has focused predominantly on understanding students' experiences of alcohol consumption and the role of binge drinking for young people at university. These studies support quantitative findings of - and provide further understanding into - a prevailing culture of excessive alcohol consumption at university (31,32,44–46,88). Interview data indicate that drinking alcohol at university is for the primary purpose of getting drunk, and to abstain from binge drinking would mean graduating with an incomplete experience of university life. Young people describe arriving at university with expectations of engaging in this culture, viewing excessive alcohol consumption as synonymous with student identity and forming a fundamental element of the complete university experience (46,124–126). Within this drinking culture, alcohol appears to assume an essential social role, with consumption – and more specifically getting drunk – permitting access into new social groups and fostering camaraderie in already established friendship circles (124–126). At the start of university life when friendships are not yet established, alcohol consumption is reported to facilitate social integration through its desirable effects on confidence, social interaction and initiation of romantic relationships (46,124–126). Induction to university life through 'Fresher's Week' appears dominated by alcohol-orientated social activities, and students meeting together to get drunk in party situations specifically provides direct opportunities for meeting new people (46,124–126).

Binge drinking thus clearly assumes a key social role at university. However, participating in such behaviour is not without tension and conflict: drinking students have reported awareness of the negative consequences and health-damaging effects of excessive alcohol consumption (46,127,128). Resultantly, alcohol-consuming students have described distancing themselves from the long-term implications of heavy drinking and claim intentions to reduce alcohol consumption following graduation; these strategies appear to justify continued engagement in binge drinking during university, whilst simultaneously evading unwanted internal conflict (46,127,128). In contrast, abstaining students have frequently described personal negative experiences with alcohol, including alcoholism in close family members, which acts as a prevailing deterrent from drinking (129). Other non-drinking students describe athletic, religious or academic identities that are not congruent with excessive alcohol consumption, and these identities similarly act as motivations for abstention (125,129). For others, however, the immediate benefits of consumption (sociability; escapism) continue to outweigh any long-term risk of addiction (128).

Not drinking – or indeed drinking sensibly – however involves acting outside of cultural norms, and is considered, by consumers, as a choice that would incur negative social consequences, risking questioning, judgment and rejection from drinking peers (130,131). Insights from North America indicate severe social consequences of alcohol abstention at university, with reports of bullying, stigmatisation and ostracisation from drinking peers (132). British studies have not reported such severe consequences, although a fear of social judgment and exclusion is reported (131,133). In the absence of sufficient self-confidence, robust identity, or already-established friendship groups, abstaining students have thus reported the need to develop strategies that justify their non-participation whilst preserving their social status within new social groups: concealment of not drinking, fabricated medically-founded excuses that demand exemption from consumption, or avoidance of situations involving alcohol have been described (131,133). Drinking moderately amidst heavy drinking norms also appears difficult: students report that intentions to drink lightly are often eroded through persuasion from heavier drinking peers, demonstrating the influence of peer pressure in student drinking culture (131).

There is additionally evidence of differing experiences of a university drinking culture by gender, particularly for students wishing not to engage in binge drinking. The alignment of heavy drinking with hegemonic masculinity appears to particularly promote excessive alcohol consumption for young men at university and makes non-conformity to such cultural norms especially threatening; male students choosing not to drink have described challenges to both their sexuality and masculinity from drinking peers (126,130). Men have also described excessive alcohol consumption as an essential feature of sporting involvement at university; there are reports of compulsory participation in alcohol-oriented challenges for acceptance into sports clubs, and accounts of team selection criteria involving drinking ability alongside sporting prowess, making abstention particularly difficult (46,126). Although female students wishing not to engage in the predominant drinking culture have reported analogous fears around social judgment and exclusion (124,133), choosing abstinence appears more readily accepted; moderate consumption is considered congruent with femininity and female students have reported greater social support from drinking peers when choosing to socialise without alcohol (126,130).

### 2.5.2 Insights into students' food choices and eating practices at university

There is a small body of qualitative research that has investigated eating behaviours of university students. In contrast to the literature reviewed above, these studies have been conducted predominantly in North America, lack depth, and largely focus on the drivers of food choice in the context of weight gain at university. Although British studies have also been published, these are few in number (34,134). This literature however unveils varied and multiple influences on students' food choice.

Existing studies highlight the numerous barriers to healthful eating for young people at university. Students consistently report pressures to conform to the eating habits of newly-formed peer groups, lack of money, absence of routine and family support, academic stress, and work schedules that do not fit in with cafeteria opening times (34,135–139). Intense lecture schedules and participation in extra-curricular activities alongside university study appear to particularly impact on students' abilities to make healthful choices, limiting time for cooking and thus promoting reliance on snack foods to meet energy needs (34,135). Elsewhere, students who have experienced greater free time - theoretically enabling adoption of healthier eating and exercise habits - have reported insufficient intrinsic motivation to adopt such behaviours (140). It is therefore important to consider motivational constructs of eating behaviour alongside the more structural limitations on student food choice.

The effect of peers on food choices at university appears bi-directional in nature: studies consistently highlight an alignment of food choices within peer groups, but this alignment has been reported to occur in both a more and less healthful direction depending on the dominating eating habits of the new social group (34,135). An unpublished North American study specifically exploring the role of social groups on dietary decisions at university has provided insight into the evolving influence of peers (141). This study conducted seven focus groups among student peer groups who regularly ate together; peer groups comprised between three and seven individuals. Discourse analysis revealed ‘dependent’ and ‘independent’ eaters within each peer group: dependent eaters relied on the opinions of other group members for their eating decisions and establishment of dietary ideals (resultantly aligning themselves with the decisions of neighbouring peers), whilst independent eaters made dietary decisions based on already-established personal preferences and ideals (141). These two typologies of eating identity could also be distinguished according to consumer age and length of friendships within each social group: independent eaters were older and had more firmly established peer relationships than their dependent peers. Male students also appeared better able to make independent eating decisions than their female counterparts (141).

A few of these qualitative studies have also elucidated a relationship between family-based eating practices and food choices at university (135,137,140). Cluskey & Grobe’s study (140) adopted a life course approach to exploring the impact of transition to university life on eating and exercise behaviour: students describing greater stability in health behaviours during this transitionary period recounted greater autonomy over food intake, meal preparation and the establishment of active lifestyles prior to university. Focus groups exploring determinants of fruit and vegetable consumption among students in New Zealand similarly highlighted the importance of establishing healthful dietary habits prior to university: students for whom such consumption represented normal behaviour described continuing to consume these foods throughout university life (137). Elsewhere, first year students have described conflict between home and university-based eating practices: for some students, periods of vacation returning to the family food environment resulted in healthier food consumption, away from the ready availability of junk food at university, whilst for others, returning home meant that newfound healthier or restrictive dietary practices established at university could not be maintained (135). Most other qualitative studies, however, have focused only on the immediate influences on food choice at university, precluding insight into students' perspectives on the role of home-based dietary practices in shaping university-based habits. There is a clear gap in our understanding of students' perspectives of how family dietary experiences impacts on university food choice.

There is also substantial evidence for an emotional dimension to food choice at university. Homesickness, loneliness and boredom represent triggers for food consumption noted by both home and international students (34,135,136,142,143). Consumption of 'nostalgic' foods – those that evoke positive memories of a students' childhood – have been specifically noted to improve affect and ease homesickness among undergraduates; likewise, 'physical comfort' foods such as coffee or desserts have been noted to provide comfort from negative emotions via the physical response experienced following consumption (143). Academic stress, particularly in relation to exams and coursework, has also been consistently described to result in the abandonment of usual eating routines in preference for increased consumption of less healthful food options (34,135,136,142). A study specifically investigating emotional eating among North American university students highlighted a differing dietary response to stress between genders (144). Both men and women described eating as a distraction from negative affect, however, whilst females spoke about making poorer food choices, increasing overall food intake during these episodes and abandoning usual pursuits of dietary regulation or restriction, male students reported reductions in food consumption during stressful periods. Students explained how absence of parental meal provision and newfound responsibility over food intake, alongside increased accessibility to convenient, energy dense food items exacerbated the effect that stress had on eating practices (144).

A UK study focusing on students' carbon footprints has also provided data on student eating practices and dietary experiences (134). By situating cameras in four student kitchens over a three week period, this study captured students' cooking practices and evidenced low dietary diversity, with frequent repetition of convenience-style meals (e.g. jars of ready-prepared sauces; pasta; rice) that required minimal cooking time, effort and space: half of all meals demanded less than 15 minutes of cooking time, and over two thirds were prepared using a single cooker (hob) component (134). During end-of-study interviews, students described pragmatic food choices, choosing processed non-perishable food items in preference to fresh ingredients, which were prone to spoilage and wastage. There was additionally little evidence of commensality – students described intentions and desires to eat together, but conflicting daily schedules between flatmates meant that eating took on a functional, rather than social, role (134). This report is in contrast to research conducted among international students attending British universities, who prioritise cooking and eating with other international peers to fulfill social needs and maintain cultural heritage (142).

In addition to this student-specific literature, Wills (145) has explored the transition to new social contexts in relation to changing food and eating practices among 16-24 year old school leavers in the UK. This study provided deeper understanding into how the multiple and complex factors associated with the transition to adult life may all impact upon the eating habits of young people: shifts in the use of leisure time, increased time pressures brought about by the need to combine college study with paid work, increased autonomy over food intake, pressures to conform to the behaviours of new social groups, and the desire to construct an adult identity were all related to changes in dietary behaviour (145). Notably, young people described conflict between their desire to re-establish stability in dietary intake following initial changes in eating patterns and practical ability to implement this: individuals who expressed desires to change newly-formed, less healthful eating habits were faced with the realisation that food preparation and other skills required for successful independent living were too naive to fulfill such desires. The period of transition into adult life was furthermore reported as being particularly complex for young women, where girls may have to grapple with conflicts between adopting normative eating behaviours (such as alcohol and junk food consumption) and a continued pressure to fulfill the slim female ideal (145). There is a need for further, in-depth insight into the food and eating practices among young people making the transition from family to university life.

Thus, although a number of qualitative studies already conducted have provided some understanding into the determinants of food choice and dietary experiences of students at university, these studies lack depth and UK research is particularly scant. There is evidence of differing drinking experiences of students attending university in North American compared to the UK (132,133). Likewise, differing food cultures between US and UK universities precludes comparison of dietary experiences, and UK-specific research is therefore necessary. The few studies conducted among UK students indicate that a number of factors unique to the university setting represent barriers to healthful eating during this time; there is also evidence that students feel unable to enact their dietary ideals, but little in-depth insight into the reasons for this (34,134). Wills (145) provided rich insight into the dietary experiences of young people making the transition out of secondary school and there is a need for further research of this depth among young people making the transition from family to university life.

## 2.6 Health implications of current dietary behaviours among university students

The nutritional implications of the broad food behaviours described above have been highlighted and are summarised in Figure 1 below; interactions between behaviours are also illustrated. This figure focuses on the detrimental effects of such behaviours on food and nutrient intake, but it should be noted that certain behaviours might also result in nutritional benefit. For example, healthful strategies to control/lose body weight – such as decreased consumption of high-fat and high-sugar foods and increased consumption of fruits and vegetables - may result in nutritional improvement (61). However, the employment of weight-loss strategies such as self-induced vomiting, use of dieting aids and dietary fat avoidance, which have been reported among university student (and adolescent) populations (58,60,61,109) may result in nutritional inadequacy. Similarly, vegetarianism may positively affect fruit and vegetable consumption and dietary fibre intake, whilst limiting the contribution of total and saturated fat to daily energy intake (146), but there may also be negative nutritional consequences (Figure 1). In general, the following figure illustrates that there are short-term implications for both micronutrient adequacy and weight gain of a number of key dietary behaviours practised by university students.

Some studies have also investigated the longer-term health implications of these behaviours. Strong evidence now exists to link alcohol consumption with the development of a range of cancers later in life (5), whilst fast food consumption has been positively associated with weight gain and insulin resistance in large prospective studies (147,148). More immediately, students dieting during their first year of university life may, paradoxically, be at greater risk of body weight gain than their non-dieting counterparts throughout this period (149,150). Regular alcohol consumption during the same period has also been associated with increased risk of weight gain (50,151,152).

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**Figure 1: Possible detrimental nutritional implications of university students' dietary behaviours**

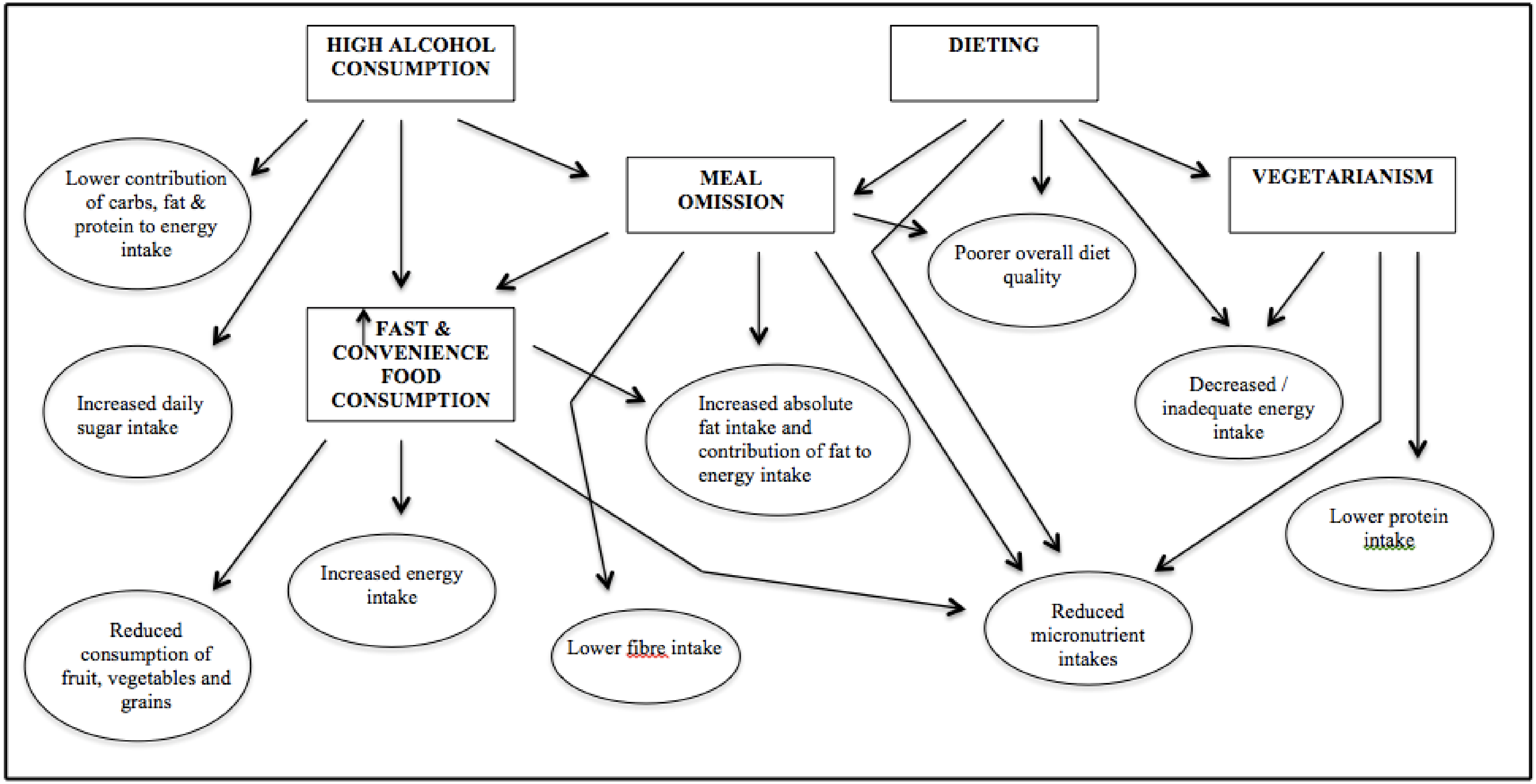


Figure 1 above illustrates the possible detrimental nutritional implications of the dietary behaviours commonly reported amongst the university student population. The figure has been constructed from a body of research: (58,61,62,103,152–155). In cases where 'lower' or 'increased' (etc.) is stated, individuals practising these behaviours have been compared to their counterparts either not practising these behaviours, or practising these behaviours to a lesser extent. Implications related to meal skipping largely refer to the omission of the breakfast meal. In this figure, the five dietary behaviours within the rectangles represent five key characteristics of students' eating behaviours as highlighted in the literature. The possible nutritional implications of these behaviours are shown in the circles. It can be seen that several of these dietary behaviours share similar nutritional implications.

Thus, in summary, university students may be affected by a number of actions and choices in relation to their diet. In the next section of this review, the focus remains on university students but shifts to specifically consider the phenomenon of body weight gain amongst this population, which has been identified in recent years.

## 2.7 Body weight gain among university students

Weight gain during students' first year at university was originally documented in North America and referred to as the 'Freshman 15' – the popular belief that students gain 15 lbs. during their first year of university. The phenomenon has subsequently been investigated in many western countries, including more recently in the UK. The small body of literature that has examined weight gain beyond the first year of university life is also reviewed below. There is a vast literature on weight gain more generally but this review has been restricted to studies conducted within the student population.

### 2.7.1 Weight gain during the first year of university

Numerous studies examining body weight change in first year university students have now been conducted. A 2009 review of 17 studies (predominantly of North American origin) measuring weight gain during this period indicated that average weight gain during the first semester is much more modest than popular beliefs, ranging from 1.3 kg to 3.1 kg (48). Among weight-gainers only, however, range of weight gain was greater and narrower (3.1 – 3.4 kg). There was also high variability in weight gain across studies, suggesting particular vulnerability to weight gain for a sub-population of students during this period (156–160). A more recent meta-analysis of 22 studies - conducted between 1993 and 2014 throughout North America, Canada and the UK - reported a similarly modest mean body weight increase of 1.21 kg over an average five-month period (161). Whilst the clinical significance of this weight gain is questionable, further analyses indicated that among weight gainers only, overall average weight gain was substantially greater at 3.38 kg.

Despite these relatively modest average weight gain figures, there is evidence that weight gain may be of clinical significance for some students. Studies including data on the number of students gaining the 'Freshman 15' (6.8 kg) indicate that approximately 10% of students are at risk of such weight gain during this period (162–164). Significant increases in the prevalence of overweight and obesity have also been reported over the same timeframe (159,160,165). In a study of approximately 200 first year European students, prevalence of overweight and obesity increased from approximately 15% to 20% over the 20-week follow-up period (160). These figures are important given indications that even mild overweight status during young adulthood may increase risk of obesity in future years (51,52). There are mixed findings in terms of how weight change corresponds to changes in lean and fat mass, and many studies have omitted any form of body composition assessment beyond BMI; however, a trend towards increases in fat mass among weight gainers is evident (160,166–172), which has important implications for chronic disease risk.

More recently there has been research interest in weight gain among British university students, and these studies report comparable findings (34,49,50,173). Indeed, a prospective, multi-site study among first year students, which measured changes in body weight and composition between arrival at university and at three and 12 months follow-up, reported modest but significant overall increases in body weight and fat mass during the initial three-month period (0.83 kg and 0.88 kg respectively) (49). However, weight change was highly variable: students reported changes in body weight between – 7.2 kg and + 11.6 kg during the first semester, indicating large inter-individual differences in susceptibility to weight gain (49). Weight change at 12 months was no longer significant, but variation in weight change was substantial (-14.7 kg to +14.2 kg); furthermore, high attrition noted at follow-up must be considered.

A study among 1275 first year university students in Scotland reported a slightly greater average weight gain of 1.8 kg over a nine-month period (34). Variability in weight change was large, ranging from -7 kg to +20 kg. Detailed assessment of body composition was not conducted in this study, however, and whether such changes were due to alterations in lean or fat mass is unknown. Cockman and colleagues (50) also examined changes in body composition during a single semester among a smaller sample of first and final year female undergraduate students. First year students gained an average of 2.55 kg with a parallel 2.67% increase in body fat. Furthermore, 22% of students reported clinically significant weight change, gaining in excess of the 'Freshman 15' (>6.8 kg).

### 2.7.2 Weight gain beyond the first year of university

A small number of studies have investigated weight gain among students beyond the first year. These studies are important to assess the longer-term clinical significance of weight gain at university, and to determine if first year weight gain is a marker for future obesity risk. The majority of these studies report a continued trend of weight gain throughout the ensuing university years, albeit at a slower rate than during first year and again substantial variability in weight change was recorded (99,100,152,163,174). A recent study among Canadian university students examining body weight changes throughout the four undergraduate years reported average weight gains of 3.2 kg and 4.1 kg among male and female subjects, respectively (174). Substantial increases in prevalence of overweight and obesity have also been identified beyond the freshman year, indicating that weight gain holds clinical significance for a number of students (100,152). Conversely, final year female students at a UK university displayed no significant changes in body weight during the autumn semester in contrast to their first year counterparts, suggesting certain weight gain promoting circumstances may be unique to the first year of university life (50). However, small sample size and potential selection biases in this study limits conclusions; further research in this area is necessary.

### 2.7.3 Weight gain among university students compared to the general young adult population

Insight into the extent to which the university environment is responsible for weight gain during this period is particularly scant and currently conflicting. Extrapolating from a linear regression model of weight gain among the general North American population, Levitsky *et al.* (149) indicated that weight gain among university students is amplified by a factor of 10 compared to the general population of the same age (153.8 g/week compared to 15 g/week respectively). A more recent North American simulation study, however, suggests that weight gain experienced by students during the first year of university is not substantially different from that encountered by non-students: university students were estimated to gain an extra 0.5lb compared to their age-matched non-student counterparts (175). Thus, these studies are inconclusive as to whether weight gain at university is clinically relevant. The author is not aware of any British studies that have examined this issue.

## 2.8 Factors associated with body weight gain among university students

A number of studies have also investigated the factors underpinning weight change at university. Although the majority of these focus on only a very small number of variables, they provide some insight into factors that may enable identification of students at particular risk of body weight gain. Such identification of pre-disposing factors is important for the development of targeted interventions.

### 2.8.1 Eating habits associated with body weight change

Changes in eating habits have been assessed alongside weight change in a number of studies. These studies have tended to measure eating habits generally, through consumption of key foods or food groups (e.g. fruit and vegetables; takeaway and processed foods; dairy foods; alcohol), rather than by assessment of energy and nutrient intake. A positive association between weight gain and tendency towards increased alcohol intake and consumption of energy-dense food choices has been reported in several studies (50,149,151,160,176). In a study among first year North American students, consumption of 'junk foods' explained 24% of the variance in body weight gain in a final regression model, whilst evening snacking and eating lunch at restaurants explained a further 6% and 5% respectively (149). Elsewhere, a study investigating the effect of alcohol intake on weight gain during the first year of university reported that students described as 'moderate-risk drinkers' (those who typically consumed 4-5 drinks on 1-3 days each week, with at least monthly participation in binge-drinking), experienced greater increases in BMI over the first semester than their less frequent alcohol-consuming counterparts (152). Subjects in this study also completed the 'Eating habits after drinking' subscale: scores on this scale were positively correlated with change in BMI, indicating that alcohol consumption may have an additive effect on energy intake beyond liquid calories alone (151). This finding is particularly pertinent in light of high prevalence of binge drinking among university students (31,32,44–46,88). Decreases in fruit and vegetable intake and increases in processed and take-away food items have also been reported to accompany weight gain in first year British university students; body weight change and dietary changes were not documented in final year students (50).

The lack of association between eating habits and weight gain in some studies is noteworthy (34,99,158,177). Similarly, studies that have employed more detailed assessment of dietary intake generally report a decrease in energy consumption paralleling weight gain (166,171,172,178). Whilst it is possible that decreases in physical activity participation at university may be at least in part responsible for the positive energy balance experienced by many weight gainers (section 2.7.2), disparity between actual and reported food consumption among this population is likely. Overweight and obese individuals are more likely to underreport energy intake compared to their healthier weight counterparts, which may help explain these findings (179).

### 2.8.2 Physical activity and body weight change

Findings concerning the relationship between physical activity and weight gain at university are also conflicting. Some studies report an inverse association between physical activity and body weight gain during the 1st year at university

(166,170,171), whilst others report a positive association (49,177), and many report no association (34,99,157,158,168,176). Increased participation in sedentary activities such as television viewing has also been associated with body weight gain (160,172).

A British study that included more detailed assessment of body composition indicated that positive associations between physical activity and weight gain may be due to advantageous increases in fat free mass (49) . However, self-reported increases in vigorous physical activity over a six-month follow-up period were associated with unintuitive increases in waist circumference and body fat percentage in an earlier North American study (170). Most other studies have omitted any anthropometric assessment or analysis beyond BMI (34,171,176,177). The self-reported nature of physical activity assessment employed in most of these studies makes desirability bias possible, threatening validity of associations. These relationships (eating habits, physical activity and body weight change) deserve further research attention.

### 2.8.3 Psychometric influences on eating behaviour

A number of psychometric influences on eating behaviour are relevant to the student population and have been examined in relation to body weight. These include dietary restraint, disordered eating/eating disorder traits, dieting and stress. Students reporting fewer eating disorder traits have been consistently reported as being weight stable compared to their symptomatic counterparts (162,174,180). Findings as to the relationship between dietary restraint and weight change are less consistent: some studies report a positive association between dietary restraint and weight gain (181), whilst others report an inverse association (182) and others no association (150,156). However, a lack of discrimination between the rigid or flexible nature of restraint may blur conclusions here (183). In a UK study, high scores on a disinhibition of eating scale were identified as positively associated with fat mass change (49).

Current or past engagement in dieting has also been associated with body weight gain. In a regression model controlling for initial body weight, recent dieting behaviour explained four percent of the variance in students' weight gain during the first semester at university (149). Lowe and colleagues (150) reported similar findings: students reporting current engagement in weight-reducing behaviours experienced significantly greater body weight gain during the first year at university than former- or never-dieting counterparts, although the very small number of current dieters in this study demands caution over interpretation of this result. The direction of such a relationship also remains unclear: it is possible that students with previous experience of, and greater vulnerability to, weight gain may be more likely to be already engaging in dieting behaviour, whilst dieting itself may induce increased energy consumption via a cycle of dietary restriction, deprivation, and ultimate overconsumption or binge-eating (184).

Emotional stress has also been frequently implicated in the etiology of university weight gain. A cross-sectional study of UK students identified greater stress levels (both in terms of severity and frequency) among students who reported weight change during the first year of university, compared to those who remained weight-stable (173). Economos and colleagues (157) also reported a positive association between workload and weight gain among female students, but a converse effect was seen in men: lack of academic confidence was strongly associated with weight loss in male students (157). In contrast, no significant association between stress and weight change during the first semester was reported in another study, although the short follow-up period may have precluded the detection of an association (185).

A substantial body of literature has investigated the relationship between food intake and (academic) stress at university. A recent UK study examining the influence of end of year examinations on food and nutrient intake among male students indicated that the effects of exam stress on food intake is various (186). This study identified three clusters of students in their response to exam stress: hyperphagic responders; students who demonstrated energy intake stability; and hypophagic responders (186).  However, no direct assessment of stress was included in this study and only male students were included. A number of other studies have consistently reported stress to manifest in increased overall dietary intake and deterioration in diet quality: increased consumption of palatable energy-dense food items, particularly among female students and restrained eaters is consistently noted (187–190). During these periods, the function of eating appears to shift from fuel provision to emotional regulation, thus promoting consumption in the absence of hunger cues (191–193). This research thus provides support for the role of stress in the etiology of university weight gain, particularly among female students.

#### 2.8.4 Initial BMI and body weight change

Several studies have additionally reported a significant inverse association between baseline (pre-university) BMI and body weight gain. Individuals entering university at a lower body weight have frequently been identified as more susceptible to weight gain compared to their heavier counterparts (49,162,174,182,194), although a smaller number of studies report an opposite association (34,158,170). It is possible that students starting university with lower body weight may be less aware of a need to engage in weight-regulatory behaviours to maintain body weight, and thus when exposed to new eating routines and autonomy over food choices, over-consumption may result. Similarly, students starting university with higher baseline BMI may be already engaging in weight-maintenance behaviours, thus reducing risk of further weight gain during this period. Alternatively, such students may arrive at university already consuming larger quantities of energy-dense foods and engaging in little physical activity, thus possibly experiencing fewer changes in energy balance during the transition to university. However, such explanations are currently speculative. Further research in this area is warranted to better identify the characteristics of young people at greatest risk of weight gain upon entry to university.

### 2.9 Summary & identification of knowledge gaps

To summarise, there are gaps in the research literature as to the dietary intake and eating behaviours of British university students. The small body of existing literature indicates that eating patterns among this population are poor, with high intakes of alcohol and energy-dense, nutrient-poor food items, alongside low consumption of fruit and vegetables and inadequate micronutrient intakes representing prevailing features of student diets. These dietary behaviours may be associated with a number of adverse health consequences both in the short- and, moreover, long-term. However, these studies are scarce and methodologically limited (e.g. small sample size; lack of detailed dietary data; absence of analytical statistics). Information on the demographic and social factors underpinning food choices among British university students is also deficient.

A small body of research has also explored the factors underpinning food choices and drinking behaviours of university students. A number of British studies have explored the role of alcohol consumption for young people at university and these have highlighted an important social function of drinking and subsequent implications of abstinence. Studies exploring food choices indicate that a multitude of factors determine students' dietary decisions. However, these studies lack depth of insight and have been particularly cursory as to the social role of food choice at university and the influences of family food habits. UK-based research is particularly scarce.

Weight gain at university, particularly during the first year, is common. Most studies report statistically significant weight gain during this period, and research that has included detailed assessment of body composition indicates increases in fat mass. However, average weight gain appears modest and the clinical significance of such gains is questionable. Research into the factors underpinning weight gain at university is diverse and conflicting: eating habits, physical activity levels, psychometric factors and baseline body weight have been implicated. UK-based research is particularly scarce. Furthermore, existing studies have sampled from the general population of university students: data on students gaining clinically significant amounts of body weight have thus been diluted amongst those who lose weight, or remain weight-stable during this period. Further focused research, specifically targeting a weight-gaining sub-group, is necessary to advance insight and better delineate the factors responsible for weight gain among university students, particularly in the UK.

This research project seeks to address these omissions in knowledge, presenting a comprehensive research design that will explore these issues.

## 2.10 Research aims and objectives

### 2.10.1 Research aim:

To explore the food choices of university students in the UK.

### 2.10.2 Research objectives:

To fulfil this aim, there are five specific research objectives:

i. To assess dietary adequacy among a UK university student population
ii. To identify dietary patterns that exist within a UK university student population
iii. To identify socio-demographic, lifestyle and other food-related behaviour characteristics of students favouring these dietary patterns
iv. To obtain an in-depth insight into the food choices and dietary practices of students at university
v. To identify eating behaviours associated with body weight gain among university students.

# CHAPTER 3.
# METHODOLOGY

## 3.1 A multi-methods approach

A pragmatic philosophical stance was adopted to address the project objectives. In contrast to the adoption of post-positivist or constructivist philosophies, the pragmatic researcher is not bound to a single philosophy or belief around what constitutes 'truth'; rather, the methodology chosen at any one time is dependent on what the researcher believes will best answer a specific research problem (195,196). Pragmatism is thus problem-focused; rejecting philosophical polarity and promoting methodological pluralism to better understand the social world (195–197). Both quantitative and qualitative approaches can thus be employed to achieve the aims and objectives of the research and enable a comprehensive understanding of the research problem in hand (196,198).

A multi-methods research approach employing both quantitative and qualitative methodologies was felt to be appropriate, allowing a broad exploration of student food choice. Quantitative methods were employed to explore the 'what' of student food choice and eating behaviour, addressing objectives, one, two, three and five: to assess dietary adequacy among a UK university student population; to identify dietary patterns that exist within a UK university student population; to identify socio-demographic, lifestyle and other food-related behaviour characteristics of students favouring these dietary patterns; and to identify eating behaviours associated with body weight gain among UK university students. In-depth insights into food choices and dietary practices (objective four) were achieved through the employment of qualitative methods to enable acquisition of rich data on the 'how' and 'why' of student food choice. Although the field of nutrition and dietetics has traditionally been dominated by quantitative research, the contribution and use of qualitative methods to enhance understanding of dietary choices and eating patterns has been recognised and become more widespread over recent years (199–203).

'Mixed methods' research is that which collects, analyses and, crucially, integrates both quantitative and qualitative data within a single research study

(204). Creswell (196) outlines two major mixed methods research designs: 'sequential' designs, where data are collected successively and findings from one method are expanded upon by another method; and 'concurrent' designs, where data are collected using both methods simultaneously and findings are integrated during data interpretation (196). Morse (205) argues that the second research component within a mixed methods design is not complete or publishable when separated from the first, 'core' research component. 'Mixed methods' research projects thus differ from 'multi-methods' projects, where multiple studies employing different methods may contribute to a fuller understanding of the research problem under investigation, but each phase of data collection represents a self-contained, complete and publishable study in its own right (205,206). Integration of findings and illustration of complementary relationships across datasets is still appropriate and possible, but there is no essential requirement for data integration (205).

The employment of the term 'multi-methods' rather than 'mixed methods' to describe the methodology adopted in this project is key. The findings from – and complementary relationships between - the different datasets in this project are considered together towards the end of the thesis, but this project did not set out to fully integrate findings from all phases of data collection according to true mixed methods research design (196,204). Instead, the different datasets collected as part of this project represent distinct studies (and will be referred to henceforth as studies), but collectively contribute to an holistic understanding of the food choices of university students in order to fulfill the overall aim of this research (205,206).

### 3.2 Employment of multivariate data reduction techniques to examine diet

The second and third research objectives of this project specifically require examination of the diets of university students using multivariate data reduction techniques to identify major dietary patterns consumed. Traditional approaches to nutritional surveillance and epidemiology have focused on single foods or nutrients, which has allowed assessment of intake relative to dietary recommendations (17) and identification of nutrient-disease relationships (207). Individuals at increased risk of dietary inadequacy and disease development based on single-nutrient findings can thereby be identified. Nutrient content alone, however, does not underpin food choice decisions (208) and foods furthermore consist of a complex combination of both known nutrients and unknown non-nutrient components. The investigation of single food-disease relationships has therefore allowed the exploration of a possible effect of unknown factors on disease risk, as well as more direct translation of findings into dietary advice (209). However, diet is a complex and multidimensional exposure and neither foods nor nutrients are consumed in isolation. The representation of diet in such a uni-dimensional manner thus does not account for the complex inter-correlations among food items that constitute a diet as it is consumed in reality, and may lead to erroneous conclusions of food/nutrient-disease relationships (209).

As a result, the last two decades have witnessed a global proliferation in the employment of dietary patterns analysis for both epidemiological (210,211) and descriptive purposes (19,22–24,212,213). This approach to analysis enables the researcher to define diet in terms of (most usually) intake of multiple interrelated food groups, thereby capturing its complex and multidimensional nature, which is representative of real life food consumption (214,215). Exploring diet in this manner may therefore enable further comprehension of diet-disease relationships and improved translation of such relationships into dietary advice (25). From a more descriptive perspective, this analytical approach allows greater insight into the different patterns of food consumption that naturally occur within a population, and subsequent identification of sub-groups who may be most in need of health promotion efforts (216).

A number of approaches to dietary patterns analysis now exist, including both score-based methods and data-driven approaches, and more recently a combination of the two (217,218). *A posteriori*, data-driven methods of principal components and cluster analysis enable identification of dietary patterns as they are adopted in reality and thus provide an alternative to the traditional single-nutrient, -food or -behaviour approaches by which to explore and define a population's diet (219,220). They may therefore be valuable in progressing understanding of the dietary behaviours and eating habits that manifest among specific population groups.

### 3.2.1 Principal components analysis and cluster analysis in exploratory nutrition research

Principal components analysis (PCA) represents the most commonly employed multivariate statistical technique to summarise diet (211), aiming to reveal the underlying patterns within a dietary dataset. Inter-correlations between intakes of foods/food groups are exploited to generate a number of dietary components that explain the maximal possible variation in food intake (218). Each food item/group entered into the PCA is correlated with each component via a factor loading, thereby indicating the relative importance of each food group to a particular pattern. The patterns generated are neither discrete nor mutually exclusive in nature, and each individual receives a score for each dietary pattern. Subjectivity inherent in labeling the dietary components extracted from the analysis limits between-study comparison, although further examination of the food groups comprising the dietary components can improve comparability. The use of further statistical analyses then allows overall scores on dietary patterns to be correlated with a range of socio-demographic and behavioural variables to enable meaningful interpretations (21–24,71). This process facilitates identification of groups of individuals - who possess similar socio-demographic or behavioural characteristics - most in need of nutritional intervention.

Cluster analysis, on the other hand, usually takes a more subject-focused approach to analysis with the aim of detecting interrelationships among subjects, rather than variables (221). This technique can therefore be used to separate individuals into discrete – and relatively homogenous – groups based on their dietary intake (25,222) therefore easing interpretation for the researcher. Cluster analysis has been employed to a somewhat lesser extent throughout the dietary literature, but a body of research that has utilised this method exists (20,73,211). Following cluster generation, further statistical analyses can again be employed to define clusters by a range of socio-demographic and other variables (20,223).

Notably, researchers who have applied both PCA and CA to the same dataset report high compatibility in patterns extracted (28,223,224). The continuous nature of food pattern scores extracted from PCA may make this method a more pragmatic approach to dietary analysis, although dual employment of these techniques may enable greater understanding of a population's diet (28,223).

### 3.2.2 Application of dietary patterns analysis to investigate university students' dietary intake

The body of UK research employing principal components or cluster analysis to define dietary patterns among children, adolescents, adults and the elderly is notable (20–24). However, few studies have employed these techniques to investigate dietary patterns among university students globally (30,116,118,119). The only UK study located employed cluster analysis on broad eating behaviours of university students but did not obtain detailed dietary intake data (30).

## 3.3 Overview & research design of the project

To address the objectives of this research (section 2.9) three major phases of data collection were undertaken, using both quantitative and qualitative methods. Following completion of a small-scale pilot study, Phase 1 (quantitative) addressed research objectives one, two and three (to assess dietary adequacy among a UK university student population; to identify dietary patterns that exist within a UK university student population; to identify socio-demographic, lifestyle and other food-related behaviour characteristics of students favouring these dietary patterns). Phase 2 (qualitative) addressed objective four (to obtain an in-depth insight into the food choices and dietary practices of students at university), and Phase 3 (quantitative) addressed objective five (to identify eating behaviours associated with body weight gain among a UK university student population).

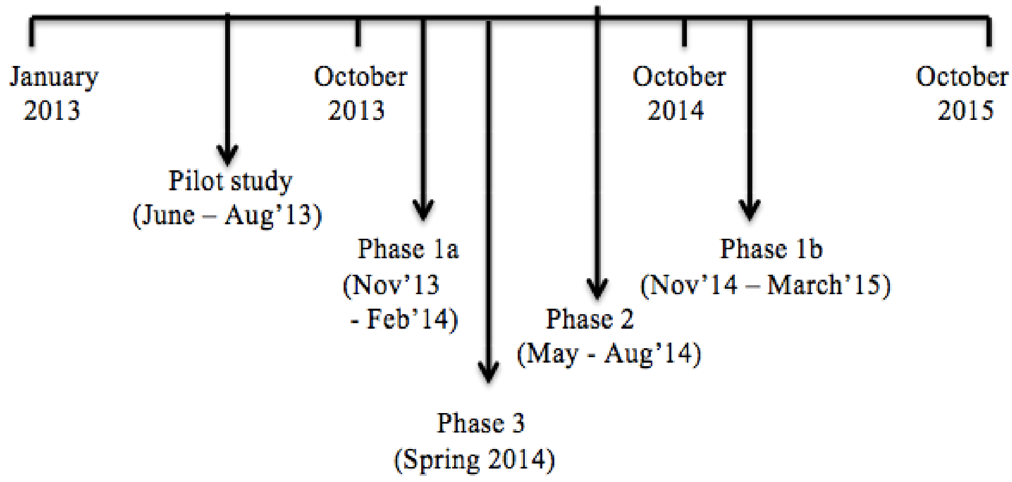
Phase 1 was a multi-centre study involving five universities throughout the UK (Universities of: Sheffield, Ulster, King's College London (KCL), Southampton and St Andrews). A web-survey, comprising a validated food frequency questionnaire (FFQ) (Tinuviel Software Ltd., Warrington, UK) alongside a number of socio-demographic and lifestyle-related questions, assessed dietary intake. Data collection was conducted in two stages: first, at the University of Sheffield (Phase 1a), and second, at the other four participating sites approximately one year later (Phase 1b). This two-stage data collection process reflected delays in obtaining ethical approval from the participating universities outside of Sheffield. This first phase of data collection was preceded by a pilot study to assess the feasibility of the study and test the web-survey employed. The details of this pilot study are provided in section 3.5.2 describing the development of the survey.

Phase 2 involved semi-structured face-to-face interviews with students at the University of Sheffield. Participants for this phase were purposefully selected on the basis of gender, year of study, ethnicity and dietary pattern scores identified during Phase 1a. Interviews were analysed using thematic analysis (225).

Phase 3 comprised a web-survey among university students from across the UK who were current members of a national weight loss programme (Slimming World UK). This phase comprised data that were made available to the author during the early stages of project inception; the Nutrition and Research Team at Slimming World developed the study instrument and collected the data, and the current author undertook all analyses. The web-survey assessed self-reported weight gain at university in conjunction with a number of behaviours relating to students' eating habits and physical activity levels. A series of analyses were conducted on these data to examine eating-related behaviours associated with body weight gain at university.

Figure 2 displays the data collection timeline. The pilot study was conducted between June and August 2013, followed by Phase 1a quantitative data collection at the University of Sheffield (November 2013 - February 2014). Phase 1b - quantitative data collection at the universities outside of Sheffield - took place between November 2014 & March 2015. Phase 2 (interviews) was conducted between May and August 2014. Data collection of Phase 3 was conducted during summer of 2013 and analysed during spring of 2014.

**Figure 2: Data collection timeline**




### 3.4 Ethical approval

Ethical approval was obtained from each participating university for Phases 1 and 2. Informed consent for participation was obtained on the first page of the web-survey, which enabled access to the full survey (Phase 1), or via written consent prior to commencement of interviews (Phase 2). Ethical approval for the pilot study was also obtained from the University of Sheffield.

For Phase 3, ethical approval was not obtained from an academic institution and this research did not fall under the remit of NHS ethics committees. However, all participants were informed of and provided written consent to their anonymised data being used for academic research and statistical purposes prior to becoming an enrolled member of Slimming World. Participants were provided with online information about the survey prior to participation and informed that by completing the survey they were consenting to participate in the study.

### 3.5 Phase 1: Web-survey on food intake among university students

#### 3.5.1 Details of the web-survey and dietary assessment method employed

The web-survey consisted of two parts: first, a validated, semi-quantitative FFQ to assess habitual dietary intake (DIETQ, Tinuviel Software Ltd., Warrington, UK), and second, questions gathering information on socio-demographics and other food-related and lifestyle behaviours. The final version of the FFQ employed asked questions on consumption of 111 foods/food groups. For questions addressing frequency of food consumption, nine response options were available, ranging from every day (7) through to once weekly (1); 'F' (8) indicated that an individual consumed a food once every two weeks, whilst 'R' (9) signified that the food was rarely or never eaten. For some questions (e.g. average number of apples eaten per week; average amount of cheese consumed per week) participants were required to report absolute quantity of consumption. A paper version of the FFQ employed is provided in Appendix A.

A FFQ was chosen as the method of dietary assessment in this project due to its ease of implementation, low cost and low respondent burden, thus optimising response rate and enabling a large sample size. FFQs additionally capture average food intake over an extended period of time, which has greater health relevance than food intake measured over only a few selected days (226). FFQs therefore also circumvent the problem of day-to-day variation in dietary intake. This was particularly pertinent to the current study, which was interested in measuring students' average food intake over the course of a university semester. The use of alternative forms of dietary assessment was considered, most pertinently estimated diet records or multiple 24-hour recalls across the course of the university semester. Whilst these alterative dietary assessment methods would have enabled greater insight into short-term nutrient intake and adequacy, the increased burden placed on both participants and researcher would have reduced sample size and precluded the collection of data at multiple sites (227). The more burdensome nature of these methods may have also increased the risk of selection bias towards students more interested in diet and health.

The specific FFQ employed in the current research (DietQ; Tinuviel Software Ltd., Warrington, UK) was largely determined by pragmatic reasons, most pertinently in terms of accessibility to the author, and specifically in an online format directly linked to the nutrient database. This online format enabled greater sample size and data collection at multiple universities. This FFQ was originally designed by the Medical Research Council (Cardiff Group), as a short (< 60 items), self-administered, dietary questionnaire for use in epidemiological studies of ischemic heart disease (228). The original questionnaire was relatively validated against 7-day weighed food records among 119 British men (228). Relative validity was assessed using Pearson's correlation co-efficients, paired t-tests and by examining the percentage of participants placed in the same, adjacent or opposite tertiles of nutrient intake distribution. Intakes of energy and nine nutrients were assessed for comparison; with the exception of vitamin C, these were all macronutrients (alcohol; cereal fibre; total fibre; total protein; sucrose; total carbohydrate; total fat; saturated fat) (228). Pearson's correlation coefficients were all significant but generally small and reported as the following: 0.30 for energy, 0.27 for total carbohydrate, 0.31 for saturated fat, 0.34 for total fat, 0.36 for vitamin C, 0.37 for total fibre, 0.41 for cereal fibre and total protein, 0.45 for sucrose, and 0.75 for alcohol (228). With the exception of alcohol and cereal fibre, the FFQ underestimated energy and nutrient intakes relative to the weighed record, and mean differences were all significant at $p < 0.01$ except for total fibre ($p < 0.05$) and alcohol (not significant) (228).

There are a number of possible explanations for this underestimation of energy and nutrient intakes by the FFQ compared to weighed records. First, the period of dietary measurement differed between the two assessment methods (12 months for the FFQ compared to seven days for the weighed record), and each method was therefore measuring a different dietary exposure (229). Second, the FFQ may have omitted some foods that made an essential contribution to nutrient intake (e.g. cakes, puddings, and jams were not included in this original version of the questionnaire, which may have made an important contribution to carbohydrate intake). In addition, this initial version of the FFQ included only the foods representing a major nutrient source in the calculation of nutrient intakes, rather than including all foods listed in the questionnaire. Finally, some foods may be consumed more frequently than once per day, but the maximum frequency option in the questionnaire was capped at seven days per week (i.e. once per day). When examining the ability of the FFQ to correctly classify individuals into the correct tertiles of nutrient intake when compared to intakes obtained from the 7-day weighed record, the FFQ placed between 41% (total carbohydrate) to 70% (alcohol) of individuals into the same tertile of consumption as the weighed record (228).

In a slightly later validation study, Fehily et al (1988) (230) compared nutrient intakes measured by the same FFQ to intakes assessed by 7-day weighed records in a sample of 665 British men. This study included all the food items listed in the FFQ for calculation of nutrient intakes, rather than just the major food sources. The mean differences between nutrient intakes (FFQ vs. weighed records) were much smaller in this study compared to those previously reported by Yarnell and colleagues (228), although most remained significantly different (230). Pearson's correlation co-efficients and the percentage of individuals placed in the same or opposite tertiles of nutrient intake were similar to figures previously reported (228).

The current version of the FFQ published for use by Tinuviel Software has been developed from its original format and now includes a more extensive food list; the final version employed in the current study can be found in Appendix 1. There is a focus on foods containing fat due to the questionnaire's use in studies of heart disease (228,231–233). Tinuviel Software has published Pearson's correlation co-efficients for this more extensive version of the FFQ for most of the same nutrients as previously assessed among a sample of 722 British adults (234); these correlations were greater than previously reported (228) and can be found in Table 1 below. These latter coefficients are congruent with results of validation studies of other FFQs (229). As highlighted above, differences in measurement period of dietary exposure, limitations in higher frequency response options in the FFQ, and possibility that the food list on the FFQ did not capture all foods frequently consumed by the sample contribute to these modest correlation coefficients (229). Furthermore, it is acknowledged that plotting the difference in intake obtained from the two methods against the mean provides a more accurate assessment of agreement (235) and these correlations should thus still be interpreted with caution. Resultantly, absolute nutrient intakes measured using this FFQ should also be interpreted with caution in the current study. In light of the results of these validation studies it is likely that measured intakes will represent an underestimate of actual intakes.

In the most recent validation study reported by Tinuviel Software Ltd., the percentage of participants classified into the same and opposite tertiles of nutrient intake distribution was also assessed. For each nutrient assessed, the FFQ ranked no more than 13% of individuals into the opposite third of nutrient intake distribution when compared to nutrient intakes measured by the 7-day weighed record (234). The full results of this validation study as published by Tinuviel Software are presented in Table 1 below (234).

It would have been desirable to conduct a re-validation of the FFQ in the current research within a contemporary young adult population, comparing FFQ data to that collected from weighed dietary records over the course of a 12 week period (equivalent to that of a single university semester), but time and resource constraints meant this was not possible. The data collected in the current research will therefore be discussed in the context of the results of these existing validation studies. In addition, calculation of predicted total energy expenditure and comparison to measured energy intakes will provide some form of assessment of misreporting of energy and nutrient intake by the current sample (see section 3.5.7).

Table 1: Results from the relative validation of the FFQ employed in the current study compared to 7-day weighed diet records (234)

| Nutrient | Correlation coefficient | % of participants in same third of nutrient distribution | % of participants in opposite third of nutrient distribution |
|---|---|---|---|
| Energy (MJ) | 0.47 | 47 | 9 |
| Protein (g) | 0.36 | 48 | 13 |
| Total fat (g) | 0.44 | 47 | 11 |
| Saturated fat (g) | 0.58 | 56 | 7 |
| P/S ratio | 0.77 | 67 | 1 |
| Starch (g) | 0.52 | 52 | 8 |
| Total sugars (g) | 0.59 | 52 | 7 |
| Fibre (g) | 0.62 | 36 | 5 |
| Vitamin C (mg) | 0.53 | 46 | 11 |
| Alcohol (g) | 0.74 | 65 | 4 |

More generally, the author notes that FFQs do not represent the most suitable method for the estimation of absolute nutrient intakes, and the utility of FFQs in epidemiological studies seeking to ascertain diet-disease relationships has been questioned (236–238). Indeed, in a large prospective cohort study assessing the relationship between dietary fat intake and breast cancer risk, for example, researchers detected an increase in disease risk when saturated fat intake was assessed using a 7-day weighed food diary, but this association was not apparent when fat intake was assessed via FFQ (237). The absolute nutrient intakes reported in this research are therefore considered in the context that FFQs are a sub-optimal method of dietary assessment for such an estimation (Chapter 8; discussion).

However, when specifically considering the dietary patterns literature, FFQs have been found to produce similar dietary patterns to more detailed, shorter term food records, implying FFQs can successfully rank participants according to dietary intake and represent a valid study instrument for dietary patterns research (239–242). They have also been reported to reproduce the same patterns over time (239,240) thus inferring reliability. Resultantly FFQs represent a popular choice of study instrument among dietary patterns researchers (22–24,28,73,212).

The second part of the web-survey consisted of 30 questions that gathered information on socio-demographic and other food-related and lifestyle behaviours (Appendix A). Questions were developed from existing literature regarding factors associated with students' eating behaviours and studies investigating dietary patterns among other populations (22–24,33). Questions on dieting/weight loss behavior, supplement use, cooking ability, smoking status, physical activity levels, weight and height, ethnicity, degree programme and year of study, religion, term-time residence and socioeconomic status (SES) were included. Initially, SES was assessed using postcode data, however the majority of participants provided only the first three digits of their postcode, which meant that conversion to an index of deprivation was not possible. An additional question addressing SES (mother's level of education) was integrated into the survey for Phase 1b of data collection; these data are therefore not available for respondents attending the University of Sheffield. Information on university attended was gathered, and data from the Higher Education Statistics Agency indicates that student SES differs between participating sites; a notably higher proportion of students at the University of Ulster are from manual occupational backgrounds (Table 1; section 3.5.3). Data were also collected on where participants most often obtained their food; however, difficulties in retrieving this data from the web-survey meant it could not be included in any analyses. Participants were asked to list the two factors given most priority when deciding what to eat in a free text question: these responses were then grouped into 14 categories for quantitative analysis. A paper version of the full survey is provided in Appendix A.

### 3.5.2 Development and refinement of the web-survey: details of the pilot study

Prior to data collection, the web-survey was tested among a sample of University of Sheffield students. Any problems associated with completion of the questionnaire and understanding of questions could therefore be detected – and acted upon - before data collection began, thus optimising success of the main study. This pilot study was also designed to estimate a response rate that could be expected in the main study, and to assess if different dietary patterns might exist within a UK university student population, thus justifying use of a dietary patterns approach to analysis.

To address these objectives, 40 students at the University of Sheffield completed the web-survey and 11 of these participated in a follow-up focus group about the survey. Students were recruited via email to reflect the sampling procedure to be used in the main study. Snowball sampling was also employed to enhance sample size. Focus groups addressed: range of response options and any ambiguities encountered when answering questions; length of the survey; use of incentives; use of promotional web-page; habitually eaten foods that were missing from the FFQ; suitability of the FFQ for international students; and any other improvements that could be made to the survey (Appendix B).

The pilot study sample comprised predominantly female (n=26) and postgraduate (n=35) students, with mean age of 25 years. A total of 50% of students indicated that they were of White British ethnicity; the remaining 50% comprised a range of ethnicities. Mean BMI was 22.7 kg/m$^2$. Of the 11 focus group participants, four were male and seven were female. Focus group participants also embraced a range of ethnicities and stages of study.

The overall response rate was estimated at approximately 8% (excluding snowball respondents), comparable to a 5% response rate reported in an online survey assessing stress and body weight among UK undergraduate students (173). Response rate for participation in follow-up focus groups was 30% (comprising participants recruited via both sampling methods). Research employing data-driven multivariate analytical techniques such as principal components analysis requires large sample sizes, calculated using the formula ‘$n \geq 50 + 8m$’, where m represents the number of dietary variables entered into the analysis (243). In line with the dietary patterns literature the number of dietary input variables in the main study was 55 (22,24,28,74), and a minimum sample size of 426 students would therefore be required. In excess of 24,000 students attended the University of Sheffield in 2012 (244) and a response rate of 8% would thus have achieved a sufficiently large sample (n = 1920 students) from this single university. However, it was decided that a multi-centre study would ensure target sample size was achieved, as well as increase the diversity of students sampled, enhancing external validity.

Approximately half of all students completing the survey indicated that it was too long; a 20-25 minute completion time was envisaged, which is longer than most online surveys that students are asked to complete. This is noteworthy, since longer surveys may compromise both response and retention rates (245). Efforts to reduce completion time, however, were restricted by the necessity to incorporate the full FFQ into the survey to optimise validity of dietary intake data obtained. Such efforts were therefore limited to the exclusion of questions within the second part of the web-survey, which had to be balanced against the desire to obtain sufficient non-dietary data to interpret the dietary patterns obtained. After consideration, the survey was kept in its current form, and participants were provided with clearer information on completion time in the main study. The author acknowledges that the length of the survey may have contributed towards a selection bias, such that students more interested in diet and health may have been more likely to participate. The employment of a participation incentive sought to reduce this potential bias.

The pilot study also revealed that a number of foods habitually eaten by participants were missing from the questionnaire. These foods were various and straddled a range of food groups, although many were vegetarian and vegan in nature. A vegetarian dietary pattern has been reported among other populations (22,24,73) and the vegetarian food items that were reported as missing by more than one participant (tofu; hummus) were therefore integrated into the questionnaire. In addition, due to the possible gaps in food intake identified in the FFQ, an open question was inserted at the end of the survey to ensure total diet was captured in the main study: participants were asked to provide details of any other foods that were eaten on average more than three times per week during the most recent university semester. This enabled identification of participants in the main survey for whom the FFQ was unable to sufficiently capture average food intake, and thus who required potential exclusion from the study (see section 3.5.5).

During focus groups, issues encountered by students whilst completing the web-survey were discussed and ways in which the survey could be improved - to both enhance response rate and data validity - were addressed. Briefly, there was some confusion over the meaning of the FFQ response options and need to complete the questionnaire in terms of average food intake. A study webpage was therefore created detailing the study instructions, which could be referred to at any time during completion of the survey (https://sites.google.com/a/sheffield.ac.uk/student-diets/). Concerns were also raised about the applicability of the FFQ to international students: non-EU students commented that many of the foods comprising a substantial proportion of their habitual dietary intake were not included in the survey. Although the FFQ employed in this study (DIETQ, Tinuviel Software Ltd, Warrington, UK) has been relatively validated against 7-day weighed diet records among British adults (228,234), whether it remains valid for non-British individuals temporarily residing in the UK is unknown. It is possible that the dietary data provided by international students might not provide an accurate representation of their habitual dietary intake, thus compromising data validity. It was therefore decided that only Home/EU students would be recruited for the main study. Furthermore, the current project sets out to explore how university life impacts upon dietary behaviour, and inclusion of international students who also have to embrace a new food culture upon arrival at university would therefore confound this focus. Notably, cultural differences in food intake did not appear to represent an issue for EU students when completing the questionnaire.

Finally, PCA of the dietary data from this pilot study revealed seven major dietary components within the dataset. Importantly, this provided evidence to suggest that university students are not a homogenous group in terms of dietary intake and eating habits, justifying a patterns approach in the main study.

### 3.5.3 Selection of universities involved in the study

Five universities from across the UK participated in the main study: Sheffield, Ulster, KCL, Southampton and St Andrews. A multi-centre study was designed to increase the number and diversity of participants, and thus enhance external validity of findings. The final universities selected for participation represent those that responded positively to an invitation to participate in the study. Invitation was initially conducted through Human Nutrition departments at each of these universities; academic staff in these departments then facilitated data collection. Some major demographic details of the student bodies comprising these participating universities are provided in Table 1. The nature of student accommodation offered for first year students in all these universities is predominantly self-catered apartments.

**Table 2: Details of participating universities: number, gender split and social class of students in 2014/15 academic year** (246–251)

| | University of Sheffield | University of Ulster | KCL | University of Southampton | University of St. Andrews |
|---|---|---|---|---|---|
| **Number of Home/EU undergraduates** | 14,087 | 19,783 | 14,371 | 12,621 | 5285 |
| **Number of Home/EU postgraduates** | 6037 | 5259 | 9188 | 5939 | 2772 |
| **Gender split of students** | 49% female 51% male | 54% female 46% male | 63% female 37% male | 52% female 48% male | 59% female 41% male |
| **Full-time first degree entrants from manual backgrounds** | 22.6% | 49.4% | 24.2% | 22.1% | Data not available |

### 3.5.4 Sampling and participant recruitment

All Home and EU students at the five participating universities represented eligible participants. A recruitment email inviting students to participate in a web-survey which investigated university students' food intake and eating habits was sent out to all students; this email outlined the details of the study and inclusion criteria for participation and emphasised that students did not have to be eating a healthy diet to participate (Appendix C). A reminder email was sent out between one and two weeks following the initial email to enhance response rate. Each university's unique protocol for the recruitment of student participants to research studies was followed and coordinated by a named academic within the Human Nutrition department. Student representatives within each academic faculty coordinated data collection at the University of Southampton; however issues of coordination involved with this approach meant that only students in the Faculty of Health Sciences were recruited. All participants were required to recall their average food intake during the most recent university semester only; this time period was chosen in order to optimise recall accuracy. Timing of data collection meant that students at three universities (Sheffield, Ulster and KCL) were required to recall their food intake during the autumn semester, whilst students at the Universities of Southampton and St Andrews recalled their food intake during the spring semester.

Participants who provided their contact details were entered into one of two prize draws, each of the same amount (20 x £50) (245,252): one prize draw was for participants at the University of Sheffield only, and the other was for participants at the four universities outside of Sheffield. The use of two prize draws reflected separate data collection times between the participating universities.

### 3.5.5 Data processing

Prior to analysis the dataset was cleaned for duplicate, non-genuine and unsuitable responders (Figure 3). Participants reporting that they were pregnant or breast-feeding at the time of the survey were excluded, since it was assumed this would have impacted upon usual food intake. Participants reporting implausible energy intakes were additionally excluded: the cut-offs for implausible energy intakes in the Nurses' Health Study (NHS) and Healthcare Professionals' Follow-up Study (HPFS) were used in the current study. Thus, men reporting energy intakes <800 Kcal/day or >4200 Kcal/day and women reporting energy intakes <500 Kcal/day and >3500 Kcal/day were excluded from the analysis (209). Using this method, 24 participants were identified as over-reporters (8 males; 16 females) and three participants were identified as under-reporters (1 male; 2 females). A recent study by Rhee and colleagues (253) comparing methods for excluding implausible energy intake reporters indicates that the use of the more complex Goldberg and predicted total energy expenditure (pTEE) methods to identify over- and under- energy reporters does not confer a major advantage over the use of the much simpler exclusion method employed in the NHS and HPFS in detecting diet-BMI relationships or classifying individuals on the basis of dietary intake. The 'gold standard' method involving total body water to identify over- and under-reporters of energy intake is unsuitable for large studies (254). Participants over 30 years of age were additionally excluded from the dataset, since this research was interested in the dietary intake and eating habits of young adults.

One of the final questions in the FFQ asked students to report any foods that they consumed on average at least three times per week during the most recent semester, that weren't listed within the questionnaire. This question was included to identify participants for whom the FFQ did not sufficiently capture usual food intake and who therefore may have been inappropriate for inclusion in the final dataset. Tables D1, 2 & 3 (Appendix D) provide a list of all the foods provided by participants in response to this question. Many of the foods listed, including most fruits and vegetables that were reported, were addressed by the FFQ, albeit indirectly within a general food group (Table D1). For example, parma ham was not listed specifically in the FFQ, however the FFQ included the food group 'ham/gammon', within which parma ham is incorporated. It is therefore possible that participants were unable to generalise consumption of specific food items into broader food groups employed in the FFQ. It is also possible that students misinterpreted, or indeed misread, the question: many foods that students listed, such as pasta, chicken and rice, were clearly listed in the FFQ (Table D2). The author therefore questions whether students reported any foods consumed >3 times per week in response to this question, rather than only foods that were not listed in the survey. In either case, however, it is unknown whether students included or excluded consumption of these foods in their FFQ responses.

In addition, several other foods that students reported were not addressed by the FFQ (Table D3). Many of these foods were reported by only one or two students (for example polenta and low calorie cooking spray), but a small number of other foods were reported by a more notable number of students (n=24 maximum); for example dried fruit, peanut butter, quinoa and cereal bars. Since students reported to consume these food items regularly (on average >3 times each week), the absence of these food items within the FFQ reduces the accuracy of food intake data obtained, ultimately threatening the validity of nutrient intakes and dietary patterns. The author considered incorporating these foods into the food intake data of participants to optimise data validity but this was not logistically feasible and several assumptions about the data (e.g. portion size; frequency of consumption) would have been necessary. Furthermore, the greatest percentage of participants reporting any one of these missing foods was small (< 2%) and any resulting impact on data validity would therefore be negligible. Resultantly, no students were excluded on the basis of missing foods reported.

**Figure 3: Cleaning of the Phase 1 dataset – target list diagram showing the number of participants excluded along with reasons for exclusion.**

1683 completed surveys received

7 identified as duplicate responders

6 identified as non-genuine responders

23 failed to meet inclusion criteria (e.g. international student)

16 failed to provide sufficient identifying data (e.g. no data on university attended)

14 students reported to be pregnant or breastfeeding at the time of the survey

27 students identified as implausible energy intake reporters

142 students >30 years of age at time of survey

**Final sample size = 1448**

### 3.5.6 Identification of outliers and assessment of pattern robustness

The data-driven nature of PCA means that the FFQ responses of one participant impacts upon the component scores of another. It was therefore important to ensure that the components retained for further analysis and interpretation were robust to such influences. Guided by the procedure outlined by Crozier *et al.* (28), a series of tests for assessing robustness were conducted to determine whether inclusion of outliers in the final dataset was appropriate.

First, participants reporting frequency of consumption of one or more of the 55 food groups greater than six standard deviations from the sample mean were identified as outliers (n=119). PCA was then performed on the dataset including these outliers (n=1448) and with outliers removed (n=1329), and the resulting component matrices were compared. The same first four dietary patterns were identified in both component matrices, although the order of the first three patterns differed.

Second, PCA was performed on a randomly selected 50% of the complete dataset (n=713) and the component matrices generated were compared to those obtained from the full dataset (n=1448). The same first four dietary patterns were again identified in both component matrices and patterns were generated in the same order. Pearson's correlation was then employed to compare component scores between the two matrices. This produced a correlation of 0.967 for component one, 0.892 for component two, 0.843 for component three and 0.982 for component four, confirming pattern robustness.

Thus, examination of the component matrices generated from these analyses revealed few major differences in composition of the first four components extracted when outliers were included in the dataset, thereby indicating pattern robustness. The final dataset taken forward for all further analyses was therefore that of 55 food groups with outliers included (n=1448).

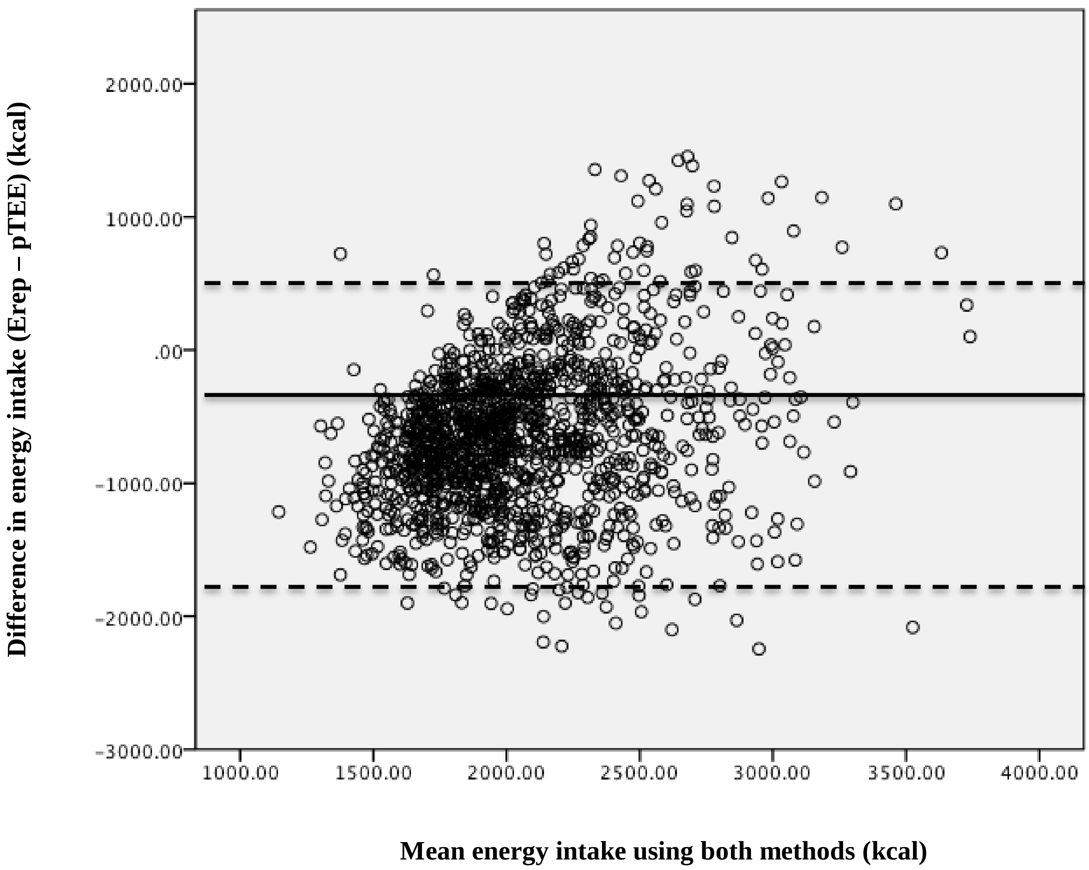
### 3.5.7 Estimating the extent of misreporting of energy intake in the final sample

To assess the extent of misreporting of energy intake in the final sample, predicted total energy expenditure (pTEE) was calculated for each subject. Predicted values were then compared to reported energy intake (Erep) as measured by the FFQ.

pTEE was calculated using the following equation: pTEE = BMR * PAL (255). The Henry equation (Appendix E) based on both height and weight was employed to calculate basal metablic rate (BMR), in line with that employed by SACN for the most recent estimation of UK population energy requirements (255,256). Occupational physical activity was assumed constant and at a population average level for the entire sample and self-reported level of leisure-time physical activity by the current sample (not very active; moderately active; very active) was therefore used to select the value for Physical Activity Level (PAL) entered into the pTEE equation. In line with SACN (255), the following PALs were employed: for 'not very active', a PAL value of 1.49 was used; for 'moderately active' a PAL value of 1.63 was used; and for 'very active' a PAL of 1.78 was used.

The extent of agreement between the two measurements (Erep and pTEE) was assessed using a Bland-Altman plot (235,257) (Figure 4). In this assessment, the predicted value is used as the theoretical value and therefore as the 'gold standard'. However, it should be noted that neither the predicted nor the measured value in this plot is completely accurate. Bland-Altman analysis indicated that energy intakes measured by the FFQ were generally lower than predicted energy requirements (difference in energy intake between the two methods was below 0 in most cases, and mean difference was also negative). In addition, the difference in energy intake between the two methods seems to increase with increasing energy intakes/requirements. The plot also reveals that subjects both over- and under- reported energy intake using the FFQ relative to predicted energy requirements. The limit of agreement – that is the mean (i.e. bias) +/- 2SD - was large.

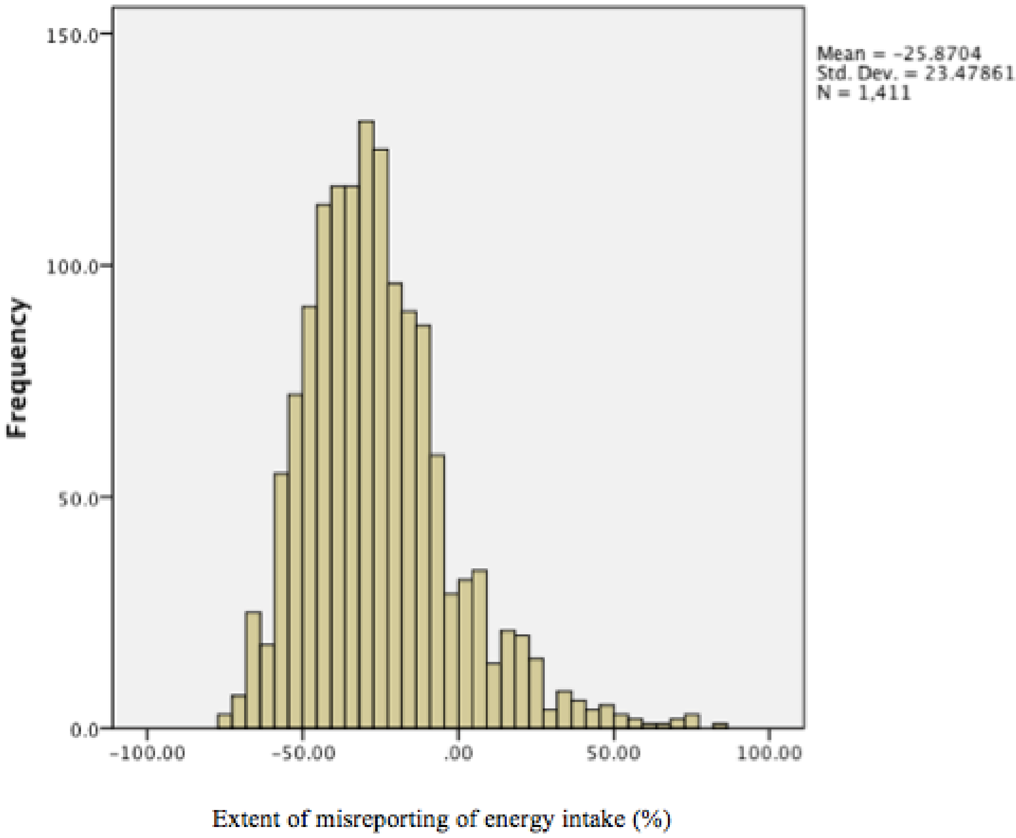
Figure 4: Bland-Altman Plot: Assessment of agreement between reported energy intake and predicted energy expenditure




This figure displays the difference between energy intake measured by the FFQ and predicted energy requirement using BMR & PAL calculations, plotted against the mean energy intake from the two methods. Mean difference (solid line) = -644 kcal; Limits of agreement (minus or plus 2 standard deviations) (dashed lines) = -1810 kcal and +518 kcal.

The extent of misreporting for each subject has also been calculated and presented as a percentage using the following equation: [(Erep – pTEE)/pTEE] * 100. A summary of the extent of misreporting by the sample using this method is presented in the histogram below (Figure 5). Negative values indicate under-reporting of energy intake, whilst positive values indicate over-reporting of energy intake relative to pTEE.

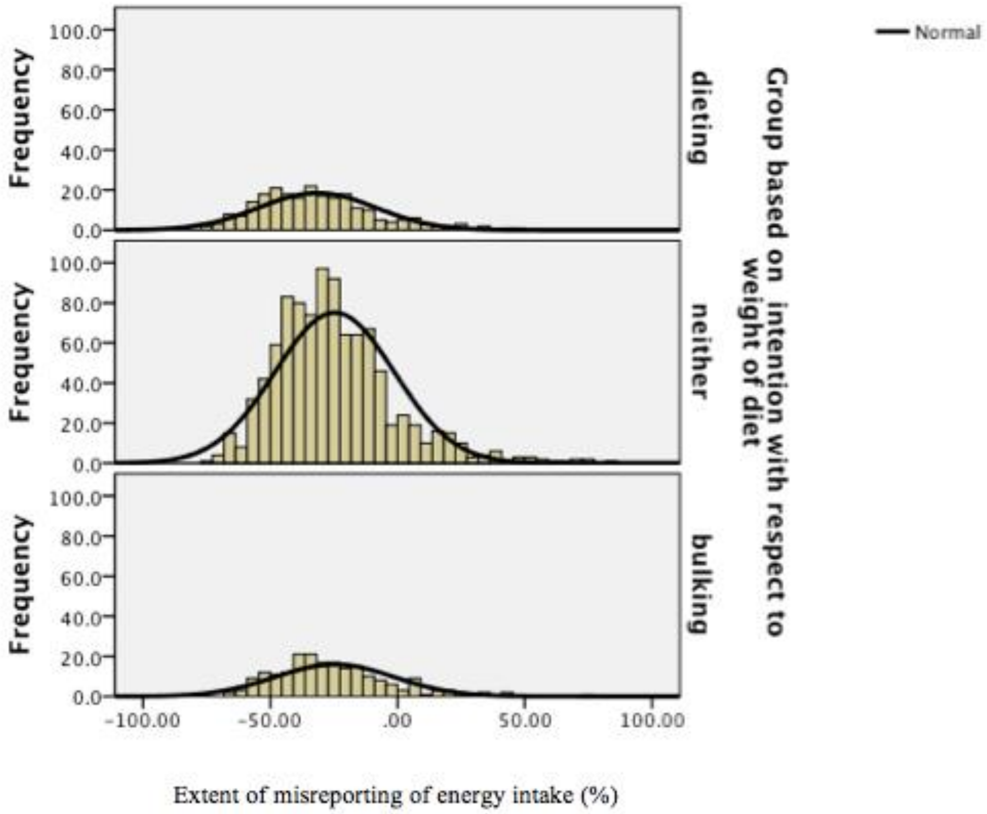
Figure 5: Histogram showing the range of misreporting of energy intake measured by the FFQ relative to predicted energy requirements as a percentage




On average, students underreported their energy intake by 26% compared to predicted energy requirements (SD 23%). Median misreporting of energy intake was 29%. However there was a large range in the degree of misreporting, from -76% (under-reporting) to +82% (over-reporting).

Since an individual's dieting status (and therefore whether an individual is in energy balance) may affect the degree of agreement between reported energy intake and pTEE, a one-way ANOVA was employed to examine differences in the degree of misreporting according to dieting status (dieting to lose weight; dieting to gain muscle mass; not dieting). This revealed a significantly greater degree of under-reporting of energy intake by 7% by students identifying themselves as dieting to lose weight at the time of the survey, compared to students identifying themselves as trying to gain muscle mass or not dieting in any way at the time of the survey (Figure 6 & Appendix F).

Figure 6: Histograms showing the distribution of misreporting of energy intake according to dieting status.




*Results from one-way ANOVA: $p < 0.001$; $F = 8.463$; $df = 2$*

### 3.5.8 Data analysis

The Statistical Package for the Social Sciences (SPSS) Version 20 was used for all statistical analyses.

#### *3.5.8.1 Assessment of nutrient adequacy*

Mean energy and nutrient intakes for male and female students were calculated separately to evaluate gender-specific nutrient adequacy. The range of nutrients assessed reflects those assessed in the most recent National Diet and Nutrition

Survey (NDNS) (17).

One-sample t-tests were employed to compare mean nutrient intakes to Dietary Reference Values (DRVs). Where applicable, the percentage of students with intakes of nutrients below the Lower Reference Nutrient Intake (LRNI) was calculated to further evaluate nutrient adequacy (17). The LRNI represents a level of intake sufficient to meet the needs of only 2.5% of the population and thus it is likely that participants with intakes below this level are not meeting nutrient requirements.

The most recently updated DRVs were used in all cases (66,76,255,258,259). Where applicable, Reference Nutrient Intakes (RNIs) were employed as the reference value; in the cases of energy and all forms of carbohydrate, the Estimated Average Requirement (EAR) and population average intakes were employed respectively. For sodium, mean intakes were also compared to the maximum recommended intake (2400mg day$^{-1}$), and the proportion of the sample exceeding this level of intake was calculated. Where applicable, intakes of all nutrients were expressed as a percentage of energy intake including alcohol.

#### *3.5.8.2 Assessment of nutrient adequacy following adjustment for misreporting of energy intake*

Since under-reporting of energy intake may adversely affect findings regarding nutrient adequacy of the sample, intakes of key nutrients were adjusted for misreporting of energy intake. Key nutrients are those identified as inadequate in the original assessment of nutrient adequacy (section 3.5.8.1); that is, nutrients for which mean intakes were significantly below RNI values, or for which >10% of subjects reported intakes below the LRNI.

In order to calculate adjusted nutrient intakes, the extent of underreporting of energy intake by dieters was first reduced by 7% (see section 3.5.7; Appendix F). Then, assuming energy intake is perfectly correlated to nutrient intake (which, it should be noted, is not necessarily the case), the following equation was used to calculate adjusted nutrient intakes:

For subjects under-reporting energy intake:

Adjusted nutrient intake = Original nutrient intake * (Y + 1)

For subjects over-reporting energy intake:

Adjusted nutrient intake = Original nutrient intake / (Y + 1)

where Y represents the degree of misreporting of energy intake (as a decimal and positive value) (see section 3.5.7). Estimation of nutrient adequacy was then calculated as described above. Only intakes of nutrients identified as inadequate in the original analysis were adjusted for misreporting of energy intake and re-assessed for adequacy.

#### *3.5.8.3 Generation of dietary patterns: Principal Components Analysis*

Nutrient and food group intakes were generated directly from FFQ data using the questionnaire and nutritional analysis software QBuilder (Tinuviel Software, Warrington, UK). The original 111 foods and food groups listed in the FFQ were condensed into 55 broader foods/food groups according to comparable usage and nutrient content, and in line with food groups employed in the published dietary patterns literature (22,24,28,74). For example, bacon, ham/gammon, canned meat, sausages and meat pie/pasties were grouped into 'processed meat'. A full list of the 55 foods/food groups is provided in Table 3 below. All frequencies of consumption were coded as follows: every day = 7; 6 days per week = 6; 5 days per week = 5; 4 days per week = 4; 3 days per week = 3; 2 days per week = 2; once per week = 1; once every 2-3 weeks (F) = 0.5; rarely/never (R) = 0. Where multiple foods/food groups were combined (in order to produce the final 55 food groups for analysis) and frequency of consumption exceeded 7, frequency of consumption was taken to mean 'occasions' rather than 'days' per week. For instance, if a participant reported consuming processed meat 11 'days' per week, this was interpreted as 11 'occasions' per week. Where absolute quantities of consumption were given (e.g. number of eggs eaten per week; grams of cheese eaten per week), these were converted to absolute amount (i.e. number of items, or grams, which was then converted into number of portions) of each food consumed per day.

**Table 3: Detail of the constituent foods comprising the 55 foods/food groups entered into the PCA**

| Food groups entered into the PCA (n = 55) | Original food groups from the FFQ (n = 111) |
|---|---|
| **White bread** | White bread |
| **Non white bread** | Brown, 50/50 or wheatgerm bread<br>Wholemeal bread or chapatis |
| **Other bread** | Other bread (e.g. rolls, teacakes, crumpets, etc) |
| **Crispbread (etc.)** | Crispbread, ryvita or cream crackers |
| **Jam, marmalade & honey (i.e. on toast)** | Jam, marmalade or honey on bread |
| **Oat/bran based breakfast cereal** | Bran flakes or sultana bran<br>Porridge or ready brek<br>All bran |
| **Other breakfast cereal** | Cornflakes<br>Sugar-or chocolate coated cereal (e.g. frosties, coco pops etc)<br>Rice krispies or Special K<br>Muesli, fruit & fibre or Cheerios<br>Weetabix, wheatflakes or shredded wheat |
| **Wheat bran** | Wheat bran |
| **Red meat & offal** | Beef (roast, steak, stewed, burgers, lasagne, bolognese, chilli, curry)<br>Lamb (roast, chops, stews, curry)<br>Pork (roast, chops, stewed, sweet & sour)<br>Liver, kidney, heart |
| **Chicken & other poultry** | Chicken/other poultry (roast, casserole, curry, sweet & sour) |
| **Processed meat (including meat pies & sausage rolls etc.)** | Bacon<br>Ham or gammon (including consumption in composite dishes)<br>Canned meat (e.g. corned beef), pate or meat spread<br>Sausages<br>Meat pie, pastie, sausage roll, samosa - shop bought<br>Meat pie, pastie, sausage roll, samosa - homemade |
| **White fish & shell fish** | White fish (cod, haddock, plaice, fish fingers, fish cakes)<br>Shellfish (e.g. prawns) |
| **Fatty fish & canned tuna** | Kipper, herring, mackerel, trout (including canned)<br>Pilchards, sardines, salmon (including canned)<br>Tuna (including canned) |
| **Potatoes (boiled, roast, mashed, jackets)** | Boiled or mashed potatoes<br>Jacket potatoes<br>Roast potatoes |
| **Chips** | Shop bought chips, oven chips, hash browns<br>Home-cooked chips |
| **Peas** | Peas |

| | |
|---|---|
| **Other green vegetables, onions, salad or tomatoes** | Other green vegetables, salad or tomatoes<br>Onions (raw, cooked, pickled) |
| **Root vegetables & sweetcorn** | Carrots<br>Parsnips, swedes, turnips or sweetcorn |
| **Baked beans** | Baked beans |
| **Pulses, beans (non-baked) & lentils** | Butter beans, broad beans or red kidney beans<br>Lentils, chick peas or dahl |
| **Pasta & rice** | Spaghetti, other pasta, noodles<br>Rice |
| **Quiche** | Quiche |
| **Pizza** | Pizza |
| **Meat alternatives** | Vegetarian burgers/sausages<br>Dishes made with TVP (soya mince) or Quorn |
| **Tofu** | Tofu |
| **Hummus** | Hummus |
| **Biscuits, cakes & sweet pastries** | Digestive biscuits/plain biscuits<br>Other sweet biscuits<br>Fruit cake/sponge cake/sponge pudding - shop bought<br>Fruit cake/sponge cake/sponge pudding - homemade<br>Fruit tart, jam tart, doughnut, danish pastry - shop bought<br>Fruit tart, jam tart, doughnut, danish pastry - homemade |
| **Confectionery** | Chocolate (e.g. Galaxy, Mars Bar, Twix, Kit Kat)<br>Sweets (e.g. fruit gums, pastilles, mints) |
| **Crisps & savoury snacks** | Crisps/savoury snacks (e.g. Quavers& tortilla chips) |
| **Nuts** | Nuts |
| **Milk- and cream-based desserts** | Ice cream, iced dessert, fool, mousse, trifle<br>Milk pudding (e.g. rice/tapioca/macaroni) |
| **Low fat / low calorie yogurts** | Low fat yogurt<br>Low calorie yogurt (e.g. Shape) |
| **Other yogurts** | Other yogurts / fromage frais |
| **Canned fruit** | Fruit canned in syrup<br>Fruit canned in juice |
| **Fresh fruit** | Apples<br>Pears<br>Oranges or grapefruit<br>Bananas<br>Other fruit (e.g. melon, strawberries, kiwi, grapes, peach/nectarine) |
| **Eggs** | Eggs |
| **Milk** | Milk |
| **Cream** | Cream |
| **Cheese** | Cheese (excluding cottage cheese)<br>Cottage cheese |
| **Butter** | Butter |
| **Low fat/olive/pufa spread** | Polyunsaturated margarine/spread<br>Olive oil spread<br>Very low fat spread (25% fat)<br>Low fat spread - other<br>Low fat spread - polyunsaturated |

| | |
|---|---|
| **Other spread** | Other soft margarine/spread (not olive)<br>Hard margarine |
| **Food that is fried** | Food that is fried (e.g. fish/onions/mushrooms/tomatoes/eggs) |
| **Tea & coffee** | Tea (non-herbal/non-green)<br>Coffee |
| **Herbal / green tea** | Herbal or green tea |
| **Added sugar (on cereal or toast)** | Honey or sugar on cereal<br>Sugar/honey in coffee/tea |
| **Fruit juice** | Fruit juice |
| **Fruit squash (not low calorie)** | Fruit squash (not low calorie) |
| **Fizzy drinks (not low calorie)** | Fizzy drinks (not low calorie) |
| **Low calorie squash & fizzy drinks** | Low calorie squash/fizzy drinks |
| **Water** | Water |
| **Alcoholic drinks** | Beer/larger/stout<br>Cider<br>Wine<br>Sherry/port/vermouth<br>Spirits/liqueurs |
| **Soups** | Vegetable-based soups<br>Cream of' soups |
| **Sauces (ready-made)** | Sauces (e.g. curry, sweet & sour) |
| **Mayonnaise, salad cream & other dressings** | Mayonnaise<br>Salad cream<br>Other dressings (e.g. French/thousand island/blue cheese) |
| *Not included as a food group/part of a food group for entry into the PCA* | Bread eaten dry<br>Fat on meat |

Principal components analysis (PCA) was employed to generate dietary components (patterns) from these food group intake data. The 55 food group variables were entered into a PCA and a varimax (orthogonal) rotation was performed to enhance interpretability of factors. The number of components retained was determined by the scree plot, parallel analysis and component interpretability (21,74,260,261). Use of the correlation matrix for PCA meant that standardisation of food group data was not required.

Foods with factor loadings of at least 0.32 were considered to be strongly associated with the component and most informative in interpreting that dietary pattern (262). A label was then assigned to each dietary pattern; this is not a perfect description of the pattern, but aids the reporting and discussion of findings. Further, as far as possible, the labels assigned to the dietary patterns in the current study are congruent with existing literature to enhance contextualisation of findings within the wider body of dietary patterns studies and aid between-study comparison and discussion.

In order to provide greater insight into absolute differeces in intake of food groups according to dietary pattern scores, students were ranked into quintiles based on their scores for each dietary component. Mean intakes of the 55 food groups across quintiles of the distribution in food intake for each dietary pattern were then calculated. One-way ANOVAs were then conducted to further examine differences in food intake between quintiles.

#### *3.5.8.4 Associations between dietary patterns and nutrient intakes*

To assess the nutritional importance of the dietary patterns obtained, dietary pattern scores were handled as continuous variables and a two-stage analysis was performed. First, Pearson's product moment correlation coefficients were calculated between pattern scores and absolute nutrient intakes. Second, partial correlation coefficients were calculated, which adjusted the first correlation for the effect of energy intake. Thus the latter calculation represents the correlation between dietary pattern scores and relative nutrient intakes. Correlation coefficients $\geq 0.5$ and $\leq -0.5$ were considered strong, whilst coefficients between 0.3 and 0.5, and -0.3 and -0.5 were considered moderate in strength; coefficients $> -0.3$ and $< 0.3$ were considered weak (263). Examination of scatter plots revealed no evidence of non-linear relationships between component scores and nutrient intakes and no further tests of association beyond correlation were therefore conducted.

#### *3.5.8.5 Associations between dietary patterns and non-nutrient variables*

To investigate the factors underpinning the four dietary patterns obtained, a series of independent t-tests and ANOVAs were initially performed to calculate associations between responses on non-nutrient variables and dietary pattern scores. A series of General Linear Models (GLMs) were then conducted to handle the large number of variables investigated. The ANOVA approach was employed for multi-variable modeling since ANOVA works with categorical variables, whilst regression analysis focuses on scalar variables. Maternal education was not included in the models: this item was not part of the survey for students at the University of Sheffield. Religion was also not included in GLMs: this was significantly associated with ethnic background (Appendix F).

Variables were categorised into five groups for entry into a GLM: 1) demographic variables: gender, age, leisure-time physical activity, BMI, smoking, ethnicity, year of study, term-time accommodation, university attended, and full-time/part-time status 2) cooking- and eating-related variables: cooking ability, animal food consumption, frequency of consumption of meals prepared using raw ingredients, frequency of consumption of meals using pre-prepared foods, frequency of consumption of ready-meals and take-aways, frequency of consumption of meals from university cafeteria, frequency of skipping breakfast, frequency of skipping lunch, and amount spent on food 3) satisfaction with eating and dieting behaviour: how student feels about his/her body, dieting status, bulking-up status, and contentment with food intake 4) dietary supplement use: multivitamin supplements, individual mineral supplements, individual vitamin supplements, protein shakes, other fitness supplements, and other dietary supplements; 5) drivers of food choice: cost, taste/preferences, health/nutritional value, dieting value/calorie content, vegetarianism/veganism, quality/freshness, ease of cooking/convenience, time available, ethical reasons, shelf-life of food, hunger/cravings, shelf-life of food, availability of food, and other factors. All variables were categorical data.

For each component a GLM was initially run with demographic variables only. Following this, four further GLMs were run, which included the significant demographic variables alongside the variables within each of the remaining four groups. Demographic variables with borderline significance were also taken forward into further models. Groups 2-5 were not considered together in a single model due to potential confounding between variables.

Finally, some models lacked fit. It was not possible to test every factor that may explain an individual's dietary pattern score, and thus it is likely that uninvestigated factors also underpin food choices among this population. Given the naturalistic setting of the current study, models that lacked fit have not been deemed unacceptable and are still reported.

## 3.6 Phase 2: Qualitative interviews with students at the University of Sheffield

### 3.6.1 Introduction

The second, qualitative, phase of data collection addressed the fourth research objective in this project, aiming to obtain an in-depth insight into the food choices and dietary practices of students at university. There were four specific research questions: first, what are the factors that drive students' food choices at university; second, how does the transition to university impact upon eating practices; third, how, if at all, do dietary practices change throughout students' university careers; and fourth, how do students' home food environments impact upon eating habits at university.

The outcomes of the quantitative study phase outlined above informed the sampling and data collection procedures of this qualitative study. Due to practical reasons concerning both timing and location, sampling and data collection of this qualitative study was informed only by the outcomes of Phase 1a (quantitative data collection at the University of Sheffield). Data collection at the other four participating sites was not completed for a further 12 months, which would have allowed insufficient time for qualitative data collection at these universities.

PCA was performed on frequency of food intake data of 575 University of Sheffield students and the resulting eight patterns, which informed sampling, are described below. The full PCA output with factor loadings are provided in Appendix G. Eight patterns informed sampling to ensure a sufficiently large sample size was achieved. The first four components retained from the PCA of the final, multi-centre, quantitative sample (n=1448) are congruent with those retained from the University of Sheffield dataset employed in this qualitative study.

The University of Sheffield is a Russell Group university located in South Yorkshire and has a student population of over 27,000 (248). On average, students require A-Level grades of AAA – ABB to achieve a place. Its campus is distributed throughout the city and it comprises five academic faculties (Medicine, Dentistry & Health; Arts & Humanities; Social Sciences; Science; Engineering; International Faculty). Fewer than one in four students are from manual backgrounds (246). Of particular note in the context of this study is that there are 18 university-run catering outlets across the campus, as well as two bars, a pub and a convenience store. First year students are accommodated mainly in two university-owned student 'villages', providing predominantly self-catered accommodation. The smaller number of catered students are provided with a £50 weekly food allowance; this is intended to cover the cost of two meals daily, which can be spent in any of the catering outlets on campus.

### 3.6.2 Methodological quality

Throughout this qualitative phase, appropriate attention was given to methodological quality to demonstrate trustworthiness of the findings presented. Guba's (264) criteria for assessing methodological quality in qualitative enquiry were followed, and strategies to promote credibility, transferability, dependability and confirmability were adopted throughout (264,265).

Credibility refers to the extent to which the current findings represent reality (265). Credibility has been specifically demonstrated in the current research through engagement in frequent meetings with the supervisory team to discuss analysis, use of probing questions throughout interviews to address any ambiguities in participants' responses, researcher reflexivity, and examination of findings in relation to existing literature (264,265). To encourage honest responses to questions asked, participants were assured that there were no right or wrong answers throughout the interview and that the food diaries brought to the qualitative interview would be used solely to stimulate discussion (see section 3.6.5); the author additionally sought to establish rapport with participants at the start of the interview through the use of introductory questions. Frequent discussions with the supervisory team ensured analysis remained firmly grounded within the data and any potentially important areas missed by the author were highlighted and discussed. A reflexive approach to data collection and analysis adopted by the author has particularly acknowledged the ways in which the author’s position as nutritionist and student have impacted upon the research process (section 3.6.8).

In order to meet Guba’s (264) criteria for transferability, full details of participants, the university from which they were sampled and the data collection procedure have been provided. Purposive sampling meant that the individuals selected for participation in this qualitative study were arguably representative of the overall undergraduate student population based on the quantitative phase. The reader is fully informed of the study’s contextual factors and subsequent boundaries and can thereby make an informed decision regarding the transferability of the current findings to comparable settings (264). Dependability and confirmability have been demonstrated by providing a clear and detailed ‘audit trail’ of the research process, as well as acknowledgement of the impact of the author on both data collection and analysis (section 3.6.8) (264–266). This ‘audit trail’ of participant selection, data collection and analysis is described below to provide the reader with a clear and detailed account of the process adopted to generate the final themes reported and discussed in this thesis (264–266).

### 3.6.3 Details of the eight dietary patterns retained from the PCA of University of Sheffield students’ food intake data

***1. Health-conscious***

- positive factor loadings (> 0.32) for fish, oat- and bran-based breakfast cereals, nuts, fresh fruit, other green vegetables and salad items, and herbal and green tea.
- negative factor loadings (< -0.32) for white bread, pizza, chips and other breakfast cereals.

***2. Vegetarian***

- positive factor loadings (> 0.32) for tofu, meat alternatives, pulses beans and lentils, hummus, nuts, and other green vegetables and salad items.
- negative factor loadings (< -0.32) for processed meat, and red meat and offal.

***3. Snacking***

- positive factor loadings (> 0.32) for biscuits, cakes & sweet pastries, milk- and cream-based desserts, confectionery, other yogurts, savoury snacks, fruit juice, canned fruit and pizza.

***4. Convenience, red meat & alcohol***

- positive factor loadings (> 0.32) for sauces, fried foods, pasta & rice, alcoholic drinks, chicken and poultry, mayonnaise salad cream and other dressings, fizzy drinks, red meat and offal, and savoury snacks.

***5. Budget cooking***

- positive factor loadings (> 0.32) for peas, root vegetables and sweetcorn, potatoes, baked beans and soups.

***6. Tea, coffee and spread***

- positive factor loadings (> 0.32) for tea and coffee, and other spread.

***7. Eggs and full fat dairy***

- positive factor loadings (> 0.32) for eggs, butter and milk.
- negative factor loadings (< -0.32) for low calorie squash and low-calorie yogurts.

***8. Bread, spread, jam and cheese***

- positive factor loadings (> 0.32) for low fat spread, non-white bread, jam marmalade and honey, and cheese.

Full details and factor loadings of these eight dietary patterns retained from the PCA of University of Sheffield student food intake data is provided in Appendix G.

### 3.6.4 Sampling of participants

The final qualitative sample was purposefully selected from those students who had participated in Phase 1a of this research, and involved a series of recruitment waves between May and August 2014. Only undergraduate students were selected for participation: it was assumed that postgraduate students would behave differently to undergraduate students in terms of their food intake, and whilst it was acknowledged that this could have provided an additional layer of insight to the enquiry it would have also diluted the richness of data obtained by interviewing only undergraduate students.

Students were purposefully sampled for participation using maximum variation sampling to ensure that students with a range of different eating patterns at university (not just 'healthy eaters') were interviewed. Sampling was also purposeful in terms of participant gender, ethnicity and year of study. This sampling strategy ensured that students with a range of different perspectives, experiences and characteristics known to impact upon dietary behaviour were included (266). Initially, a small (n=26) subset of undergraduate students was invited, via email, to take part in an interview about food choices and eating habits at university. All invited students had indicated that they were willing to be contacted regarding participation in follow-up research at the end of the web-survey. A second email was sent out approximately one week later to enhance response (Appendix H). This initial subset of students comprised those with dietary pattern scores in the top or bottom decile on at least three of the first five dietary patterns identified. It also reflected the demographics of the sample in terms of gender and ethnicity, and embraced students from the range of undergraduate years of study; each dietary pattern was represented by at least ten invited students. The first five components were selected at this stage because they represented the most interpretable and meaningful components.

Due to poor response from this first recruitment strategy, however - only four participants were recruited – two further waves of recruitment emails were sent out. The recruitment criteria were widened slightly with each wave to further enhance response. Recruitment wave two comprised students with at least two dietary pattern scores in the top or bottom deciles of the first five dietary patterns identified (n = 34), and six students were recruited using this strategy. Wave three comprised students with at least three dietary pattern scores in the top or bottom quintile of the first eight dietary patterns identified (n = 95). This wave yielded eight participants. In total, 18 female participants were recruited.

Since the above recruitment process gave rise to a female-only sample, a further recruitment email was then sent out to male students identified during the first three waves of recruitment (Appendix I). This yielded only two participants. Therefore, finally, all male students who provided their telephone number at the close of the web-survey (n=20) were contacted by telephone, irrespective of pattern scores. Five participants were recruited using this strategy. 25 interviews were conducted in total: 18 of these were with female students and seven were with male students.

The final sample was also influenced by the time of year at which the interviews were conducted. Interviews took place between May and August 2014, which meant that many undergraduate students were currently sitting exams or had already left the university for summer vacation. As a result, medical students - who work to a different academic calendar and were therefore still at university over the summer period - were over-represented among male students, whose interviews were conducted towards the end of the data collection period. Full details of study participants, along with dietary patterns scores, are provided in chapter six.

The total number of interviews conducted was determined pragmatically. A sample size of 25 was considered appropriate in fulfilling the purposive sampling categories and providing sufficient data to achieve the study aims, although there is a lack of consensus over any definite number in qualitative research (267). The use of theoretical saturation to determine sample size was considered, but due to the timing of data collection there was insufficient time to transcribe and perform preliminary data analysis between interviews; it was considered important to complete the interviews before the start of the new academic term so that any new eating behaviours that may have been adopted over the summer vacation period, or in the new academic year, would not interfere with participants' abilities to reflect on their eating habits at the time of the survey the previous year. Even though theoretical saturation was not used to inform the sampling number, subsequent analysis did indicate that saturation had occurred, with analysis of the later interviews revealing no new emergent themes.

### 3.6.5 Development of the interview schedule

The interview schedule was developed according to the research questions (Appendix J). All participants completed a one-day estimated food diary on the day prior to the interview, which they brought with them to the interview. Participants were required to note down everything they had consumed (food and drink), when, where and with whom they had consumed it, and to provide any other comments around their dietary choices made at that time if they wished. This food diary was employed to stimulate discussion around food choices at the start of the interview and to help participants convey their accounts about dietary practices at university (145,202). Participants were informed about the role of this diary and assured it would not be analysed nutritionally in an attempt to reduce deviation from usual eating practices during its completion.

Following a brief introduction by the author and questions to establish rapport, the main interview was divided into three sections. First, a series of questions were asked relating to the one-day food diary. Participants were asked to talk the author through his/her food diary, focusing on why those particular foods were eaten. Next, more focused questions further addressed the factors influencing students' food choices, both in terms of what the student had eaten yesterday (i.e. referring to the student's food diary) and more generally at university. The extant literature on factors influencing food choice, particularly among a university student population, informed the development of these questions (135,136,138–140,268). Some questions (e.g. those on vegetarianism; ethical food consumption; health as a driver of food choice) also reflected the composition of the dietary patterns identified in the University of Sheffield quantitative dataset. The second section of the interview focused on the food environment at home and how this compared to university. Students were specifically asked about how, if at all, they believed their eating habits at home had influenced their eating habits at university. The third section of the interview addressed the transition to university life, focusing on how and why students felt this transition impacted upon their current food choices and eating habits. Students were also asked to describe and explain any changes to their eating habits throughout their time at university to date. Finally, students were given the opportunity to talk about anything else they deemed relevant relating to their food choices and eating habits at university. The author piloted the interview schedule on a student who did not participate in the study prior to commencing data collection; this was conducted to ensure questions were clear and non-ambiguous, and that the interview was a suitable length. Beyond this schedule, interviews were respondent-driven and the author used probing questions throughout to ensure rich accounts of students' dietary experiences were obtained.

### 3.6.6 Data collection

The author conducted all interviews to ensure consistency in questions asked. Interviews were conducted in a private room in the University of Sheffield. All participants were provided with an electronic version of the participation information sheet prior to attending the interview and consent was obtained before the interview commenced (Appendix K & L). All interviews were recorded using an audio recorder for full transcription at a later date. The majority of interviews lasted around one hour; the shortest interview was 38 minutes and the longest was 93 minutes.

### 3.6.7 Data analysis

All interviews were transcribed verbatim by the author and one assistant, and analysed by the author. Participants were identified by participant number throughout and where necessary, data was decontextualised to ensure anonymity. Interviews were analysed thematically and thus no single theoretical lens underpinned analysis. Regular meetings were held with the author's supervisory team to discuss data analysis and ensure that analysis remained firmly grounded in the data. Analysis was an iterative process, conducted in six major stages (225):

i. Data familiarisation: the author read through each transcript fully before any coding began, familiarising herself with the content of the whole dataset. Brief notes regarding possible meanings and patterns within the data item were made after reading each interview.
ii. Generation of initial codes: the author thoroughly coded each interview. Initial codes represented aspects of the data that the author deemed meaningful in answering the research questions. As many potential themes as possible were coded and if appropriate, a single extract of data was coded multiple times. All interviews were thoroughly re-read following initial coding to ensure that codes were

consistent across interviews and no relevant data had been missed. A coding scheme comprising the code, its definition and any other comments regarding the code was created.

iii. Generation of themes: codes were then grouped together into potential sub-themes and themes. An initial thematic map was created and interconnections between sub-themes and themes were identified. This was a recursive step and codes were moved around until themes made most sense. Codes that did not appear to fit into main themes were temporarily grouped into a 'miscellaneous' category; no codes were discarded at this stage.

iv. Review of themes: data extracts within each potential theme were then reviewed to ensure themes were coherent and represented the meanings within the dataset. This step was repeated until the author was satisfied that the final thematic map accurately reflected the meanings within the whole dataset. Any remaining codes that still did not fit into these final themes were discarded.

v. Final defining and naming of themes: themes were defined and named by determining the aspect of data that each theme captured. Steps III & IV were returned to if themes were too complex to be coherently defined; these themes were then re-reviewed and further refined. Several intermediary thematic maps were generated before the final map was produced (Appendix M).

vi. Writing the report: the final step involved producing the analytic narrative. Data extracts are embedded within the written report to highlight the point being made.

### 3.6.8 Researcher reflexivity

To further enhance methodological quality and credibility of the qualitative findings presented in this thesis, a reflective journal was kept during data collection to facilitate researcher reflexivity and acknowledge the impact of the author on data collection and analysis (264–266,269). Journal notes predominantly included the author's thoughts on how the interview went, general thoughts on the interview content and how this was similar or different to previous interviews, and reflections on what the author could have done better (for example, missed opportunities for further probing and therefore deeper insight). The author specifically sought to build on the latter reflections during subsequent interviews.

Moreover, the author reflects on her position as a trained nutritionist and the impact that this may have had on the data collected. Purposeful sampling ensured that students with a range of eating patterns at university were recruited, and participants were assured at the start of interviews that this study was interested in students adopting a range of dietary habits at university and would involve no judgment or evaluation of eating patterns. The position of researcher as nutritionist enabled deep probing into areas of dietary interest that may not have been possible if the researcher had not possessed such knowledge. However, the author also acknowledges that participants may have been reticent to describe poor eating behaviours because of her background.

The author also acknowledges her current position as a student and previous experiences of both undergraduate and postgraduate study, which may or may not be comparable to the experiences of students participating in this research. Whilst such a position may have aided the establishment of rapport with participants and thus the generation of rich and honest data, she acknowledges that her own experiences of university life and factors influencing her dietary choices during this time may have influenced the probing questions asked during interviews, as well as shaping how she read and coded transcripts during data analysis. Indeed, the author was aware of making comparisons of interview data to her personal experiences during both coding of transcripts and theme generation. The author therefore sought to reduce the impact of this bias on both data collection and analysis. Brief reflective notes made following each interview included thoughts on how the interview content related to her preconceptions on the topic and subsequent reflections on what she could have done better; the latter were acted upon during subsequent interviews. In addition, regular meetings and discussion with the author’s supervisory team were held during data analysis: these meetings ensured the author remained open to data that was outside of her personal experiences and preconceptions, and ensured that analysis remained firmly grounded within the data. One member of the supervisory team also read a small number of coded transcripts to ensure that this was the case.

## 3.7 Phase 3: Survey among university student members of a national weight loss programme

This third phase of the project addressed the final research objective, thus aiming to identify eating behaviours associated with body weight gain at university. This was achieved by analysis of survey data on weight change and eating behaviours among university student members of a national weight loss programme (Slimming World, UK).

### 3.7.1 Overview of Slimming World, UK

Slimming World is the largest UK-based private weight loss organisation. Founded in 1969 in Derbyshire, there are now over 800,000 Slimming World members attending over 10,000 Slimming World groups at sites throughout the UK and Ireland (270). Approximately 95% of members are female (270). The organisation is open to adults of all ages who wish to lose weight and achieve a healthy body weight. To ensure members do not continue to lose weight beyond this point, Slimming World stops the membership of individuals who continue to lose weight below a healthy level. There are now additionally unique Slimming World memberships for pregnant women and young people aged 11-15 years.

Slimming World's weight loss programme is based upon three key elements: Food Optimising, Body Magic, and IMAGE (Individual Motivation And Group Experience) therapy. In Slimming World's Food Optimising diet plans, foods are not weighed, calorie-counted or measured, but instead divided into 'Free Foods', 'Healthy Extras' and 'Syns'. 'Free Foods' are those foods with low energy density and high satiating value and can therefore be eaten without limits (e.g. fruit and vegetables); 'Healthy Extras' are of slightly higher energy content but ensure a healthy balanced diet is achieved, such as milk and cheese; and finally 'Syns' are typically energy dense with low satiating value, such as alcohol, crisps and chocolate; the extent to which these foods are limited depend on the diet plan followed. 'Body Magic' represents the exercise element of Slimming World's weight loss programme, helping move members from a sedentary to an active lifestyle to further improve health and ensure long-term weight loss success.

Members work through four levels of ‘Body Magic’, from Bronze (10 minutes of activity on four or more days of the week), through to Gold (30 minutes of activity on at least 5 days of the week), and finally platinum when individuals reach ‘Lifelong Body Magic’ and maintain regular exercise habits. Finally, ‘IMAGE therapy’ is a weekly group support session lead by a Slimming World consultant, where members come together to offer each other weight loss support, advice, information and encouragement. Online membership packages are also available.

A recent audit of body weight change over a three-month period indicated that engagement in the Slimming World weight loss programme results in an average weight loss of 3.9 kg (equivalent to a 4.4% reduction in baseline body weight and a BMI change of -1.4 kg/m$^2$) (270). For members with high attendance at weekly group sessions (75% of all sessions over a 14-week period) weight loss is greater (-6.8 kg among high attenders vs. -2.3 kg for lower attenders) (270).

### 3.7.2 Development and content of the survey

A survey to examine eating behaviours of students at university prior to joining Slimming World was developed by the Nutrition and Research Team at Slimming World, UK. The survey collected the following information: gender; age; student status (current vs. former student); number of years at university; self-reported amount of weight gain at university; self-reported class of body weight prior to starting university (underweight – severely overweight); perceived reasons for weight gain; previous attempts at weight loss; perceived barriers to consuming a healthy diet at university; cooking ability; self-reported understanding of a healthy diet (non-existent – very good); frequency of consumption of fruits and vegetables, fast food/takeaways and convenience foods/ready meals; perceived healthfulness of food available on campus; alcohol consumption; effect of alcohol intake on food choices; ability to cook, shop and eat healthily on a student budget; factors influencing food choices at university; and physical activity levels at university. Participants were asked to answer all questions retrospectively, in relation to their behaviours at university before joining Slimming World. Response options (e.g. frequency of consumptions; categories of weight gain; factors influencing food choices) were provided for each question.

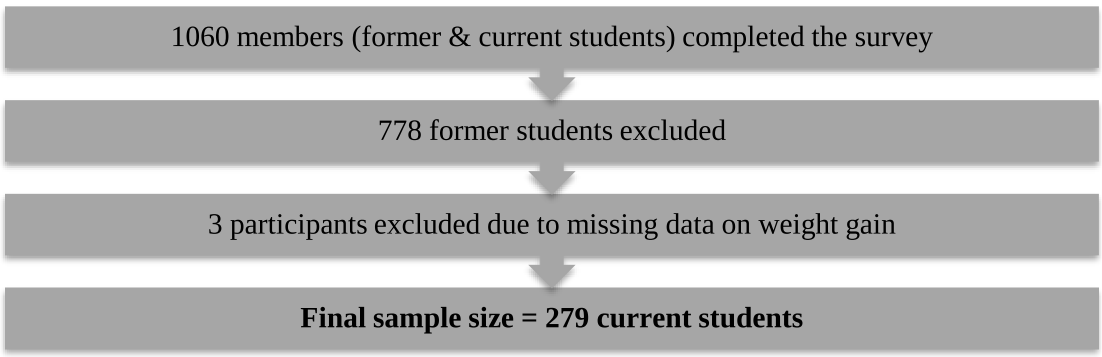
### 3.7.3 Participant recruitment

All members of Slimming World UK who were past or current university students were invited, via email, to complete the online survey during summer 2013. There were no incentives for participation.

### 3.7.4 Data processing

1060 members completed the survey. Former students were excluded from the analysis: it was assumed that these students would have reduced ability to accurately recall eating habits at university prior to joining the programme (n = 778). Three participants were excluded due to missing data on weight gain (Figure 4).

**Figure 7: Cleaning of the Phase 3 dataset - figure showing the number of participants excluded along with reasons for exclusion.**




### 3.7.5 Data analysis

Cross tabulations and chi-square tests for independence were employed to examine factors associated with weight gain at university. The Monte Carlo significance test was used for all analyses due to insufficient frequencies in some groups. Self-reported weight gain at university prior to joining Slimming World was grouped into five categories for analysis: 0 kg (i.e. students who reported that their weight remained stable whilst at university); <3.2 kg (<0.5 stones); 3.2-6.4 kg (0.5-1 stone); 6.4-12.7 kg (1-2 stones); >12.7 kg (>2 stones). No participant in the current study reported weight loss at university prior to joining Slimming World. Where category of weight gain was examined against perceived reasons for weight gain at university, weight stable students were excluded from the analysis.

## CHAPTER 4.
## RESULTS I: FOOD & NUTRIENT INTAKES AMONG UNIVERSITY STUDENTS IN THE UK

### 4.1 Introduction

This chapter presents findings on dietary adequacy among a university student population, addressing the first objective of this research project. Data were obtained during Phase 1 (multi-centre web-survey on dietary intake of university students). Socio-demographic and eating-related characteristics of the sample are first presented, followed by food and nutrient intake data.

### 4.2 Socio-demographic characteristics

A total of 1448 students were included in the final analyses (Figure 3). Of these, 1064 (73.5%) were female and 384 (26.5%) were male. The majority of students were of White British ethnicity (n=911; 62.9%) and registered for full-time study (n=1394; 96.3%). The mean age of the sample was 21.5 years; 60% of students were between 17 and 21 years. Nature of term-time residence was varied: most students (n=610; 42.1%) lived in private accommodation with other students/friends during the university semesters, whilst 340 (23.5%) students lived in university self-catered accommodation; only 58 students (4.0%) lived in university- catered accommodation. The majority of respondents were from the Universities of Sheffield (n=567; 39.2%), Ulster in Northern Ireland (n=443; 30.6%) and KCL (n=305; 21.1%). The remaining students were from the Universities of Southampton (n=79; 5.5%) and St Andrews, Scotland (n=54; 3.7%). Just over one-third of students were studying a health-related degree. The majority of students (n=1000; 69.1%) reported a healthy BMI (18.5 – 24.99 $kg/m^2$); mean BMI was 22.8 $kg.m^{-2}$. Table 2 below provides full socio-demographic details of the sample.

**Table 4: Socio-demographic characteristics of the Phase 1 sample (n=1448)**

| | | Number | Percentage (%)$^{\gamma}$ |
|---|---|---|---|
| **Gender** | Male | 384 | 26.5 |
| | Female | 1064 | 73.5 |
| **Age (years)** | 17-21 | 873 | 60.3 |
| | 22-25 | 412 | 28.5 |
| | 26-30 | 163 | 11.3 |
| **BMI (kg.m$^{-2}$)** | <18.5 | 112 | 7.7 |
| | 18.5-24.9 | 1000 | 69.1 |
| | 25-29.9 | 220 | 15.2 |
| | ≥30 | 76 | 5.2 |
| **Leisure-time physical activity** | Not very active | 473 | 32.7 |
| | Moderately active | 748 | 51.7 |
| | Very active | 227 | 15.7 |
| **University attended** | University of Sheffield | 567 | 39.2 |
| | University of Ulster | 443 | 30.6 |
| | KCL | 305 | 21.1 |
| | University of Southampton | 79 | 5.5 |
| | University of St Andrews | 54 | 3.7 |
| **Faculty of study** | Arts | 252 | 17.4 |
| | Social science | 285 | 19.7 |
| | Engineering | 109 | 7.5 |
| | Science | 212 | 14.6 |
| | Medicine and health | 521 | 36.0 |
| **Full or part time status** | Full time | 1394 | 96.3 |
| | Part time | 54 | 3.7 |
| **Year of study** | 1$^{st}$ year undergraduate | 489 | 33.8 |
| | 2$^{nd}$ year undergraduate | 301 | 20.8 |
| | 3$^{rd}$ year undergraduate | 264 | 18.2 |
| | 4$^{th}$ or higher year undergraduate | 136 | 9.4 |
| | Postgraduate | 245 | 16.9 |
| | Other | 13 | 0.9 |
| **Term-time residence** | University catered accommodation | 58 | 4.0 |
| | University self-catered accommodation | 340 | 23.5 |
| | Private accommodation with other friends/students | 610 | 42.1 |
| | Private accommodation on own | 63 | 4.4 |
| | With parents/relatives | 205 | 14.2 |
| | With partner | 107 | 7.4 |
| | With parents/partner & children | 48 | 3.3 |
| | With children only | 9 | 0.6 |
| | Other | 8 | 0.6 |
| **Ethnic background** | White British | 911 | 62.9 |
| | White Irish | 235 | 16.2 |
| | Other White ethnicity | 139 | 9.6 |
| | Mixed ethnicity | 45 | 3.1 |
| | Asian/Asian British | 69 | 4.8 |
| | Black/African/Caribbean/Black | 15 | 1.0 |
| | British | 16 | 1.1 |
| | Other | 18 | 1.2 |
| | Would rather not say | | |

| | | | |
|---|---|---|---|
| **Mother's level of education** | CSE | 80 | 5.5 |
| | Vocational | 59 | 4.1 |
| | O Level | 184 | 12.7 |
| | A Level | 96 | 6.6 |
| | Degree | 342 | 23.6 |
| | Would rather not say | 120 | 8.3 |
| | Not asked[Ψ] | 567 | 39.2 |
| **Smoking habits** | Never smoker | 1090 | 75.3 |
| | Ex-smoker | 72 | 5.0 |
| | Social smoker | 192 | 13.3 |
| | Regular smoker | 94 | 6.5 |

[γ] where percentages do not total 100% this is due to missing data

[Ψ] This question was not included in Phase 1A and therefore data are not available for University of Sheffield students

### 4.3 Eating behaviours and other eating-related characteristics

Table 3 below provides information on the eating habits of the sample. Just under two-thirds of students described themselves as regular meat eaters, whilst approximately 10% of students identified themselves as vegetarian. The majority (55%) of students reported the highest level of cooking ability, and 73% consumed self-cooked meals from raw ingredients 'every' or 'most' days. One in four students reported that they consumed meals cooked from pre-prepared foods, which could be assumed to represent convenience foods, at least most days. Approximately 30% of students reported that they skipped breakfast at least most days. Just under one quarter of students spent < £20 on food each week; a weekly food budget of £20-29 was most common. Almost one in five students spent > £40 on food each week. Very few (6.1%) students were 100% content with their food intake at university, although just less than one-third of students (29.1%) reported that they were 80% happy with their food intake; 12.3% were only 20% happy. Approximately one in five students were either dieting to lose weight or 'bulk up' at the time of the survey. Generally, use of dietary supplements by the sample was low; multivitamins were the most commonly consumed supplement (16.8% of students reported using these). A number of different factors were identified as major drivers of food choice at university. Of these, 'cost/value for money' was reported by approximately two-thirds of students. Other commonly reported factors included 'health/nutritional value' (28.0%), 'taste/preferences' (25.8%), 'ease of cooking/convenience' (16.8%), and 'dieting value/calorie content' (11.5%).

**Table 5: Eating behaviours and other eating-related characteristics of the Phase 1 sample**

| | | Number | Percentage (%)[γ] |
|---|---|---|---|
| **Consumption of animal foods** | Regular meat eater | 878 | 60.6 |
| | Occasional consumption of meat/poultry/fish | 421 | 29.1 |
| | Avoids all meat/poultry/fish but consumes eggs & dairy | 95 | 6.6 |
| | Avoids all meat/poultry/fish/eggs but consumes dairy | 28 | 1.9 |
| | Avoids all animal-derived products including honey (vegan) | 26 | 1.8 |
| **Cooking ability** | Wide range of meals from raw ingredients | 797 | 55 |
| | Limited range of meals from raw ingredients | 579 | 40 |
| | Can cook only using pre-prepared foods | 51 | 3.5 |
| | Unable to cook at all | 21 | 1.5 |
| **Consumption of self-cooked meals from raw ingredients** | Every day | 405 | 28 |
| | Most days | 650 | 44.9 |
| | Occasionally | 303 | 20.9 |
| | Rarely/never | 90 | 6.2 |
| **Consumption of self-cooked meals using pre-prepared foods** | Every day | 64 | 4.4 |
| | Most days | 313 | 21.6 |
| | Occasionally | 735 | 50.8 |
| | Rarely/never | 336 | 23.2 |
| **Consumption of ready-meals & take-aways** | Every day | 11 | 0.8 |
| | Most days | 121 | 8.4 |
| | Occasionally | 776 | 53.6 |
| | Rarely/never | 540 | 37.3 |
| **Consumption of meals at university cafeteria** | Every day | 34 | 2.3 |
| | Most days | 103 | 7.1 |
| | Occasionally | 386 | 26.7 |
| | Rarely/never | 925 | 63.9 |
| **Frequency of skipping breakfast** | Every day | 129 | 8.9 |
| | Most days | 291 | 20.1 |
| | Occasionally | 380 | 26.2 |
| | Rarely/never | 648 | 44.8 |
| **Frequency of skipping lunch/dinner** | Every day | 21 | 1.5 |
| | Most days | 104 | 7.2 |
| | Occasionally | 505 | 34.9 |
| | Rarely/never | 818 | 56.5 |
| **Money spent on food each week** | < £20 | 342 | 23.6 |
| | £20-29 | 524 | 36.2 |
| | £30-39 | 335 | 23.1 |
| | £40-49 | 146 | 10.1 |
| | ≥£50 | 101 | 7.0 |

| | | | |
|---|---|---|---|
| ***Satisfaction with eating and dieting behaviour*** | | | |
| **How student feels about his/her body** | Far too thin | 17 | 1.2 |
| | A little too thin | 117 | 8.1 |
| | Just right | 614 | 42.4 |
| | A little overweight | 623 | 43.0 |
| | Very overweight | 77 | 5.3 |
| **Currently dieting to lose weight** | Yes | 308 | 21.3 |
| | No | 1140 | 78.7 |
| **Currently dieting to bulk up/gain muscle mass** | Yes | 279 | 19.3 |
| | No | 1169 | 80.7 |
| **Contentment with food intake*** | 20% | 178 | 12.3 |
| | 40% | 335 | 23.1 |
| | 60% | 125 | 8.6 |
| | 80% | 421 | 29.1 |
| | 100% | 89 | 6.1 |
| ***Use of dietary supplements*** | | | |
| **Use of multivitamin supplements** | Yes | 243 | 16.8 |
| | No | 1205 | 83.2 |
| **Use of mineral supplements** | Yes | 63 | 4.4 |
| | No | 1385 | 95.6 |
| **Use of vitamin supplements** | Yes | 110 | 7.6 |
| | No | 1338 | 92.4 |
| **Use of protein shakes** | Yes | 82 | 5.7 |
| | No | 1366 | 94.3 |
| **Use of other fitness supplements** | Yes | 23 | 1.6 |
| | No | 1425 | 98.4 |
| **Use of other dietary supplements** | Yes | 39 | 2.7 |
| | No | 1409 | 97.3 |
| ***Major factors determining food choice*** | | | |
| **Cost/value for money** | Yes | 871 | 60.2 |
| | No | 577 | 39.8 |
| **Taste/preferences** | Yes | 374 | 25.8 |
| | No | 1074 | 74.2 |
| **Health/nutritional value** | Yes | 405 | 28.0 |
| | No | 1043 | 72.0 |
| **Dieting value/calorie content** | Yes | 167 | 11.5 |
| | No | 1281 | 88.4 |
| **Vegetarianism** | Yes | 22 | 1.6 |
| | No | 1426 | 98.4 |
| **Ethical reasons** | Yes | 20 | 1.5 |
| | No | 1428 | 98.5 |
| **Quality/freshness** | Yes | 98 | 6.8 |
| | No | 1350 | 93.2 |
| **Ease of cooking/convenience** | Yes | 243 | 16.8 |
| | No | 1205 | 83.2 |
| **Shelf-life of food** | Yes | 21 | 1.5 |
| | No | 1427 | 98.5 |
| **Hunger/cravings** | Yes | 32 | 2.2 |
| | No | 1416 | 97.8 |
| **Availability of food** | Yes | 45 | 3.1 |
| | No | 1403 | 96.9 |

| | | | |
|---|---|---|---|
| **Time available** | Yes | 41 | 2.8 |
| | No | 1407 | 97.2 |
| **Variety** | Yes | 24 | 1.7 |
| | No | 1424 | 98.3 |
| **Other** | Yes | 152 | 10.5 |
| | No | 1296 | 89.5 |

$^{\gamma}$ percentages which do not total 100% is due to missing data

### 4.4 Intakes of key food groups

Using FFQ data, mean consumption of fruit and vegetables, oily fish and red and processed meat – foods for which there are recommended levels of consumption - were calculated for both male and female students separately (Table 4). On average, male students consumed 2.9 portions of fruit and vegetables each day; consumption among female students was similar at 3.2 portions per day. This was significantly less than the recommended consumption of '5-a-day' for both genders ($p < 0.001$). A total of 85% of female students and 89% of males reported consuming fewer than five daily portions of fruit and vegetables over the most recent semester. Oily fish consumption was 1.6 and 1.3 servings per week for males and females respectively, which significantly exceeded recommendations (271) ($p < 0.001$). However, data on oily fish consumption among the current sample is likely to be an overestimation of actual consumption due to the inclusion of canned tuna within this food group in the FFQ. Finally, male students consumed 7.8 servings of red or processed meat each week, whilst females consumed 5.1 servings per week. Detailed information on portion size was not gathered for this food group however, and comparison to recommended intake - which is currently set at no more than seven 70g servings per week (272,273) - is therefore limited.

**Table 6: Mean intakes of fruit and vegetables, total and oily fish, and red and processed meat and comparison to recommended intakes, by gender**

| | | Males | | Females | |
|---|---|---|---|---|---|
| | Recommended intake | Mean consumption | *p*-value | Mean consumption | *p*-value |
| **Fruit & vegetables** (portions per day) | 5 | 2.9 | <0.001 | 3.2 | <0.001 |
| **Total fish** (portions per week) | 2 | 2.9 | <0.001 | 2.5 | <0.001 |
| **Oily fish** (portions per week) | 1 (140g) | 1.6 | <0.001 | 1.3 | <0.001 |
| **Red & processed meat** (servings per week) | 7 | 7.8 | 0.003 | 5.1 | <0.001 |

### 4.5 Nutrient adequacy I: comparison of nutrient intakes to Dietary Reference Values

Tables 5 and 6 provide details of mean nutrient intakes of male and female participants respectively, in relation to UK DRVs (66,238,240,241,257). Energy intake was significantly lower ($p < 0.001$) than the estimated average requirement for both males and females (based on the needs of the general population at median physical activity level, (255). Intakes of non-starch polysaccharides, potassium and selenium were also significantly lower than reference nutrient intakes (RNIs) for both males and females ($p < 0.001$). For females only, intakes of iron ($p < 0.001$) and copper ($p < 0.001$) were also significantly lower than RNIs. Intakes of all other micronutrients assessed were either significantly greater than, or not significantly different from, RNIs.

Intakes of non-milk extrinsic sugars (NMES) were significantly greater than the current 5% energy contribution recommended maximum intake of free sugars in both genders (258), but significantly lower than the previous recommended maximum intake for NMES (76), ($p < 0.001$). It should be noted that the current calculation for intake of NMES does not include sugars from fruit juice, and therefore intakes by the current sample are likely to be an underestimate of free sugars intake. Both male and female students also significantly exceeded the recommended population average intake of saturated fat as a contribution to energy intake ($p < 0.001$). When alcohol consumers were considered separately from the whole sample, both male and female consumers significantly exceeded the recommended 5% contribution of alcohol to energy intake ($p < 0.001$).

Average intake in terms of units of alcohol/week was significantly greater than the recently updated recommended 14 units (275) among male consumers only (20.8 units); 35% of men and 18% of women exceeded 14 units weekly. However, 541 students (37%) reported no consumption of alcohol, clearly meeting population targets. The contributions of total fat and total carbohydrates to energy intake were significantly, although not substantially, lower than the recommended population averages for both male and female students ($p < 0.001$). In contrast, protein intakes were significantly and substantially greater ($p < 0.001$) than the RNI for both sexes.

A notable proportion (>10%) of both male and female students failed to meet the Lower Reference Nutrient Intakes (LRNIs) for selenium (males 10.2%; females 24.2%), whilst 11.4% of females did not meet the LRNI for potassium, and 10.9% of male students failed to meet the LRNI for Vitamin A. Almost one in three female students (30.3%) failed to consume the LRNI for iron. Additionally, in excess of 85% of all students did not meet the new recommended population average intake of 30g of NSP per day (258). 21.1% of males and 8.8% of females exceeded the recommended maximum sodium intake of 2400mg/day (259), whilst over 80% of all students consumed in excess of 5% of their total energy intake from NMES. Finally, almost all students (97% of males; 98% of females) failed to meet the new recommended intake for Vitamin D of 10 μg/day.

**Table 7: Mean nutrient intakes of male students (n = 384) in relation to UK DRVs** (66,76,255,258,259,275)

| Nutrient | DRV | Mean intake | Mean difference from DRV | *p*-value | % of sample with intakes <LRNI $^{\gamma\ \Psi\ \Sigma\ \eta}$ |
|---|---|---|---|---|---|
| **Energy (MJ $day^{-1}$)** | 10.9 | 8.4 | -2.5 | <0.001 | N/A |
| **Energy (kcal $day^{-1}$)** | 2605 | 2003 | -602 | <0.001 | N/A |
| **Protein (g $day^{-1}$)** | 55.5 | 97.1 | 41.6 | <0.001 | N/A |
| **Total carbohydrate (% total energy)** | 50 | 46.5 | -3.5 | <0.001 | N/A |
| **NMES (% total energy)** | 5<br>10 | 8.6 | 3.6<br>-1.4 | <0.001<br><0.001 | $80.7^{\Psi}$<br>33.1 |
| **NSP (g $day^{-1}$)** | 30 | 21.4 | -8.6 | <0.001 | $86.5^{\gamma}$ |
| **Total fat (% total energy)** | 33 | 32.3 | -0.7 | 0.01 | $45.1^{\Psi}$ |
| **Saturated fat (% total energy)** | 10 | 12.3 | 2.3 | <0.001 | $80.0^{\Psi}$ |
| **Monounsaturated fat (% total energy)** | 13 | 11.5 | -1.5 | <0.001 | N/A |
| **Polyunsaturated fat (% total energy)** | 6.5 | 5.2 | -1.3 | <0.001 | N/A |
| **Alcohol $^{\omega}$ (% total energy)** | 5 | 7.4 | 2.4 | <0.001 | $40.1^{\Psi}$ |
| **Alcohol $^{\omega}$ (units/week)** | 14 | 20.8 | 7.8 | <0.001 | $35^{\Sigma}$ |
| **Vitamin A (µg $day^{-1}$)** | 700 | 903.7 | 203.7 | <0.001 | 10.9 |
| **Thiamin (mg $1000kcal^{-1}$)** | 0.4 | 0.8 | 0.4 | <0.001 | 0.0 |
| **Riboflavin (mg $day^{-1}$)** | 1.3 | 2.0 | 0.7 | <0.001 | 3.4 |
| **Niacin (mg $1000kcal^{-1}$)** | 6.6 | 11.2 | 4.6 | <0.001 | 0.0 |
| **Vitamin $B_6$ (µg g $protein^{-1}$)** | 15 | 24.3 | 9.3 | <0.001 | 0.0 |
| **Vitamin $B_{12}$ (µg $day^{-1}$)** | 1.5 | 7.5 | 6.0 | <0.001 | 1.6 |
| **Folate (µg $day^{-1}$)** | 200 | 279.7 | 79.7 | <0.001 | 0.5 |
| **Vitamin C (mg $day^{-1}$)** | 40 | 95.1 | 55.1 | <0.001 | 0.3 |
| **Vitamin D (µg $day^{-1}$)** | 10 | 3.4 | 6.6 | <0.001 | 96 |
| **Vitamin E (mg $day^{-1}$)** | 4 | 6.1 | 2.1 | <0.001 | N/A |
| **Iron (mg $day^{-1}$)** | 8.7 | 11.5 | 2.8 | <0.001 | 1.3 |
| **Calcium (mg $day^{-1}$)** | 700 | 972.8 | 272.8 | <0.001 | 3.1 |
| **Magnesium (mg $day^{-1}$)** | 300 | 306.6 | 6.6 | 0.184 | 8.9 |
| **Sodium (mg $day^{-1}$)** | 1600<br>2400 | 2538.7 | 938.7 | <0.001 | 8.9<br>$51.6^{\eta}$ |
| **Potassium (mg $day^{-1}$)** | 3500 | 3239.2 | -260.8 | <0.001 | 8.6 |
| **Zinc (mg $day^{-1}$)** | 9.5 | 11.7 | 2.2 | <0.001 | 2.3 |
| **Copper (mg $day^{-1}$)** | 1.2 | 1.2 | 0.0 | 0.057 | N/A |
| **Selenium (µg $day^{-1}$)** | 75 | 66.7 | -8.3 | <0.001 | 10.2 |
| **Iodine (µg $day^{-1}$)** | 140 | 201.1 | 61.1 | <0.001 | 4.2 |

$^{\gamma}$ no LRNI is set for NSP; this value therefore refers to the percentage of the sample not meeting the population average intake

$^{\Psi}$ these values refer to the percentage of the sample exceeding the population average intake

$^{\omega}$ the value reported for alcohol intake here is consumers only (n=269)

$^{\Sigma}$ this value refers to the percentage of students with alcohol intakes above 14 units/week

$^{\eta}$ this value refers to the percentage of students with sodium intakes above 2400mg

**Table 8: Mean nutrient intakes of female students (n = 1064) in relation to UK DRVs** (66,76,255,258,259,275)

| Nutrient | DRV | Mean intake | Mean difference from DRV | *p*-value | % of sample with intakes <LRNI $^{\gamma\ \Psi\ \Sigma\ \eta}$ |
|---|---|---|---|---|---|
| **Energy (MJ day$^{-1}$)** | 8.70 | 6.9 | -1.8 | <0.001 | N/A |
| **Energy (kcal day$^{-1}$)** | 2079 | 1642 | -437 | <0.001 | N/A |
| **Protein (g day$^{-1}$)** | 45.0 | 81.1 | 36.1 | <0.001 | N/A |
| **Total carbohydrate (% total energy)** | 50 | 49.0 | -1.0 | <0.001 | N/A |
| **NMES (% total energy)** | 5<br>10 | 8.6 | 3.6<br>-1.4 | <0.001<br><0.001 | 82.4 $^{\Psi}$<br>33.3 |
| **NSP (g day$^{-1}$)** | 30 | 20.5 | -9.5 | <0.001 | 89.6 $^{\gamma}$ |
| **Total fat (% total energy)** | 33 | 31.3 | -1.7 | <0.001 | 38.1 $^{\Psi}$ |
| **Saturated fat (% total energy)** | 10 | 12.0 | 2.0 | <0.001 | 75.2 $^{\Psi}$ |
| **Monounsaturated fat (% total energy)** | 13 | 10.8 | -2.2 | <0.001 | N/A |
| **Polyunsaturated fat (% total energy)** | 6.5 | 5.1 | -1.4 | <0.001 | N/A |
| **Alcohol $^{\omega}$ (% total energy)** | 5 | 6.2 | 1.2 | <0.001 | 24.7 $^{\Psi}$ |
| **Alcohol $^{\omega}$ (g/day)** | 14 | 13.2 | -0.80 | 0.208 | 18 $^{\Sigma}$ |
| **Vitamin A (µg day$^{-1}$)** | 600 | 796 | 196 | <0.001 | 7.2 |
| **Thiamin (mg 1000kcal$^{-1}$)** | 0.4 | 1.0 | 0.6 | <0.001 | 0.0 |
| **Riboflavin (mg day$^{-1}$)** | 1.1 | 1.8 | 0.7 | <0.001 | 4.1 |
| **Niacin (mg 1000kcal$^{-1}$)** | 6.6 | 11.3 | 4.7 | <0.001 | 0.3 |
| **Vitamin $B_6$ (µg g protein$^{-1}$)** | 15 | 23.2 | 8.2 | <0.001 | 0.0 |
| **Vitamin $B_{12}$ (µg day$^{-1}$)** | 1.5 | 6.1 | 4.6 | <0.001 | 3.0 |
| **Folate (µg day$^{-1}$)** | 200 | 249.1 | 49.0 | <0.001 | 1.1 |
| **Vitamin C (mg day$^{-1}$)** | 40 | 101.4 | 61.4 | <0.001 | 0.2 |
| **Vitamin D (µg day$^{-1}$)** | 10 | 2.7 | 7.3 | <0.001 | 98 |
| **Vitamin E (mg day$^{-1}$)** | 3.0 | 5.6 | 2.6 | <0.001 | N/A |
| **Iron (mg day$^{-1}$)** | 14.8 | 9.9 | -4.9 | <0.001 | 30.3 |
| **Calcium (mg day$^{-1}$)** | 700 | 886.3 | 186.3 | <0.001 | 4.3 |
| **Magnesium (mg day$^{-1}$)** | 270 | 266.1 | -3.9 | 0.102 | 4.2 |
| **Sodium (mg day$^{-1}$)** | 1600<br>2400 | 2187.5 | 587.5 | <0.001 | 0.0<br>15.9 $^{\eta}$ |
| **Potassium (mg day$^{-1}$)** | 3500 | 2894.4 | -605.5 | <0.001 | 11.4 |
| **Zinc (mg day$^{-1}$)** | 7.0 | 9.5 | 2.5 | <0.001 | 0.9 |
| **Copper (mg day$^{-1}$)** | 1.2 | 1.0 | -0.2 | <0.001 | N/A |
| **Selenium (µg day$^{-1}$)** | 60 | 54.3 | -5.7 | <0.001 | 24.2 |
| **Iodine (µg day$^{-1}$)** | 140 | 183.6 | 43.6 | <0.001 | 6.4 |

$^{\gamma}$ no LRNI is set for NSP; this value therefore refers to the percentage of the sample not meeting the population average intake

$^{\Psi}$ these values refer to the percentage of the sample exceeding the population average intake

$^{\omega}$ the value reported for alcohol intake here is consumers only (n=638)

$^{\Sigma}$ this value refers to the percentage of students with alcohol intakes above 14 units/week

$^{\eta}$ this value refers to the percentage of students with sodium intakes above 2400mg/day

## 4.6 Nutrient adequacy II: comparison of nutrient intakes to Dietary Reference Values following adjustment for misreporting of energy intake

Tables 9 and 10 below provide details of mean nutrient intakes of male and female participants respectively in relation to UK DRVs, following adjustment of nutrient intakes for misreporting of energy intake (see section 3.5.8.2 for details). The nutrients reported in the following tables represent only those identified as problematic in the original analysis above (i.e. nutrients for which mean intakes were significantly below RNI value, or for which >10% of subjects reported intakes below the LRNI, or for which >10% of subjects exceeded maximum recommended intakes in absolute intake terms). Note that sample sizes are slightly reduced compared to the original analyses above: this is due to missing height or weight values for a small number of participants, which precluded calculation of pTEE and adjusted nutrient intakes.

**Table 9: Mean nutrient intakes of male students (n=378) in relation to UK DRVs following adjustment for misreporting of energy intake**

| Nutrient | DRV | Mean intake | Mean difference from DRV | *p*-value | % of sample with intakes <LRNI $^{\gamma\,\eta}$ |
|---|---|---|---|---|---|
| **NSP (g day$^{-1}$)** | 30 | 26.6 | -3.4 | <0.001 | 69.6 $^{\gamma}$ |
| **Vitamin A (µg day$^{-1}$)** | 700 | 1126.5 | 426.5 | <0.001 | 5.8 |
| **Vitamin D (µg day$^{-1}$)** | 10 | 4.2 | -5.8 | <0.001 | 93.9 |
| **Sodium (mg day$^{-1}$)** | 1600<br>2400 | 3133.2 | 1533.2 | <0.001 | 82.3 $^{\eta}$ |
| **Selenium (µg day$^{-1}$)** | 75 | 83.3 | 8.3 | <0.001 | 1.6 |

$^{\gamma}$ no LRNI is set for NSP; this value therefore refers to the percentage of the sample not meeting the population average intake

$^{\eta}$ this value refers to the percentage of students with sodium intakes above 2400mg/day

**Table 10: Mean nutrient intakes of female students (n=1033) in relation to UK DRVs following adjustment for misreporting of energy intake**

| Nutrient | DRV | Mean intake | Mean difference from DRV | *p*-value | % of sample with intakes <LRNI [γ η] |
|---|---|---|---|---|---|
| **NSP ($g\ day^{-1}$)** | 30 | 24.8 | -5.2 | <0.001 | 74.5 |
| **Vitamin D ($\mu g\ day^{-1}$)** | 10 | 3.2 | -6.8 | <0.001 | 96.6 |
| **Iron ($mg\ day^{-1}$)** | 14.8 | 11.9 | -2.9 | <0.001 | 7.5 |
| **Sodium ($mg\ day^{-1}$)** | 1600<br>2400 | 2610.7 | 1010.7 | <0.001 | 59.9 [η] |
| **Potassium ($mg\ day^{-1}$)** | 3500 | 3471.7 | -28.3 | 0.197 | 1.7 |
| **Copper ($\mu g\ day^{-1}$)** | 1.2 | 1.2 | 0.0 | 0.266 | N/A |
| **Selenium ($\mu g\ day^{-1}$)** | 60 | 64.8 | 4.8 | <0.001 | 7.4 |

[γ] no LRNI is set for NSP; this value therefore refers to the percentage of the sample not meeting the population average intake
[η] this value refers to the percentage of students with sodium intakes above 2400mg/day

Following adjustment for misreporting of energy intake, mean intake of selenium by male students was no longer significantly below the RNI value. Fewer than 10% of male students also now had intakes of selenium or vitamin A below the LRNI value. Similarly, for female students, mean intakes of potassium, copper and selenium were no longer significantly lower than the RNI value and the proportion of students failing to meet the LRNI for these micronutrients was reduced to fewer than 10%. Mean intakes of iron by female students remained significantly below the RNI, but the proportion of students failing to meet the RNI for iron was reduced from approximately 30% (original reported intakes) to 7.5% (adjusted intakes).

In contrast, mean intakes of NSP and Vitamin D by both male and students remained significantly and substantially below DRVs ($p < 0.001$) following adjustment for misreporting of energy intake. Approximately 75% of students failed to meet the 30g/day recommended intake of NSP (258) and in excess of 90% of all students did not meet the recommended intake for Vitamin D of 10µg/day (66). Finally, following adjustment for misreporting of energy intake, the majority of all students (80% males; 60% females) now exceeded the recommended maximum sodium intake of 2400 mg/day.

# CHAPTER 5.
# RESULTS II: DIETARY PATTERNS AMONG UNIVERSITY STUDENTS IN THE UK

## 5.1 Introduction

This chapter presents results from the multivariate statistical analyses of dietary data from the same 1448 participants presented in Chapter 4. Therefore, the reader is referred back to sections 4.2 and 4.3 for the socio-demographic and eating-related characteristics of the sample. The findings presented here address the following two research objectives: to identify dietary patterns that exist within a UK university student population; and to identify socio-demographic, lifestyle and other food-related behaviour characteristics of students favouring these dietary patterns.

## 5.2 Dietary patterns: Results from the Principal Components Analysis

Food intake data of the 55 food groups (see section 3.5.8.3) from the 1448 students (males and females combined) were entered into the PCA. Guided by the scree plot (Figure 5), parallel analysis (Appendix N) and component interpretability, four principal components were retained, which explained 21.7% of the total variance in food intake. The first component explained 8.4% variance; the three remaining components explained 5.7%, 4.2% and 3.4% of the variance in food intake respectively. Table 7 shows the factor loadings of each of the food groups in the four dietary components retained. Food groups with factor loadings $\geq 0.10$ & $\leq -0.10$ are displayed; those $\geq 0.32$ are highlighted in bold and those $\leq -0.32$ are italicised.

**Figure 8: Scree plot from the PCA. The elbow of this scree plot informed the number of components retained.**

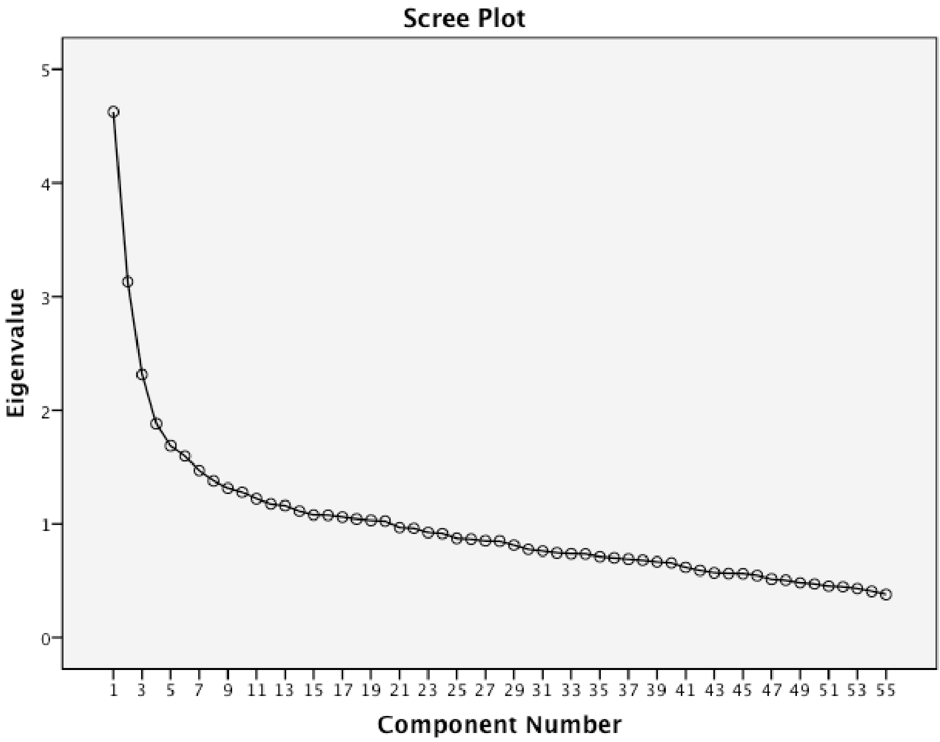


**Table 11: Factor loadings of the 55 food groups in the four principal components extracted from the PCA of frequency of food intake data of 1448 university students**

| Food group (% variance) | Vegetarian (8.4%) | Snacking (5.7%) | Health-conscious (4.2%) | Convenience, Red Meat & Alcohol (3.4%) |
|---|---|---|---|---|
| **Pulses, beans & lentils** | **0.642** | -0.113 | 0.216 | |
| **Tofu** | **0.627** | | | 0.105 |
| **Meat alternatives** | **0.586** | 0.126 | -0.109 | 0.121 |
| **Hummus** | **0.585** | | 0.147 | |
| **Chicken/poultry** | *-0.456* | | 0.106 | 0.277 |
| **Processed meat** | *-0.453* | 0.277 | | **0.354** |
| **Red meat & offal** | *-0.439* | 0.163 | 0.134 | **0.332** |
| **Biscuits, cakes & sweets** | | **0.623** | | -0.106 |
| **Milk & cream-based desserts** | | **0.531** | 0.160 | |
| **Confectionery** | -0.174 | **0.524** | | |
| **Crisps & savoury snacks** | | **0.413** | -0.170 | 0.253 |
| **White bread** | -0.141 | **0.393** | -0.209 | 0.214 |
| **Fruit juice** | | **0.354** | | |
| **Other bread** | 0.104 | **0.342** | | |
| **Canned fruit** | 0.101 | **0.320** | 0.100 | -0.124 |
| **Fruit squash (not low calorie)** | | 0.293 | -0.182 | |
| **Other yogurts** | | 0.276 | 0.216 | -0.105 |
| **Other spread** | | 0.251 | | |
| **Added sugar in tea, coffee & cereal** | | 0.239 | | 0.128 |
| **Quiche** | 0.201 | 0.218 | | 0.124 |

| | | | | |
|---|---|---|---|---|
| **Fatty fish & canned tuna** | -0.120 | | **0.616** | |
| **White fish & shell fish** | -0.157 | | **0.531** | |
| **Nuts** | **0.324** | | **0.491** | |
| **Eggs** | -0.151 | -0.120 | **0.477** | **0.350** |
| **Fresh fruit** | 0.174 | | **0.443** | -0.108 |
| **Other green vegetables, onions & salad items** | **0.369** | -0.258 | **0.376** | 0.127 |
| **Oat- & bran-based breakfast cereals** | | -0.172 | **0.372** | -0.170 |
| **Herbal & green tea** | 0.313 | -0.153 | **0.365** | |
| **Low fat & low-calorie yogurts** | | | **0.334** | -0.308 |
| **Tea & coffee** | | 0.122 | 0.251 | |
| **Fried food** | | | | **0.503** |
| **Pasta & rice** | 0.135 | | | **0.451** |
| **Ready-made sauces** | | | | **0.396** |
| **Pizza** | | **0.327** | -0.171 | **0.392** |
| **Chips** | -0.160 | 0.301 | -0.221 | **0.379** |
| **Alcoholic drinks** | | | | **0.328** |
| **Butter** | -0.166 | 0.137 | | 0.312 |
| **Mayonnaise, salad cream & other dressings** | -0.115 | 0.249 | 0.225 | 0.277 |
| **Cream** | | 0.128 | 0.198 | 0.209 |
| **Crispbread** | 0.144 | | 0.132 | -0.179 |
| **Peas** | | | 0.115 | |
| **Boiled, mashed, roast & jacket potatoes** | -0.211 | 0.261 | | 0.113 |

| | | | | |
|---|---|---|---|---|
| **Root vegetables & sweetcorn** | 0.237 | | 0.300 | |
| **Baked beans** | | 0.112 | | 0.112 |
| **Wheat bran** | | | 0.124 | -0.136 |
| **Low calorie squash & fizzy drinks** | | 0.115 | | |
| **Non-white bread** | | | | |
| **Low fat, olive & pufa spread** | | | -0.124 | |
| **Fizzy drinks (not low calorie)** | -0.180 | **0.332** | -0.204 | 0.282 |
| **Jam, marmalade & honey** | | 0.255 | | -0.125 |
| **Cheese** | 0.214 | 0.145 | | 0.218 |
| **Water** | | -0.253 | 0.292 | |
| **Milk** | -0.162 | 0.107 | 0.120 | 0.106 |
| **Other breakfast cereals** | -0.150 | 0.168 | -0.194 | |
| **Soups** | 0.209 | 0.125 | 0.215 | |

The first dietary component had high positive factor loadings (≥ 0.32) for pulses, beans and lentils, tofu, meat alternatives, hummus, nuts, and other green vegetables and salad items. It had high negative factor loadings for poultry, processed meat, and red meat and offal. This dietary pattern was labeled 'vegetarian', because there was a clear tendency towards consumption of non-meat protein sources and avoidance of all meat and fish products for individuals scoring highly on this pattern. The second dietary component had high positive factor loadings for biscuits, cakes and sweet pastries, milk- and cream-based desserts, confectionery, crisps and savoury snacks, fruit juice, other bread, pizza and fizzy drinks. This component was labeled 'snacking', because it was mainly characterised by snack-type foods that generally don't represent components of main meals, require no preparation and offer many options for mobile consumption. The third component had high positive factor loadings for fatty fish and canned tuna, white- and shellfish, nuts, eggs, fresh fruit, other green vegetables and salad items, oat- and bran-based breakfast cereals, herbal and green tea, and low fat/low calorie yogurts. This dietary pattern was labeled 'health-conscious', because it was characterised by foods typically associated with improved health, and it is congruent with dietary components labeled 'health-conscious' or 'prudent' in previous studies (22,28,73). Finally, the fourth component was labeled 'convenience, red meat & alcohol', because it had high factor loadings for red meat and savoury foods requiring little or no preparation, and it was the only component to load on alcoholic drinks. There were high factor loadings for fried food, pasta and rice, ready-made sauces, pizza, chips, alcoholic drinks, processed meat, red meat and offal, and eggs; there was a strong negative factor loading for low fat/low calorie yogurts.

### 5.3 Intakes of food groups across quintiles of the distribution in dietary pattern scores

Tables 12A-D below display intakes of selected food groups across quintiles of dietary pattern scores. For each pattern, only foods with factor loadings ≥ 0.32 and ≤ -0.32 are displayed, since these are the foods most strongly associated with the component and most informative in interpreting that dietary pattern (262). Details of intakes across quintiles of pattern scores for the complete 55 food groups for each dietary pattern is provided in Appendix O.

For each dietary pattern there is a clear gradient in frequency (or quantity) of consumption across quintiles of pattern score for these selected foods. For example, students in the highest quintile of the 'vegetarian' dietary pattern reported consuming meat alternatives on average 3.5 days of the week; students in the bottom quintile of this pattern did not consume these foods on any day. There was also a clear gradient in the frequency of meat consumption across quintiles of vegetarian pattern scores: students in the top quintile consumed chicken, red meat and processed meat on two or fewer days each week, compared to their counterparts with scores in the bottom fifth who consumed these foods on at least five days each week. Students with scores in the top quintile for the 'snacking' pattern consumed 'biscuits, cakes and sweet pastries' and 'confectionery' on every or six days of the week respectively; their bottom-quintile counterparts reported consuming these foods on approximately only one day of the week. There was a particularly clear gradient in fresh fruit consumption across quintiles of ‘health-conscious’ dietary pattern score: students in the lowest quintile reported consuming approximately three portions of fruit each week; this is in contrast to students in the top quintile of pattern scores who reported consuming 12 portions each week. In terms of the ‘convenience, red meat and alcohol’ component, students in the bottom quintile of scores on this dietary pattern reported consuming less than half a glass (or measure) of alcohol each day, in contrast to two daily glasses (or measures) by students in the top quintile of scores. Students with scores in the highest quintile of this pattern also consumed red meat/offal and processed meat on more than four days each week, compared to their lowest quintile counterparts who reported consuming these foods on fewer than two days each week.

**Tables 12A-D: Frequency of intakes of selected food groups across quintiles of distribution in dietary pattern scores.**

**Table 12A: Frequency of intakes of selected food groups across quintiles of distribution in dietary pattern scores - Pattern 1: 'Vegetarian'**

| | Percentile group of Component 1 – 'Vegetarian' dietary pattern | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Food/food group** | **Quintile 1** | | **Quintile 2** | | **Quintile 3** | | **Quintile 4** | | **Quintile 5** | | |
| | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | ***p* value** |
| **Pulses/beans/lentils (days/week)** | 0.33 | 0.68 | 0.43 | 0.78 | 0.81 | 1.13 | 1.48 | 1.71 | 3.68 | 3.24 | **<0.001** |
| **Tofu (days/week)** | 0.00 | 0.04 | 0.02 | 0.10 | 0.01 | 0.08 | 0.06 | 0.23 | 0.65 | 1.23 | **<0.001** |
| **Meat alternatives (days/week)** | 0.08 | 0.31 | 0.23 | 0.81 | 0.26 | 0.78 | 0.91 | 2.03 | 3.59 | 3.71 | **<0.001** |
| **Hummus (days/week)** | 0.06 | 0.24 | 0.13 | 0.35 | 0.26 | 0.53 | 0.64 | 1.04 | 1.86 | 2.02 | **<0.001** |
| **Chicken/poultry (days/week)** | 4.17 | 1.96 | 3.20 | 1.73 | 2.73 | 1.62 | 2.34 | 1.84 | 1.34 | 2.03 | **<0.001** |
| **Red meat & offal (days/week)** | 5.05 | 3.66 | 3.45 | 2.36 | 2.65 | 2.17 | 2.11 | 1.97 | 1.11 | 1.93 | **<0.001** |
| **Processed meat (days/week)** | 5.19 | 3.71 | 3.63 | 3.07 | 2.76 | 2.14 | 2.27 | 2.09 | 1.03 | 1.85 | **<0.001** |
| **Nuts (days/week)** | 0.77 | 1.33 | 0.79 | 1.33 | 0.97 | 1.55 | 1.46 | 1.95 | 2.29 | 2.42 | **<0.001** |
| **Other green veg/salad /tomatoes/onion (days/week)** | 5.16 | 3.69 | 5.86 | 3.26 | 6.89 | 3.46 | 7.63 | 3.40 | 9.34 | 3.45 | **<0.001** |

**Table 12B: Frequency of intakes of selected food groups across quintiles of distribution in dietary pattern scores - Pattern 2: 'Snacking'**

| | Percentile group of Component 2 – 'Snacking' dietary pattern | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Food/food group** | **Quintile 1** | | **Quintile 2** | | **Quintile 3** | | **Quintile 4** | | **Quintile 5** | | |
| | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | ***p* value** |
| **White bread (slices/day)** | **0.17** | 0.36 | **0.44** | 0.66 | **0.60** | 0.79 | **0.76** | 0.87 | **1.09** | 8.00 | **<0.001** |
| **Other bread (slices or pieces/day)** | **0.05** | 0.11 | **0.14** | 0.23 | **0.17** | 0.26 | **0.24** | 0.31 | **0.40** | 5.14 | **<0.001** |
| **Pizza (days/week)** | **0.34** | 0.42 | **0.67** | 0.83 | **0.70** | 0.61 | **0.87** | 0.88 | **1.12** | 6.00 | **<0.001** |
| **Biscuits, cakes & sweet pastries (days/week)** | **1.22** | 1.65 | **1.94** | 2.00 | **3.37** | 2.82 | **4.11** | 2.95 | **7.17** | 34.00 | **<0.001** |
| **Confectionery (days/week)** | **1.51** | 1.73 | **2.59** | 2.19 | **3.36** | 2.36 | **4.09** | 2.82 | **5.93** | 14.00 | **<0.001** |
| **Crisps/savoury snacks (days/week)** | **0.86** | 1.22 | **1.48** | 1.60 | **2.02** | 1.97 | **2.29** | 1.92 | **3.17** | 7.00 | **<0.001** |
| **Nuts (days/week)** | **1.64** | 2.25 | **1.00** | 1.59 | **1.14** | 1.78 | **1.15** | 1.73 | **1.35** | 7.00 | **<0.001** |
| **Milk- & cream-based desserts (days/week)** | **0.27** | 0.44 | **0.45** | 0.60 | **0.64** | 0.78 | **0.90** | 0.99 | **1.86** | 9.00 | **<0.001** |
| **Canned fruit (days/week)** | **0.11** | 0.35 | **0.23** | 0.89 | **0.25** | 0.66 | **0.34** | 0.93 | **0.87** | 13.00 | **<0.001** |
| **Fizzy drinks (not low calorie) (days/week)** | **0** | 1 | **1** | 2 | **1** | 2 | **1** | 2 | **2** | 7 | **<0.001** |

**Table 12C: Frequency of intakes of selected food groups across quintiles of distribution in dietary pattern scores - Pattern 3: 'Health-conscious'**

| | Percentile group of Component 3 – 'Health-conscious' dietary pattern | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Food/food group** | **Quintile 1** | | **Quintile 2** | | **Quintile 3** | | **Quintile 4** | | **Quintile 5** | | |
| | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | ***p* value** |
| **Oat/bran-based breakfast cereal (portions/week)** | **0.38** | 1.16 | **0.96** | 1.78 | **1.48** | 2.22 | **2.13** | 2.64 | **2.89** | 2.90 | **<0.001** |
| **White fish & shell fish (days/week)** | **0.46** | 0.62 | **0.82** | 0.95 | **1.01** | 1.01 | **1.54** | 1.31 | **2.27** | 1.76 | **<0.001** |
| **Fatty fish & canned tuna (days/week)** | **0.33** | 0.64 | **0.79** | 1.06 | **1.07** | 1.08 | **1.71** | 1.42 | **3.04** | 2.69 | **<0.001** |
| **Other green veg/salad /tomatoes/onion (days/week)** | **4.99** | 3.72 | **5.91** | 3.53 | **7.32** | 3.54 | **7.56** | 3.27 | **9.11** | 3.25 | **<0.001** |
| **Nuts (days/week)** | **0.37** | 0.78 | **0.65** | 1.09 | **0.93** | 1.37 | **1.48** | 1.89 | **2.84** | 2.48 | **<0.001** |
| **Low fat/low calorie yogurts (days/week)** | **1.02** | 2.14 | **1.55** | 2.57 | **1.94** | 2.63 | **2.75** | 3.22 | **4.09** | 3.85 | **<0.001** |
| **Fresh fruit (portions/ week)** | **3.28** | 3.80 | **4.51** | 4.99 | **6.50** | 6.14 | **8.95** | 7.30 | **12.22** | 9.75 | **<0.001** |
| **Eggs (number/day)** | **0.18** | 0.27 | **0.26** | 0.28 | **0.41** | 0.42 | **0.46** | 0.43 | **0.80** | 0.68 | **<0.001** |
| **Herbal/green tea (cups/day** | **0.15** | 0.44 | **0.37** | 0.79 | **0.68** | 1.26 | **0.83** | 1.25 | **1.52** | 1.85 | **<0.001** |

**Table 12D: Frequency of intakes of selected food groups across quintiles of distribution in dietary pattern scores - Pattern 4: 'Convenience, Red Meat & Alcohol'**

| | Percentile group of Component 4 – 'Convenience, red meat & alcohol' dietary pattern | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Food/food group** | **Quintile 1** | | **Quintile 2** | | **Quintile 3** | | **Quintile 4** | | **Quintile 5** | | |
| | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | ***p* value** |
| **Red meat & offal (days/week)** | **1.91** | 2.29 | **2.35** | 2.22 | **2.78** | 2.33 | **2.82** | 2.45 | **4.53** | 3.82 | **<0.001** |
| **Processed meat (days/week)** | **1.88** | 2.14 | **2.28** | 2.21 | **2.84** | 2.43 | **3.02** | 2.74 | **4.86** | 4.13 | **<0.001** |
| **Chips (days/week)** | **0.79** | 1.11 | **1.09** | 1.42 | **1.24** | 1.41 | **1.68** | 1.68 | **2.52** | 2.51 | **<0.001** |
| **Pasta & rice (days/week)** | **2.93** | 1.94 | **3.83** | 2.04 | **4.51** | 2.20 | **4.73** | 2.09 | **6.01** | 2.72 | **<0.001** |
| **Pizza (days/week)** | **0.43** | 0.45 | **0.59** | 0.73 | **0.61** | 0.54 | **0.83** | 0.78 | **1.23** | 1.21 | **<0.001** |
| **Eggs (number/day)** | **0.23** | 0.29 | **0.33** | 0.34 | **0.41** | 0.38 | **0.43** | 0.45 | **0.72** | 0.72 | **<0.001** |
| **Food that is fried (days/week)** | **0.87** | 1.16 | **1.37** | 1.33 | **1.82** | 1.47 | **2.34** | 1.55 | **3.35** | 1.97 | **<0.001** |
| **Alcoholic drinks (measures or glasses/day)** | **0.42** | 0.74 | **0.74** | 1.26 | **0.85** | 1.35 | **1.30** | 1.83 | **2.02** | 2.58 | **<0.001** |
| **Ready-made sauces (days/week)** | **0.54** | 0.75 | **0.75** | 0.81 | **1.01** | 1.08 | **1.31** | 1.35 | **1.93** | 1.57 | **<0.001** |

### 5.4 Correlations between dietary pattern scores and nutrient intakes

Table 13 displays Pearson's correlation coefficients (both absolute and energy-adjusted) between dietary pattern scores and estimated nutrient intakes from FFQ data. There was a very weak negative correlation between the 'vegetarian' pattern and energy intake ($r = -0.096$; $p < 0.01$). Following adjustment for energy intake, there were moderate positive correlations ($0.3 \geq r < 0.5$; $p < 0.01$) between this pattern and intakes of fibre, copper and thiamin. The 'health-conscious' pattern was the most nutrient-dense dietary pattern, with significant positive, moderate correlations ($r > 0.3$; $p < 0.01$) for intakes of selenium, vitamin D, vitamin $B_{12}$, and biotin both before and after adjustment for energy intake. There were also moderate positive correlations between this pattern and absolute intakes of magnesium, iodine and vitamin E, but the strength of these relationships were attenuated upon adjustment for energy. There was a weak but positive correlation between this 'health-conscious' pattern and energy intake ($r = 0.271$; $P < 0.01$). The 'snacking' and 'convenience, red meat and alcohol' dietary patterns exhibited the strongest correlations with energy intake ($r = 0.582$ and $r = 0.547$ respectively). Additionally, the 'snacking' pattern was strongly positively correlated with absolute intakes of total, saturated and monounsaturated fat, total carbohydrates, total sugars and NMES ($r > 0.5$; $P < 0.001$). However, with the exception of NMES, the strength of all these correlations were attenuated following adjustment for energy intake. Following adjustment, alcohol intake was negatively correlated with scores on this pattern ($r = -0.317$; $P < 0.01$). Both total and monounsaturated fat were strongly positively associated with scores on the 'convenience, red meat and alcohol' dietary pattern ($r > 0.5$; $P < 0.001$), however these relationships weakened upon adjustment for energy intake. Only intake of total sugars was strongly and negatively correlated with this pattern following adjustment ($r = -0.577$; $P < 0.01$).

**Table 13: Pearson's correlations between dietary pattern scores and estimated average daily nutrient intakes from frequency of food intake data**. Correlation coefficients between absolute nutrient intakes and relative nutrient intakes adjusted for energy intakes are both shown. Correlation coefficients ≥0.5 are highlighted in bold.

| | **Vegetarian** | | **Snacking** | | **Health-conscious** | | **Convenience, red meat & alcohol** | |
|---|---|---|---|---|---|---|---|---|
| **Nutrient** | **Absolute** | **Adjusted** | **Absolute** | **Adjusted** | **Absolute** | **Adjusted** | **Absolute** | **Adjusted** |
| **Energy (kcal)** | -0.096 $^{\gamma}$ | | **0.582** $^{\gamma}$ | | 0.271 $^{\gamma}$ | | **0.547** $^{\gamma}$ | |
| **Protein (g)** | -0.304 $^{\gamma}$ | -0.389 $^{\gamma}$ | 0.309 $^{\gamma}$ | -0.343 $^{\gamma}$ | 0.483 $^{\gamma}$ | 0.469 $^{\gamma}$ | 0.491 $^{\gamma}$ | 0.334 $^{\gamma}$ |
| **Total fat (g)** | -0.171 $^{\gamma}$ | -0.183 $^{\gamma}$ | **0.602** $^{\gamma}$ | 0.232 $^{\gamma}$ | 0.291 $^{\gamma}$ | 0.116 $^{\gamma}$ | **0.535** $^{\gamma}$ | 0.134 $^{\gamma}$ |
| **Total carbohydrate (g)** | 0.073 $^{\gamma}$ | 0.322 $^{\gamma}$ | **0.633** $^{\gamma}$ | 0.316 $^{\gamma}$ | 0.101 $^{\gamma}$ | -0.287 $^{\gamma}$ | 0.330 $^{\gamma}$ | -0.358 $^{\gamma}$ |
| **NMES (g)** | -0.163 $^{\gamma}$ | -0.110 $^{\gamma}$ | **0.696** $^{\gamma}$ | **0.524** $^{\gamma}$ | -0.124 $^{\gamma}$ | -0.393 $^{\gamma}$ | 0.234 $^{\gamma}$ | -0.174 $^{\gamma}$ |
| **Saturated fat (g)** | -0.266 $^{\gamma}$ | -0.326 $^{\gamma}$ | **0.638** $^{\gamma}$ | 0.347 $^{\gamma}$ | 0.166 $^{\gamma}$ | -0.098 $^{\gamma}$ | 0.485 $^{\gamma}$ | 0.080 $^{\gamma}$ |
| **Monounsaturated fat (g)** | -0.241 $^{\gamma}$ | -0.306 $^{\gamma}$ | **0.558** $^{\gamma}$ | 0.144 $^{\gamma}$ | 0.302 $^{\gamma}$ | 0.142 $^{\gamma}$ | **0.507** $^{\gamma}$ | 0.091 $^{\gamma}$ |
| **Polyunsaturated fat (g)** | 0.018 $^{\gamma}$ | 0.143 $^{\gamma}$ | 0.430 $^{\gamma}$ | -0.026 | 0.336 $^{\gamma}$ | 0.209 $^{\gamma}$ | 0.492 $^{\gamma}$ | 0.137 |
| **Total sugars (g)** | 0.019 | 0.123 $^{\gamma}$ | **0.602** $^{\gamma}$ | 0.333 $^{\gamma}$ | 0.295 $^{\gamma}$ | 0.154 $^{\gamma}$ | 0.043 | **-0.577** $^{\gamma}$ |
| **Fibre (g)** | 0.443 $^{\gamma}$ | **0.551** $^{\gamma}$ | 0.080 $^{\gamma}$ | -0.259 $^{\gamma}$ | 0.386 $^{\gamma}$ | 0.306 $^{\gamma}$ | 0.096 $^{\gamma}$ | -0.207 $^{\gamma}$ |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sodium (mg)** | 0.113[γ] | 0.286[γ] | 0.439[γ] | -0.002[γ] | 0.313[γ] | 0.172[γ] | 0.436[γ] | 0.040[γ] |
| **Potassium (mg)** | 0.035 | 0.196[γ] | 0.360[γ] | -0.240[γ] | 0.472[γ] | 0.451[γ] | 0.352[γ] | -0.212[γ] |
| **Calcium (mg)** | 0.073[γ] | 0.183[γ] | 0.449[γ] | 0.106[γ] | 0.315[γ] | 0.189[γ] | 0.199[γ] | -0.258[γ] |
| **Magnesium (mg)** | 0.229[γ] | 0.461[γ] | 0.253[γ] | -0.347[γ] | **0.509**[γ] | 0.482[γ] | 0.304[γ] | -0.197[γ] |
| **Iron (mg)** | 0.147[γ] | 0.332[γ] | 0.247[γ] | -0.350 | 0.339[γ] | 0.214 | 0.400[γ] | -0.017 |
| **Copper (mg)** | 0.343[γ] | **0.545**[γ] | 0.229[γ] | -0.256[γ] | 0.458[γ] | 0.387[γ] | 0.340[γ] | -0.035 |
| **Zinc (mg)** | -0.264[γ] | -0.318[γ] | 0.289[γ] | -0.382[γ] | 0.391[γ] | 0.304[γ] | 0.483[γ] | 0.080[γ] |
| **Selenium (mg)** | -0.221[γ] | -0.208[γ] | 0.208[γ] | -0.259[γ] | **0.584**[γ] | **0.555**[γ] | 0.423[γ] | 0.115[γ] |
| **Iodine (µg)** | -0.260[γ] | -0.247[γ] | 0.259[γ] | -0.065 | **0.524**[γ] | 0.488[γ] | 0.126[γ] | -0.224[γ] |
| **Vitamin A (µg)** | 0.132[γ] | 0.163[γ] | 0.050 | -0.129[γ] | 0.362[γ] | 0.314[γ] | 0.065 | -0.095[γ] |
| **Vitamin E (mg)** | 0.163[γ] | 0.286[γ] | 0.347[γ] | -0.022 | **0.505**[γ] | 0.447[γ] | 0.244[γ] | -0.145[γ] |
| **Vitamin D (µg)** | -0.136[γ] | -0.113[γ] | 0.015 | -0.209[γ] | **0.645**[γ] | **0.613**[γ] | 0.159[γ] | -0.009 |
| **Thiamin (mg)** | 0.484[γ] | **0.558**[γ] | 0.217[γ] | 0.010 | 0.044 | -0.059 | 0.200[γ] | 0.004 |
| **Riboflavin (mg)** | -0.223[γ] | -0.216[γ] | 0.338[γ] | -0.090[γ] | 0.394[γ] | 0.298*[γ] | 0.210[γ] | -0.258[γ] |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Niacin (mg)** | -0.359 $^{\gamma}$ | -0.429 $^{\gamma}$ | 0.221 $^{\gamma}$ | -0.377 $^{\gamma}$ | 0.465 $^{\gamma}$ | 0.408 $^{\gamma}$ | 0.408 $^{\gamma}$ | 0.008 |
| **Vitamin $B_6$ (mg)** | -0.210 $^{\gamma}$ | -0.226 $^{\gamma}$ | 0.266 $^{\gamma}$ | -0.435 $^{\gamma}$ | 0.332 $^{\gamma}$ | 0.199 $^{\gamma}$ | 0.439 $^{\gamma}$ | -0.011 |
| **Vitamin $B_{12}$ (mg)** | -0.315 $^{\gamma}$ | -0.311 $^{\gamma}$ | 0.180 $^{\gamma}$ | -0.163 $^{\gamma}$ | **0.583** $^{\gamma}$ | **0.537** $^{\gamma}$ | 0.230 $^{\gamma}$ | -0.065 |
| **Folate (µg)** | 0.177 $^{\gamma}$ | 0.313 $^{\gamma}$ | 0.191 $^{\gamma}$ | -0.294 $^{\gamma}$ | 0.416 $^{\gamma}$ | 0.329 $^{\gamma}$ | 0.253 $^{\gamma}$ | -0.155 $^{\gamma}$ |
| **Biotin (µg)** | 0.088 $^{\gamma}$ | 0.169 $^{\gamma}$ | 0.100 $^{\gamma}$ | -0.319 $^{\gamma}$ | **0.690** $^{\gamma}$ | **0.673** $^{\gamma}$ | 0.212 $^{\gamma}$ | -0.123 $^{\gamma}$ |
| **Vitamin C (mg)** | 0.202 $^{\gamma}$ | 0.244 $^{\gamma}$ | 0.163 $^{\gamma}$ | -0.017 $^{\gamma}$ | 0.299 $^{\gamma}$ | 0.237 $^{\gamma}$ | 0.009 | -0.197 $^{\gamma}$ |
| **Alcohol (g)** | 0.023 | 0.064 | -0.020 | -0.317 $^{\gamma}$ | 0.026 | -0.086 $^{\gamma}$ | 0.345 $^{\gamma}$ | 0.180 $^{\gamma}$ |

$^{\gamma}$ significant at $p < 0.01$

## 5.5 Associations between dietary pattern scores and non-nutrient variables: outputs from preliminary analyses and general linear models

To examine the factors underpinning each of the four dietary components retained from the PCA, preliminary analyses (independent t-tests; ANOVAs) were initially conducted (Table 14). A series of GLMs were then generated to provide greater insight into the independent associations between dietary pattern scores and each of these variables. Variables entered into the model were categorised into five groups: demographic variables; cooking- and eating-related variables; variables relating to satisfaction with eating and dieting behaviour; dietary supplement use; and drivers of food choice. Further details of the variables that comprise these groups can be found in section 3.5.8.4. A summary roadmap of the approach used to generate the five models presented in the ensuing sections of this chapter is provided in Figure 9 below. It should be noted that groups 2-5 were not considered together in a single model to ensure models were parsimonious. In addition, Figure 10 displays the theoretical basis of the regression approach used in this analysis to identify the key influences on the consumption of each of the dietary patterns. A summary of the GLM results is then presented as a single concept diagram (Figure 11), alongside detailed written description. These concept diagrams highlight the significant independent associations within each model for each dietary pattern. Full details of these GLMs, including details of significant post-hoc associations, are provided in Appendix P.

Figure 9: Figure displaying a roadmap of the approach used to generate the five GLMs

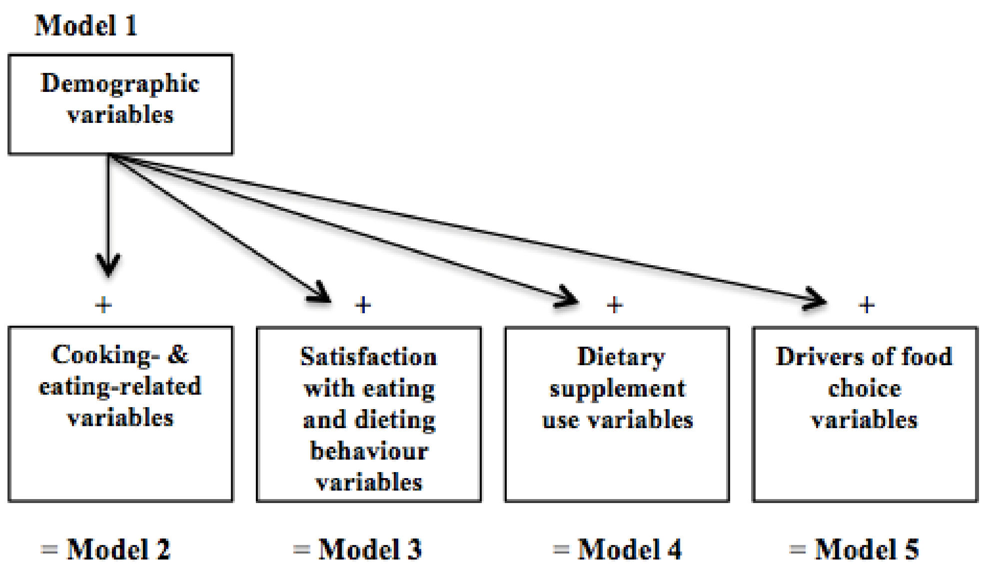
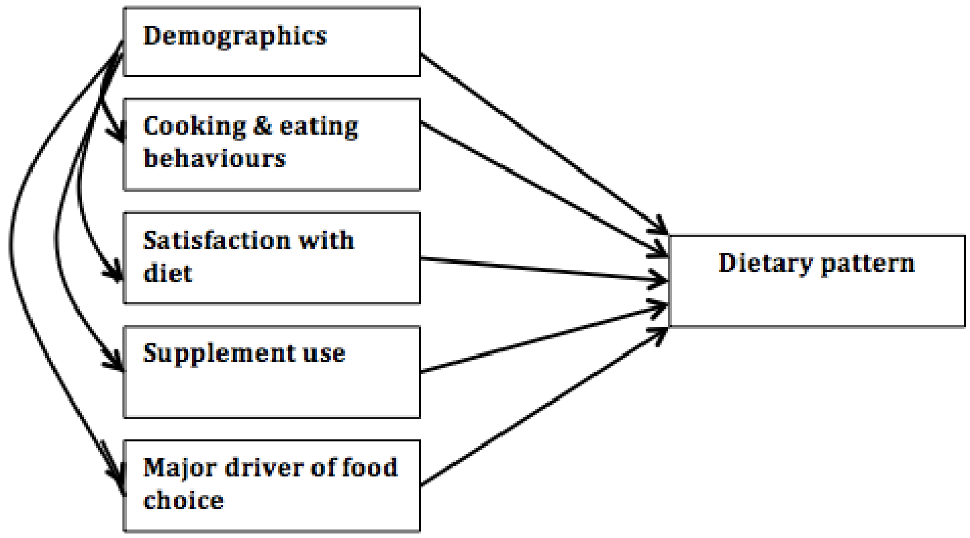



Figure 10: Figure displaying the theoretical basis of the regression approach used in the analysis to identify key influences on dietary pattern consumption



### 5.5.1 Component 1 – Vegetarian

#### Preliminary analyses

Preliminary analyses revealed a number of significant associations between non-nutrient variables and scores on the 'vegetarian' dietary pattern (Table 14). High scores on this pattern were associated with female gender ($p$ < 0.001), middle age group (22-25 years) ($p$ = 0.020), moderate leisure-time physical activity levels ($p$ < 0.001) and having a mother educated to degree level ($p$ < 0.001). Low scores were associated with White Irish ethnicity ($p$ < 0.001), BMI of > 25 kg.m$^2$ ($p$ < 0.001), Christian faith ($p$ < 0.001) and living with parents/other relatives ($p$ < 0.001). Students at the University of Ulster and those who studied engineering had lower scores than students at other universities and studying in different faculties ($p$ < 0.001).

High scores on the 'vegetarian' pattern were also associated with greatest self-perceived cooking ability ($p$ < 0.001), most frequent consumption of meals cooked from scratch ($p$ < 0.001), rare consumption of pre-prepared foods ($p$ < 0.001), and takeaways/ready meals ($p$ = 0.001), use of mineral supplements ($p$ = 0.027) and being 100% content with food intake ($p$ = 0.014). Students reporting current dieting behaviour to gain muscle mass had lower scores than their non-dieting counterparts ($p$ < 0.001). Several perceived determinants of food choice were also associated with 'vegetarian' pattern score: high scores were associated with 'health/nutritional value' ($p$ < 0.001), 'ethical reasons' ($p$ = 0.022) and 'vegetarianism/veganism' ($p$ < 0.001), whilst low scores were associated with 'taste/preferences' ($p$ < 0.001), 'cost/value for money' ($p$ < 0.001) and 'ease of cooking/convenience' ($p$ = 0.007).

#### General Linear Models

In Model 1 (demographic variables only) (Figure 11; Appendix P), female gender ($p$ < 0.001), middle age group ($p$ = 0.020), moderate leisure-time activity levels ($p$ = 0.045) and ex-smoker status ($p$ = 0.025) were independently associated with higher scores on the vegetarian dietary pattern. Attendance at the University of Ulster was independently associated with lower 'vegetarian' pattern scores ($p$ < 0.001)

In Model 2 (demographic variables & food/eating related variables) (Figure 11; Appendix P), female gender ($p < 0.001$), middle age group ($p = 0.020$), greatest self-reported cooking ability ($p = 0.036$), least frequent consumption of pre-prepared foods ($p < 0.047$) and lower consumption of animal products ($p = 0.036$) were independently associated with higher ‘vegetarian’ pattern scores. Attendance at the University of Ulster ($p < 0.001$) was independently associated with lower scores.

In Model 3 (demographic variables & satisfaction with eating and dieting behaviour) (Figure 11; Appendix P), female gender ($p < 0.001$), middle age group ($p = 0.005$), moderate leisure-time physical activity levels ($p = 0.014$) and ex-smoker status ($p = 0.018$), were independently associated with higher scores. Attendance at the University of Ulster ($p < 0.001$) and current engagement in dieting behaviour to gain muscle mass ($p = 0.013$) were associated with lower scores.

In Model 4 (demographic variables & supplement use) (Figure 11; Appendix P), female gender ($p < 0.001$), middle age group ($p = 0.005$), moderate leisure-time physical activity levels ($p = 0.015$), ex-smoker status ($p = 0.031$) and use of multivitamin supplements ($p = 0.008$) were independently associated with higher ‘vegetarian’ pattern scores. Attendance at the University of Ulster remained independently associated with lower scores ($p < 0.001$).

In Model 5 (demographic variables & major determinants of food choice) (Figure 11; Appendix P), female gender ($p < 0.001$), middle age group ($p = 0.020$) moderate leisure-time physical activity level ($p = 0.004$), ex-smoker status ($p = 0.004$), and reporting ‘ethical reasons’ ($p = 0.014$) and ‘vegetarianism/veganism’ ($p < 0.001$) as major determinants of food choices were independently associated with higher pattern scores. Attendance at the University of Ulster ($p < 0.001$) and reporting ‘cost/value for money’ ($p < 0.001$), ‘taste/preferences’ ($p < 0.001$), ‘dieting value/calorie content’ ($p = 0.002$), ‘quality/freshness’ ($p = 0.008$), ‘convenience/ease of cooking’ ($p < 0.001$) and ‘other’ factors ($p = 0.006$) as major drivers of food choice were associated with lower scores.

### 5.5.2 Component 2 – Snacking

#### Preliminary analyses

Preliminary analyses revealed a number of significant associations between non-nutrient variables and scores on the 'snacking' dietary pattern (Table 14). High scores on this pattern were associated with youngest age group (17-21 years) ($p$ = 0.042), first year undergraduate status ($p$ = 0.031), registered in full-time study ($p < 0.001$), Christian faith ($p < 0.001$), low leisure-time physical activity levels ($p < 0.001$), and living with parents/other relatives ($p < 0.001$). Students attending the University of Ulster had higher scores than students at other universities ($p < 0.001$).

High scores on the convenience pattern were also associated with low self-reported cooking ability, frequent skipping of breakfast, frequent consumption of pre-prepared foods, take-aways/ready-meals and meals from university cafeteria, and being discontent with food intake ($p < 0.001$). Current dieting behaviour, either to lose weight ($p < 0.001$) or bulk up ($p$ = 0.024), avoidance of animal products ($p$ = 0.010), daily consumption of meals prepared from raw ingredients ($p < 0.001$), and use of fitness supplements were associated with lower scores ($p$ = 0.018). Several perceived drivers of food choice were also associated with 'snacking' pattern scores: students who reported 'taste/preferences' ($p$ = 0.024) and 'convenience/ease of cooking' ($p$ = 0.003) as major drivers of their food choices had higher scores, whilst those reporting 'health/nutritional value' ($p < 0.001$) and 'dieting value/calorie content' ($p <$ 0.001) had lower scores.

#### General Linear Models

In Model 1 (demographic factors only) (Figure 11; Appendix P), low leisure-time physical activity ($p < 0.001$), attendance at the University of Ulster ($p$ = 0.003), full time student status ($p$ = 0.001) and living with parents/other relatives ($p <$ 0.001) were independently associated with higher 'snacking' pattern scores.

In Model 2 (Figure 11; Appendix P), lower leisure-time physical activity participation ($p$ = 0.012), attendance at the University of Ulster ($p$ = 0.029), living with parents/other relatives or in university catered accommodation ($p$ = 0.033), and full-time student status ($p < 0.001$) were independently associated with greater pattern score. Infrequent consumption of meals prepared from raw ingredients ($p < 0.001$), and frequent consumption of pre-prepared foods ($p < 0.001$) and ready meals/take-aways ($p < 0.001$) were also independently associated with high 'snacking' pattern scores.

In Model 3 (Figure 11; Appendix P), lower leisure time physical activity participation ($p = 0.001$), living with parents/relatives or in university catered accommodation ($p = 0.003$), attendance at the University of Ulster ($p < 0.001$) and full-time student status ($p < 0.001$) remained independently associated with greater 'snacking' pattern scores. Reporting that their body was a 'little too thin' ($p = 0.040$) and no current engagement in weight loss behaviour ($p < 0.001$) were also independently associated with higher scores, whilst greater contentment with dietary intake was associated with lower scores ($p < 0.001$).

In Model 4 (Figure 11; Appendix P), lower leisure-time physical activity levels ($p < 0.001$), attendance at the University of Ulster ($p < 0.001$), living with parents/other relatives or in university self-catered accommodation ($p = 0.001$) and full-time student status ($p < 0.001$) were independently associated with higher scores. There were no independent associations with dietary supplement use in this model.

Finally, in Model 5 (Figure 11; Appendix P), lower leisure-time physical activity levels ($p = 0.002$), attendance at the University of Ulster ($p = 0.006$), living with parents/other relatives or in university self-catered accommodation ($p = 0.006$) and full-time student status ($p < 0.001$) remained independently associated with higher 'snacking' pattern score. Reporting 'health/nutritional value' ($p < 0.001$) and 'dieting value/calorie content' ($p < 0.001$) as major determinants of food choice was associated with lower scores.

### 5.5.3 Component 3 – Health-conscious

#### Preliminary analyses

There were a number of significant associations between non-nutrient variables and scores on the 'health-conscious' dietary pattern (Table 14). Higher scores were associated with White Other ethnicity ($p < 0.001$), greatest engagement in leisure-time physical activity ($p < 0.001$), 3rd year of undergraduate study ($p = 0.010$) and living alone in private accommodation ($p < 0.001$). Low scores were associated with youngest age group (17-21 years) ($p < 0.001$), first year of undergraduate study ($p = 0.010$), living in university self-catered accommodation ($p = 0.004$), White British ethnicity ($p < 0.001$) and studying for a degree in a Science faculty ($p < 0.001$). Students at the University of Sheffield had significantly lower 'health-conscious' pattern scores than students at all other universities ($p < 0.001$).

Higher 'health-conscious' pattern scores were also significantly associated with greatest self-perceived cooking ability, most frequent consumption of meals made from raw ingredients and pre-prepared foods, rare consumption of takeaways and ready-meals, greater consumption of animal products, infrequent meal skipping, greater amounts of money spent on food, supplement use, current engagement in dieting behaviours (both to bulk up and lose weight), and greatest contentment with food intake ($p \leq 0.001$).

Students who reported 'health/nutritional value' and 'dieting value/calorie content', as major drivers of their food choices had significantly higher health-conscious diet pattern scores than students who did not report these factors as major influences on their food choices ($p < 0.001$). Those reporting 'cost' ($p < 0.001$), 'taste/preferences' ($p = 0.001$), 'convenience/ease of cooking' ($p < 0.001$), 'vegetarianism/veganism' ($p = 0.044$) or 'other' factors ($p = 0.009$) as major drivers of their food choices had lower scores.

**General Linear Models**

In Model 1 (demographic variables only) (Figure 11; Appendix P), greatest leisure-time physical activity levels ($p < 0.001$), White Other ethnicity ($p = 0.004$) and third year of undergraduate study ($p = 0.041$) were independently associated with higher scores on the 'health-conscious' pattern. Youngest age group ($p = 0.015$) and attendance at University of Sheffield were independently associated with lower scores ($p < 0.001$).

In Model 2 (Figure 11; Appendix P), the five significant demographic factors identified in Model 1 remained independently associated with ‘health-conscious’ pattern scores. Additionally, greatest self-perceived cooking ability ($p = 0.002$), most frequent consumption of meals from raw ingredients ($p < 0.001$), pre-prepared foods ($p = 0.002$), greatest amount of money spent on food ($p < 0.001$), at least occasional consumption of animal products ($p < 0.001$) and infrequent skipping of breakfast ($p < 0.001$) were independently associated with higher health-conscious pattern scores. Rare – compared to occasional or almost daily - consumption of take-aways/ready meals was associated with lower scores ($p = 0.042$).

In Model 3 (Figure 11; Appendix P), greatest leisure-time physical activity levels ($p < 0.001$), White Other (vs. White British and White Irish) ethnicity ($p = 0.004$), 3$^{rd}$ year undergraduate status ($p = 0.014$), and current engagement in behaviour to lose weight ($p < 0.001$) were independently associated with higher pattern scores. Youngest age group ($p = 0.003$) and attendance at University of Sheffield remained associated with lower scores ($p < 0.001$).

In Model 4 (Figure 11; Appendix P), greatest leisure-time physical activity levels ($p < 0.001$), White Other (vs. White British and White Irish) ethnicity ($p = 0.007$), 3$^{rd}$ year undergraduate status ($p = 0.013$), and use of protein shakes ($p = 0.007$) and other fitness supplements ($p = 0.011$) were independently associated with higher pattern scores. Youngest age group ($p = 0.004$) and attendance at University of Sheffield remained independently associated with lower scores ($p < 0.001$).

In Model 5 (Figure 11; Appendix P), greatest leisure-time physical activity levels ($p < 0.001$), White Other (vs. White British and White Irish) ethnicity ($p = 0.018$), 3$^{rd}$ year undergraduate status ($p = 0.003$) and reporting ‘health/nutritional value’ ($p = 0.006$) as a major determinant of food choices at university were independently associated with higher ‘health-conscious’ pattern scores. Youngest age group ($p = 0.010$), attendance at University of Sheffield ($p < 0.001$), and reporting ‘cost/value for money’ ($p < 0.001$), ‘taste/preferences’ ($p = 0.001$), 'vegetarianism/veganism' ($p < 0.001$), 'convenience/ease of cooking' ($p < 0.001$), 'time available' ($p < 0.001$) and 'other' factors ($p = 0.020$) as major determinants of food choices were independently associated with lower scores on the health-conscious pattern.

### 5.5.4 Component 4 – Convenience, red meat and alcohol

#### Preliminary analyses

Preliminary analyses revealed a number of significant associations between non-nutrient variables and 'convenience, red meat & alcohol' pattern scores (Table 14). Higher scores on this pattern were associated with male gender, ($p < 0.001$), BMI ≥ 30 $kg.m^2$ ($p = 0.005$), regular or social smoker status ($p < 0.001$), attendance at the University of Ulster ($p = 0.002$) and studying in an Engineering faculty ($p < 0.001$). Lower scores were associated with moderate leisure-time physical activity levels ($p = 0.006$) and studying a medicine- or health-related degree ($p < 0.001$).

High scores on this pattern were also associated with being a regular meat eater ($p < 0.001$), frequent consumption of pre-prepared foods ($p = 0.027$), takeaways/ready-meals ($p < 0.001$), and meals from university cafeteria ($p < 0.001$), current engagement in dieting behaviour to 'bulk up' ($p < 0.001$) and use of several dietary supplements ($p < 0.01$). Low scores were associated with current engagement in dieting behaviour to lose weight ($p < 0.001$), infrequent breakfast skipping ($p < 0.001$), spending less money on food ($p < 0.001$), and reporting 'health/nutritional value' ($p < 0.001$) and 'dieting value' ($p < 0.001$) as major drivers of food choice.

#### General Linear Models

In Model 1 (demographic variables only) (Figure 11; Appendix P), male gender ($p < 0.001$), lowest leisure-time physical activity levels ($p = 0.032$), and regular/social smoking status ($p < 0.001$) were independently associated with higher scores on the 'convenience, red meat & alcohol' diet pattern. An independent inverse association between living alone in private accommodation and score on this pattern approached significance ($p = 0.053$).

In Model 2 (Figure 11; Appendix P), higher pattern scores were independently associated with male gender ($p < 0.001$), regular/social smoking status ($p < 0.001$), most frequent consumption pre-prepared foods ($p = 0.040$), frequent consumption of ready-meals/take-aways ($p < 0.001$), frequent breakfast skipping ($p < 0.001$) and regular consumption of animal products ($p < 0.001$). Lower scores were independently associated with living alone ($p = 0.026$) and spending less money on food ($p < 0.001$).

In Model 3 (Figure 11; Appendix P), male gender ($p < 0.001$), regular or social smoking status ($p < 0.001$) and current engagement in dieting behaviour to gain muscle mass ($p = 0.036$) were independently associated with higher 'convenience, red meat & alcohol' pattern scores. Moderate leisure-time physical activity levels ($p = 0.004$) and current engagement in weight loss behaviours ($p = 0.049$) were associated with lower scores.

In Model 4 (demographic variables and supplement use) (Figure 11; Appendix P), male gender ($p < 0.001$), lowest leisure-time physical activity levels ($p = 0.002$), regular/social smoking status ($p < 0.001$) and use of vitamin supplements ($p = 0.013$) were independently associated with higher 'convenience, red meat & alcohol' pattern score ($p < 0.001$).

Finally, in Model 5 (Figure 11; Appendix P), male gender ($p < 0.001$), and regular/social smoking status ($p < 0.001$) remained independently associated with higher scores on the 'convenience, red meat & alcohol' pattern. Moderate leisure-time physical activity levels ($p = 0.040$) and reporting 'cost/value for money' ($p = 0.044$), 'health/nutritional value' ($p < 0.001$) and 'dieting value/calorie content' ($p < 0.001$) as major drivers of food choice was independently associated with lower scores.

**Table 14: Outputs from preliminary analyses (independent t-tests & ANOVAs) between dietary pattern scores and non-nutrient variables**. Significant associations ($p < 0.05$) are highlighted in bold. Common superscript letters indicate significant post-hoc differences between categories within each variable.

| | Vegetarian | | Snacking | | Health-conscious | | Convenience, red meat & alcohol | |
|---|---|---|---|---|---|---|---|---|
| **Demographic variable** | Means | *p* value | Means | *p* value | Means | *p* value | Means | *p* value |
| *Gender* | | | | | | | | |
| Male | **-0.218** | **< 0.001** | 0.044 | 0.314 | -0.024 | 0.586 | **0.466** | **< 0.001** |
| Female | **0.079** | | -0.016 | | 0.009 | | **-0.168** | |
| *Age* | | | | | | | | |
| 17-21 | **-0.059[a]** | **0.020** | **0.053[a]** | **0.042** | **-0.087[ab]** | **< 0.001** | 0.005 | 0.138 |
| 22-25 | **0.101[a]** | | **-0.087[a]** | | **0.107[a]** | | 0.038 | |
| 26-29 | **0.059** | | **-0.065** | | **0.199[b]** | | -0.121 | |
| *Leisure-time physical activity* | | | | | | | | |
| Not very active | **-0.123[a]** | **0.001** | **0.191[ab]** | **<0.001** | **-0.304[ab]** | **<0.001** | **0.095[a]** | **0.006** |
| Moderately active | **0.086[a]** | | **-0.029[ac]** | | **0.037[ac]** | | **-0.081[a]** | |
| Very active | **-0.026** | | **-0.303[bc]** | | **0.512[bc]** | | **0.512** | |
| *BMI kg m$^{-2}$* | | | | | | | | |
| <18.5 | **0.086[ab]** | **< 0.001** | 0.157 | 0.091 | -0.055 | 0.085 | **-0.024** | **0.005** |
| 18.5-24.9 | **0.067[cd]** | | -0.037 | | -0.010 | | **-0.047[a]** | |
| 25-29.9 | **-0.219[ac]** | | 0.032 | | 0.140 | | **0.133** | |
| ≥30 | **-0.296[bd]** | | 0.167 | | -0.164 | | **0.309[a]** | |
| *Smoking status* | | | | | | | | |
| Never | -0.028 | 0.068 | -0.001 | 0.598 | **-0.024** | **0.027** | **-0.024[ab]** | **< 0.001** |
| Ex | 0.283 | | -0.113 | | **0.179** | | **-0.047** | |
| Social | 0.050 | | 0.066 | | **0.144** | | **0.133[a]** | |
| Regular | 0.007 | | -0.035 | | **-0.154** | | **0.309[b]** | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Ethnicity* | | | | | | | | | |
| White British | **0.009[ab]** | **< 0.001** | **-0.013** | **0.033** | **-0.078[a]** | **< 0.001** | -0.009 | | 0.336 |
| White Irish | **-0.322[acd]** | | **0.148** | | **0.016** | | 0.145 | | |
| White Other | **0.284[bc]** | | **-0.120** | | **0.326[a]** | | -0.178 | | |
| Mixed | **0.162** | | **-0.095** | | **0.227** | | 0.040 | | |
| Asian/Asian British | **0.281[d]** | | **0.100** | | **-0.008** | | 0.034 | | |
| Black/Black British | **-0.220** | | **0.006** | | **-0.004** | | -0.247 | | |
| Other | **0.055** | | **-0.507** | | **0.615** | | 0.275 | | |
| Rather not say | **0.229** | | **-0.040** | | **0.160** | | -0.340 | | |
| *Year of study* | | | | | | | | | |
| 1st year UG | **0.022** | **0.028** | **0.113[a]** | **0.031** | **-0.119[a]** | **0.010** | 0.015 | 0.241 | |
| 2nd year UG | **-0.097** | | **0.005** | | **-0.024** | | 0.002 | | |
| 3rd year UG | **-0.078** | | **-0.064** | | **0.171[a]** | | -0.065 | | |
| ≥ 4th year UG | **-0.013** | | **-0.093** | | **0.089** | | 0.174 | | |
| Postgraduate | **0.143** | | **-0.118[a]** | | **0.027** | | -0.046 | | |
| Other | **0.465** | | **0.142** | | **0.110** | | -0.228 | | |
| *Term-time accommodation* | | | | | | | | | |
| Uni catered | **-0.007** | **< 0.001** | **0.326** | **< 0.001** | **-0.163** | **0.004** | 0.140 | 0.271 | |
| Uni self-catered | **0.110[a]** | | **-0.085[a]** | | **-0.173[ab]** | | 0.002 | | |
| Private with friends | **0.031[b]** | | **-0.091[b]** | | **0.002** | | 0.006 | | |
| Private on own | **0.179[c]** | | **0.003** | | **0.310[a]** | | -0.322 | | |
| Parents/relatives | **-0.293[abcd]** | | **0.307[ab]** | | **0.177[b]** | | 0.059 | | |
| Partner | **0.084[d]** | | **-0.043** | | **0.065** | | -0.013 | | |
| Parents/partner + | **-0.308** | | **0.250** | | **-0.026** | | -0.043 | | |
| children | **-0.255** | | **-0.261** | | **0.234** | | 0.023 | | |
| Children only | **0.130** | | **-0.372** | | **0.411** | | 0.035 | | |
| Other | | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *University* | | | | | | | | |
| Sheffield | **0.046**[abc] | **< 0.001** | **-0.079**[a] | **< 0.001** | **-0.240**[abcd] | **< 0.001** | **-0.030** | **0.002** |
| Ulster | **-0.442**[adef] | | **0.229**[abc] | | **0.008**[ae] | | **0.121**[ab] | |
| KCL | **0.382**[bd] | | **-0.162**[b] | | **0.277**[bef] | | **-0.002** | |
| Southampton | **0.211**[eg] | | **0.039** | | **0.365**[cf] | | **-0.218**[a] | |
| St Andrews | **0.681**[cfg] | | **-0.189**[c] | | **0.360**[d] | | **-0.340**[b] | |
| *Faculty* | | | | | | | | |
| Arts | **0.119**[ab] | **< 0.001** | 0.049 | 0.238 | **-0.054** | **< 0.001** | **0.094**[a] | **0.001** |
| Social science | **-0.140**[acd] | | 0.017 | | **0.025**[a] | | **0.045** | |
| Engineering | **-0.440**[bcef] | | 0.045 | | **-0.102** | | **0.282**[b] | |
| Science | **0.048**[e] | | -0.147 | | **-0.251**[ab] | | **-0.019** | |
| Medicine & health | **0.078**[df] | | 0.004 | | **0.129**[b] | | **-0.116**[ab] | |
| *Full-time vs. part-time student status* | | | | | | | | |
| Full-time | -0.002 | 0.745 | **0.017** | **< 0.001** | -0.004 | 0.489 | 0.005 | 0.371 |
| Part-time | 0.043 | | **-0.451** | | 0.092 | | -0.120 | |
| *Mother's level of education*[γ] | | | | | | | | |
| CSE | **-0.309**[a] | **< 0.001** | 0.192 | 0.157 | 0.057 | 0.163 | 0.110 | 0.315 |
| Vocational | **-0.222**[b] | | 0.124 | | 0.126 | | -0.076 | |
| O level | **-0.182**[c] | | 0.121 | | 0.072 | | 0.102 | |
| A level | **-0.101**[d] | | 0.120 | | 0.270 | | -0.005 | |
| Degree | **0.251**[abcde] | | -0.063 | | 0.244 | | -0.060 | |
| Rather not say | **-0.258**[e] | | 0.084 | | 0.015 | | 0.125 | |
| *Nationality* | | | | | | | | |
| British | **0.029**[ab] | **< 0.001** | -0.014 | 0.093 | **-0.047**[a] | **0.002** | **-0.013** | **0.009** |
| Irish | **-0.339**[acd] | | 0.136 | | **0.005**[b] | | **0.180** | |
| Other North/Western European | **0.515**[bc] | | -0.306 | | **0.203** | | **-0.237** | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Central/Eastern European | **0.268[d]** | | -0.014 | | **0.429[ab]** | | **-0.130** | |
| Southern European | **0.140** | | 0.080 | | **0.153** | | **-0.382** | |
| Other | **0.003** | | -0.083 | | **0.337** | | **0.111** | |
| *White British vs. Non White British* | | | | | | | | |
| White British | 0.009 | 0.670 | -0.013 | 0.509 | **-0.078** | **< 0.001** | -0.009 | 0.661 |
| Non-White British | -0.015 | | 0.023 | | **0.133** | | 0.015 | |
| *Religion* | | | | | | | | |
| Christianity | **-0.239[abcd]** | **< 0.001** | **0.138[a]** | **< 0.001** | 0.029 | 0.050 | -0.032 | 0.381 |
| Hinduism/Sikhism | **0.501** | | **0.095** | | -0.665[a] | | -0.351 | |
| Islam | **0.043** | | **0.027** | | 0.118 | | -0.197 | |
| Judaism | **1.152[ae]** | | **-0.337** | | 0.749[a] | | -0.207 | |
| Buddhism | **-0.164** | | **-0.889** | | -0.134 | | -0.377 | |
| Atheism/Agnostic | **0.199[b]** | | **-0.133[a]** | | -0.045 | | 0.071 | |
| Other | **0.199[c]** | | **0.078** | | 0.113 | | -0.007 | |
| Rather not say | **0.064[de]** | | **-0.135** | | -0.052 | | -0.015 | |
| *Cooking ability* | | | | | | | | |
| Wide range | **0.155[ab]** | **< 0.001** | **-0.122[abc]** | **< 0.001** | **0.188[ab]** | **< 0.001** | -0.010 | 0.198 |
| Limited range | **-0.168[a]** | | **0.091[ad]** | | **-0.203[a]** | | -0.011 | |
| Pre-prepared only | **-0.441[b]** | | **0.601[bd]** | | **-0.569[b]** | | 0.297 | |
| Unable to cook at all | **-0.183** | | **0.651[c]** | | **-0.160** | | -0.021 | |
| *Animal food consumption* | | | | | | | | |
| Regular meat eater | **-0.378[abcd]** | **< 0.001** | **0.040[a]** | **0.010** | **0.038[a]** | **0.001** | **0.171[ab]** | **< 0.001** |
| Flexitarian | **0.147[aefg]** | | **-0.043[b]** | | **0.025[b]** | | **-0.345[ac]** | |
| Lacto-ovo | **1.552[beh]** | | **0.006[c]** | | **-0.194** | | **0.050[c]** | |
| Ovo | **1.671[cfi]** | | **-0.027** | | **-0.627[ab]** | | **-0.396[b]** | |
| Vegan | **2.904[dghi]** | | **-0.651[abc]** | | **-0.293** | | **0.074** | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Meals made from raw ingredients* | | | | | | | | |
| Every day | **0.229**[abc] | **< 0.001** | **-0.338**[abc] | **< 0.001** | **0.437**[abc] | **< 0.001** | 0.393 | 0.382 |
| Most days | **-0.017**[ade] | | **-0.001**[a] | | **-0.213**[abe] | | 0.074 | |
| Occasionally | **-0.215**[bde] | | **0.317**[b] | | **-0.054**[bd] | | -0.051 | |
| Rarely/never | **-0.182**[c] | | **0.460**[c] | | **0.223**[ce] | | -0.032 | |
| *Meals made from pre-prepared foods* | | | | | | | | |
| Every day | **-0.075** | **< 0.001** | **0.127**[a] | **< 0.001** | **0.437**[ab] | **< 0.001** | **0.393**[a] | **0.027** |
| Most days | **-0.164**[a] | | **0.337**[bc] | | **-0.213**[ac] | | **0.074**[bc] | |
| Occasionally | **-0.070**[b] | | **-0.017**[bd] | | **-0.054**[bd] | | **-0.051**[bd] | |
| Rarely/never | **0.188**[ab] | | **-0.300**[acd] | | **0.233**[cd] | | **-0.032**[acd] | |
| *Ready-meals/take-aways* | | | | | | | | |
| Every day | **-0.062** | | **0.871**[ab] | | **0.378** | | **0.603**[a] | |
| Most days | **-0.152**[a] | **0.001** | **0.636**[cd] | **< 0.001** | **-0.250**[a] | **< 0.001** | **0.416**[bc] | **< 0.001** |
| Occasionally | **-0.080**[b] | | **0.063**[ace] | | **-0.093**[b] | | **0.073**[bd] | |
| Rarely/never | **0.151**[ab] | | **-0.251**[bde] | | **0.182**[ab] | | **-0.210**[acd] | |
| *Meals in university cafeteria* | | | | | | | | |
| Every day | -0.041 | 0.077 | **0.515**[ab] | **< 0.001** | -0.128 | 0.575 | **0.113** | **0.001** |
| Most days | -0.180 | | **0.382**[cd] | | -0.110 | | **0.331**[ab] | |
| Occasionally | -0.060 | | **0.060**[ac] | | 0.106 | | **0.045**[a] | |
| Rarely/never | 0.047 | | **-0.086**[bd] | | 0.013 | | **-0.060**[b] | |
| *Skipped breakfast* | | | | | | | | |
| Every day | -0.061 | 0.391 | **0.268**[ab] | **< 0.001** | **-0.372**[ab] | **< 0.001** | **0.228**[a] | **< 0.001** |
| Most days | -0.050 | | **0.207**[cd] | | **-0.176**[c] | | **0.352**[bc] | |
| Occasionally | 0.069 | | **-0.050**[ac] | | **-0.057**[ad] | | **-0.008**[bd] | |
| Rarely/never | -0.006 | | **-0.119**[bd] | | **0.187**[bcd] | | **-0.199**[acd] | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Skipped lunch/dinner* | | | | | | | | |
| Every day | 0.022 | 0.667 | **0.278** | **0.028** | **-0.104** | **0.019** | -0.155 | 0.502 |
| Most days | 0.007 | | **0.273[ab]** | | **-0.166** | | 0.038 | |
| Occasionally | 0.043 | | **-0.051 [a]** | | **-0.077[a]** | | -0.046 | |
| Rarely/never | -0.028 | | **-0.010 [b]** | | **0.071[a]** | | 0.028 | |
| *Amount spent on food* | | | | | | | | |
| *<£20* | 0.043 | 0.634 | -0.065 | 0.293 | **-0.233[abc]** | **< 0.001** | **-0.267[abcd]** | **< 0.001** |
| *£20-29* | 0.005 | | 0.009 | | **-0.056[de]** | | **-0.035[aef]** | |
| *£30-39* | 0.000 | | -0.014 | | **0.133[ad]** | | **0.128[b]** | |
| *£40-49* | -0.025 | | 0.152 | | **0.140[b]** | | **0.274[ce]** | |
| ≥£50 | -0.135 | | 0.003 | | **0.438[ce]** | | **0.266[df]** | |
| *How feels about body* | | | | | | | | |
| Far too thin | -0.017 | 0.699 | 0.209 | 0.069 | **-0.162** | **0.041** | **0.388** | **0.033** |
| Little too thin | -0.111 | | 0.219 | | **-0.086** | | **0.174** | |
| Just right | -0.222 | | -0.015 | | **0.018** | | **0.023** | |
| Little overweight | 0.030 | | -0.045 | | **0.041[a]** | | **-0.076** | |
| Very overweight | -0.051 | | 0.107 | | **-0.311[a]** | | **0.077** | |
| *Dieting status* | | | | | | | | |
| Yes | -0.0003 | 0.995 | **-0.237** | **< 0.001** | **0.256** | **< 0.001** | **-0.181** | **< 0.001** |
| No | <0.0001 | | **0.064** | | **-0.069** | | **0.049** | |
| *Bulking-up status* | | | | | | | | |
| Yes | **-0.189** | **< 0.001** | **-0.121** | **0.024** | **0.236** | **< 0.001** | **0.256** | **< 0.001** |
| No | **0.045** | | **0.029** | | **-0.056** | | **-0.061** | |
| *Contentment with diet* | | | | | | | | |
| 0% content | **0.007[a]** | **0.014** | **0.095[a]** | **< 0.001** | **-0.061[ab]** | **< 0.001** | 0.011 | 0.400 |
| 20% content | **-0.058[b]** | | **0.215[bc]** | | **-0.155[cd]** | | -0.099 | |
| 40% content | **-0.112[c]** | | **0.047[d]** | | **-0.159[ef]** | | -0.040 | |
| 60% content | **-0.058[d]** | | **-0.022** | | **-0.070[g]** | | 0.044 | |
| 80% content | **0.049** | | **-0.108[b]** | | **0.172[ace]** | | 0.017 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 100% content | **0.364**[abcd] | | **-0.387**[acd] | | **0.399**[abdfg] | | 0.167 | |
| *Multivitamins* | | | | | | | | |
| Yes | 0.114 | 0.103 | -0.007 | 0.908 | **0.219** | **0.001** | 0.087 | 0.135 |
| No | -0.023 | | 0.001 | | **-0.044** | | -0.018 | |
| *Mineral supplements* | | | | | | | | |
| Yes | **0.416** | **0.027** | 0.000 | 0.998 | **0.586** | **0.001** | **0.334** | **0.007** |
| No | **-0.019** | | 0.000 | | **-0.027** | | **-0.015** | |
| *Vitamin Supplements* | | | | | | | | |
| Yes | 0.221 | 0.068 | -0.138 | 0.131 | **0.447** | < **0.001** | **0.281** | **0.002** |
| No | -0.018 | | 0.011 | | **-0.037** | | **-0.023** | |
| *Protein shakes* | | | | | | | | |
| Yes | -0.241 | 0.083 | -0.091 | 0.397 | **0.733** | < **0.001** | **0.548** | < **0.001** |
| No | 0.014 | | 0.005 | | **-0.044** | | **-0.033** | |
| *Other fitness supplements* | | | | | | | | |
| Yes | 0.044 | 0.831 | **-0.049** | **0.018** | **1.284** | **0.001** | **0.831** | < **0.001** |
| No | 0.000 | | **0.008** | | **-0.021** | | **-0.013** | |
| *Other dietary supplements* | | | | | | | | |
| Yes | 0.048 | 0.761 | -0.101 | 0.523 | **0.510** | **0.001** | -0.030 | 0.757 |
| No | -0.001 | | 0.003 | | **-0.014** | | 0.001 | |
| ***Drivers of food choice*** | | | | | | | | |
| *Cost* | | | | | | | | |
| Yes | **-0.087** | < **0.001** | 0.006 | 0.772 | **-0.092** | < **0.001** | -0.007 | 0.757 |
| No | **0.131** | | -0.009 | | **0.139** | | 0.010 | |
| *Taste/preferences* | | | | | | | | |
| Yes | **-0.102** | **0.007** | **0.101** | **0.024** | **-0.140** | **0.001** | 0.069 | 0.120 |
| No | **0.036** | | **-0.035** | | **0.049** | | -0.024 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Health/nutritional value* | | | | | | | | |
| Yes | **0.176** | **< 0.001** | **-0.386** | **< 0.001** | **0.319** | **< 0.001** | **-0.154** | **< 0.001** |
| No | **-0.068** | | **0.159** | | **-0.124** | | **0.060** | |
| *Dieting value/calorie content* | | | | | | | | |
| Yes | -0.082 | 0.257 | **-0.261** | **< 0.001** | **0.308** | **< 0.001** | **-0.325** | **< 0.001** |
| No | 0.011 | | **0.034** | | **-0.040** | | **0.042** | |
| *Vegetarianism/veganism* | | | | | | | | |
| Yes | **1.533** | **< 0.001** | -0.294 | 0.165 | **-0.427** | **0.044** | -0.145 | 0.493 |
| No | **-0.024** | | 0.005 | | **0.007** | | 0.002 | |
| *Quality/freshness* | | | | | | | | |
| Yes | -0.078 | 0.422 | -0.037 | 0.705 | **0.159** | **0.103** | -0.048 | 0.624 |
| No | 0.006 | | 0.003 | | **-0.012** | | 0.003 | |
| *Convenience/ease of cooking* | | | | | | | | |
| Yes | **-0.175** | **< 0.001** | **0.177** | **0.003** | **-0.333** | **< 0.001** | 0.092 | 0.114 |
| No | **0.035** | | **-0.036** | | **0.067** | | -0.019 | |
| *Time available* | | | | | | | | |
| Yes | -0.165 | 0.285 | 0.278 | 0.071 | **-0.416** | **0.007** | -0.147 | 0.339 |
| No | 0.005 | | -0.008 | | **0.012** | | 0.004 | |
| *Ethical reasons* | | | | | | | | |
| Yes | **0.699** | **0.022** | 0.291 | 0.189 | 0.306 | 0.168 | -0.174 | 0.433 |
| No | **-0.010** | | -0.004 | | -0.004 | | 0001 | |
| *Shelf-life of food* | | | | | | | | |
| Yes | 0.152 | 0.484 | 0.015 | 0.945 | 0.167 | 0.441 | -0.374 | 0.085 |
| No | -0.002 | | -0.0002 | | -0.002 | | 0.005 | |
| *Hunger/cravings* | | | | | | | | |
| Yes | -0.027 | 0.879 | -0.216 | 0.217 | -0.272 | 0.119 | 0.111 | 0.527 |
| No | 0.0006 | | 0.005 | | 0.006 | | -0.003 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Variety* | | | | | | | | |
| Yes | -0.213 | 0.293 | 0.025 | 0.871 | -0.331 | 0.102 | 0.262 | 0.195 |
| No | 0.004 | | 0.000 | | 0.006 | | -0.004 | |
| *Availability of food* | | | | | | | | |
| Yes | 0.222 | 0.882 | 0.248 | 0.091 | -0.194 | 0.186 | 0.005 | 0.973 |
| No | -0.001 | | 0.005 | | 0.006 | | 0.000 | |
| *Other* | | | | | | | | |
| Yes | **-0.173** | **0.024** | 0.088 | 0.249 | **-0.199** | **0.009** | 0.019 | 0.798 |
| No | **0.020** | | -0.010 | | **0.023** | | -0.002 | |

$^{\gamma}$ Participants from the University of Sheffield are excluded from this analysis

**Figure 11:** Diagram summarising the results of the GLM, and thus the key influences on adherence to each dietary pattern. Black cells represent associations where $p < 0.01$; grey cells represent associations where $p < 0.05$)

| | **Pattern 1: Vegetarian** | **Pattern 2: Snacking** | **Pattern 3: Health-conscious** | **Pattern 4: Convenience, red meat & alcohol** |
|---|---|---|---|---|
| **Demographics** | | | | |
| Gender | | | | |
| Age | | | | |
| Year of study | | | | |
| LTPA | | | | |
| University | | | | |
| BMI | | | | |
| Smoking status | | | | |
| Ethnicity | | | | |
| Term-time residence | | | | |
| Faculty | | | | |
| Full time / part time | | | | |
| **Cooking & eating behaviour** | | | | |
| Cooking ability | | | | |
| Animal food consumption | | | | |
| Meals made from scratch | | | | |
| Meals from pre-prepared foods | | | | |
| Ready meals & take aways | | | | |
| Meals in uni cafeteria | | | | |
| Skipping breakfast | | | | |
| Skipping lunch/dinner | | | | |
| Amount spent on food | | | | |
| **Satisfaction with diet** | | | | |
| How student feels about body | | | | |
| Dieting status | | | | |
| Bulking up status | | | | |
| Contentment with diet | | | | |
| **Supplement use** | | | | |
| Multivitamins | | | | |
| Mineral supplements | | | | |
| Vitamin supplements | | | | |
| Protein shakes | | | | |
| Other fitness suppls. | | | | |
| Other dietary suppls. | | | | |
| **Major drivers of food choice** | | | | |
| Cost | | | | |
| Taste/preferences | | | | |
| Health/nutrit. value | | | | |
| Dieting value | | | | |
| Vegetarian/veganism | | | | |
| Quality/freshness | | | | |
| Convenience/ease | | | | |
| Time available | | | | |
| Ethical reasons | | | | |
| Shelf-life | | | | |
| Hunger/cravings | | | | |
| Food availability | | | | |
| Other | | | | |

# CHAPTER 6.

# RESULTS III: RESULTS FROM INTERVIEWS WITH STUDENTS – UNDERSTANDING FOOD CHOICES AND DIETARY PRACTICES AT UNIVERSITY

## 6.1 Introduction

This chapter presents the results from Phase 2, qualitative interviews with undergraduate students at the University of Sheffield. This study addressed the fourth objective of this research project: to obtain an in-depth insight into the food choices and dietary practices of university students in the UK. It specifically aimed to answer four research questions: first, what are the factors that drive students' food choices at university; second, how does the transition to university impact upon eating practices; third, how, if at all, do dietary practices change throughout students' university careers; and fourth, how do students' home food environments impact upon eating habits at university.

## 6.2 Sample characteristics and overview

Twenty-five undergraduate students from the University of Sheffield participated in an individual, face-to-face, semi-structured interview exploring food choices and dietary practices at university. The sample was purposefully selected using maximum variation sampling to promote sample heterogeneity and ensure students with a range of eating habits were interviewed (section 3.6.4). The final sample consisted of eighteen women and seven men, which reflected the major demographic characteristics of the quantitative dataset and comprised students with extreme scores on the first eight dietary patterns identified among participants at the University of Sheffield. Participants with extreme scores on one (or more) of these dietary patterns often had more mid-way scores on other patterns, and students with a full range of scores on each of the dietary patterns were therefore interviewed. This purposeful sampling thus ensured that not only 'healthy eaters' or those individuals particularly interested in food, diet and/or health were selected, enabling rich insight into the differing eating habits and drivers and meanings of food choice for young adults at university. Table 11 below displays the demographic characteristics of the sample, alongside dietary pattern score deciles.

**Table 15: Phase 2 participant characteristics and dietary pattern scores**

| | | | | | | | Dietary patterns 1-8 $^{\gamma}$: Scores within dietary patterns (ranking by decile) $^{\Psi}$ | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Participant number** | **Gender** | **Age** | **Ethnicity** | **Faculty of study** | **Year of UG study** | **BMI** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| **1** | Female | 20 | White British | Arts | 2nd year | 17.4 | 5 | 1 | 10 | 5 | 10 | 10 | 5 | 6 |
| **2** | Female | 20 | White British | Arts | 2nd year | 23.4 | 3 | 10 | 1 | 10 | 3 | 6 | 7 | 5 |
| **3** | Female | 20 | White British | Social Sciences | 1st year | 23.6 | 1 | 10 | 9 | 9 | 1 | 10 | 1 | 8 |
| **4** | Female | 20 | White Other | Social Science | 3rd year | 18.8 | 1 | 3 | 10 | 1 | 6 | 2 | 4 | 6 |
| **5** | Female | Not provided | Asian/ Asian British | Social Sciences | 2nd year | Not provided | 9 | 2 | 10 | 7 | 7 | 4 | 8 | 9 |
| **6** | Female | 19 | White Other | Arts | 1st year | 19.4 | 9 | 10 | 1 | 5 | 5 | 8 | 4 | 9 |
| **7** | Female | 20 | White British | Social Sciences | 2nd year | 22.6 | 7 | 3 | 7 | 1 | 1 | 5 | 6 | 2 |
| **8** | Female | 21 | White British | Social Sciences | 3rd year | 21.0 | 8 | 7 | 10 | 1 | 6 | 4 | 6 | 4 |
| **9** | Female | 21 | White Other | Social Sciences | 1st year | 20.0 | 10 | 10 | 6 | 2 | 2 | 8 | 3 | 1 |
| **10** | Female | 20 | White British | Science | 2nd year | 22.6 | 1 | 5 | 3 | 8 | 3 | 7 | 9 | 1 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **11** | Female | 21 | White British | Science | 3rd year | 22.9 | 9 | 9 | 1 | 3 | 3 | 4 | 2 | 4 |
| **12** | Female | 19 | White British | Science | 1st year | 19.9 | 3 | 7 | 7 | 9 | 8 | 10 | 1 | 9 |
| **13** | Female | 20 | White British | Science | 3rd year | 21.2 | 9 | 3 | 2 | 7 | 1 | 6 | 9 | 9 |
| **14** | Female | 19 | Mixed | Social Sciences | 1st year | 20.6 | 9 | 1 | 4 | 4 | 7 | 8 | 10 | 5 |
| **15** | Female | 21 | White British | Science | 3rd year | 19.1 | 5 | 3 | 2 | 1 | 9 | 4 | 9 | 2 |
| **16** | Female | 21 | White British | Science | 3rd year | 20.3 | 10 | 8 | 4 | 5 | 9 | 1 | 2 | 5 |
| **17** | Female | 24 | White British | Medicine & health | 2nd year | 24.7 | 4 | 5 | 10 | 1 | 6 | 9 | 10 | 4 |
| **18** | Female | 21 | Other | Medicine & health | 2nd year | 17.6 | 9 | 8 | 6 | 1 | 7 | 4 | 3 | 2 |
| **19** | Male | 21 | White British | Science | 2nd year | 20.4 | 10 | 4 | 1 | 10 | 10 | 8 | 1 | 10 |
| **20** | Male | 22 | Mixed | Medicine & health | 2nd year | 19.6 | 3 | 6 | 10 | 5 | 10 | 1 | 8 | 3 |
| **21** | Male | 20 | White British | Engineer-ing | 1st year | 22.8 | 2 | 7 | 5 | 10 | 7 | 4 | 4 | 10 |
| **22** | Male | 21 | Asian/ Asian British | Medicine & health | 2nd year | 25.5 | 5 | 5 | 7 | 7 | 1 | 6 | 2 | 5 |
| **23** | Male | 20 | White British | Medicine & health | 2nd year | 22.2 | 5 | 5 | 1 | 7 | 7 | 10 | 10 | 10 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **24** | Male | 19 | White British | Science | 1st year | 20.9 | 4 | 4 | 7 | 9 | 4 | 3 | 8 | 1 |
| **25** | Male | 20 | White British | Medicine & health | 1st year | 22.6 | 8 | 2 | 10 | 9 | 8 | 1 | 10 | 10 |

γ Component labels: 1 – health-conscious; 2 – vegetarian; 3 - snacking; 4 –convenience, red meat & alcohol; 5 – budget cooking; 6 – tea, coffee & spread; 7 – eggs & full fat dairy; 8 – bread, spread, jam & cheese

Ψ decile 1 = bottom decile; decile 10 = top decile

At times, participants' accounts of their food choices and dietary decisions contradicted pattern scores. Participants frequently reflected on their food and eating practices during earlier years of study or unique periods of university life; these periods often differed from current or habitual practices and thus created disparity between dietary pattern scores and qualitative accounts of eating practices. For a few participants, dietary practices had also evolved since the time of quantitative data collection and dietary pattern scores were those not representative of eating practices at the time of qualitative data collection. This dynamic nature of food choice at university is a finding in itself and is highlighted throughout the ensuing themes. It is also possible that participants' spoken accounts of their food and eating practices differ from what and how they eat in reality, representing a further possible source of inconsistency between participants' quantitative and qualitative data (276). It should additionally be noted that employment of PCA to identify dietary patterns within the quantitative dataset meant that participants could have high scores on more than one dietary pattern: a few participants had high scores on seemingly contrasting (i.e. both more and less healthful) dietary patterns, highlighting the complex nature and multitude of often opposing influences on food choice.

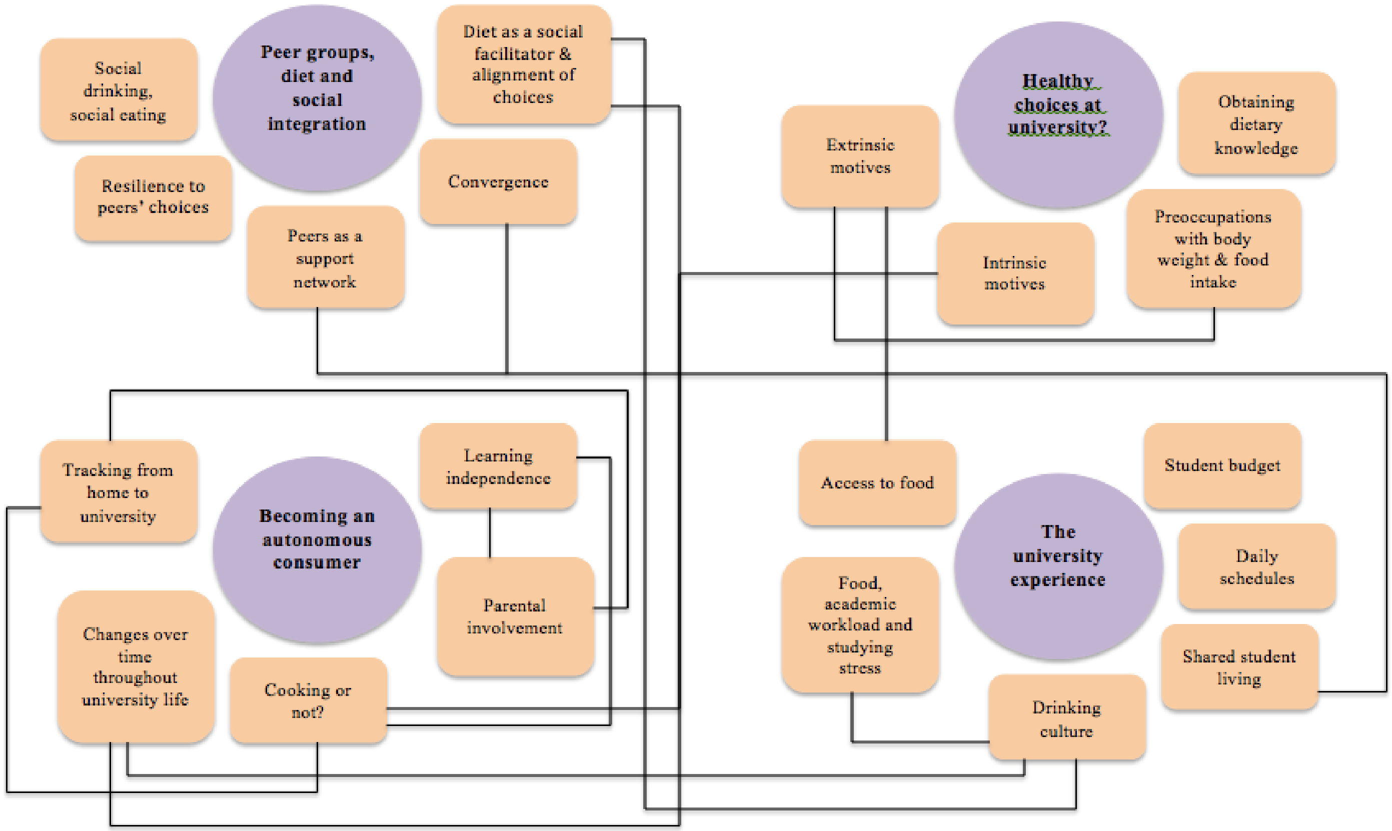
Analysis of interview data revealed four substantive themes: 1) 'Peer groups, diet and social integration'; 2) 'The university experience'; 3) 'Healthful choices at university?' and 4) 'Becoming an autonomous consumer'. These candidate themes, each comprising a number of sub-themes, are described in detail below and summarised in Table 12 and Figure 12 (thematic map). Whilst each theme, and sub-theme, has been presented as distinct, it should be noted that the underpinnings of dietary behaviour at university are various and inter-related. Indeed, what participants in this study ultimately decided to eat or drink at any single time resulted from a complex interplay of multiple influences. Several interconnections therefore exist between themes, evidencing the complexities of food choice, and these major interconnections have been highlighted via the black lines between sub-themes on the thematic map presented below (Figure 12). For example, the sub-theme 'tracking from home to university' was connected to the sub-theme 'parental involvement': the extent to which a student's diet at university reflected their diet in the family home was also related to the extent to which a student's parents were involved in their food provision at university. At the same time, both 'parental involvement' and 'tracking from home to university' represented unique sub-themes in their own right: tracking of food choice from home to university was about more than parental involvement in food provision at university, whilst parental involvement at university had effects beyond – and separate from - the tracking of food choices. In a similar vein, 'drinking culture', a sub-theme of the candidate theme 'The University Experience' is connected to the sub-themes 'food, academic workload and studying stress', 'changes over time throughout university life' and 'diet as a social facilitator and alignment of choices'. Indeed, the sub-theme 'drinking culture' represents the seemingly prerequisite need to engage in excessive alcohol consumption at university in order to experience university. However, such engagement in excessive drinking impacted upon students' ability to establish new social networks, was related to the intensity of academic study at any given time, and appeared particularly relevant to the start of university life. As a student's university career progressed, dietary choices also more generally evolved, highlighting the dynamic nature of eating (and drinking) practices at university; such temporal change was evidenced across all themes and has been described within the following results. The themes presented below cover four major areas that underpin dietary decision-making of young adults at university.

**Table 16: Themes and sub-themes identified during thematic analysis of interview data**[γ]

| Theme | Sub-theme |
|---|---|
| **Peer groups, diet and social integration** | Diet as a social facilitator and alignment of choices |
| | Convergence |
| | Social eating, social drinking |
| | Resilience to peers' choices |
| | Peers as a support network |
| **The university experience** | Daily schedules |
| | Shared student living |
| | Student budget |
| | Access to food |
| | Food, academic workload and studying stress |
| | Drinking culture |
| **Healthful choices at university?** | Extrinsic motives for consuming a healthful diet |
| | Intrinsic motives for consuming a healthful diet |
| | Obtaining dietary knowledge |
| | Pre-occupations with body weight and food intake |
| **Becoming an autonomous consumer** | Learning independence |
| | Tracking from home to university |
| | Cooking or not? |
| | Parental involvement |
| | Changes over time throughout university life |

[γ] A full version of the coding scheme can be viewed in Appendix

**Figure 12:** Final thematic map displaying major themes (purple circles), sub-themes (orange rectangles) and connections between sub-themes (black lines)



### 6.3 Peer groups, diet and social integration

This candidate theme encompasses the multiple ways in which diet has a social role at university, highlighting participants' awareness of others in the context of their dietary choices and relationship with food. It comprises four sub-themes, which are described below. There is additionally an element of temporality between sub-themes, such that as students progressed through university, food and drink's social role evolved accordingly.

#### 6.3.1 Diet as a social facilitator and alignment of choices

During the initial stages of university life, the young people in this study described being faced with the need to establish new friendships, settle into shared student living with flatmates and generally feel accepted by newfound peers. Dietary behaviours seemed to play a key part in this process with food and drink (namely alcohol) taking on the role of a social facilitator during the initial months at university. Food was described as an effective icebreaker in the early days and weeks, with students sharing, typically less healthful, meals with flatmates in order to get to know one another. During this time, cooking individual meals seemed to obstruct opportunities for peer bonding and socialising, although this role of food seemed to be somewhat short-lived:

*I think the first week, like my mum the first day she bought loads of pizzas, so the first day we all just ate pizza together, so it was kind of a way, cos you didn't know each other, it was like you could talk around having like, you didn't want to cook different meals all the time. Like fresher's week you probably did eat a bit more together, I think we maybe had a take-away one night or something, so in that week we did eat a lot more together, but other than that I think gradually maybe after like 2 weeks we did our own thing. (P7, female)*

Sharing eating occasions, going out for lunches and having coffee with fellow students was described as another means through which to get to know new people. This latter role appeared to be endorsed by the university in their formal advice for induction:

*You were told to go out for coffees with people, go out for lunch with people and it's just like part of meeting people just going out for coffee and lunch and stuff. (P8, female)*

At the same time, many participants additionally described actively changing their food and drink choices away from what they might prefer to consume and to align themselves with their peers in an attempt to integrate into new peer groups and avoid exclusion from social activities. More often than not this process involved alcohol consumption (sometimes to excess) or consuming typically less healthful foods such as take-aways. Several participants described feeling a *'pressure'* - albeit often perceived - to conform to the dietary norms of those around them. The following quote from a third year female student (who scored highly on the vegetarian and health-conscious patterns), explains how this pressure was most intense during her first year:

*I'd say in first year I was more likely to be influenced by my peers, just because you're still trying to fit in and you don't want to be the one that says no or gets a bit left out because you haven't gone for the meal out and like you've missed something, house bonding or course-friend bonding or something like that. (P16, female)*

In a similar vein, but with a contrasting outcome, a small number of participants described aligning their dietary behaviours in a more positive direction when they found themselves surrounded by peers who ate more healthily than they otherwise might. This altered food selection also appeared to represent a conscious attempt to promote social inclusion and avoid negative peer judgment on food choices:

*People in my flat are actually quite healthy, like they cook proper meals. I think if they didn't I'd be more influenced to get takeaways and stuff. But cos they don't I feel like I've gotta be more healthy kind of thing. (P3, female)*

For other students, this existence of a pressure to conform was recognised, but peers' choices acted more as a vehicle that enabled submission to desired temptations, rather than a pressure to engage in dietary behaviours they would otherwise choose to avoid. These participants described enjoying eating fast food and drinking alcohol, and were therefore easily persuaded to join in with these behaviours when an opportunity arose:

*Realistically speaking I do enjoy going out and I do enjoy having a drink, so if someone says to me 'oh come on, it'll only be for a couple' I don't really have a strong sense inside me saying 'no, don't do it', unless I have a reason and then I won't do it [...] but if it's* *kind of, oh I've got nothing else to do, there's nothing else important going on the next day, then I am quite easily persuaded to go out, have another drink, stay for a bit longer. Yeah cos it's enjoyable, so I just do. (P10, female)*

### 6.3.2 Convergence

Throughout university participants also described a relatively passive process of convergence of eating behaviours within social groups; this was particularly the case among housemates. Eating habits such as skipping breakfast or frequent consumption of 'junk' food, which might have been viewed as unusual or unacceptable before arriving at university, became commonplace and subsequently normalised and adopted:

*Initially I think it did surprise me that a lot of people couldn't cook or ate the way they did […] but now as it's gone on, I think it's kind of normalised it in a way, in my head, that people eat a lot of kind of bad food in one way, like pizzas and crisps and whatever else, because you see people doing it […] you do think 'oh it isn't good that I do this', but on the other hand everyone's doing it. So I think it normalises it a little bit and then that kind of maybe makes you feel like it's what everyone does. (P6, female)*

In a similar vein, peer groups also influenced students' attitudes to food and body image. This was particularly the case for the following female student (who scored highly on the health-conscious dietary pattern). This participant found herself in a house where dieting and weight concerns were the norm, which impacted upon her own eating behaviour:

*In second year and third year I've lived with the same bunch of people three of which are girls and all three of them I think they're sort of always dieting and their eating habits are very much, you know they're always thinking 'oh you know, I need to lose weight' and 'ooh why did I eat all that?' and you all do sort of become a bit like each other in that in your eating patterns I suppose. And then, yeah, none of them have breakfast - none of the three girls have breakfast, so that's probably why I've just slowly, well often I won't have it. (P8, female)*

For students who shared cooking responsibilities with housemates or partners, compromise over dietary preferences and a resultant convergence of food choices was required. This often meant that students wishing to make healthful choices at university had to sacrifice some of these desires to ensure shared cooking was successful.

In contrast, for a few students, poor food choices made by close peers actually acted as a deterrent from adopting similarly unhealthful habits. Witnessing at first hand the extent of poor consumption patterns made some young people realise that they didn't want to fall into these routines themselves, thereby providing a stimulus for embracing more healthful dietary practices:

*I dunno what I was expecting from like other peoples' cooking abilities but I had, I was in a flat of five. One of them could cook. [One of my flatmates] was incredibly lazy when it came to cooking and sort of lived on a diet of pizzas, like those microwaveable Rustler's burgers stuff, so I don't know how he survived from that. And even like, he wouldn't have a plate because he didn't want to wash up so he'd just eat his pizza off the pizza box and that sort of stuff. Erm so if anything that scared me away from the fast food alternatives. Like seeing him like that and I don't want that to be me. (P21, male)*

### 6.3.3 Social eating, social drinking

As the young people in this study progressed through university, there was also evidence of an evolving social role of food and drink. Once friendships were formed, diet's role as a social facilitator lessened and it became more a mechanism through which to catch up - and enjoy spending time – with already established friendship groups. This most often involved eating out of the house, or, for a minority of students, having a few drinks in the local pub. Going out for meals or drinks also seemed to have a particular role in celebration, either to celebrate someone's birthday or to mark the end of a semester, exams or other academic deadline.

*I do eat out quite a lot actually, probably once a week, once or twice a week. Erm, because I've got like quite a lot of different like friendship groups, so I have like hockey and I have my course mates and my house mates and then if it's peoples birthdays we end up going out for a meal, and then I've got some friends who go to the same uni so if they're coming up to visit we do meals out and stuff, and then quite a lot of Thursdays I'll go to Revs and have a meal there (P10, female)*

A few other students highlighted food's role in displaying affection within romantic relationships. Female students described boyfriends buying them *'treats'* following a hard day, or going out for meals together to mark a special occasion or simply spend time together.

### 6.3.4 Resilience to peers' choices

Several participants also described a resilience to influence by peers when making dietary decisions, with the pressure or feeling of a need to conform to peer group norms described above (section 6.3.1) being particularly intense only during the first year of university. After this point, when friendship groups were more firmly established, food and drink's role as a social facilitator again became less salient and students recounted feeling more able to make independent decisions around consumption, reporting greater levels of self-confidence and resultant indifference to any potential peer judgment. This was particularly the case for students wanting to eat more healthfully. During this process, students also described gravitating towards peers with congruent interests and belief systems, which further acted to reduce the (perceived) need to alter dietary behaviours in order to fit in with peers with whom they shared day-to-day living, but had little other common interests. The following quote from a participant now in the later years of her second undergraduate degree evidences this changing role of food and drink as she navigated her way through social integration during the initial months at university:

*Fresher's Week was probably, I probably had the most [alcohol] then and erm, cos you're trying to socialise with people and you don't want to be the person in the corner not drinking (laughs) so, you want to kind of like fit in with everyone, whereas when I came [to the University of Sheffield] I felt like I didn't need to fit in, that I was my own person, I felt more confident coming to dentistry. I didn't feel like I had to drink to please people, I felt like my personality should do that anyway. (P17, female, second degree)*

A few other participants described being able to stand apart from peer group norms more immediately, but only when there were specific reasons that enabled them to circumvent such pressures around food and drink consumption. Participants specifically spoke about how being older or vegetarian provided excuses that were more readily accepted by peers and thus enabled them to flout dietary norms:

*People do notice when you don't, you don't drink. Erm and for me I think it's quite easy* *because I'm older than most of my peers, like I'm 21 already and everyone else is like 19 now, so you know I can easily be the grown-up that doesn't get completely wasted. (P9, female)*

*I think now that I'm vegetarian my diet might be slightly more independent, so yeah, maybe before I might have been more sucked into 'let's get a take-away, let's get loads of food' and I wouldn't really be able to say maybe I don't want to eat that much food or I want to eat more healthy food. (P8, female)*

### 6.3.5 Peers as a support network

Finally, a few participants also spoke about how their peers, particularly housemates, had a positive influence on their food choices. Examples emerged as to how peers with more healthful dietary behaviours acted as a stimulus to adopt congruent habits, and/or provided encouragement when working towards a mutual goal of following a particular diet. A support network of like-minded peers seemed particularly important for the adoption of more healthful dietary behaviours in the midst of less healthful eating norms. This was particularly the case for students wanting to follow specific diets, including vegetarianism:

*With vegetarianism I think it definitely, erm I think two, three, like sometimes it's almost 50:50 in our groups, like 50 percent vegetarians, 50 percent non vegetarians, so erm that's definitely kind of helped me stick to it. Erm I've been a vegetarian for 3 years but when you're constantly around people who are bickering and sort of making comments about how you don't eat meat, even though it's really none of their business it makes it harder, so it's kind of nice to have a supportive group there (P9, female)*

Another participant recognised how peers can provide an emotional support network that reduces the need to resort to using food for coping during stressful periods. During particularly intense phases of study requiring long periods of lone working, the consumption of large amounts of junk food was represented as an attempt to fill a void of emotional support:

*Interviewer: And is [eating junk food when feeling stressed] something you've noticed more in third year or is that something that you've noticed throughout uni?*

*Participant: Erm, more in third year - I wonder if it's related to the fact you're on your own a lot more so you're just sort of, yeah cos obviously if you're around other people* *you might not just work your way through a lot of bad food, but yeah. Yeah. (P8, female)*

## 6.4 The university experience

This second major theme depicts university as a unique setting for influences on dietary behaviour. It encompasses a number of sub-themes, each representing a different determinant of, or impact on, dietary practices specific to university life, and further highlights the dynamic nature of food intake at university as these influences evolve throughout an individual's university career.

### 6.4.1 Daily schedules

The move to university for all of the participants in this study brought with it new daily routines and schedules, which impacted upon food choices and eating practices in a number of ways. Schedules at university varied according to degree demands and engagement in extra-curricular activities, but several participants described spending little time in their student house, often characterised by late returns from sports team practices or long days in the library and ultimately leaving little time that could be dedicated to cooking meals from scratch. Following long days of library-based study examples emerged of students resorting to eating out of the house instead of returning home to cook their own meals. This meant food preparation requirements could be eschewed when finishing the day tired and hungry:

*If you're in the library 'til like seven, eight and you just kind of, you don't really want to go home, cook your dinner, you'll just say 'oh shall we just go to here and get a bite to eat?' And you'll just go out there. (P24, male)*

For students on health-related degree courses with long days on placement, time pressures were particularly intense and timetables often unpredictable, similarly minimising time available for cooking. Although participants recognised that sharing meal preparation responsibilities with housemates would spread the burden of cooking when time pressures were great, this was often not possible due to incompatible daily routines and eating times. As a result, many students relied on ready meals and other pre-prepared foods in the face of hectic agendas; foods were chosen that required minimal preparation and cooking effort, freeing up time for the completion of other daily tasks and priorities:

*When we used to have training on a Monday night I knew that was get back quite late, I wouldn't want to be waiting ages for something, so I'd normally have something that was quite like, put in the oven when you get back, so I could shower and then eat it afterwards. The same with when I go to the gym and I really plan around like having something that I don't have to be, can just be cooking while I shower and not having to be over it (P12, female)*

At the same time, however, most students recognised that lack of time *per se* was not completely responsible for a lack of consumption of home-cooked food in the face of hectic schedules. Rather, when faced with the prospect of cooking a meal from scratch after a long day at university, many participants lacked motivation to spend time in the kitchen, ascribing this to laziness, rather than an absolute lack of time:

*Sometimes yeah, I would just give in and be like 'I could cook or instead I could just, I could just order […] I think I use the excuse that I am quite busy, as an excuse not to always prepare a home cooked meal but I think if I planned a bit more, in honesty, I probably could cook a fairly balanced meal most evenings. I just don't at the moment, cos, yeah because I'm lazy. (P20, male)*

For students for whom home-cooked and healthful food choices were a priority, meals were adapted and simplified to ensure such priorities could still be fulfilled when time was short:

*In the evening just like being tired or like I can't be bothered but I still try and make like healthy food, but it's just like quicker. Maybe not as exciting, erm but I still try and get like vegetables and you know, protein and all that. (P18, female)*

Other participants, particularly those with fewer degree contact hours or other commitments, described lacking routine and structure to their days at university, which, whilst meaning much more time was spent in the student house, equally impacted upon eating practices. Since participants were independent and responsible for only their own dietary decisions at university, this lead to the adoption of unconventional schedules by some students, contrasting to previous routines within the family environment. As a result, meals were often missed or consumed at unusual times. This disruption to usual eating schedules was described by both male and female participants:

*That's probably the biggest change from back home and here. That not having a very strict time when things are cooked, everything sort of shifted later. So I'd be having lunch at three or four, even just, not even after a night out, just on an average day. And then I'd probably have dinner at like 11 or midnight or something. And our entire flat became a bit nocturnal. (P21, male)*

*If I didn't have to be in that day I'd get up later and do my uni work later and go to the library and then I'd skip breakfast and just go straight to lunch, but usually before uni I'd have breakfast at around about like 7 or 8 depending what time I'm in (P14, female)*

Daily lecture schedules also impacted on whether certain meals were consumed in or out of the house. For students living too far away from university to walk home during lunch or other lecture breaks, such times provided participants with the opportunity to eat and catch up in one of the university food outlets, and these occasions came to fulfill social as well as nutritional functions as peer groups were established. In contrast, for students with fewer university contact hours and/or only short breaks between lectures, consumption of food at home was promoted:

*My housemates eat at like [university food outlet] like all the time. But I don't really have like the hours in between like lectures or seminars that people tend to go to uni ones, 'cause they're closer and they're convenient and they know what they're getting but I don't really tend to have that, I'll have like a couple of hours in the morning and then just nothing. So it's not, it's convenient for me to go home and eat, rather than eat out at lunchtime and stuff like that, which is the main reason why I don't. (P16, female)*

### 6.4.2 Shared student living

Sharing accommodation with large numbers of other students also impacted upon eating habits and food choices at university. Several participants described aspirations of a community-led student living, including attempts at collective cooking and sharing family-type meals such as Sunday roasts, but in reality such living circumstances represented groups of young people living independent lives in the same space, with resultant associated challenges. Diverging schedules, individual food preferences among housemates and/or fussy eating made shared cooking particularly challenging and promoted independent meal creation:

*I think it works out better doing it separately cos not everyone eats the same things. Cos like me and [one of my flatmates] are vegetarian, so we wouldn't eat the same as the others anyway, and then our other housemate seems to survive from pasta and bacon, which isn't something I'd be interested in having everyday. (P2, female)*

Whilst some participants seemed very satisfied with the cooking facilities available at university, several others described inadequate kitchen facilities for these living contexts, particularly in terms of insufficient fridge, freezer or cooking space. This meant students were unable to store as many fresh ingredients as they would like - impacting particularly upon fruit and vegetable intake - or were unable to cook large quantities of food and then freeze portions for consumption at a later date. The latter lead to a number of challenges associated with cooking-for-one, and often resulted in students not wanting to go to the effort of cooking a single meal portion from scratch, instead preferring to opt for pre-prepared convenience foods, which required less effort and cooking time. Sharing a single oven and small number of cooking plates between in some cases as many as ten people also restricted both the amount of time students could spend cooking and the complexity of meals prepared. These constraints ultimately resulted in reliance on convenience food, which required less preparation time and space, freeing up the cooking area for other students:

*The kitchen is quite limiting sometimes, because it's quite small and we've only got like four rings and a little oven so if there's five of us all trying to cook at the same time, you might just go for something like pasta and sauce, just because it takes like one pan, rather than trying to cook an entire meal (P16, female)*

Issues of trust were also described with one student explaining how her food was stolen from the kitchen when living in first year catered halls of accommodation. Such thefts resulted in food being stored in her bedroom, which impacted upon the type of food purchased, limiting choices to non-perishable, typically snack food items requiring no fridge or freezer storage. Many participants also described issues of kitchen cleanliness when living with large numbers of other students. Living in a house or flat with an untidy kitchen, typically characterised by an accumulation of several students’ unwashed pots and dishes, dirty work surfaces and unchanged bins deterred these participants from wanting to spend time in the kitchen cooking. Once again, this ultimately resulted in altered food choices - namely consumption of meals requiring little or no cooking and/or preparation efforts - ensuring minimal time could be spent in such a kitchen space. Whilst for some students this resulted in an additional source of promotion for ready meal or convenience food consumption, for others there was evidence of a *"disheartening"* experience and reliance on more snack-type meals:

*I'd say it's probably the fact that you share a flat with 10 people, and erm the fact that I don't always wanna spend a really long time in there cooking, because it can be pretty disgusting, and when we're all busy it's only me and 2 other people who kind of tidy it for everyone, so if we're busy it's gonna be kind of dirty. So I feel like yesterday I didn't wanna sit in my kitchen and eat really, so I just quickly chopped up some raw vegetables and got out kind of thing. (P6, female)*

### 6.4.3 Student budget

Limited student budgets were described by the majority of participants in this study, which directly impacted upon dietary choices. Students needed to decide how much of their often limited funds to allocate to the numerous financial demands of university. Socialising, food and alcohol all emerged as drains on funds and the priority placed on each of these areas of university life was central in determining the proportion of budget spent on food choices during this time. In an attempt to save money and ensure other financial outgoings could be met, several students described adapting their food choices and eating practices upon arrival at university to reduce food costs. For some students these changes had a positive impact on dietary intake, including limiting consumption of typically costly snacks, ready meals and take-aways, and at times substituting meat-based meals for vegetarian alternatives:

*For dinner I had like a potato and bacon omelette thing. Erm cause it's quite cheap. And I wouldn't say I'm a vegetarian but I certainly reduce my meat intake when I'm away from home. Mainly for cost, because sort of if you go for cheap meat it's pretty dodgy, like cheap sausages and stuff like that. I'd rather not eat it than have that quality of meat. (P21, male)*

For others, however, particularly those whose choices were driven exclusively by which foods were cheapest, irrespective of quality, origin or nutritional value, these changes resulted in a tendency towards non-perishable, lower quality, often more processed food items and/or limited variety in food intake:

*I do visit quite a few friends from other universities, so that takes up money, and playing hockey and going on socials, that takes up money, and so the money for food went down a lot. And because of that I just looked at what's the cheapest food I can get, what's the easiest food I can get, I don't really think about where it's from or how it's, yeah the quality, I just kind of buy, especially when you can go to Aldi and get a lot of stuff there that's cheap, but not the best source. (P10, female)*

*I used to eat like fried rice every single night, because it was cheap, and the noodles with like an egg or something, because it was cheap. And I didn't really think about what was healthy and stuff, I just thought oh this is what I can afford at the moment, and this is what I can make at the moment (P5, female)*

In contrast, for students for whom healthful and quality food consumption was a priority, funds for other areas of student life were sacrificed to increase money available for food purchases and thereby to ensure such desires could be fulfilled. For some students little attention was given to food costs and there was close to free rein in food choice. Several others, however, acknowledged being faced with small and restrictive student budgets but were savvy in their food purchasing patterns, limiting consumption of convenient but more expensive pre-prepared food items, seeking out offers, buying in bulk and opting for foods within 'value' ranges to maintain healthier choices and ensure such priorities could be fulfilled:

*I think [money] does like have quite an impact […] I still like buy erm like foods with good nutritional value, they might just not be as fancy, erm or like I'll buy like sort of fresh food, rather than like having it prepared, because that's more expensive as well. Erm, and yeah, I think, yeah just sort of going for maybe like Tesco Value instead of maybe Tesco Finest, things like that. Erm, and maybe sort of buying in bulk, because that's a bit cheaper as well. Erm I think I still buy enough food, but maybe just not as, erm, yeah, not as fancy. (P18, female)*

At the same time, limited financial resources were also described as the barrier between desires and behaviour, forcing students to make purchases outside of their values and priorities, particularly concerning the ethical nature of their food choices. Several participants described wanting to buy organic or ethically sourced or produced food items, but with insufficient money available at university, these more expensive choices could represent only future hopes and aspirations:

*I would buy free-range chicken, but they are so expensive. I just can't afford to buy it. I would like to buy them, but I just can't. (P24, male)*

### 6.4.4 Access to food

Physical access to food also influenced eating practices at university. The majority of participants in this study lived in shared student flats or houses within student-dense suburbs, located in close proximity to numerous convenience stores and, particularly, take-away outlets. Such easy access to fast food made purchases convenient, promoting consumption. This consumption pattern was particularly the case at times when students were vulnerable to easy options, such as during drinking occasions, in busy schedules that increased time pressures, and when experiencing instances of lacking motivation to cook. Students acknowledged that if such food outlets weren't so easily accessible they would be less likely to represent their default option at these times.

*I definitely eat a lot more take-aways and ready meals at university just cos there seems to be a lot more on offer, the fact that I live in an area where there's three takeaways within a stone's throw from each other, and that's very close to my house, it's quite easy to just go and get one if I can't be bothered to cook, which a lot of the time I'm not even cooking that much anyway […] If they were further away, if there weren't as many I don't think I'd eat as many as I do. (P10, female)*

The density of - and easy access to - costly convenience stores coupled with a lack of larger supermarkets within student suburbs also impacted upon food choices. Participants explained how fresh food items - particularly fruit and vegetables - obtained from local stores were expensive and often quickly perished, impeding their purchase and consumption. In contrast, for students passing independent and good value grocery or whole food stores *en route* from university to home, consumption of fresh foods was promoted.

*I didn't have [a particular whole foods shop], which made quite a bit of a difference. So I was shopping quite a bit more just at Spar just as they were on the way home, so that makes a huge difference I think. Erm, because vegetables are quite expensive from* *supermarkets, and don't always last as long and things like that. They're not always as fresh. That, yeah, what was accessible made a big difference. (P11, female)*

In a somewhat different vein, participants’ access – or physical proximity – to food within their student house also influenced food and eating practices; this appeared particularly the case among female students. Insufficient kitchen storage space meant several participants, particularly first year students living in university accommodation, were required to keep food in their rooms, which provided a constant reminder of food available for consumption and a resultant temptation to snack, particularly when vulnerable to distraction during studying:

*I've not got much cupboard room so I have to keep a lot of stuff in my room. And I think that kind of, cos I'm working and I'll see food around me then I'll want to eat that food. So I think next year I'll be able to put it in the kitchen so when I'm in my room it won't be distracting me and I won't be thinking about it, so I won't eat it as much. (P3, female, first year)*

An ‘out of sight, out of mind’ relationship with food seemed to prevail during studying, and for students with an absence of food in close proximity, snacking could be more easily avoided. This second year student explains how the transition from university accommodation to private housing reduced her easy access to food and subsequent snacking behaviour whilst studying at home:

*Being in a flat it was easy to just go and get something to eat and take it back to your room or just sit and eat it there, whereas this year being in a big house it's 2 quite substantial flights of stairs to get to the kitchen, so if you're going to like, I don't, I think that's one of the reasons that I don't really snack, cos it's not really worth like going up and down the stairs, so I just wait until I have like a main meal and just go down and eat it down there. (P7, female)*

### 6.4.5 Food, academic workload and studying stress

For all of the participants in this study, academic workload and stresses at university also impacted upon dietary choices in some way. Whilst for the majority of participants, university was seen, at least in part, as a time to have fun and focus on the present rather than the future, as students advanced through their degree, the emphasis placed on academic studies augmented, with a resultant impact upon dietary decisions. As such, dietary habits were dynamic, and fluctuated as a student's university career progressed. For most students, academic achievements from the first year of a university degree did not contribute to their final grade, and participants portrayed this as a time when the university experience could be fully grasped. Excessive alcohol consumption, ensuing hangovers and little academic focus were described and missing lectures was deemed acceptable, with few, if any, detrimental academic consequences. As students progressed beyond their first year, however, both academic workload and the importance placed on studying increased, and alcohol consumption patterns were adapted accordingly. Participants described consciously limiting their alcohol intake to ensure that concentration and academic productivity could be optimised:

*Well in first year when you first arrive, it's all very exciting and you're meeting loads of new people and […] because it's your first year […] you're not so fussed about having to pay attention in lectures sort of thing. If you go to a lecture and you are slightly hung over and you miss sort of what they're saying, you're not as bothered, as fussed yeah…but then as the sort of year's gone on […] I won't go out at the week and have a drink because I'll have placement the next day and I want to be sort of focused for placement, whereas if you're sat in a lecture theatre you can just sort of blend in to everybody (P23, male)*

A similar experience was described for students with no professional placements. The following interview extract from a 3rd year female science student, for example, provides further insight into the fluctuation of alcohol consumption in line with academic workload. As academic pressures heightened, alcohol intake was reduced, but once the intense period of study was completed, consumption increased as alcohol resumed a more celebratory and social role:

*Now I feel it's not cost really, cos it's like always been the same price, it's just not wanting to feel hung over the next day that's been limiting my drinking in third year, cos you're always thinking 'oh but I'm sacrificing a day's work' and 'I'm not going to be able to get up early enough to get a computer in the library' […] And, yeah, anytime that's kind of three weeks before a deadline I won't go out cos I have to be in the library […] But now it's got to after exams we're kind of drinking whatever we want and just like it's not drinking to get drunk so much as drinking to enjoy it and to get a bit merry like at four o'clock in the afternoon. (P16, female)*

Cooking habits were also affected during periods of heightened workload, with a shift away from home-cooked meals to a reliance on more pre-prepared foods. This shift represented an attempt to free up time that could be used for studying as well as to enable meal consumption away from the home when a greater number of hours spent in the library were deemed necessary:

*I think I'm quite a good cook, I just don't cook very much […] I think it's probably mostly lack of time. Yeah, I think that's probably the major reason […] But I've sort of thought third year, you don't really have time to be spending like an hour or two on your evening meal preparation and stuff, so yeah. (P8, female)*

Cooking was particularly viewed as an (somewhat luxury) activity that took valuable time away from studying during exam periods. Several students referred to feelings of guilt when spending more than minimal time in the kitchen, which could instead be used working at their desk. Thus for the majority of students who described regularly cooking meals from scratch during usual term-times, pre-prepared, convenience foods were a valuable resort in order to maximise time available for studying during more intense periods:

*Exam period was when I ate a lot of pizza. Just all I ate was pizza it seemed […] I was just like revising, revising, and I didn't want to like stop for two hours and make [myself] a really nice meal or anything so I just used to throw a pizza in the oven and forget about it for twenty minutes and carry on revising. (P24, male)*

During these more intense phases of heightened academic stress, despite recognition that more healthful food choices would likely enhance study/revision outcomes, these periods were additionally associated with an abandonment of usual eating regulation and/or attempts to consume a healthy diet. Students reported stressful periods during which there was little impetus to pursue a healthy diet, instead relying on consumption of ‘junk’ and snack foods. There was a recurrent view that usual healthful eating focus and endeavours could be resumed once such periods were completed - irrespective of whether or not this was the case in practice - which appeared to legitimise these eating habits and circumvent usual feelings of guilt. This was the case for both male and female participants. The following male student explains how stress experienced during intense periods of study displaced his usual weight and health concerns:

*You sort of tell yourself that it doesn't matter because you're just eating to get yourself through these exams and afterwards you can change and lose all the weight and things […] your health does go a bit downhill when you're studying. And I know it really shouldn't. You're supposed to get loads of sleep and get exercise and eat healthily but I think most of that goes a bit out of the window when you're stressed generally. (P20, male)*

For some students, food was used more consciously as a coping mechanism during stressful periods. Eating clearly took on a role beyond the provision of fuel with students opting for sugar-rich food items such as sweets and chocolate to '*feel better'* rather than out of response to hunger cues or to satisfy energy needs. For a small number of female students, these eating episodes involved the consumption of – most often unintentionally - large amounts of food energy. A third year female student (who scored highly on the 'snacking' pattern) provided particular insight into this:

*You always find yourself buying just like comfort food when you're working. So you'll just buy like, I'm probably quite bad for it, you'll just buy like you know a packet of cookies and you might just eat the whole thing in a short amount of time, and just little chocolate bars and stuff […] you'll eat a lot of fruit, but then you'll also eat a lot of bad junk food. Erm, but, yeah it's kind of strange cos all the while you'll be trying to eat healthily while you're doing all that but yeah sort of you do binge but, if that makes sense (P8, female)*

*At about 4, 5 o'clock I hit a brick wall doing work and felt really demoralised and ate like about that much chocolate [uses hands to estimate size and laughs] which, I guess is about half a bar, for this, and chocolate biscuits and cake, all at once (P12, female)*

Several students also described eating to provide distraction from studying and/or to relieve associated boredom. Such consumption took place in the absence of hunger cues and often resulted in increased consumption of energy-dense snack food items. For a few students, eating whilst working seemed to aid concentration, whilst for others eating represented more a means through which to take a break from – or an excuse to avoid – studying. This pattern of consumption was different from during lectures or placement, for example, when boredom did not seem to be an issue and thoughts were more divorced from food. The following quote by a first year female student illustrates this role of food during academic revision stress:

*I think quite often I'm not hungry, I just make food to sort of distract myself so I don't have to revise, and eat out of boredom kind of thing […] I think if I was at lectures, cos it would be more interesting, I wouldn't think about food, but cos I'm bored I'm looking for any distractions, so food's quite a good distraction. (P3, female)*

Food also appeared to provide participants with motivation to engage in intense periods of academic study, with students rewarding themselves by eating tasteful – although typically less healthful – food items. Consumption of usually forbidden 'treat' foods during these periods seemed at least in some small way to compensate for the stress and monotony associated with impending exams and other academic deadlines:

*[…] with coursework where I know it's like you have a deadline and you have to meet it and I always leave it to the last minute, it will be like a systems of like reward, so like if you do work, if you've done a bit of reading, it'll just kind of get you through sitting there looking at a screen, I think snacks and things like that come into it a lot more […] either you buy snacks and go to the library, or what we do is we go to the library like from 9 till 5, then have an hour for lunch and go and like kind of treat yourself to something. So like go to the cafe or something. So yeah, I think it's like a system of treats. (P6, female)*

### 6.4.6 Drinking culture

Excessive alcohol consumption, particularly during the first year, seemed to represent a fundamental feature of both the expected and lived university experience. Even those students who had engaged in heavy drinking prior to university described a clear shift in drinking behavior upon arrival. A unique university drinking culture had a central role in social integration and acceptance. 'Pre-drinking' (excessive pre-loading of alcohol intake at home prior to going out into town) seemed integral to this culture which was then followed by further – but usually lesser – alcohol consumption at nightclubs later into the evening. 'Pre-drinking' represented an effective means by which to consume large amounts of alcohol both cheaply and easily and to socialise with peers before going out:

*My boyfriend, his house, they have this thing called the 'vat', and it's pretty much a big vat, and everyone puts in money and they basically just make a big cocktail and then you* *spoon out your own cocktail and then drink it until it's gone, so there's probably quite a lot of alcohol in that, but it's quite nice. It doesn't seem like you're drinking that much. (P10, female)*

For participants who were members of sports clubs at university this drinking culture was particularly intense, with excessive alcohol consumption forming an important and necessary part of the process of being accepted into the club and demonstrating commitment to fellow teammates. Weekly sports nights, where students went out with their teammates, were also typically characterised by large quantities of alcohol consumption, at times beginning early in the evening straight after a match or following a competition during the day. Whilst this was not the case for all sports clubs – the role of alcohol in a club lacking a competitive team element seemed much less central - for several participants in this study, sports club membership contributed substantially to their engagement in binge drinking at university:

*Second year, that was when I joined rowing, so that had a huge impact on the amount that I drank because the socials they had every other week erm and you'd always go to pre-drinks first […] it was more of a social getting to know each other type of thing, like especially the first term, you had to go to every social to be accepted into like, just to be accepted into the group, for them to know you were serious about rowing, you had to go to the socials, erm, so that was, I'd definitely have at least like, much more than I would if I went out with just my housemates. (P16, female)*

For several students, the university drinking experience extended beyond the drinking episodes themselves, tracking into late night (or indeed early morning) food consumption and hangover antidotes. Stopping off at the local take-away or curry house with peers *en route* home following a night out was commonplace and fulfilled a social, as well as nutritional, role:

*Erm if you're on a night out and everyone goes for chips after, and you're tipsy you're like 'yes, chips are a great idea at this point in time, why not have curry sauce all over them' erm, and the next day, if I'm feeling hung over then I'm definitely too lazy to cook. I'm not going to cook anything I just want like toast, pasta, crisps, just carbs is all I want to eat the next day. And we might take a trip to like McDonald's if someone has got their car. (P16, female).*

Regardless of the social role in post-drinking food consumption, the majority of students engaging in binge-drinking whilst at university recounted changes to eating practices following drinking episodes. Disinhibition of usual eating routines and regulation was described, characterised by consumption of less healthful, often otherwise forbidden, food items. For the few students who experienced hangover nausea, food intake the following day was reduced, but then compensated for by similar over-indulgence upon appetite return, either way promoting over-consumption of food energy on the days following drinking sessions.

*If I've been on a night out the night before, the next day I always feel hungrier, like I could eat a really big sandwich or something, then I'd feel hungry an hour later. I've, I've just always been like that when I've been drinking so that day I just I eat a lot, maybe like double overall or like triple more than I normally would […] it's usually more filling things like sandwiches or erm yeah sandwiches really and I'd have like more, more of, and erm crisps as well which I wouldn't normally eat (P15, female)*

For the majority of participants the university drinking culture described above represented a source of enjoyment and fun that was welcomed, and formed an integral and positive component of their university experience. These students recognised drinking's social importance and the potential pressure that others may experience to drink, but engaged in excessive alcohol consumption because they wanted to, not because they felt they had to. In contrast, for a few participants, this drinking culture represented a source of conflict between values, desires and behaviour. This was particularly the case during the first year of university when alcohol seemed to adopt such a central role in social integration. Once friendship groups, generally consisting of like-minded individuals, were more firmly established and non-engagement in excessive alcohol consumption no longer posed a social threat, however, engaging in non-drinking related social activities became much easier (section 6.3).

## 6.5 Healthful choices at university?

Health awareness was an underlying theme throughout the interviews, with all participants demonstrating awareness of the need to eat a balanced diet to promote optimum health and well-being, irrespective of the composition of their current diet. The participants in this study frequently made reference to or evaluated the healthfulness of their own - and others' - dietary choices; less healthful choices were spoken about in a disapproving manner, and healthy choices were aspirational for many. The sub-themes that follow encompass participants' relationships with food and their connections between dietary knowledge and behaviour at university. Students described both intrinsic and extrinsic motives for pursuing a healthful diet (or not) whilst at university, and both personal experiences and the source of dietary knowledge seemed important for the ultimate translation of this knowledge into behaviour.

### 6.5.1 Extrinsic motives for consuming a healthful diet

For several students, personal experiences of the relationship between (poor) diet and health acted as a trigger for the consumption of a healthier diet at university. A few participants described recent diagnoses of nutrition-related diseases among family members, which had heightened their realisation of the importance of - and strengthened their motivation for - making healthful choices:

*Well my dad's got heart disease and he had to have a quadruple heart bypass and ever since then what we've ate at home has been like drastically changed, erm, so that has definitely influenced what I cook and how I cook it. So if I've got bacon or something I'll always grill it, I'll always grill everything I can really, erm, and then so I do tend to, I am conscious like of the balance of my meals, like some protein and some carbs and some like fruit and veg, like veg and like fruit to snack on instead of just reaching for like pasta constantly, because I'm aware of, I dunno, just seeing, yeah seeing the consequences of how diet can affect you. (P16, female)*

Other students spoke about experiencing more immediate negative effects of poor dietary choices on their well-being, including weight gain, which similarly served to enhance motivation to consume more healthful foods.

*I try to keep healthy. So I try to eat 5 fruit and veg a day, and also cos of other effects, it definitely like affects erm, how I feel, if I, if I eat a lot of erm sugary fatty foods I'll feel very like un-energised and tired so like groggy, so I try to eat fresh fruit and veg cos it does keep me feeling healthy (P12, female)*

In contrast, for some participants without this personal connection between diet and health, diet-related diseases were viewed as a more distant phenomenon and participants perceived a current protection from the ill effects of a poor diet. Youthfulness, exercise involvement and/or current healthy weight status were perceived as factors that meant participants were exempt from a need to consume a healthful diet at university:

*I'm young and I've got a good metabolism and I do quite a lot of exercise. So those things mean that I pretty much eat what I want […] I do recognise that there are certain things, like eating lots of vegetables that you need to do throughout your whole life. And I think my diet will change when I get a bit older. But at the moment I eat a lot (laughs). Erm and I eat a lot of fat and salt and sugar but […] I've been pretty slim my whole life, never had a problem with weight, no matter how much I eat. Erm, but if I did, I'm pretty sure that I'm the kind of person to be disciplined about what they ate. But I don't have to be, because I'm fine. (P25, male)*

For other students, healthful dietary choices were pursued to complement other areas of life. Among some male participants there was evidence of a strong desire to maintain a certain physique, with these students describing eating well to help attain competitive sporting goals, and/or to ensure that their efforts in the gym were optimised, or at the very least not wasted. This latter sentiment seemed pervasive among male gym-goers:

*I think if you're going regularly, like at least three or four times a week then erm I'd say everyone feel they need to, you know, make the most of it. You know if you're going five hours a week, that's quite a bit investment of time and if you're eating crap then you can just break even, erm, so I'd say that most people I talk to they do eat, yeah very well. (P19, male)*

The degree to which such fitness goals impacted upon dietary choices and a student’s relationship with food varied, but was in some cases extreme, with one male participant describing how he strives to eliminate all non-fruit sugar from his diet to maximise training outcomes. For others, food was described more as a fuel, more simply enabling sufficient energy intake for completion of daily exercise goals. A few other students spoke about making dietary decisions to optimise academic success. For students with intensive degree programmes involving many contact hours and/or long days on placement, a healthy diet was viewed as a way to better cope with these demands and make the most of their degree; students described limiting alcohol consumption and choosing foods rich in nutrients to aid concentration and boost immune health. Sensible dietary choices were also regarded as important for good revision outcomes, despite temptations to consume less healthful foods:

*Especially around revision times, I could sit and fill my face with rubbish all day, and I kind of like stop and think about if I'm sat at my desk filling my face with rubbish, that's actually not a good idea, cos I'm just going to end up really tired. So I think it's, I think I think about more what I'm eating during revision because I know that I have to be awake for long periods of time and I need to make sure that I've got enough energy. (P2, female)*

### 6.5.2 Intrinsic motives for consuming a healthful diet

For a minority of participants, the motives for consuming a healthful - or sustainable - diet were (or had become throughout university) more internalised. These students described choosing such foods because they either enjoyed the taste, the consequential feeling of looking after their bodies, or - particularly for environmentally conscious choices - it made them feel good. Similarly, preferring the taste of typically less healthful foods acted as a prevailing deterrent from healthier choices. Several students acknowledged that they could, and should, be making more healthful food choices, but the fact that they preferred the taste of less healthful foods reinforced this behaviour:

*It's much more about the taste, and not about how good or bad it is for you. Because at the moment I eat stuff mostly based on how nice it tastes and how cheap it is. But yeah I do, to a certain extent, think of 'oh I'll go to [the local takeaway] tonight, that's bad'. Probably shouldn't do that every night. But it doesn't really make a whole lot of difference to my decisions. Erm yeah, it's more about the taste. (P25, male)*

Other students described an already established identity around eating habits, which tracked into life at university. Whilst for some students this could act to perpetuate less healthful habits (for example high meat consumption), the opposite effect was true for others, for whom healthier choices could be sustained in the face of less healthful norms and temptations. This preformed eating identity was described by both male and female participants:

*I'm not someone who takes like a big bag of sweets to their desk and like eats them while they're revising. Like if I ever get hungry I just have a little something and just put it away, it's not about there's something always there like grazing on food, no, yeah. (P13, female)*

*Even in first year compared to other students I'd still kind of have a natural I guess instinct to go for healthier foods. Like I'd always have wholemeal bread because that's what we always had at home so I just kind of carried on with that […] and I'm just used to having you know fruit in the fruit bowl, that type of thing, so I'd always have an apple a day that sort of thing. Erm so that probably, yeah, that was always kind of a, part of who I am I guess. So yeah I guess that carried on. (P19, male)*

### 6.5.3 Obtaining dietary knowledge

The source of dietary information also appeared to be important in determining whether advice was ultimately translated into behaviour, both in terms of pursuing a healthful and/or sustainable diet. For participants studying health-related degree courses, diet-related knowledge gained through these courses of study – and in some cases first-hand placement experiences of the effects of a poor diet – strengthened students' motivation to follow healthful diets.

*I used to have a lot of sugary sports drinks and because I now do dentistry I realised that it's caused a bit of erosion on my back teeth so now I've tried to cut back on that, and cut back on the acid attacks […] so ever since doing dentistry my dietary habits have changed because I've realised the effects. But I never was as bothered about, I used to have a lot of fizzy drinks and erm fruit juice, which has affected my molars now and now I realise so I have to change my habits. (P17, female)*

In contrast, the behavioural impact of diet-related messages obtained via the media on students' eating practices was more questionable. Whilst several students simply described a detachment from the media whilst at university – most often due to the absence of a television in their student abode – and a resultant disconnect between food choices and diet-related media messages, a few students did recognise the media as a source of diet-related knowledge. Several of these students specifically recalled a recommendation to consume seven portions of fruit and vegetables, whilst another recounted a news story of the calorie content of alcoholic beverages, leading to a re-evaluation of current intake. However, for the majority of students, these media-based messages were shrouded with doubt and cynicism, with students ultimately returning to already-established beliefs. Thus for the majority of participants these messages were ignored:

*In the news when you sort of hear things about health and like what you eat and what you drink, you kind of have to take it with a pinch of salt because you don't know where they've got their information from, and a lot of it's sort of, it's just common sense […] knowing that I have to have green things on my plate, and brown things on my plate, and some fruit as well. It's common sense really, I don't pay too much attention to what's in the news. (P2, female)*

### 6.5.4 Preoccupations with food intake & body weight

For a small number of - predominantly (but not exclusively) female – participants, dietary decisions were fraught with concerns surrounding food's impact on health and body weight. The pervasive slim-ideal that permeates modern westernised society was clearly present among female students and, whilst most participants recognised that this ideal was manipulated, unrealistic and unattainable, it nonetheless impacted upon these students' relationships with food. Skipping meals, stories of housemates on fad diets, media-driven dietary misconceptions (particularly surrounding carbohydrate intake) and alternative strategies to reduce energy intake, such as replacing food with fluid consumption, were all described. For many of these students food choices were based wholly on calorie content, with the health impact and eating enjoyment resulting from these decisions clearly secondary to their potential impact on weight status:

*If I'm looking at like a lasagne versus like a chicken curry thing and one has more calories, but I'm kind of feeling, even if I'm like craving lasagne a bit more if that's got more calories then I'll tend to go for the one that hasn't, even though I might not prefer it but, I don't know. It's based on calories. (P16, female)*

For other students, both male and female, this preoccupation with dietary choices was additionally health-based, resulting in feelings of guilt when poor choices were made and clearly interfering with students' relationships with food. This second year male participant, for example, describes experiencing such guilt and explains how he uses exercise and calorie consumption to negate these feelings:

*Yesterday, when I had the KFC I felt bad about that. That's a bad bit of me yesterday. But at the same time I didn't eat many calories overall I don't think so it was ok. And I went to* *the gym, so I always feel a bit good if I've eaten something bad but I go to the gym I can kind of offset it in my mind a bit. (P20, male)*

Resultantly, several students also described ways to limit consumption of energy-dense guilt-provoking food items at university, most often by avoiding purchasing such foods in the first place. Whilst such a strategy appeared an effective means by which to promote consumption of a healthful diet for some students, it additionally raised questions over the healthfulness of certain participants' relationships with food and their body.

*I won't buy in biscuits so I can't eat biscuits, if that makes sense. Erm I don't have any chips in the freezer so I can't make myself chips etc. Erm so it's not like I could eat badly if that makes sense. Erm so that's kind of a help, so yeah, sometimes, it happened when I got like one of those cravings, erm, erm so yeah. In my line, if you're only buying good food you can only eat good food. (P19, male)*

### 6.6 Becoming an autonomous consumer

The final main theme to emerge involved the change that coming to university had on participants, particularly in terms of them becoming an 'autonomous consumer'. That is, the transition from having incomplete – if any – responsibility over dietary decisions within the family home to becoming wholly responsible for food intake at university. For all the participants in this study the transition to university involved, at least in the first instance, leaving the parental home and moving into shared student living, and this was accompanied by newfound autonomy over food choices and eating practices. The degree to which such autonomy represented a new experience varied among participants according to the extent of food involvement prior to arrival - either in the family home or during a 'gap' year away - but either way the transition to university represented a marked increase in responsibility over food choices for all of the participants interviewed. Whilst for some students this provided a welcomed opportunity for the establishment of novel eating habits, for others it represented a testing time of learning and conflict between experiences, desires and actions. This final theme encompasses the dietary decisions – and their numerous influences - made by students as they began and progressed through life at university into an autonomous consumer, whilst additionally illustrating the dynamic nature of students' perspectives on eating (and drinking) practices during this time.

### 6.6.1 Learning independence

The journey towards dietary autonomy at university was one of learning and development, characterised by a process of experimentation and trial and error. Many participants described little previous experience of dietary responsibility and thus entered a minefield of issues in shopping, planning, storing and preparing food upon arrival at university. Students quickly learned from initial less successful attempts at both food shopping and meal preparation, which included expensive and wasteful supermarket experiences or over-production of food-for-one, and subsequent fine-tuning of these processes lead to the establishment of more successful and efficient routines around dietary practices. The process of learning to prepare meals from scratch at university, especially for those participants with little previous food involvement, was a particular case of trial and error as students figured out how and what to cook. Less successful attempts at meal creation shaped more successful ones. The internet was an important resource of cooking advice, with students using videos as a means through which to learn new food preparation skills. Foods were often bought without meals in mind and online recipes were subsequently consulted to enable creation of meals from already-purchased food items:

*It was often trial and error, buying a load of potatoes, like right 'how do I cook this'. I'd look on the internet, and then for some reason I dunno, some people find that you can't actually do it from the internet, I don't really see why. Yeah my flatmates, they'd buy a load of stuff and you know, they'd say 'how do I cook this', just Google it, it's fine, that's how I learned how to cook fish, you know it's pretty simple. So yeah, a definite learning curve. (P19, male)*

For students with more naïve cooking proficiency, peers – most often housemates – also sometimes acted as a resource through which to develop their abilities, with participants with more advanced skills teaching their less able counterparts. For others, meal ideas and recipes were borrowed from housemates consuming less familiar foods and meals, providing a stimulus for students to expand their dietary variety.

*You pick up on what other people are eating, and you just go 'how do you make that?'*

*and you will try and make that and you will just keep adding to what you can make really. (P24, male)*

Following the initial transition to university, which disrupted previous dietary practices, participants described quickly settling down into new routines around food and eating. Habits were established around both shopping behaviours as well as foods and meals consumed. There were many moments throughout university when these routines were disrupted or exceptions were made, as noted earlier (e.g. revision periods; hangovers; times of celebration), but the establishment of habits at university simplified the decision making process involved in dietary choices. This reinforced consumption patterns, whether healthful or not. For participants developing more healthful habits at university (daily cooking of meals from scratch for example) these choices were eventually no longer questioned and instead became an integral component of daily life.

*There were times in first year maybe like once or twice a week where I'd make myself kind of like a decent dinner, so it would be you know a range of food and everything. Whereas second year it's pretty much every single day, because I don't have anything else to eat if that makes sense, so it kind of has to be that. And it's become a routine so I don't really question it either, which helps a lot. (P19, male)*

Equally, for participants with less healthful behaviours (daily consumption of convenience foods for example), these choices too became habitual and embedded within daily norms.

*I don't think back in November […] that there was anything particularly going on that made me want to eat more convenience food, it was just that that was the habit I've fallen in to, from just being at uni generally. (P20, male)*

Within these new routines, some participants also described planning their meals for the week in advance. This ensured sufficient food was stocked at all times and minimised waste from poorly planned purchasing. Other students remained more impulsive in their consumption patterns throughout university, not planning what was to be consumed until required. This lack of planning often promoted consumption of take-aways or snack foods when students finished university hungry with nothing at home prepared to cook or eat. Several other students described basing their meals on what was in the fridge, but with an absence of advanced planning. This meant participants ate better towards the beginning of the week when the fridge was fully stocked, but as the week progressed and the fridge became empty, food choices became determined more by what was leftover or needed eating, and consumption of fresh food subsequently decreased.

*I eat a lot of vegetables […] there's certain times of the year where it changes and of the week where it changes but at the start of the week I often have a lot of fresh salad and fruit and veg in so I'll eat a lot of that earlier on and then as it kind of gets to the end of the week it will kind of peter out towards eating more 'beans on toast' style food which is less like fresh (P12, female)*

Despite the challenges associated with becoming an autonomous consumer at university, however, participants were emphatic in their enjoyment of dietary independence, even if this was at times accompanied by a disconnect between desired and actual consumption patterns. Participants enjoyed being able to choose exactly what and how much they wanted to eat, which represented an important component of adult independence.

*[…] it feels good. I mean you're in charge of what you're doing, it's a completely new feeling, and I'm like 'yes Mother I can do this, there you go'. Erm, yeah, I dunno, it's like preparing me for after university life, for when I will be an adult and will have to pay bills […] I would not go back, I wouldn't say 'ok, my eating habits are really bad and I need to go home to change myself again'. I wouldn't do that like ever ever, cos you know it's the taste of freedom and being in charge of you, it's wonderful. (P4, female)*

For some participants, dietary independence allowed overt manipulation of food and energy intake or dietary restriction, free from parental interference or concern. For others, it enabled food choices that matched personal preferences and better fitted in with daily schedules and exercise plans or fitness goals. This lead to feelings of greater control over life as a whole:

*I like to know […] I'm taking in the right amount of food for the activity I'm doing that day, so erm if […] I'm gonna go and run ten miles, I want to know that I've eaten a starchy meal early on in the day, that I've given it two hours to go down, so I guess it just helps me to feel a lot more in control of my life, being able to control my food. Erm, whereas at home I feel like it's another kind of thing, not taken away from me but just* *unusual for me now, I go back home and I can't decide exactly what I'm gonna eat. (P12, female)*

As students progressed through university, a number of factors were recognised as impacting on dietary decisions, many of which appeared to represent barriers to healthful food consumption patterns. However, the majority of participants maintained an acceptance of personal responsibility over their food and eating practices. Students with poorer habits, including high intakes of alcohol, snack foods or ready-prepared meals, were more often than not dissatisfied with their current consumption patterns, describing intentions and desires to consume a healthier diet. These students acknowledged it was possible to adopt such a diet at university, and that their current failings resulted ultimately from internal rather than external barriers. A second year female student (with a low health-conscious pattern score) articulated this particularly clearly, highlighting her own motivation and willpower as the prevailing barriers to improving her eating habits at university:

*I am in control of my behaviour, it is me, I need to, I need to change it - it's not really, it doesn't help that the university experience pushes you in ways about like drinking and eating bad food and take aways and stuff, it doesn't help, but I am the one who is eating it, so, yeah, I need to take control of myself […] As much as other people can influence me like eating more take-aways and erm the fact that they're closer and I am going out more, it is really my decision to buy the food that I do, and a lot of the people around me are buying better food that is probably cheaper, and eating healthily, and it's, yeah that's probably the strongest factor, is my self and my own will and getting out there and actually putting effort into actually cooking food, yeah. (P10, female)*

### 6.6.2 Tracking from home to university

For many of the participants in this study, food and eating practices adopted during the initial few months at university appeared strongly influenced by those previously assumed in the family home. In fact for many participants, habits adopted at university clearly reflected those previously practiced at home. As a result, for participants exposed to healthier dietary habits within the family food environment (consuming home-cooked meals on a daily basis for example), these behaviours often appeared to track forward into early university life, providing a base upon which students could build throughout the ensuing months ahead.

Congruently, but with contrasting outcome, for those students for whom less healthful practices were commonplace within the home food environment (regular consumption of ready-meals and convenience foods for example), these habits also went on to represent students' initial default choices at university. For the majority of participants, such familiar eating routines were embraced simply because they represented firmly established habits, and as such, were considered 'normal' and students identified – at least initially - no reason to change.

*Even in first year compared to other students I'd still kind of have a natural I guess instinct to go for healthier foods. Like I'd always have wholemeal bread because that's what we always had at home so I just kind of carried on with that. Erm yeah someone bought in some white bread for the house, and I was like 'what is this?!' you know. It's so weird erm and I'm just used to having you know fruit in the fruit bowl, that type of thing, so I'd always have an apple a day that sort of thing. Erm so that probably, yeah, that was always kind of a, part of who I am I guess. So yeah I guess that carried on, in first year I was lazy, but it wasn't that bad really. (P19, male)*

A few students also recognised how their shopping habits also mirrored that of their parents, further highlighting the influence of family food practices on choices made at university, although on a more sub-conscious level:

*I think how I've been brought up to like see food and what I'm used to my mum buying in the supermarket greatly influences like the amount of time that I spend in each section at the supermarket, which is weird. But she just kind of scoots past kind of the sweets and snacks and things and just like fruit and veg and then tinned beans and stuff, and just seeing what my parents cooked around me, what they class as good and bad, I automatically do. I have never questioned what they think is good and bad (P16, female)*

For other students, the adoption of home-based eating practices at university represented a more conscious attempt at providing familiarity and comfort in an otherwise completely new environment. In these cases, food represented a link between family and student life, helping students feel more 'at home' in the absence of any other consistent or familiar routine during the initial months at university. This emotional link was described by both male and female participants:

*The three main meals thing and always having breakfast has just been drilled into me, so that's like my main habits, just, three meals, has definitely come from home. And yeah, just making choices based on what we would normally have in the fridge, so like a healthier kind of yoghurts, things like that […] I nick cookbooks from home and like nicked recipes from home. I think that's, like, I don't cos they're healthier, I think it's just quite comforting to have stuff that you used to have at home, it's like 'aww' reminding me. (P16, female)*

*I sort of got the recipes from my mum for the stuff I like and I've kept that going. Erm which might be a bit boring and all but, I dunno. I suppose it might also be that bit that it would remind you of home as well and that would be something I like about it as well, I'm not sure. (P21, male)*

It was also at home, prior to arriving at university, that students seemed to establish their core values surrounding the ethical and environmental implications of food choices and for many these were also taken forward into university life. For participants who were educated about the origins of food and for whom ethical and quality choices were the norm, these values permeated food choices at university:

*Participant: If I'm gonna cook meat, I'll always want it to be you know, like free-range eggs and I would choose organic meat if it didn't seem too expensive over a standard cut of whatever. If I went to Tesco I'd try and go for a top-end thing. I would never go for a value range meat thing. I think that if I can't afford meat then I'm not going to eat meat today because I don't like feeling like I'm eating something unethical.*

*Interviewer: […] Sure, and where do you think those kind of values that you've established have come from?*

*Participant: I think just from being educated and just from you know, knowing, knowing how things work […] I guess just my upbringing really […] I just was brought up to eat well and to understand that good food does cost good money and I think that's more I think my upbringing than the media influence but I just think that adds to the fact that I know well, that I believe that what I am doing is right by buying better quality food. (P20, male)*

### 6.6.3 Cooking or not?

As students moved to and progressed through university and became responsible for their own food intake, a number of further interrelated factors determined whether students cooked their own meals – and what these meals comprised - during this time. For some participants, little, if any, previous exposure to cooking responsibilities within the home food environment meant that the transition to university represented the first occasion that students were responsible for their own dietary intake; cooking thus represented a new experience fraught with challenges around meal creation. Primitive cooking skills restricted the variety of meals prepared and lead students to rely on a small number of very simple (often pasta-based) meals, which could be repeated throughout the week. Such repetition not only threatened dietary diversity, but also quickly became monotonous and therefore promoted the use of convenience foods, which could enhance meal variety without the need for advancements in cooking skills. Pre-prepared foods also had a particularly important role in the diets of students who lacked any basic cooking skills, enabling students to meet their energy needs and maintain dietary autonomy at university.

*To be honest up until recently in the past few months, I haven't really cooked, I mean I never actually cooked properly until last year and last year I was in catered accommodation so I still hadn't cooked until I came into my house this year. So last semester I was eating quite badly, well not that badly, in that I mean I cooked a meal every night but I often ate potato waffles and like quite a lot, um, just cos I didn't know how to cook anything honestly [laughs]. So I ate quite a lot of fish fingers and chicken fingers (P1, female)*

In contrast, several other participants described arriving at university with already sophisticated (or at least above basic) cooking skills, resulting either from parental expectations of meal involvement or cooking responsibilities within the family food environment prior to university, or due to parents specifically teaching students how to cook before leaving home. These students described far greater confidence in the kitchen than their less skilled counterparts and preparing meals from scratch represented a less onerous task, accepted as a normal part of daily life.

*I think if you do have an active role in preparing food at home you're used to cooking and you just know how to boil an egg, or just like, some people didn't know how to boil an egg in first year and, just things like that. So you feel more comfortable in the kitchen like using all the different things, and I'll always just use stuff and just add it in. Everyone's like 'oh no, you're not following the recipe', it's like well I'm more comfortable like playing around with food than other people might be because they haven't seen other people do it at home, and they haven't like practised it at home and know that if it goes wrong it doesn't matter, you'll just cook something else, it's fine. (P16, female)*

Regardless of students' food preparation experiences and skills, whether (or not) students enjoyed cooking also determined the amount of time dedicated to meal preparation at university. For participants for whom time spent in the kitchen fulfilled roles beyond the provision of fuel to stave off hunger, time was invested into preparing meals from scratch; these students described cooking as an activity to relax and unwind, or a way to spend time with partners, which promoted its integration into daily life:

*I really love cooking, so that, that makes a big difference. It's kind of like my down time, so, yeah. I probably spend around an hour a day cooking, at least. (P11, female)*

On the other hand, when cooking represented little more than a means of meeting energy requirements, students struggled to find the motivation to dedicate time to food preparation. These students saw little reason to improve their skills or expand their cooking repertoire at university, instead once again exploiting the convenient and effortless nature of prepared foods, freeing up time that could be spent on more enjoyable activities. There was a shared perspective that cooking was an activity to be engaged in if it was found pleasurable and enjoyed, rather than a fundamental feature of the daily experience of university life.

*I haven't really expanded it much since coming to uni because I'm not too bothered about expanding it really [...] from helping out [at home] I do sort of know how to do certain things and stuff. Yeah but I haven't really expanded since coming to uni, because I'm not bothered about doing it so I don't put any time in to expanding my cooking ability. Because I'm happy with what I can cook already [...] I'm not sort of interested in food enough to go out and learn how to make new things. (P23, male)*

Whilst cooking-for-one so often the case at university meant students could make meal choices independent of others' preferences, the practicalities of this also impacted upon meal composition. Participants spoke about many recipes being designed for multiple portions, and cooking sophisticated recipes - demanding notable time and ingredients - for one person was thus inefficient and unsustainable. Cooking in bulk circumvented this issue, enabling creation of more complicated composite meals (for example lasagne) and alleviating daily cooking demands. However, when freezer space was limited, longer-term storage for consumption at a later date was not possible and students quickly realised that eating the same meal on multiple and consecutive nights of the week was not their diet of choice. As a result, students often opted for more simple meals, such as stir-fry or pasta and sauce, which required fewer ingredients and could more easily be prepared as a single portion demanding less cooking effort.

*I do enjoy cooking at uni. It's difficult, it does limit what I can make cos when you're trying to make just a meal for one and the freezer space is limited, so I can't make something that I would for four people and then freeze most of it, so that limits the kind of thing that I'm going to cook. 'Cause sometimes it's not worth getting all the ingredients if you're only gonna make like half a portion of two of like those chickens and erm, loads of like spices and stuff, so I tend to not make as interesting meals as I would at home. (P16, female)*

For the same reason, students described not feeling *'bothered'* to cook and meals were occasionally substituted with snack-type foods, or pre-prepared foods were used:

*Sometimes it can get quite boring cooking for yourself, and not really having like a family to sit down with people to share what you've made [...] sometimes for myself you know I just think 'oh I can't be bothered' so I'll just eat a carrot or I'll just eat some noodles kind of thing. So in one way I think it means you can be much more decisive and experimental about what you want, cos there's no-one saying like 'no, it's too expensive' or whatever, but in another way I feel like sometimes it means that you can't be bothered to cook some of the things that you might want to. (P6, female)*

Several participants also recognised their own laziness as a barrier to cooking at university. As students arrived at university and began preparing their own food they realised the notable time and effort, beyond that initially anticipated, that was required to prepare meals from scratch. Comparisons were made to the home food environment where consuming home-cooked (and often healthier) food was easier when not being fully responsible for their own meals, or where certain facilities such as a dishwasher facilitated the cooking process. Many participants described possessing insufficient motivation to prepare and cook food from scratch, instead opting for easier alternatives including ready meals, convenience foods or take-aways.

*I eat a lot healthier at home, erm, I think that's because more of the healthier foods do take longer and I'm quite a lazy cook so I go for stuff that is quite easy to do so just like chicken, and you can just like cook a chicken, whereas at home my family does more like vegetables and stir-frys and yeah, food that's probably healthier for you, but I don't do that at university [...] it's a lot easier for me at the moment just to plonk some things in a pan and just leave it, or just shove something in the oven. (P10, female)*

### 6.6.4 Parental involvement

For a minority of participants, parents maintained - at least at times – their role as food provider for students at university. Parents were occasionally described accompanying participants to the supermarket - enabling consumption of more expensive food items otherwise beyond student budgets – or provided home-cooked meals, which could be frozen for consumption at a later date as an alternative to shop-bought ready-meals. Whilst these parental gestures reduced students' autonomy over their food intake, they were spoken about positively and appreciated. For other participants, parents exerted a more subtle influence on food choices at university, with students limiting the extent to which they fulfilled their dietary desires at university to appease parental concerns. This was particularly the case for students who wished to exercise a somewhat restrictive diet at university:

*I'm erm, pescatarian, but I occasionally, yeah, I very rarely eat fish (laughs) because my mum would kill me if I didn't (laughs). And I occasionally eat dairy, but not a lot. (P11, female)*

In contrast, despite a few participants speaking of parents expressing concern over their poorer food choices at university, the majority of participants described an absence of overt parental influence on their dietary decisions during this time. For several students, university represented the opportunity to reject familial rules around eating, drinking and staying out late, and to exert their newfound freedom, often involving greater consumption of previously forbidden or restricted 'junk' food and alcohol. Home routines were also rejected on a more subtle level and for students who wanted the opportunity to eat more healthfully, restrict their energy intake, or consume food not previously available within the family home, university provided the opportunity to do this.

*My family at home don't have dairy products really […] they have things like ice cream occasionally, erm but we never have like fresh cow's milk […] they always have like soya butter which is horrible stuff. Erm so I think that's impacted me, in that as soon as I started cooking for myself, I loved using dairy products, so I'd have a lot of butter and I drink a glass of milk quite often. Which I had never done throughout my childhood and I'd always thought, you know, milk tasted really weird, and soya milk was amazing. And now I've moved away I've realised actually milk tastes really nice and soya milk is a pretty weird construction anyway (P25, male)*

For some participants, the adoption of these new dietary practices represented permanent changes to eating habits. Healthful or restrictive eating patterns established at university were more often than not maintained at home during vacation periods, and new recipes discovered as a student were integrated into meal consumption patterns upon return to the parental home. This enabled students to continue to exert their newfound autonomy over dietary decisions upon return to the family food environment.

*When I go home I buy a lot of my own food now […] if [my parents are] at work and I'm not at work then I don't wanna be like eating rubbish things for lunch, that erm, that could be like lying around, like an easy option […] if there's a pizza [...] in the freezer and like before I came to uni I'd probably have put that in the oven and said yeah, that's lunch, but erm [during recent university vacation periods] I kind of bought a lot of my own like potatoes and veg and chicken and stuff and a lot of salad, and I ate, I kind of ate that for my lunch, instead of just putting a pizza in. That's, I think that's the main difference really […] I actually like try and make something nutritious. (P24, male)*

For others, changes to dietary choices executed during the initial period of freedom from parental governance were more short-lived, particularly when these changes were in a less healthful direction. Students realised that greater consumption of ‘junk’ foods, which had been previously limited at home, was not conducive to optimum well-being and students subsequently settled down into more sustainable routines, closer to those previously experienced at home:

*The first couple of weeks, erm my mum had sent me off with loads of stuff in the freezer and stuff so I was able to cook things that reminded me of home […] But then I started, slightly later on than that when I started to, like had to do the first big supermarket shop and things like that that I was like 'ooooooh freedom, I can buy whatever I want!' so then I guess I went a bit towards like crisps and like cake and stuff like that, but then I quickly realised like ok this is making me feel gross so I went like kind of in between I guess. (P16, female)*

As students progressed throughout university the way in which home food was viewed also evolved. University represented the first occasion that participants were fully responsible for their own food intake and they subsequently soon realised the substantial time and effort required to produce tasteful home-cooked meals. This instigated an increased appreciation of food previously provided within the family environment. Being presented with dinner on the table during vacation periods was no longer taken for granted and several students also described greater involvement in family meal preparation after moving to university in an attempt to share the burden of food provision with their parents.

*I think I appreciate like my mum and dad more when I go home, just because I realise how time consuming it is to prepare food and like how nice it is to have like a home cooked meal […] I feel like I always enjoy going home because we always have like big Sunday dinners and erm it's exactly how I'm used to having it […] My parents like make everything like the Yorkshire puddings and stuff whereas we have like Aunt Bessie's here, so like it's not quite the same here. So like I think I appreciate it more going back home. (P17, female, second degree).*

On the contrary, a minority of students developed a newfound disapproval of home food following establishment of dietary autonomy at university. Participants described developing their personal approaches and norms to food preparation whilst at university, which at times differed from those employed in the parental home and created conflict when returning to eating meals as a family during vacation periods. This 2$^{nd}$ year male student describes his newfound perspective on parental-cooked meals when returning home from university:

*[…] they'll just look at me weirdly as if I'm some posh snob coming back from university, so I tend not to say anything, but I kind of, my perspective has changed a little bit. And I notice that [my mum will] put loads of oil on when she's cooking and I'm like 'what are you doing? You don't need that much oil! You can cook things differently'. I do sometimes give [my mum] tips and ideas. (P22, male)*

Returning home was also often a time of increased food consumption. Several participants arrived home to a full fridge and stocks of typically more expensive snack foods or *'treats'*, which were free for the taking. These food items were usually beyond a student's budget at university and thus were made the most of during vacation periods at home. Other young people described parents more specifically trying to ensure they were eating enough during holidays periods at home in an attempt to ensure students did not lose weight or go hungry upon return to university. It seemed that there was a shared view by some parents that university was a time of food scarcity:

*[…] when I go home my mum makes the portions really big cos she thinks, I'm like the first person in my family to go to uni, and she just has it in her head that all uni students are starving all the time cos all they can eat is beans. And she's like 'I've made you a really big portion of whatever, make sure you eat it all'. And what does, my dad jokes that she's trying to fill my cheeks before I go back to Sheffield […] Yeah, I think I eat more - I have food pushed on me at home. (P2, female)*

### 6.6.5 Changes over time throughout university life

Finally, as participants progressed through university the priority placed on different areas of life changed and the meaning attached to certain dietary practices evolved accordingly. These changing perspectives had a particular impact on student's alcohol intake. The initial transition to and months at university were generally not considered a time that should be dedicated to the pursuit of academic success or long-term health, but rather represented a unique opportunity to engage in new experiences and have fun in the absence of many of the responsibilities of working adult life. Excessive alcohol consumption had not been experienced prior to university for some participants, and the novelty of being drunk promoted engagement in binge drinking throughout the first year:

*I think it's just because everything's quite new and you just, like most people back home won't have been, like had the opportunity to be going out on like a Monday night, Tuesday night, Wednesday night, Thursday night, whatever night it is, it's just like whatever night you want to go out and there's always, there's so many places to go out and I wanna go to all of them. (P24, male)*

The initial months of university life also represented a period of increased enthusiasm to cook meals from scratch for some participants. Investing time and effort in meal preparation was another means through which students could fully exploit the novelty of their newfound autonomy over food intake:

*For the first week, for Fresher's Week, then, me and my mum had made like some chillis and bologneses and things and like frozen them, so I didn't have to worry about like cooking in Fresher's Week, I could just get to know everyone, enjoy myself and do what I wanted to do really. But then after that, afterwards, erm I think everyone was quite excited to cook their own food, cos everyone was making a lot of effort to cook for the first, for the first couple of weeks [...] just because they'd never really had the opportunity to cook for themselves like every night. Erm I think, I think everyone quite enjoyed it. (P24, male)*

As life at university progressed, however, students' priorities and foci shifted and they settled into more sustainable eating and – more pertinently - drinking practices. Time available for cooking was reduced as university commitments (social or otherwise) and time pressures mounted, and participants initially spending notable time in the kitchen each day felt unable to dedicate such substantial time to food preparation, simplifying meals and often relying on more pre-prepared options. At the same time, the novelty of excessive alcohol consumption weakened and being drunk no longer held the same appeal as it once did. Students began to realise that they enjoyed participating in alternative social activities that did not involve (excessive) alcohol intake and subsequent hangovers, further serving to reduce engagement in binge drinking. On top of increasing academic demands impacting dietary decisions (section 6.4.5), participants attributed 'growing up' to their shift in priorities and drinking practices during this time:

*Interviewer: So do you feel that you drink less now than you did in first and second year?*

*Participant: Yeah I think so. Both sort of frequency and like if we are going out you know I will say I don't want to get too drunk because it's just not nice and I think you do, well I've realised you know I don't like drinking a lot, it's not my social activity of choice, I'd much rather do something that doesn't involve drinking, or if it does involve drinking just have one or two. Yeah, you definitely grow out of the binge drinking thing. (P8, female)*

## 6.7 Summary

In summary, four substantive themes were identified from interview data of 25 undergraduate university students about dietary practices at university, providing insight into four major areas of dietary decision making for young people during this time. These themes were identified as: ‘Peer groups, diet and social integration’; ‘The university experience’; ‘Healthful eating at university?’ and ‘Becoming an autonomous consumer’. What ultimately determined students’ dietary behaviours whilst at university was the result of a complex interplay of numerous factors. Participants arrived at university with the need to take complete – and more often than not newfound - responsibility over their food intake and ensuring their nutritional needs were met, and university life represented a time when these young people navigated their way through this journey to autonomy. A number of factors, including the family food environment and new peer groups appeared particularly influential in this journey. Participants were clearly aware of the need to adopt healthful lifestyles and consume health-promoting diets, but a number of factors, both internal and external, interfered with students’ abilities to translate this knowledge into behaviour during higher educational study. Several of these factors were attributed to the unique university setting, with challenges of shared living, small budgets, intense periods of academic study and integrating oneself into new social groups amidst a binge drinking culture all interfering with dietary decisions during this time. In addition, dietary practices at university were dynamic, evolving as an individual’s university career progressed. This dynamic nature of food and eating practices reflected changes to meanings attached to food and drink, alongside evolving competing life demands and the priorities placed on these.

# CHAPTER 7.
# RESULTS IV – EATING BEHAVIOURS ASSOCIATED WITH BODY WEIGHT GAIN AMONG UNIVERSITY STUDENTS IN THE UK

## 7.1 Introduction

This chapter presents the results from Phase 3, involving university student members of the national slimming programme, Slimming World, UK. This study aimed to identify eating behaviours associated with body weight gain among university students in the UK, thus addressing the final research objective in this project. The Nutrition and Research Team at Slimming World collected the data; the author carried out all analyses.

## 7.2 Sample characteristics

98.2% (n = 274) of respondents were female. Approximately half of the sample (47.3%) was between 18 and 21 years of age and just under one quarter (22.6%) of respondents were between 22 and 30 years old. The majority of responders had been members of Slimming World for less than one month (45.5%) or between 3-6 months (30.5%) at the point of survey.

## 7.3 Weight gain, eating habits and physical activity levels at university prior to joining Slimming World

Table 13 provides descriptive data for the sample. Approximately 40% of respondents reported gaining between 6.4 and 12.7 kg during their time at university while almost one in four (23.5%) reported gaining in excess of 12.7 kg. Just over one quarter of the sample reported gaining between 3.2 and 6.4 kg during their first year alone, whilst a further one in four students reported gaining between 6.4 and 12.7 kg during this time period.

There was a range of self-reported physical activity levels with few of the cohort reporting high ('active' or 'very active') levels (5.1%) and most (44%) reporting that they were 'not at all' or 'rarely' active prior to joining Slimming World. One in three students indicated that they consumed fruit and vegetables once a week or less. Self-reported consumption of takeaways/fast food meals and ready meals/convenience foods was high: approximately half of the sample consumed these foods at least ‘a few’ or more often than three times per week respectively. One third (33.7%) of respondents reported that they consumed alcohol on at least three nights of the week. Finally, in excess of one third of the sample reported that they were unable to cook a number of more complex dishes from raw ingredients, such as roast dinner and casserole. A total of 82.5% of the sample agreed with the statement ‘students need support to learn how to cook healthy food/meals’. 92.9% agreed that ‘students need support to learn how to eat healthily on a budget’.

**Table 17: Self-reported weight gain, eating behaviours and physical activity levels at university prior to joining Slimming World**

| | | Percentage (%) | Number |
|---|---|---|---|
| **Self-reported body weight gain throughout university** | 0 kg | 14.0 | 39 |
| | <3.2 kg | 9.0 | 25 |
| | 3.2-6.4 kg | 22.6 | 63 |
| | 6.4-12.7 kg | 34.1 | 95 |
| | >12.7 kg | 20.4 | 57 |
| **Self-reported body weight gain during the first year** | 0 kg | 17.2 | 44 |
| | <3.2 kg | 21.1 | 59 |
| | 3.2-6.4 kg | 27.6 | 77 |
| | 6.4-12.7 kg | 27.2 | 76 |
| | >12.7 kg | 6.8 | 19 |
| **Consumption of alcohol** | Never/less than once per week | 30.5 | 85 |
| | 1-2 nights per week | 35.5 | 99 |
| | 3 or more nights per week | 33.7 | 94 |
| **Consumption of takeaways & fast food at university** | None or one a week | 49.1 | 137 |
| | A few a week | 46.6 | 130 |
| | >5 a week | 3.9 | 11 |
| **Consumption of ready meals & convenience foods** | Never/once a week | 21.2 | 59 |
| | 1-3 per week | 31.5 | 88 |
| | 3-5 per week | 29.4 | 82 |
| | >5 per week | 17.9 | 50 |

| | | | |
|---|---|---|---|
| **Consumption of fruits & vegetables** | Never/once a week | 32.6 | 91 |
| | 2-3 times per week | 28.7 | 80 |
| | 4-5 times per week | 13.6 | 38 |
| | Every day | 24.7 | 69 |
| **Physical activity levels** | Not at all active | 14.3 | 40 |
| | Rarely active (<30 minutes/week) | 30.1 | 84 |
| | Sometimes active (30-60 minutes/week) | 25.4 | 71 |
| | Fairly active (60-90 minutes/week) | 15.1 | 42 |
| | Active (90-120 minutes/week) | 10.0 | 28 |
| | Very active (>120 minutes/week) | 4.7 | 13 |
| | | 0.4 | 1 |
| **Proportion of students reporting that they are able to cook specific meals** | Baked beans on a jacket potato | 91.4 | 255 |
| | Tinned spaghetti hoops on toast | 93.2 | 260 |
| | Cheese on toast | 95.0 | 265 |
| | Scrambled eggs on toast | 86.0 | 240 |
| | Spaghetti bolognese | 70.6 | 197 |
| | Chilli con carne | 55.9 | 156 |
| | Curry | 52.3 | 146 |
| | Stir-fry | 78.5 | 219 |
| | Homemade burger | 54.1 | 151 |
| | Homemade soup | 60.6 | 169 |
| | Shepherd’s Pie | 63.8 | 178 |
| | Casserole/Stew | 52.0 | 145 |
| | Roast dinner | 61.6 | 172 |
| | Full English Breakfast | 84.2 | 235 |

### 7.4 Associations between weight gain and eating behaviours

Chi-square tests indicated statistically significant associations between level of weight gain and a number of eating behaviours and related factors. Key findings are summarised below in a series of bar charts. Complete results tables of these chi-square analyses are provided in Appendix R.

Specifically, a significantly greater proportion of students reporting greatest weight gain at university (>12.7 kg) reported most frequent consumption of ready meals and convenience foods ($\chi^2$ = 37.08; df = 12; $p$ < 0.001) and least frequent consumption of fruits and vegetables ($\chi^2$ = 26.587; df = 12; $p$ < 0.01) compared to students in other categories of weight gain (Figures 13 & 14). Congruently, a significantly higher proportion of weight stable students reported that they consumed fruit and vegetables 'every day' compared to students in other categories of weight gain ($\chi^2$ = 26.587; df = 12; $p$ < 0.01) (Figure 14).

Figure 13: Category of weight gain at university vs. frequency of ready meal & convenience food consumption

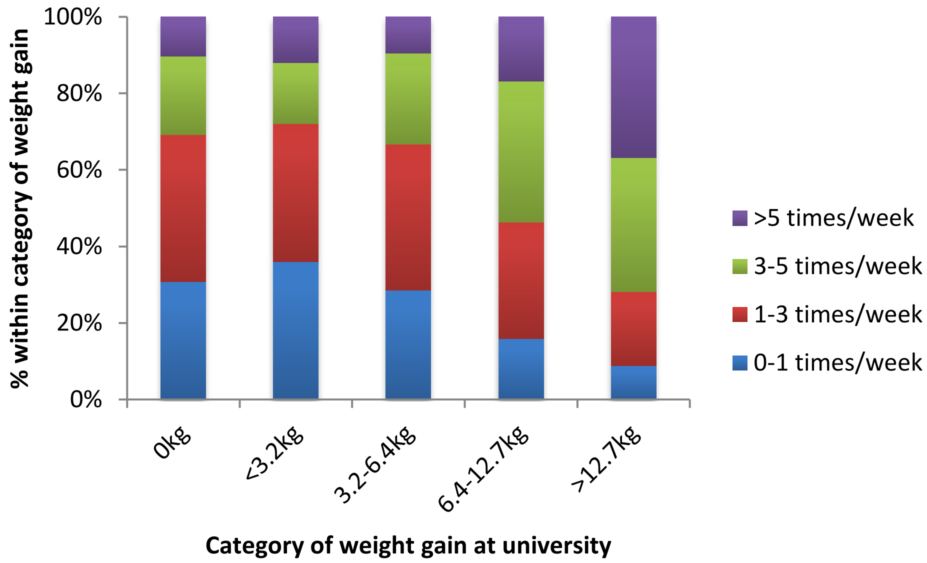
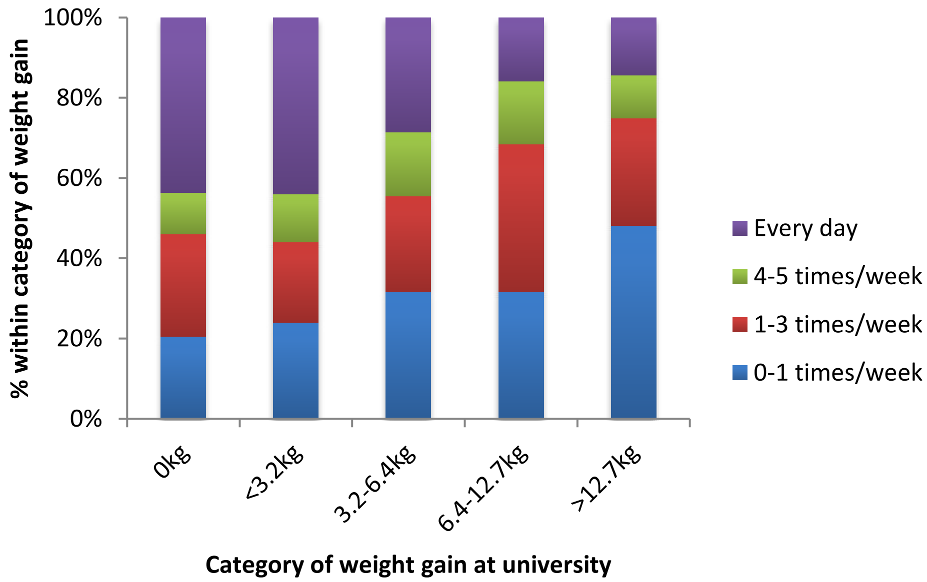
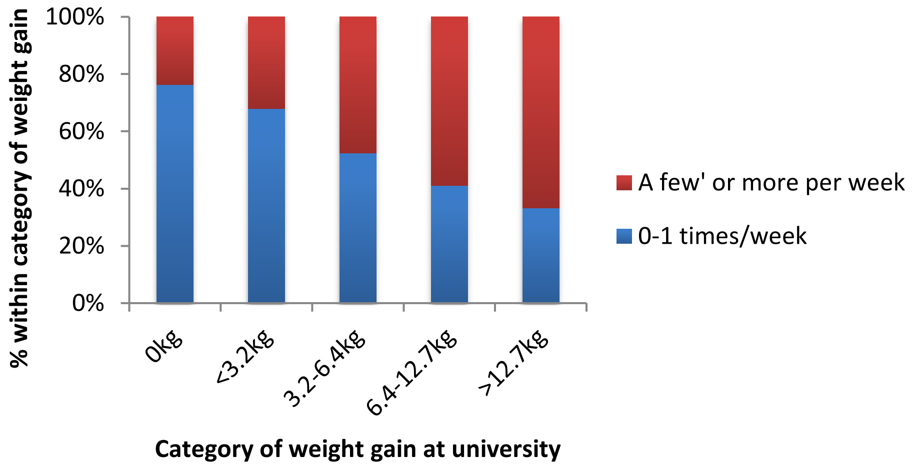



Figure 14: Category of weight gain at university vs. frequency of fruit & vegetable consumption



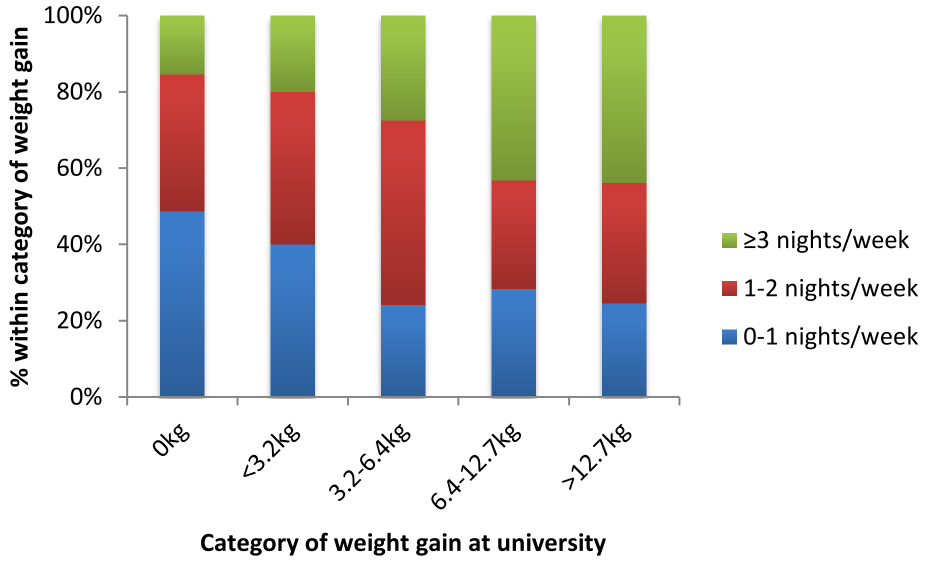
There was additionally a clear positive association between frequency of consumption of takeaways/fast food and body weight gain ($\chi^2 = 23.232$; df = 4; $p < 0.001$). An increasing proportion of students consumed 'a few or more' take aways or fast food meals each week with increasing category of weight gain (Figure 15).

Figure 15: Category of weight gain at university vs. consumption of takeaways & fast food




Significantly greater proportions of students in the weight stable group reported least frequent consumption of alcohol (0-1 nights per week) compared to other groups ($\chi^2 = 21.419$; df = 8; $p = 0.006$) (Figure 16). Congruently, significantly greater proprotions of students in the two highest categories of weight gain (6.4-12.7kg & >12.7kg) reported most frequent alcohol consumption at university (≥3 nights per week) compared to students reporting lesser weight gain ($\chi^2 = 21.419$; df = 8; $p = 0.006$) (Figure 16). Weight stable students were also less likely to report an effect of drinking alcohol on consumption of takeaways and fast food ($\chi^2 = 12.481$; df = 4; $p = 0.013$).

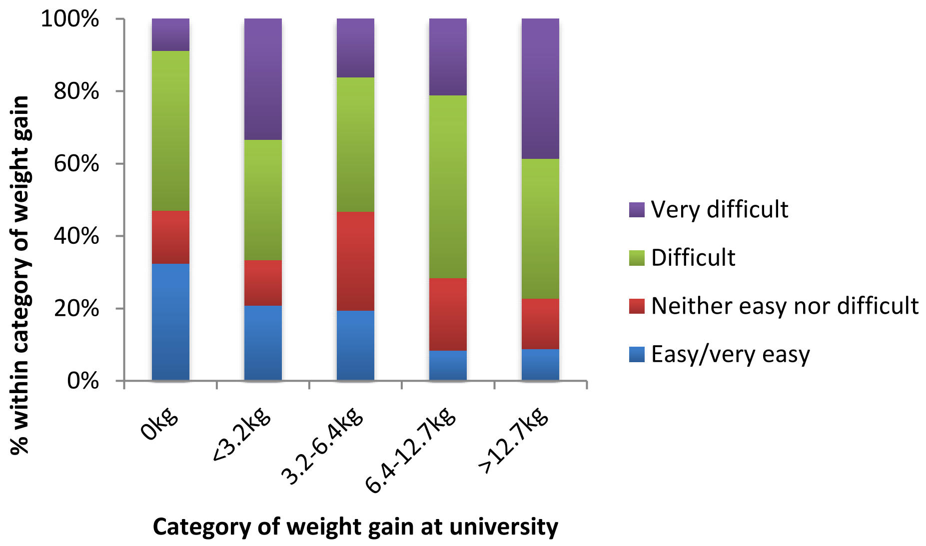
Figure 16: Category of weight gain at university vs. frequency of alcohol consumption




When perceived reasons for weight gain at university were examined, only 'eating unhealthily due to stress relating to studies' was significantly associated with level of weight gain at university ($\chi^2$ = 13.202; df = 3; $p$ = 0.004). A greater proportion (90%) of students in the 6.4-12.7 kg group attributed their weight gain to stress compared to approximately 70% of students in other groups (Appendix R – Table R7). There was also only one significant association between weight gain and factors influencing food choice at university: respondents in the weight stable group were less likely to report cost as an important influence on their food choices at university ($\chi^2$ = 19.198; df = 4; $p$ = 0.001) (Appendix R – Table R8).

A significantly greater proportion of students in the highest category of weight gain (>12.7kg) reported that they found it 'very difficult' to 'shop, cook and eat healthily on a student budget' ($\chi^2$ = 30.262; df = 12; $p$ = 0.002) (Figure 17).

Figure 17: Category of weight gain at university vs. perceieved ability to 'shop, eat & cook healthily on a student budget'

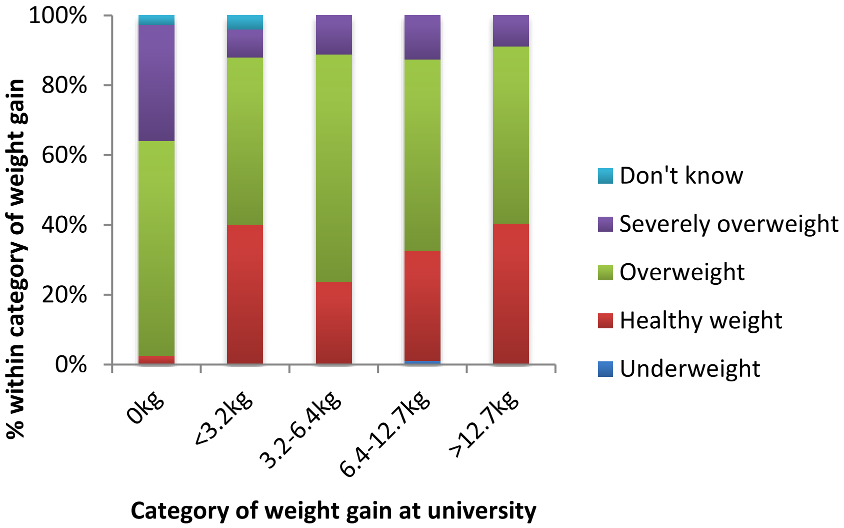



There were additionally several significant associations between cooking ability and category of weight gain. Specifically, a significantly higher proportion of students in the weight stable group reported that they were able to cook the following meals from scratch: curry ($\chi^2$ = 9.619; df = 4; $p$ = 0.048); stir-fry ($\chi^2$ = 14.244; df = 4; $p$ = 0.006); homemade burger ($\chi^2$ = 10.889; df = 4; $p$ = 0.029); soup ($\chi^2$ = 12.994; df = 4; $p$ = 0.012); casserole/stew ($\chi^2$ = 16.230; df = 4; $p$ = 0.002); and full English breakfast ($\chi^2$ = 10.970; df = 4; $p$ = 0.025). Full details of these associations can be found in Appendix R – Table R11.

There was also a significant association between weight gain and physical activity levels at university: a smaller proportion of students reporting greatest weight gain at university (>12.7 kg) reported that they were 'fairly active' (5.3%) or 'active'/'very active' (3.5%) compared to students in other categories of weight gain ($\chi^2$ = 43.227; df = 16; p = <0.001) (Appendix R – Table R9).

Finally, there was a significant association between baseline body weight and weight gain at university: a significantly greater proportion of students reporting greatest weight gain at university (>12.7kg) started university at a healthy weight ($\chi^2$ = 37.530; df = 16; p = 0.002), compared to students gaining between 3.2 & 12.7kg of body weight and to those remaining weight stable. In contrast, students reporting weight stability at university were more likely to begin university classified as 'severely overweight' compared to students in other categories of weight gain ($\chi^2$ = 37.530; df = 16; p = 0.002) (Figure 18).

Figure 18: Category of weight gain at university vs. self-reported body weight at the start of university



# CHAPTER 8.
# DISCUSSION

## 8.1 Introduction

This chapter discusses the findings reported in the previous four chapters in relation to existing literature. Strengths and limitations of each study, along with implications for policy and future research are also discussed. The chapter is presented as five sections: the first four sections comprise a discrete discussion of each results chapter, and the final section highlights complementary outcomes between the four studies and provides further reflections on the overall project findings.

## 8.2 Discussion of Results I – Food & nutrient intakes among university students in the UK

### 8.2.1 Summary of principal findings

This study set out to assess dietary adequacy of university students in the UK. To date, there has been only fragmented study of UK university students' food intake. Existing studies are limited by small sample sizes and/or sampling from a single university only, and detailed assessment of diet is especially lacking. The current study addresses an important gap in the literature with a survey of 1448 students, representing one of the first British studies to provide detailed information on nutrient adequacy among this population (35,92,94).

Intakes of energy and key foods and nutrients obtained from frequency of food intake data were compared to DRVs. Mean intakes of most nutrients met RNIs (or EARs), indicating nutrient adequacy. However, intakes of several key foods and nutrients did not meet recommendations. Consumption of fruit and vegetables for both male and female students was substantially below the 5-a-day recommendation, whilst male students exceeded the recommended intake of red and processed meat. Energy intakes were significantly below the current EAR (255) for both males and females. In addition, a notable proportion (>10%) of male students failed to meet the LRNI for selenium and vitamin A, whilst a similar proportion of female students had selenium, potassium or iron below the level of the LRNI. Very few (<3%) students reported intakes of Vitamin D that met new dietary recommendations (66). Substantial proportions of both male and female students also exceeded new intake recommendations for ‘free’ sugars, failed to meet the updated recommendations for non-starch polysaccharides (NSP), and exceeded DRVs for total and saturated fat. Approximately half of male students and 15% of female students also exceeded the recommended maximum daily intake of sodium (272). Over one third of participants reported no alcohol consumption, although average intake among male consumers exceeded weekly sensible limits.

However, it was estimated that participants under-reported energy intake by approximately 26% compared to pTEE. When nutrient intakes were adjusted for misreporting of energy intake, fewer students fell below the RNI and LRNI thresholds. Nevertheless iron intakes of female students remained significantly below the RNI, but the proportion of students failing to meet the LRNI was reduced from 30% to 7.5%. Similarly, mean intakes of potassium, copper and selenium amongst female students, and selenium intake amongst male students, were no longer problematic. However, intakes of NSP remained significantly below the DRV for both male and female students, with over two-thirds of all students failing to meet the recommended intake. Vitamin D intake also remained inadequate, with in excess of 90% of all students having a vitamin D intake below the recommended intake of 10μg/day (66).

### 8.2.2 Discussion of findings in relation to other studies

Comparison of the current findings to other studies is based principally on data from the most recent NDNS due to a lack of university student-specific research. The under consumption of fruit and vegetables identified in the current study is analogous to national figures for young adults aged 16-24 years (69) as well as to data from a large lifestyle survey of students from seven UK universities (32). Other studies have reported slightly higher intakes among university student samples (31,34). These latter studies sampled from one university only and employed a single question to assess diet vs. calculation from FFQ responses. The use of a single question may increase the risk of social desirability bias, although studies using this approach have not universally reported higher intakes (32). Fruit and vegetables contribute to the intake of several key nutrients including fibre and potassium, which is congruent with low reported intakes of these nutrients identified in the current study.

Absence of data on portion size of red and processed meat limited comparison to recommendations, but the mean number of weekly servings among male students surpassed the seven portions currently advised (272,273). This figure is in line with national dietary data on red and processed meat intake for young adults, which highlighted over-consumption by approximately one third of 16-24 year olds (69). Comparative literature on UK students' dietary intake did not report red and processed meat intake (30,33). However, these studies noted frequent consumption of take-aways and fast food, which may be rich in these meats. Given the extent of under-reporting of energy intake identified in the current sample it is possible that true red meat consumption may be higher than identified here.

Energy intakes reported in the current study were similar to most recent NDNS data for the general adult population (18,69,70), but lower than those reported among a small sample of students from a single university (94). Absolute differences in intake between populations may be a function of methodological divergence in diet assessment and/or real differences in intake, but all studies indicate energy inadequacy relative to theoretical requirements. This reported inadequacy is of note in light of recent research reporting university as a period of increased risk of body weight gain (34,49,50,277). Energy intakes are also lower than those reported in a 2003 study of first year undergraduate students; this study assessed dietary intake using the current FFQ and reported intakes that exceeded DRVs (35). Whilst it is possible that first year students may rely on energy dense foods to a greater extent than students from other years, a post-hoc analysis showed no gradient in energy intake by year of study (Appendix P). With increasing media attention to the problem of obesity it is likely that the entire cohort of students have underreported consumption of energy dense foods. Indeed, estimation of predicted energy expenditure in the current study indicated that on average students under-reported energy intake by approximately 26%. Furthermore, it is acknowledged that energy intakes assessed by FFQ have a wider distribution relative to dietary records (278) and previous validation studies of the current FFQ congruently indicate underestimation (228,234). Although participants reporting extreme energy intakes were excluded from the current dataset, average intakes were biased towards under-reporting. In keeping with such bias, only 8% of students fell in the underweight category. However, the extent of under-reporting identified in the current study is in line with that reported in the most recent NDNS, which indicated under-reporting of energy intake by one-third when diet record data were compared to DLW expenditure data (18).

Given popular beliefs that excessive alcohol consumption is endemic among university students, it is pertinent that 37% of the current sample reported abstinence during the most recent semester. Excessive alcohol consumption clearly does not represent a central component of contemporary university life for all students. Existing literature also reports alcohol abstention by a sub-set of students; exact figures vary but are generally lower than those in the current study (33,46,47,279). The non-randomised sample selection and thus possible self-selection bias in the current study may help explain these differences. For participants reporting consumption, average intakes exceeded recommendations, both at the level of percent contribution to energy intake (male and female students) and weekly units of alcohol (male consumers only) (76,275) although it is noteworthy that average alcohol intake among men met the former 21 units/week recommendation. National data similarly indicates excessive contribution of alcohol to energy intake among young adults, and reports a congruent gender pattern (69,70). Existing student-specific research reports high proportions of students consuming alcohol at levels beyond sensible limits with regular engagement in binge drinking (31,32,44–46,88). Quantitative data on binge drinking was not obtained in the current study, but the qualitative study of this research project has provided further insight into how alcohol is consumed (sections 6.4.6). Given that the short-term health impacts of drinking vary according to how alcohol is consumed (280–282), it would have been pertinent to include a question on binge drinking within the main survey.

Mean intakes of NMES, NSP and saturated fat were also divergent from DRVs, with high proportions (>80%) of students failing to meet the most recently updated recommendations (76,258). Furthermore, free sugars intake is likely to be underestimated since fruit juice sugars were not included in the current calculations. Data are congruent with other research reporting that NMES, NSP and saturated fat intakes do not meet DRV targets among both students and the wider young adult population (69,70,94,113,114). Similarly, a number of student-specific studies also report high intakes of confectionery/snacks and takeaway/fast food, alongside low intakes of fruit and vegetables (30–32). It is noteworthy that even following adjustment for misreporting of energy intake, the majority of students still did not meet recommended intakes of NSP.

Iron intake of female participants was far from adequate, with approximately one third failing to meet the LRNI for dietary iron. However, when reported iron intakes were adjusted for misreporting of energy intake, this figure was reduced to 7.5%, although mean intakes remained significantly below the RNI. However, this adjusted intake figure may still not represent an accurate estimation of true iron intake: energy intake was assumed perfectly correlated to iron intake in the calculation of adjusted intake, which may not be the case in reality. Adjusted intakes may therefore represent an overestimation of actual intakes. Low iron intakes have previously been noted in a 1995 study of UK university students (92). National data reports similarly low intakes among up to 50% of young women aged 16-24 (69,70). Biochemical markers of iron status were not measured in the current study and the author is not aware of any such data in UK students. However, national data recorded low serum ferritin in over 25% and 15% of adolescent and adult females respectively (283) whilst an Australian study reported that one third of female university students had low serum ferritin (284). Since meat and meat products represent a major source of iron in the British diet (17,18), it could be expected that vegetarian students would record lower iron intakes. However, although post-hoc analyses indicated inadequate iron intakes in all groups (regular meat eaters; occasional meat-eaters; non meat-eaters), vegetarian students had greater reported iron intakes than their regular or occasional meat-eating counterparts (Appendix Q). The reduced bioavailability of non-haem iron, however, means vegetarian students may still be at particular risk of biochemical deficiency. It would be pertinent to undertake biochemical assessment of iron status among this population.

One in ten male and one in four female students additionally reported selenium intakes below the level of the LRNI. However, these figures were reduced to fewer than 2% of men and 8% of women following adjustment for misreporting of energy intake. National data indicates a greater extent of potential inadequacy with at least one in four working age men and one in two women in this category; similar figures are reported among 11-18 year olds (17,18). However, energy intake was under-reported by approximately one-third (compared to DLW data) in this national sample and selenium intakes are therefore also likely underreported. Fayet-Moore *et al.* (284) reported an 11% prevalence of selenium insufficiency in their study of Australian female students. A biochemical reference range is not currently established for plasma selenium concentration in the UK and the health impacts of consuming <LRNI of selenium are not clear; current figures should therefore be interpreted cautiously (285). In addition, the selenium content of some foods is dependent on soil selenium concentration, potentially resulting in misclassification of selenium intakes (285) and difficulties in assuming that either reported or adjusted selenium intakes are representative of actual intake. Meat and meat products are major contributors to selenium intakes in the UK (17,18) - this contribution was reflected in lower selenium intakes in vegetarian students (Appendix R).

In light of recently updated dietary intake recommendations for vitamin D, it is noteworthy that less than 10% of the current sample reported intakes that met recommendations both before and after adjustment for misreporting of energy intake (66). There are currently no such available data from the general population to contextualise this finding, although up to 25% of adolescents and adults have plasma 25(OH)D concentrations indicative of deficiency (66). The current finding may indicate the need to consider dietary supplementation to meet recommendations.

Finally, mean daily salt intakes exceeded maximum recommendations, particularly so in men (one in two men had intakes > 6g) (259). Following adjustment for energy intake, approximately four out of five men and two-thirds of women were estimated to exceed maximum daily sodium intakes. It is possible that these adjusted intake figures remain an underestimation of sodium intake due to the omission of discretionary salt consumption in the calculation of sodium intake. National data reports similar excesses among both adults and adolescents (67,68,286). Data on sodium intake among other university student-specific samples are lacking, however reports of high intakes of convenience foods are congruent with high sodium intakes (33).

### 8.2.3 Strengths & limitations of the study

The findings discussed above should be considered in light of methodological strengths and limitations. Importantly, the employment of a FFQ enabled detailed assessment of average diet over the course of a university semester, whilst minimising participant (and researcher) burden. The latter permitted a multi-centre study with large sample size. Most previous research among this population has failed to provide detailed assessment of diet or has been limited by small samples (30,32,33,35,94) and these are thus major strengths of the current study.

The FFQ employed has been previously validated against 7-day weighed records in a sample of British adults (228,234) and correlation coefficients are analogous to those reported for alternative FFQs (229,287). However, this FFQ has not been recently validated nor validated among a student-specific population (228,234) and it is possible that some contemporary foods habitually consumed by students were not included in the food list. Whilst the research team believed there was no reason to assume that the university student population would behave substantially differently to the general adult population in terms of range of food groups consumed, the most recent validation study of the FFQ is dated by some 20 years, and changes in population-level food consumption trends may mean the food list employed in the current FFQ does not accurately capture food intake among a contemporary adult population (288). Such an incomplete food list would have reduced data validity in terms of accurate estimation of nutrient adequacy (229). The issue was addressed in a small-scale pilot study prior to data collection, which identified missing foods and included such foods into the FFQ for the main study; two vegetarian food items (hummus and tofu) were subsequently included (section 3.5.2). However, it is possible that other habitually consumed food items were not included in the food list.

The lack of recent validation of the FFQ in a student population raises two issues: 1) do students choose food groups substantially different from the adult population? And 2) is the food list substantially dated? Household food expenditure data indicates that in the last 20 years, the British diet has changed towards an increase in eating out, italienisation of the diet (pasta and pasta sauces) and a growth in ready meal consumption (289,290). Therefore, misclassification of intake for these food groups may have occurred due to a lack of detail on these foods in the FFQ. However, the research team believed there was no reason to assume that the food list for the core staple foods, i.e potatoes, fruit and vegetables, meat, fish, dairy and fats, would be inappropriate for a university student population. There was additionally evidence of students experiencing problems with interpreting some questions on the FFQ (some students reported certain food items as 'missing' that were included within the survey - see section 3.5.5 and Appendix D). This omission will have further reduced the accuracy of absolute nutrient intakes reported.

It was not possible to re-validate the FFQ within a contemporary university student population due to time and financial constraints, although the author does acknowledge that this would have improved the quality of the nutrient intake data reported. A number of limitations associated with FFQs more generally – e.g. necessity to recall food intake in terms average consumption over a designated period; bias towards over-reporting of more healthful foods and under-reporting of less healthful food items; combining individual food items into broader food groups within the food list – all interfere with the accurate estimation of dietary and nutrient intake. These drawbacks make FFQs a sub-optimal choice of dietary assessment method for the measurement of absolute nutrient intakes (227,291,292). Interpretation of absolute nutrient intakes measured by FFQs must therefore be interpreted with caution.

Estimation of misreporting of energy intake of the sample by calculation of pTEE from BMR equations and estimation of PAL provided some form of retrospective performance assessment of the FFQ. This indicated an average under-reporting of energy intake by approximately 26% compared to predicted values, with resultant implications for validity of reported nutrient intake data. This demands caution over any conclusions drawn around nutrient adequacy in the current dataset. The adjustment of nutrient intakes for under-reporting of energy intake enabled additional insight into intake adequacy of nutrients identified as inadequate in the original, unadjusted analysis. However it should be acknowledged that adjusted intakes were calculated by assuming energy and nutrient intake are linearly correlated which is likely not the case; adjusted data should thus be interpreted with a continued degree of caution. It should be noted that use of food records or multiple 24-hour recalls to assess diet were considered, but these would have substantially reduced sample size and may not have captured habitual intake. Furthermore, it should be noted that reported intakes are broadly in line with national data of young adults, which supports confidence in interpretation of findings.

The employment of a convenience sample is also a limitation. Convenience sampling is associated with selection bias, therefore precluding generalisation of findings to the wider student population. It is possible that health-conscious or food-orientated individuals are over-represented in the current sample relative to the general student body. Use of study incentives attempted to reduce this bias. Random sampling would have been desirable, but university protocols for student recruitment precluded this. The low response rate (estimated at < 5%), although comparable to previous online student surveys (173) also prohibits generalisation of findings. Response rate was particularly poor at two sites (Universities of Southampton and St Andrews). Social desirability bias is also possible, which may have resulted in over-estimation of more healthful food items (e.g. fruit and vegetables) and under-estimation of less healthful foods, including alcohol. However, this is a limitation of all dietary research using recall methods of assessment.

### 8.2.4 Implications for policy and future research directions

This study has important implications for both university policy and future research direction. Whilst mean intakes of the majority of nutrients met RNIs, a proportion of young adults at university were not consuming nutritionally adequate diets, even following adjustment of nutrient intakes for misreporting of energy intake. This has consequences for both long- and short-term health.

Gender differences in dietary adequacy also have important implications for any future dietary initiatives.

In the short term, binge or heavy drinking among students has been particularly associated with negative consequences. Increased risky sexual behaviours, mood disturbance and negative impacts on academic study (e.g. missing class) have been reported (280,281,293,294). High levels of alcohol consumption have also been implicated in the aetiology of university weight gain (152). Likewise, heavy drinking has been associated with weight gain among the general population (295). High intakes of sugars may also lead to poor oral health and energy over-consumption (258).

In the longer term, high intakes of alcohol and red and processed meat, alongside low consumption of fruit and vegetables increases risk for the development of a number of cancers and other chronic conditions, including diabetes, hypertension and coronary heart disease (5,296–298). The food intakes recorded in the current study by some students may thus have serious health consequences if adopted in the long-term.

The low dietary iron intakes identified among approximately one third of students (or 7.5% following adjustment for misreporting of energy intake) may not necessarily translate into iron deficiency anemia. National high prevalence of dietary inadequacy among girls and women of reproductive age sits alongside a relatively low prevalence of iron-deficiency anemia (IDA) and SACN has resultantly suggested that the DRVs for iron may be too high (272). However, these population groups, particularly those of low income, have been identified at particular risk of IDA (272). In the face of small student budgets it is conceivable that university students are among those at greatest risk. Low intakes of iron and selenium are particularly pertinent to university food policy in light of current sustainability initiatives to reduce meat consumption among students (299). Haem iron represents the most bioavailable source of dietary iron and additional reductions in meat consumption may further threaten iron status (272).

This study should now be replicated among a representative sample of British university students to further examine dietary adequacy. Further research is necessary to obtain a more accurate insight into both energy and nutrient adequacy before any recommendations for university policy can be made. It would have been useful to have collected dietary data using an alternative form of dietary assessment (e.g. estimated diet records) from a sub-set of participants to provide further and contemporary information on the relative validity of the FFQ in a university student population. Time and resource constraints meant this was not possible in the current study, but a re-validation of the FFQ is recommended before any further use of the FFQ in a young adult population. For future research amongst this population, the use of estimated food records or multiple 24-hour recalls over the course of an academic semester/year would circumvent some of the limitations associated with employing a FFQ discussed above, and provide greater insight into how foods and drinks are consumed (e.g. meal timing / binge drinking). Biochemical assessment of iron status among female students would also be pertinent. Given the long term health implications of several of the dietary behaviours practiced by participants in this study, it is also important to establish whether habits established at university track forward into working adult life or remain unique to the university setting.

### 8.2.5 Conclusion

Existing studies investigating food intake of British university students lack detailed assessment of diet and this study therefore aimed to provide contemporary information on dietary adequacy of university students in the UK. Although mean intakes of most nutrients met DRVs, intakes of several key foods and nutrients did not meet recommendations; if accurate, this has implications for students' biochemical nutrient status and future disease risk if such levels of consumption are continued in the longer term. The employment of a convenience sample of students limits generalisability of current findings to the wider student population, but the concerning intakes of some nutrients identified in this study provides justification for future research interest in this population.

## 8.3 Discussion of Results II – Dietary patterns among university students in the UK

### 8.3.1 Summary of principal findings

This study aimed to identify dietary patterns that exist within a UK university student population. It also set out to identify major socio-demographic, lifestyle and other behavioural characteristics of students favouring these patterns. University students now represent a substantial proportion (50%) of the young adult population (36), and an individual's university career may be influential in the establishment of long-term eating patterns and thus chronic disease risk. To date there has been only fragmented study of UK university students' food intake. Most existing studies lack detailed assessment of diet and/or are limited by small sample sizes and sample from a single university only (30,32,33,94). This is the first study to assess dietary intake among a British university student population using multivariate statistical methods to establish patterns of consumption using detailed dietary intake data.

Four major dietary patterns were identified, indicating that university students are a heterogeneous population in terms of food intake. These patterns explained approximately one fifth of the variance in food intake among the sample and were labeled 'vegetarian', 'snacking', 'health-conscious' and 'convenience, red meat & alcohol'. Insight into the demographic and lifestyle factors associated with these dietary patterns was achieved using statistical modeling and enabled identification of sub-groups of students favouring particular diets. Students favouring these patterns could be distinguished by a number of key characteristics: gender, age, university attended and cooking ability. There was additionally evidence of clustering of lifestyle behaviours such that students who favoured less healthful diets also reported greater engagement in other lifestyle risk factors.

### 8.3.2 Discussion of findings in relation to other studies

Comparison of the current findings to existing research is based both on data from studies of the general British adult and adolescent populations as well as the small body of student-specific research. The principal findings of this study are discussed in detail in the ensuing sections.

#### *8.3.2.1 Heterogeneity in student food intake and comparison to existing literature*

Similar dietary patterns to the first three identified in the current sample have been consistently reported among both adult and adolescent populations in the UK (22–24,29). This suggests that the student population may not differ substantially in their eating habits relative to the general population. The fourth pattern identified is more unique, although it is in line with the predominant component (labeled 'drinker/social') identified among a representative sample of young adults in Northern Ireland (29), and congruent with a minor component (labeled 'red meat & alcohol') extracted in an analysis of national dietary data (300). It also shares characteristics with the 'processed' patterns reported among British adolescents and working age men (23,24). An earlier (1996) study among a representative sample of the UK adult population also reported that university students favoured a diet rich in sweet foods, congruent with the current 'snacking' pattern (72). It is likely that other UK studies investigating dietary patterns among adult populations have included university students, but lack of specific identification of students at the analytic stage limits comparison (19,23,28,300).

The 'snacking' and 'convenience, red meat and alcohol' patterns are congruent with the small body of literature specifically focusing on the food preferences of British university students. Existing studies allude to non-prudent consumption patterns, reporting low consumption of fruit and vegetables alongside high intakes of confectionery, alcohol, and fried, ready-made and convenience foods as defining features (30,32,33). The 'convenience, red meat & alcohol' pattern is particularly consistent with popular beliefs surrounding the diets of university students, reinforcing the current stereotype that students possess poor dietary habits, drinking large quantities of alcohol coupled with frequent consumption of take-aways and ready-meals. Importantly, the current analysis revealed that these two patterns were nutrient-poor, highlighting their less healthful nature and possible association with negative health outcomes if adopted in the longer term (6,301,302).

The 'health-conscious' pattern is at odds with the stereotype of student eating habits. This component was rich in foods considered health promoting and characterised by the most favourable nutrient profile. Thus, not all students make poor dietary choices at university. A recent cluster analysis of eating behaviours among a smaller sample of British university students reports a comparable 'favourable eating behaviours' cluster (30). This cluster was characterised by high consumption of fruit and vegetables alongside low intakes of convenience and fast food, although lack of detailed dietary data in this study limits comparison. A prudent pattern is consistently reported among British adults and adolescents (22–24,28,300,303).

It is of note that the predominant pattern identified in the current study was a vegetarian diet. A vegetarian pattern has been described in the wider UK diet pattern literature, although often explaining a smaller proportion of the variance in dietary intake (22–24). The proportion of participants who identified themselves as vegetarian in the current study (10%) is greater than the 3% reported among the general UK adult population (89), although lower than the one in four prevalence previously reported among a sample of university students in Northern Ireland (33). Although the reduced expense of a meat-free diet may make this a popular choice among students for whom food budgets are small, students reporting 'cost' as a major driver of food choices had lower vegetarian pattern scores. The self-selected nature of the current sample means a particularly health- or environmentally-conscious sub-group of the student population may have been recruited, which may explain the predominance of a vegetarian pattern. Generalisability of findings regarding the predominance of patterns identified is therefore not possible, however the author would contend that a presence of a vegetarian pattern in the wider student population is likely. Increasing national attention to the consumption of a more sustainable, reduced meat diet may also contribute to the adoption of a vegetarian-style diet.

In light of popular beliefs surrounding university drinking culture and high rates of binge-drinking previously documented in this population (31,32,44–46,88), it is noteworthy that only one component ('convenience, red meat & alcohol') was high in alcoholic beverages and positively correlated with alcohol intake. The 'vegetarian' and 'health-conscious' patterns exhibited no clear relationship with alcohol intake, the 'snacking' pattern was negatively correlated with alcohol consumption (upon adjustment for energy intake). However it should be noted that the relatively small overall proportion of heavy drinkers within our sample limits absolute conclusions about alcohol-based dietary patterns.

#### *8.3.2.2 Clustering of lifestyle behaviours*

In line with existing research among university students and general adult populations there was evidence of aggregation of lifestyle behaviours (31,72,304–307). Students favouring more healthful dietary patterns reported greater engagement in other health-promoting lifestyle choices, including not smoking, greater participation in physical activity and greater consumption of fruit and vegetables. These students were also more likely to report 'health/nutritional value' as a major driver of their food choices at university. More pertinently, however, students with high scores on the 'convenience, red meat & alcohol' pattern were also more likely to smoke, report more frequent consumption of take-aways and pre-prepared foods and engage in lower levels of physical activity. This is important, since the negative health outcomes associated with multiple lifestyle risk factors are greater than the sum of individual health risk behaviours (79,308) and these students are thus at particular risk of poor future health outcomes. It is noteworthy that students tending towards this pattern were also more likely to be male; this gendered nature of dietary preference is discussed further in section 8.3.2.5 below. Identifying students with poor lifestyle behaviour profiles is essential for targeted health promotion efforts among this population.

#### *8.3.2.3 University attended is associated with dietary patterns consumed*

In the current sample of students, dietary preferences varied between participating universities. Generally, students at the University of Ulster favoured less healthful patterns, whilst those at the Universities of Southampton, St Andrews and KCL tended towards more healthful diets. Students attending the University of Sheffield were least likely to adopt a 'health-conscious' dietary pattern. There are a number of possible explanations for this. Firstly, these differences in dietary consumption patterns may arise from regional differences in dietary preferences. Whilst each university student body comprises a geographically heterogeneous group of individuals, there may be congruence between the dietary preferences of a region and its university student population, particularly for universities attracting greater numbers of students from the same locality. Research on regional differences in food intake in Britain is limited but broadly in line with current findings, indicating that people living in the south of England tend towards healthier diets than those in the north of England, Scotland and Northern Ireland (19,72). National data also indicate that the population of Northern Ireland consumes a diet of poorer quality than the UK as a whole (17,18). A congruent pattern ('drinker/social') has also been identified as the predominant pattern among a representative sample of Northern Irish young adults (29). However, dietary patterns research focusing on young British adults is scarce, which limits comparison (28,29). The author is aware of only one existing student-specific study that has sampled from multiple universities to enable comparison to the current finding (32). This study also reported differences in key dietary behaviours (fruit and vegetable intake; confectionery consumption; binge-drinking) between the seven participating sites, although absence of information regarding site location limits comparison (32).

It is also possible that university attended is acting as a proxy measure for SES. The differences observed between universities may therefore be reflective of a socioeconomic gradient in food intake rather than regional differences in dietary preferences. Missing data on social class for participants at the University of Sheffield precluded inclusion of this variable in final analyses (GLMs), although preliminary analyses indicated a positive association between mother's level of education and 'vegetarian' diet scores. Information from HESA provides evidence for differences in social class between participating universities, with a substantially greater proportion of students at the University of Ulster coming from manual occupational backgrounds; breakdown of available maternal education data by university in the current study corroborates these differences (246) (Appendices S & T). The wider literature consistently reports a positive association between socioeconomic status and diet quality across UK population groups (22–24,71,303,309), which substantiates the possibility that differences in dietary pattern scores between participating sites could be explained by differences in social class background. However, the tendency for students at the

University of Sheffield to score lowest on a ‘health-conscious’ diet is not in line with this explanation. More complete information on social class in the current study would have been enlightening.

Selection bias may provide a further explanation. There were differences in recruitment method between the Universities of Sheffield and Ulster (recruitment email distributed directly to all students via a global mailing list), and the other three participating sites (e.g. study advertisement on student volunteers webpage). These recruitment differences may have demanded differing levels of motivation from students to complete the survey, thus possibly increasing the proportion of food- or health-orientated individuals within the latter samples who may adopt more healthful diets.

Finally, lack of association between university attended and consumption of the ‘convenience, red meat & alcohol’ diet also deserves attention. This suggests that this pattern is pervasive across all universities studied, substantiating popular beliefs that the diet of British university students is one of poor quality.

#### *8.3.2.4 Older students favour more healthful dietary patterns at university*

This study also revealed that older students favoured more healthful diets at university. Most pertinently there was evidence of a positive linear relationship between age and scores on the ‘health-conscious’ pattern, indicating that older students adopt more favourable dietary habits at university than their younger counterparts. It is possible that as students mature they become increasingly aware of the impact of dietary choices on health and well-being, and health thus becomes an increasingly important determinant of food choice. Studies among the general UK adult population report a congruent tendency towards more healthful patterns with increasing age among both men and women (19,22,23,72). A survey conducted among a large sample of Northern Irish university students also alluded to a positive gradient in diet quality by year of study (first year students consumed fewer fruits and vegetables, and more ready meals relative to other years) (33). In contrast, most other recent student-specific research has failed to detect an association between eating habits and age (or year of study), although absence of detailed dietary assessment in most of these studies may have precluded the ability to detect any differences (30–32,34,35).

In contrast to the wider literature (19,22,23,72), it is of note that no association between age group or year of study was identified in relation to scores on the ‘snacking’ or ‘convenience, red meat and alcohol’ patterns. Existing research focusing on the drinking behaviours of university students indicates that alcohol intake (particularly binge-drinking) declines with age (46,88). However, differences in assessment method of alcohol intake (absolute intakes vs. alcohol consumption as part of a whole dietary pattern) and absence of data on binge-drinking in the current dataset limits comparison.

#### *8.3.2.5 Gender differences in dietary preferences among university students*

There was also evidence of a gendered nature of food intake among the current sample, focusing around meat consumption. Specifically, female students favoured a ‘vegetarian’ diet, whilst men scored more highly on the ‘convenience, red meat & alcohol’ pattern. Existing research among university student samples that has examined gender differences in dietary intake is broadly in line with the current finding, reporting greater meat and fast food consumption among male students (33,102,310,311). Similarly, studies providing specific data on vegetarianism report a greater prevalence among female students (33,310), whilst national survey data also indicates greater red meat consumption among men (17,18). The ‘social/drinker’ pattern identified among Northern Irish young adults, which loaded highly on both alcohol and red meat, was also favoured by males (29). However, the most recent British study investigating dietary behaviours among university students failed to identify any gender differences between four clusters of eating patterns (30). Lack of detailed dietary intake data in this study, however, may have reduced the ability to detect any gender difference in food intake.

It is noteworthy that no gender difference in scores on the ‘health-conscious’ pattern was detected. This is in contrast to the wider literature, which has highlighted that females favour prudent dietary patterns relative to their male counterparts (24,71,72). This difference may be due to gender disparities in beliefs around the importance of healthy eating and engagement in regulating food intake for health or weight outcomes (32,123,310). The lack of gender difference in the current study may thus indicate that both male and female students are equally concerned with regulating their food intake for health (or weight) outcomes.

The gendered nature of dietary preference in the present study focused very much around the consumption of red meat (and alcohol). In contrast to womanhood, manhood is socially – rather than physically or biologically – constructed and maintained, and men must therefore engage in external choices to ensure masculinity is preserved (312). Food eaten influences how a consumer is perceived by others, and dietary choices therefore represent a strategy through which to convey one's gender. There is a body of literature which highlights the concept that red meat consumption assumes a particularly important role in the demonstration of hegemonic masculinity in westernized society; this idealised, 'real' male is physically strong, muscularly defined, emotionally detached and competitive (313,314). With a minority of recent exceptions (315,316), male meat eaters have been consistently perceived as more masculine, whilst adopting a meat-free diet threatens this status (317–319). The media reinforces this relationship between virility, drinking beer and consuming red meat, contributing to the perceived necessity to engage in such practices to be considered a 'real' man (314,320–322). In a similar vein, favouring of a lower fat, vegetarian diet by female students is equally in line with society's contemporary expectations of femininity and gender roles (323).

#### *8.3.2.6 Students reporting greater cooking ability adopt healthier dietary patterns at university*

Finally, despite just over half of the current sample reporting confidence in cooking a wide range of meals from raw ingredients, almost as many students reported limited (or non-existent) cooking ability. Moreover, this study provides evidence for a positive association between cooking ability and diet quality among university students. Specifically, students reporting greater self-rated cooking ability were more likely to adopt healthier (vegetarian; health-conscious) diets than their less skilled counterparts. This association has not been previously documented among a university student population, although the wider body of literature on this relationship, whilst scarce, corroborates this association (324–326). Indeed, in a large sample of Swiss adults, even after controlling for health-consciousness, cooking skills were positively correlated with vegetable consumption (women only), whilst negatively correlated with intakes of both sugar-sweetened beverages (women only) and convenience foods (men and women) (327). Positive, albeit small, improvements in diet quality following interventions targeting cooking skills in low income population groups have also been reported (325,326), although no significant improvement in fruit and vegetable consumption was noted following a four-session web-based cooking demonstration intervention among North American university students (328). However, the short-term nature and use of an FFQ to assess dietary change were limitations of this latter intervention. Since cooking skills interventions could represent a feasible and cost-effective approach to improving dietary intake among the student population, further research in this area would be pertinent.

It is noteworthy that no association was identified between cooking ability and scores on the less healthful dietary patterns (snacking; convenience, red meat & alcohol), despite students favouring these patterns reporting infrequent consumption of meals prepared from raw ingredients alongside greater reliance on take-aways and pre-prepared foods. A positive association between meal preparation frequency and diet quality has been previously reported among young adults in North America, however cooking ability represented only one of multiple barriers to cooking meals from scratch (329). Whilst it is likely that students who lack culinary skills may be forced to rely on convenience foods to ensure meal provision, other factors such as time pressures and (lack of) cooking enjoyment may be more salient in determining students' decisions around consumption of these foods (329,330).

### 8.3.3 Strengths and limitations of the study

The current study has a number of major strengths. Firstly, employment of an FFQ in the current research minimised participant (and researcher) burden and thus enabled detailed assessment of diet in a multi-centred study of large sample size with geographical diversity. Sampling students from multiple years of study also meant that differences in dietary preference by year of study (or age) could be unveiled. Previous research has failed to provide detailed measurement of diet or has been limited by small samples and assessment of first year students only (30,32,33,35,94).

Many of the methodological limitations of this research have been already delineated in the earlier chapter on nutrient intake and the reader is thus referred back to section 8.2.3. However, it should be noted that despite the limitations of FFQs in terms of measurement of absolute nutrient intake, FFQs represent a suitable method for ranking participants according to dietary intake and represent a valid study instrument for dietary patterns research (239–242). Additionally, however, inadequate data on socioeconomic status precluded any detection of an association between this variable and dietary pattern scores in this study. This is particularly pertinent in light of a consistent relationship between social class and diet in studies of the general population (19,72,303,309). Such data may have also provided further insight into the association between diet and university attended. Since the most appropriate measure of social class in dietary studies varies according to the population under study (22–24,303) and university represents a period of life transition when many young people become, for the first time, their own food provider, future studies should incorporate a composite measure of social class to provide greatest insight into this relationship.

### 8.3.4 Implications for policy and future research directions

This study has important implications for both university policy and future research directions. Firstly, the current findings highlight that not all students consume poor diets at university: there is a sub-group of students who are clearly health-conscious, consume nutritionally favourable diets and are not in need of dietary intervention. Indeed, both prudent and plant-based dietary patterns appear protective against chronic disease risk (6,29,210,301,331). Importantly, however, this study also revealed a sub-group of students who adopt poor diets alongside other unfavourable lifestyle behaviours at university. These students may be at risk of both nutritional inadequacy and poor health outcomes if such behaviours are adopted in the longer term (29,302,332). Moreover, biomarkers of cardiovascular disease risk have already been identified among young adults following less healthful dietary patterns (those characterised by consumption of crisps, chips, soft drinks and sugar-rich foods) (29). Given the heterogeneity in dietary behaviours identified in this study, any future health promotion messages or dietary intervention efforts must be targeted towards students most at risk to ensure interventions are optimally effective. Messages around reducing consumption of red meat and alcohol are needed and these should be specifically targeted towards male students. There is evidence that university students want information on healthful eating (333) and university services (e.g. students' union; university health services) would be appropriately placed to provide students with information and support in this area.

This study also highlights a number of future research needs. Firstly, given the limitations discussed above and inability to generalise current findings to the wider student population, it would be pertinent to replicate this research among a large representative sample of British university students. Employment of an alternative method of dietary assessment (e.g. multiple 24-hour recalls; estimated food record) would also overcome a number of the limitations associated with the current FFQ. Secondly, in light of the association between cooking ability and dietary consumption patterns, a pilot study to investigate the potential for a cooking skills intervention to improve dietary intake among this population would also be enlightening. Finally, whilst eating patterns at university may be important for short-term nutritional adequacy and well-being (281,282,294), the public health impact of dietary patterns and other lifestyle risk factors established during this period become most important if these behaviours track forward into working adult life and represent a blueprint for long-term dietary preferences. Longitudinal research is now needed to investigate this possibility.

### 8.3.5 Conclusion

This study set out to identify dietary patterns that exist within a UK university student population and to identify major sociodemographic, lifestyle and other behavioural characteristics of students favouring these patterns. It represents the first study to assess dietary intake among a British university student population using multivariate statistical methods to establish patterns of consumption using detailed dietary intake data. Most existing studies have lacked detailed assessment of diet and/or are limited by small sample sizes and sampling from a single university only (30,32,33,94).

Four major dietary patterns were identified, indicating that university students are a heterogeneous population in terms of food intake. Two of these patterns ('vegetarian'; 'health-conscious') could be considered health promoting (32,33,94,210), whilst the two other patterns ('snacking'; 'convenience, red meat & alcohol') appear less healthful and may be associated with undesirable health consequences if adopted in the long-term (29,302,332,334–336). A number of key characteristics (gender, age, university attended and cooking ability) could distinguish students favouring these patterns. There was also evidence of clustering of lifestyle behaviours such that students who favoured less healthful diets reported greater engagement in other unfavourable lifestyle risk factors. Future studies should now replicate this research within a representative sample of British university students, and examine longitudinally whether dietary patterns established at university track forward into long-term, working adult life.

## 8.4 Discussion of Results III: Interviews with students - understanding food choices and dietary practices at university

### 8.4.1 Summary of principal findings

This qualitative study set out to explore the food choices and dietary practices of university students in the UK. Specifically, it aimed to answer four research questions: first, what are the factors that drive students' food choices at university; second, how does the transition to university impact upon eating practices; third, how, if at all, do dietary practices change throughout students' university careers; and fourth, how do students' home food environments impact upon eating habits at university. As far as the author is aware this study represents the first attempt to explore in depth the dietary experiences of a UK student population, although there is a literature on North American students' experiences (135,138–140,337–339). Research into food and eating practices during the more general transition from youth to adulthood is also scarce (145). In light of the poor dietary habits reported among university students to date (30–34), there is a clear need for better understanding of the factors shaping the eating decisions of this group. These study findings are particularly important given that close to 50% of the UK's young adult population now enters higher education (36) and understanding and insight into the factors underpinning their dietary decisions is necessary to inform future health promotion policy.

Thematic analysis of interview data revealed four substantive themes representing critical elements of students' dietary decisions: 'Peer groups, diet and social integration'; 'The university experience'; 'Healthful eating at university?' and 'Becoming an autonomous consumer'. Although these themes were identified as separate constructs it became clear that food choices were permeated by multiple social, moral and nutritional meanings, and dietary decisions were resultantly complex and multifaceted. Within this complex mesh of factors underpinning students' food choices, there were four outstanding findings that map directly to the research questions: multiple factors underpin dietary decisions at university; the influence of peers and food's social role at university; the role of the family food environment in food choice at university; and the dynamic nature of food and eating practices at university. These areas will be discussed and contextualised in relation to relevant literature in the following sections.

It should be highlighted that existing qualitative studies seeking to understand food choices at university have provided only superficial understanding. Specifically, these studies have neglected the wider meanings and implications of food choices in students' lives; equally they have failed to consider the influence of family-based dietary experiences, which has been suggested as a key influence in studies adopting a life-course framework to understanding food choice (340–343). By considering students' dietary experiences and decisions more holistically, this study has provided a more complete understanding of young people's food choices at university.

### 8.4.2 Discussion of findings in relation to other studies

#### *8.4.2.1 Multiple factors underpin dietary decisions at university*

In keeping with existing models of food choice among both university students and the wider population, influences at an intra-personal, inter-personal and extra-personal (environmental) level were apparent (136,208). The majority of students interviewed had healthful dietary ideals, and these influences were predominantly spoken about in the context of barriers to healthful choices and striving to achieve these ideals. Peer influences, daily schedules (leading to time scarcity), academic stresses, inadequate kitchen facilities, kitchen cleanliness, culinary skills, issues of trust between housemates, easy access to fast and convenience food, previous food norms and small student budgets all interacted to shape students' preparation of meals from scratch and ability to consume a healthful diet at university. These constraints are generally consistent with those previously reported by university students (34,135,136,138,140,327,339,344–346). Some constraints appear more unique to the university setting (e.g. kitchen cleanliness) than others (e.g. access to fast and convenience food; budget).

However, it became clear that no individual constraint acted as the sole catalyst to food choice at university. In keeping with Bava *et al's* (347) qualitative study exploring the impact of time scarcity on food choice among women, dietary decisions seemed to represent a series of trade-offs between constraints and ideals, which largely depended on the resources students possessed to negotiate these constraints (e.g. culinary experience), opposing positive influences on food choice (e.g. positive peer influence) and the priority students placed on healthful eating compared to other aspects of university life. The latter seemed particularly important in determining whether or not students were able to overcome the barriers to less healthful food choices and was often shaped by personal experiences of diet-disease relationships, such as heart disease in close family members; this seemed to strengthen beliefs regarding the negative consequences of consumption, particularly among female students. Qualitative research exploring alcohol consumption at university has similarly noted negative experiences (e.g. alcoholism in close relatives) as a principal motive for alcohol abstinence (46,129). These findings are also in keeping with existing models of preventive health care behaviour (348,349), which highlight a critical role of health beliefs for engagement in health-promoting behaviour. Quantitative studies specifically examining the effect of health beliefs on dietary intake at university report that perceived disease susceptibility and severity are important in predicting importance of healthful eating and food choice, particularly among female students (350,351).

Students prioritising healthful eating possessed strategies to enable favourable food choices in line with consumption ideals in the face of constraints. These strategies included simplifying meals to enable continued consumption of home-prepared food in the face of time pressures, and sacrificing other areas of student life to liberate money for better quality food. It was clear that what represented a barrier to one student (e.g. budget; time scarcity) was not necessarily a barrier to another. It is therefore important that strategies to encourage the adoption of a healthy diet in student populations do not fixate on any single possible cause.

#### *8.4.2.2 Influence of peers and food's social role at university*

For all the young adults in this study, transition from school to university represented much more than geographical relocation and academic progression, but was a milestone within the wider context of transition from youth to adulthood. During this time, students were faced with the need to construct their own adult identities and establish feelings of belongingness within new social groups, away from the comfort of an already-established connected family life. Food was a powerful social facilitator, enabling students to 'break the ice' and begin to establish relationships with new peers through the sharing of communal eating occasions in the early days of university life. These meals frequently involved consumption of typically less healthful, popular youth foods, such as take-aways or pizzas (352,353). During the initial months at university there was evidence that eating occasions and dietary choices were co-opted by young people, particularly females, to fit in to new social groups. For the few students who found themselves surrounded by peers with more healthful eating patterns there was a shift to more favourable food choices, but more often this pursuit of social integration seemed to result in tending towards less healthful patterns of eating. A bidirectional influence of peers on (healthful) eating behaviour at university is congruent with existing research among students, which notes that peers can act as both a deterrent from and source of social support for healthful lifestyle behaviours (34,136,139,327,345). Such alignment of choices is also in keeping with cross-sectional research, which generally reports a positive association between food choices and perceived peer eating norms among both adolescent and young adult populations (354,355). Young people during transition out of secondary school have similarly described food choices based on what would enable them to best fit in with new peer groups, resulting in greater consumption of 'junk' food, and often in the absence of any hunger cues (145).

Food holds multiple roles in contemporary society, far beyond provision of fuel and nutrients, and the wider literature supports the essential function of dietary decisions in construction of identity and building of social relationships among young people (353,356–358). Research examining the formation of consumption stereotypes and food personalities notes that healthy eating may carry notable social risks in situations where social relationships are not yet established (323,353,357,358). Food carries multiple and varied social meanings, and consumption of particular foods can be used to convey personality and social standing (323,359). As such, people can shape the image they wish to portray through the foods they choose to consume. Teenagers consistently attach socially desirable values ('popular'; 'fun'; 'independent') to consumption of 'junk' foods, whilst more healthful foods have been associated with parental attachment and may convey personality images such as ‘weird’, ‘unpopular’ and ‘geeky’ (353,357,358). Adult food choice may also be used as a barometer to make similar personality judgments (323,359). Following a stereotypical student diet of pizzas, take-aways and alcohol thus has connotations of having – and being - fun, thereby promoting integration with peers.

At the same time, there was a dichotomy between consumption of ‘junk’ foods that promoted social integration and consumption of ‘health’ foods that promoted achievement of the westernized slim ideal of female beauty (358,360). This tension often led to feelings of guilt following consumption of junk food. A minority of male students described similar tensions when deviating from muscle building dietary regimes (320). Students’ descriptions of following restrictive diets (such as low sugar, low calorie or missing meals) provide evidence for somewhat potentially dysfunctional relationships with food and is in keeping with high rates of dieting among healthy weight individuals and engagement in extreme weight loss behaviours among young adult populations (33,53,54,58,60).

The specific function of alcohol consumption in building new friendships at university identified in this study is also in line with existing literature (124–126,129,145). Current findings provide further evidence for a university (binge) drinking culture extending beyond just sharing alcohol, to dealing with hangovers and exchanging stories of drunken escapades, which fosters further camaraderie within peer groups (124–126). In an environment where building new relationships is critical, such a social role of alcohol thus makes abstention difficult. In a similar vein to the consumption of junk food, (excessive) alcohol consumption was welcomed to a degree, but also created tensions for some students, who felt their dietary ideals and personal beliefs were compromised; these tensions are consistent with those previously described among non-drinking students (128,129).

The finding that this strong social role of food (and drink) evolved throughout university is also in keeping with the extant qualitative literature. As friendships strengthened and identities became more firmly established, dietary choices became less important as a method of integration and communication of a desired image (133,141). Irby’s (141) recent study examining eating identities among university students revealed two groups of consumers (‘independent eaters’ and ‘dependent eaters’) and is particularly consistent with current findings. ‘Independent eaters’ were older, described more firmly established friendships and were thus able to base their food choices on personal preferences and food ideals. In contrast, the food choices of ‘dependent eaters’ – who were typically younger females and more socially insecure - were contingent on both the opinions and behaviours of others (141).

Given food’s clear social role at university, it could perhaps be expected that students would prioritise eating together within peer groups, but there are indications that this was a minority experience. Students described eating together during breaks between lectures, but the documentation of commensality within shared student houses was non-existent or sparse at best. Whilst sharing accommodation with peers is the overarching norm at university, it seems that living ‘together’ represents only a communal existence within a single space. A paucity of qualitative research into students’ dietary experiences means that this finding cannot be fully contextualised, although one study among British students provides evidence for similarly short-lived attempts at communal cooking (134); divergent schedules and food preferences were again put forward as prohibiting factors. Paradoxically, however, sharing cooking and eating communally may address many of the constraints that students report (e.g. inadequate cooking space; cooking for one; time scarcity) (361).

#### *8.4.2.3 Influence of the home food environment on dietary practices adopted at university*

This study also highlighted an important relationship between family eating practices and food choices at university. In line with studies adopting a life course approach to understanding food choice (340–342), for many participants, family food practices represented a template for those assumed at university. It is at home where values, preferences and norms around both food and drink purchasing and consumption are established (132,342) and these practices went on to represent many students’ default choices at university. Adoption of familial eating practices served to simplify the decision making process involved in food choice and students generally identified little reason to change core eating patterns; students in New Zealand have similarly noted the importance of fruit and vegetable consumption habits established at home on those adopted at university (327). For many students the home food environment represented the springboard upon which dietary repertoires could be expanded, and this is also in line with studies showing a tracking of childhood and adolescent dietary practices into adulthood (39–41). Such tracking may also arise because, as students made clear, familial meals have an emotional function, providing comfort and stability in an unfamiliar environment (143).

Research specifically investigating the role of familial food and eating practices during the transition to university and adult life is scant, although this limited literature indicates an influence of dietary practices established in the family home on young adult eating patterns. Indeed, in a North American longitudinal study, greater involvement with food preparation during adolescence has been associated with greater food preparation from scratch during young adulthood (26). Other studies similarly report a dependence on childhood practices in the establishment of university-based behaviours and preferences: students brought up in family environments where practices such as using food as a reward, commensality and home-cooking are the norm, are more likely to adopt these behaviours at university (362,363), whilst a positive association between familial and university-based food preferences has also been reported (362). An earlier study, which similarly reported a lasting effect of parental dietary beliefs and behaviours on eating and drinking habits at university proposed a 'windows of vulnerability' model of dietary change, postulating that parental influence on an individual's behaviours will endure to some degree in the face of alternative socialising agents (364).

In contrast, for a minority of students the transition to university represented an opportunity to consciously reject familial food rules and test out riskier dietary behaviours, such as increased junk food consumption, alcohol intake and dietary restriction. This rejection has been previously noted (145) and seems to represent a means through which students can demonstrate newfound autonomy during the transition to adult independence. In accordance with earlier studies among both children and university students (364–366) such rebellion seemed particularly marked in students who had experienced more restrictive dietary practices at home. However, entire rejection of familial eating practices was most often ephemeral with students quickly realising that such riskier behaviours were not conducive to well-being and thus shifting back towards more sustainable and familial eating patterns. Wills (145) similarly identified a process of experimentation followed by readjustment among young people during the transition out of secondary school.

#### *8.4.2.4 Dietary practices at university are dynamic*

Evidence of a dynamic nature of food and eating practices at university permeated all major themes in this analysis. Dietary practices fluctuated in response to changing schedules of university life, with intense periods of academic study, 'Fresher's Week' and end of term celebratory events particularly invoking divergence from usual eating routines. In addition to this background flux in food practices, there was also evidence of a longitudinal trajectory in food choice and dietary habits over students' entire time at university.

The employment of food for coping with academic stress is in keeping with a large body of literature. The deterioration in diet quality found here - specifically reports of greater snacking and use of junk food - is congruent with reports of greater consumption of high-fat and high-sugar 'comfort' food in response to academic stress, with female students seeming particularly vulnerable to such emotional eating (143,144,186,187,192,367). There is also evidence to suggest that restrained eaters are especially susceptible to a hyperphagic response to emotional stress triggers (189–191,368). Students' reports of an abandonment and disinhibition of usual dietary regulation particularly resonates with this literature. Justification of this abandonment of healthful eating pursuits by intentions to resume such endeavours following completion of stressful periods echoes strategies employed to legitimise excessive alcohol consumption: students reported intentions to reduce alcohol intake following graduation, which seems to justify excessive consumption whilst at university (127,128).

Aside from transitory periods of poorer dietary practices, there was little talk indicating an overall deteriorating trajectory in eating or drinking habits. Although snack and convenience foods continued to fulfill important functions during intense periods of academic study, novelty of newfound freedom to engage in riskier dietary choices no longer held the same appeal and students became increasingly confident in their adult autonomy. The latter particularly enabled food choices freer from those of surrounding peers and students could become truer to more healthful dietary ideals. Studies exploring the role of alcohol at university also highlight a downward trend in consumption throughout university as novelty of becoming drunk weakens and alcohol's financial burden is realised (128). Existing qualitative studies exploring students' food and eating practices have included only first year students or focused somewhat superficially on the barriers/enablers to healthful eating at university, prohibiting insight into students' evolving food choice experiences and trajectories (34,135–140,339). Evidence from longitudinal studies tracking food intake during this period is also scant. However, with the exception of alcohol, these provide evidence for an overall reduction in food intake throughout the first year (35,369); studies monitoring intake beyond this indicate little further change in consumption patterns (99,100).

### 8.4.3 Strengths and limitations of the study

To the authot's knowledge, this study represents the first attempt to qualitatively explore in depth the dietary experiences of university students in the UK. Qualitative methodology enabled in depth exploration of various themes underpinning students' dietary decisions at university, and allowed the author to further probe participants' experiences and accounts throughout. Furthermore, employment of maximum variation sampling ensured that both male and female students from a range of undergraduate years of study who favoured different eating patterns at university were sampled. These are major strengths of the current study.

A number of limitations should also be noted. Firstly, only students at the University of Sheffield were sampled. This was due to pragmatic decisions concerning the scale of the project and timing of data collection, and sampling from this one institution was robust. However, sampling at only one institution reduced the breadth of insight: universities differ in their provision of student residences and catered food provision, as well as the SES composition of the student body, which may have provided an additional layer of insight and enhanced relevalence of findings to the wider student population (266). Specifically, the University of Sheffield attracts students from higher socioeconomic backgrounds than some other universities (e.g. Ulster) (246) and lack of socioeconomic data for University of Sheffield students in this study meant maximum variation sampling could not incorporate this variable into the participant selection procedure. The current findings may thus not necessarily reflect the experiences of students at other universities or of differing social class backgrounds.

Similarly, the inclusion of postgraduate students in this study may have also provided an additional layer of insight. Postgraduate students may have different experiences of dietary decision-making at university, and would have provided further insight into the evolving trajectory of eating habits during an individual's university career identified here. Postgraduate students were not included in the current sample to ensure that rich and in depth insight into the dietary practices of undergraduate students was not diluted by increasing the breadth of enquiry.

Finally, analysis was conducted solely by the author. Verification of findings by either participants and/or additional researchers has been argued to reduce the risk of lone researcher bias and thus strengthen findings (370). However, since different researchers may legitimately interpret qualitative data differently, others have argued against this based on a range of recognised epistemological positions (371). Adopting a robust and iterative analytical procedure alongside regular meetings with the supervisory team to discuss analysis and emerging findings ensured the current themes were data driven (225).

#### 8.4.4 Implications for policy and future research directions

This study has implications for both future research direction and university food policy. Generally, students possessed healthful dietary aspirations at university, but described a number of barriers to achieving this; this created disparity between dietary ideals and eating habits in practice. Targeting these specific barriers to food choice – for example, increasing accessibility to healthful food items and providing greater food storage facilities in student residences – may help improve the eating patterns of young adults at university. There are also implications for planning of the built environment: the current findings highlight that convenience is an important factor for some students, and universities should thus consider closely the density of fast food outlets in areas recognised as having high students numbers. Provision of more healthful convenience food options in these areas could be considered. In addition, this study highlighted a deterioration in food intake during stressful periods: university staff in roles supporting students (for example, personal tutors; students' union and counselling service staff) may be well placed to increase students' awareness of the impact of stress on diet and offer advice or information on healthy eating habits. At the same time, food clearly has an important social role for students at university and any initiatives to improve food choice or alcohol intake during this period should also acknowledge these social constructs of dietary decisions.

Existing North American research indicates that communal eating among students at university is associated with more healthful eating patterns, promotes social integration and may be furthermore advantageous in terms of budget, time pressures and development of cooking skills (361,372). Such commensality may thus help overcome many of the barriers to healthful eating described by students in this study, whilst simultaneously addressing the social constructs of university food choice. The current findings highlight that sharing of meals at university is not the norm and universities should look critically at the culinary set-up for students to better promote and facilitate communal eating among housemates. Future research should examine the potential benefits – and feasibility - of such eating among British university students.

The arguably dysfunctional relationships with food described by a few students in this study also has policy implications. Dietary decisions have meaning beyond health (and weight), and future dietary messages for this population group should consider ways in which to acknowledge the multiple roles and meanings of food and drink, and tensions caused by this. This is particularly pertinent in light of high prevalence of dieting among healthy weight individuals and disordered eating symptomatology identified among this population group (33,53,54,56,58,60). Universities should also consider further promotion of alcohol-free activities through which to integrate socially at the start of university life to ensure inclusivity for all students. Students wishing not to engage in the prevailing culture of excessive alcohol consumption should not be expected to simply ‘manage’ not drinking at university, but rather provided with an equal opportunity to experience university life alongside their drinking peers.

The evolving trajectory of food choice throughout students’ university careers identified in this study also represents an area for future research focus. The health impacts of (poor) dietary practices at university - and thus implications for policy - will differ according to whether such practices are limited to only students’ first year or entire university career (and beyond). Quantitative studies to track food choice throughout this period are needed. Additionally, many students justified poor dietary choices by intentions to adopt healthier diets upon graduation: research is necessary to examine whether or not such changes are the case in practice.

Finally, although the current sample comprised students with a diverse range of eating practices, participants attended a single university, were of Home/EU origin, and predominantly female. Perspectives of international students, those from more socially disadvantaged backgrounds and further insights into the dietary experiences of male students, would be enlightening. Alternative qualitative methods – such as participant observation or students’ written stories/narratives – would also enable greater insight into and understanding of students’ dietary decisions at university (125,267,347).

### 8.4.5 Conclusion

This study represents one of the first studies to qualitatively explore the food choices and dietary practices of university students in the UK. Four substantive themes were revealed (‘Peer groups, diet and social integration’; ‘The university experience’; ‘Healthful eating at university?’; ‘Becoming an autonomous consumer’), which represented major elements of students’ dietary decisions. It became clear that dietary choices at university were multi-faceted, dynamic and imbued with social and familial meanings. The findings from this study are not proposed as conclusive or generalisable to the wider student population, but address an important gap in the literature by providing in-depth insight into the lived dietary experiences of young adults at university. The use of maximum variation sampling ensured that students adopting a range of dietary patterns were interviewed. The important social role of food (and drink) at university should be particularly considered during the development of any future health promotion initiatives in this population. A number of areas of further research need have also been highlighted, which should now be addressed in future studies.

## 8.5 Discussion of Results IV – Eating habits associated with body weight gain among university students

### 8.5.1 Summary of principal findings

This study set out to identify eating behaviours associated with weight gain among university students in the UK. The current sample reported clinically significant weight gain whilst at university (>12.7 kg for almost one in four students), which has important long-term health implications and deserves research attention. Clear associations between weight gain and a number of eating habits were identified, specifically around the consumption of fruit and vegetables, alcohol, and convenience/fast food. Associations between weight gain and stress, cooking ability and pre-university body weight were also noted.

### 8.5.2 Discussion of findings in relation to other studies

As weight gain increased diet quality decreased, with students reporting greatest weight gain reporting least frequent consumption of fruits and vegetables and most frequent consumption of alcohol, fast foods, take-aways, ready meals and convenience foods. Cockman and colleagues have similarly reported poorer food choices among weight-gaining students (50), whilst research in general adult samples supports a positive association between takeaway consumption and body weight gain (373,374). These foods are energy-dense, and thus in the absence of compensatory dietary modification or changes to activity levels to counterbalance such consumption, positive energy balance and weight gain will result (373).

The interaction between alcohol intake and take-away consumption identified in the current study should also be highlighted. As well as reporting greater absolute alcohol intake, weight-gaining students were more likely to report increased consumption of take-away/fast foods following drinking, further contributing to positive energy balance. A North American study investigating the effects of alcohol consumption on students' body weight and eating patterns has similarly reported a greater tendency for 'moderate-risk' drinkers (those reporting most frequent alcohol consumption, including monthly binge-drinking sessions) to over-consume food-energy and make less healthful food choices following drinking episodes, as well as gain greater body weight during a single semester, than their 'low-risk' or non drinking counterparts (151). More generally the literature on the effect of alcohol on appetite and body weight appears complex, although there is consistent evidence to suggest that energy consumed from alcohol is supplementary to food-energy, and that in the short-term, pre-meal alcohol ingestion results in over consumption (375). The association between alcohol consumption and body weight is less clear - there are possible gender effects, a preponderance of cross-sectional studies precluding conclusions around a causal relationship, a need for better control of other lifestyle behaviours in observational studies, and experimental studies are limited by short-term follow-up periods (295,375). However, a positive association between heavy drinking and body weight gain has been reported (295,376,377). There is also evidence to suggest that individuals with impulsive personality types may be more vulnerable to both binge-eating and -drinking, further promoting overconsumption of energy and thus increasing risk of weight gain among certain individuals (375).

Stress was also perceived as a factor leading to weight gain for students gaining between 6.4 and 12.7kg of body weight in the current research, congruent with some existing studies among university students (157,173). The relationship between stress and food intake is accepted as bi-directional in nature, but high stress has been reported to induce a hyperphagic response and tendency to consume high-fat, high-sugar foods in female students and restrained eaters in particular (187–190,367). Moreover, a recent qualitative study exploring emotional eating behaviours among North American university students reported that female students identified stress as a primary trigger for abandonment of normal eating patterns and resultant increased food consumption (144). Elsewhere, less healthful eating and drinking behaviours (low fruit and vegetable consumption; increased binge drinking) have been reported to cluster together with higher levels of psychological stress among students (31). The fact that students reporting greatest weight gain were not so likely to report stress as a perceived reason for their weight gain is unclear, although one possible explanation may be that these students are less susceptible to emotional hunger cues and overconsume energy for other reasons. However, in the absence of any psychometric measures of eating behaviour this can only be speculated.

Additionally, a clear association between cooking ability and weight gain was identified and it was possible to discriminate students by level of weight gain according to their ability to cook more culinary complex meals. Weight-stable students reported greater confidence in cooking more complex meals (e.g. curry; homemade burger), which may reduce reliance on comparable energy-dense convenience foods and takeaways. These students were also more confident in their ability to eat healthily on a student budget, further indicative of greater cooking confidence and possibly pre-university experience in food preparation (although the latter can be only speculated). No differences in ability to cook more simple meals (e.g. baked beans on jacket potato) were detected across the different categories of weight gain, however this is likely because over 80% of the sample could cook these meals, rendering them unimportant in discriminating level of weight gain. There has not been explicit examination between cooking skills and weight status, however research consistently points towards a positive association between cooking ability and diet quality (327,330) and there is a reported axis between cooking skills, consumption of ready meals and risk of obesity, supporting current finding (324).

Finally, it is noteworthy that students in the current study who began university at a healthy body weight were more vulnerable to gaining greater body weight than those who started university already overweight. The relationship between baseline body composition and weight change among university students has been previously examined, but findings are conflicting (162,176,182,378). It is possible that students arriving at university overweight are already engaging in practices to prevent further weight gain, whilst those who begin university at a healthy body weight are less aware of a need to engage in behaviours that promote weight stability. Greater awareness among students about the risk of body weight gain at university may therefore be necessary.

### 8.5.3 Strengths & limitations of the study

The major strength of this study is its unique focus on a weight-gaining sub-group of the student population; this is in contrast to other studies, which have sampled from the general population of students (49,50). Despite this novel focus, however, a number of limitations should also be acknowledged. Specifically, all data in the current study was gathered using self-report and retrospective measures; lifestyle information (e.g. eating habits) may have been particularly difficult to accurately recall given that lifestyle changes would have been promoted – and likely implemented - upon joining Slimming World. However, the author sought to reduce the likelihood of such error by including only current students in the dataset. High correlations have also been reported between self-reported and researcher-measured weight among university student populations (152,156). There is additionally no reason to believe any form of recall bias according to weight gain group occurred, and associations should therefore remain valid. Additionally, the sample was 98% female. This female predominance reflects the gender split of the national Slimming World membership (270), but prohibits extrapolation to the general student body.

### 8.5.4 Implications for policy and future research direction

This study revealed that a sub-group of students are at risk of clinically significant weight gain at university, and identified a number of dietary behaviours related to such body weight gain. Ultimately this research is important to inform the development of interventions to reduce clinically significant weight gain during this period. Before any recommendations to university policy can be made, however, further research is needed. Future studies should focus on this unique weight-gaining sub-group of the student population to further delineate reasons for weight gain and identify students most at risk. Prospective research is particularly necessary to strengthen findings, whilst qualitative methods would further enhance understanding. British research investigating weight gain among a comparable non-student population would also be pertinent to determine the extent to which the university setting is responsible for such weight gain.

### 8.5.5 Conclusion

This study set out to examine eating habits associated with weight gain among university students in the UK. In contrast to the extant literature, the current study uniquely focused on a weight-gaining sub-group of the student population; clinically significant weight gain at university was reported by a number of students. Weight gain was associated with less healthful dietary choices, greater self-reported stress-related weight gain and fewer culinary skills. Future research needs have been highlighted.

## 8.6 Complementary relationships between studies

The final section of this discussion brings together findings from the different studies conducted in the research project, as advocated by Morse (205). Complementary findings between the second (dietary patterns among university students) and third (interviews with university students) studies in this project represent the focus of this section, but links with study four (eating habits associated with body weight gain among university students) are also made. Five key areas are highlighted and discussed below.

### 8.6.1 A dynamic nature to food and eating practices at university

Firstly, both the dietary patterns analysis and the qualitative study revealed a dynamic nature to food and eating practices at university. Specifically, the quantitative finding that older students and those in more advanced years of study favoured more healthful diets is supported by qualitative data, which highlighted a trajectory towards more healthful food choices as students progressed through university. Congruent with Irby's study on eating identities of North American university students (141), older students were more able to be autonomous in their dietary decisions: once friendships were established there was no longer a need to make food choices founded on social integration goals and these young adults could instead make choices more closely in line with personal – and most often healthful - dietary ideals. At the same time, the novelty of newfound freedom to make independent, often less healthful, choices at the start of university life lost appeal as students began to realise that poor diets were not conducive to well-being, thus further promoting more healthful consumption patterns as students advanced through university.

Although students described an overall trajectory towards more healthful choices during advancing years of study, snack and convenience foods continued to fulfill important functions throughout university life from the qualitative data; this was particularly the case during periods of intense academic workload or when engagement in extra-curricular activities meant need for solutions to time pressures was great. This insight was in line with quantitative data showing a lack of association between the less healthful patterns ('snacking'; 'convenience, red meat & alcohol') and age (or year of study). Interviews also provided evidence for a changing role of alcohol consumption from social facilitator, to a means by which to celebrate (e.g. following completion of university examinations) or simply socialise with already-established friendship groups as students progressed through university. In keeping with existing qualitative studies (124,126,127), drinking thus also seemed to maintain its place as an essential element of the higher education experience throughout university life. It is noteworthy, however, that the current qualitative dataset revealed students' intentions to adopt healthier diets and reduce alcohol consumption following graduation from university.

The interconnections between the qualitative and quantitative studies highlighted above are difficult to contextualise within the wider literature due to little comparable data. Generally there is an indication that alcohol consumption declines with advancing year of study, although these studies have assessed alcohol intake specifically rather than part of a whole dietary pattern (33,46,88). Devine and colleagues (33) survey of Northern Irish university students also pointed towards healthier eating behaviours (less frequent consumption of ready meals; greater fruit and vegetable consumption) among students in more advanced years of study, although lack of detailed dietary data and analytical statistics in this study limits comparison. Most other UK-based student studies have not identified a relationship between age/year of study and food intake (30,32,34,35). However, these studies have been limited by modest sample sizes, lack of detailed dietary assessment or focus on only first year students. Longitudinal examination of food intake during higher educational study and the ensuing years following university life is needed.

### 8.6.2 Culinary ability and eating practices at university

Secondly, both qualitative and quantitative data highlight the critical role of cooking ability in following a healthful dietary pattern at university. Students' self-reported cooking ability aligned positively with scores on the 'health-conscious' and 'vegetarian' patterns. Similarly, qualitative data reinforced that cooking skills were essential: students lacking such skills were forced to compromise on healthful dietary ideals and instead relied on convenience food items requiring little culinary experience or expertise, in order to preserve both dietary diversity and autonomy. Furthermore, the final study reported in this project revealed an association between cooking skills and weight gain at university: students reporting greater weight gain reported fewer cooking skills and lower confidence in their ability to eat healthily on a student budget compared to their weight-stable counterparts. These findings resonate with the extant literature, which report associations between cooking ability, diet quality/convenience food consumption and body weight (327,330,379). The current qualitative study revealed that some students who had little – or no - culinary responsibility in the home environment prior to coming to university felt a need to improve such skills during university life. These skills were often developed using internet resources or at times by learning from peers.

A number of dietary interventions have now been conducted among university students (380), however only one (North American) study has examined the effect of a cooking intervention on food choices (328). This study reported no significant change in fruit and vegetable intake following a short (four-session) web-based, student-focused cooking demonstration intervention (328), although employment of an FFQ to detect dietary change and short-term intervention period may have reduced the ability to detect any intervention effect. Given that both quantitative and qualitative studies in this project indicate an important role in cooking ability for consumption of a healthful diet at university, investigation of the effect of a cooking skills intervention on food consumption in British students is warranted.

The lack of association between cooking ability and scores on the ‘snacking’ and ‘convenience, red meat & alcohol’ patterns identified in the dietary patterns study might seem counterintuitive, but qualitative data provides further insight here. Interviews with students revealed multiple influences on food choice for students at university: convenience food consumption was driven not only by culinary skill, but also time pressures, cooking enjoyment, availability of clean and adequate kitchen facilities, and priority placed on consuming healthful and/or home-cooked meals. Thus, whilst cooking ability may be imperative for consuming a healthful diet and ensuring students have choice over their dietary decisions at university, cooking skills *per se* may not remove the need to rely on convenience or snack foods during this time.

### 8.6.3 Health orientation and food choice at university

Thirdly, both the qualitative and quantitative analyses demonstrate a primary and important role of health orientation in underpinning adoption of a healthful diet at university. Specifically, students reporting ‘health/nutritional value’ as a primary influence on their food choices had high scores on a ‘health-conscious’ dietary pattern. This association was complemented by qualitative data: students describing strong diet-health beliefs, often shaped by personal experiences of the effects of a poor diet, seemed better able to overcome barriers to healthful food consumption than their counterparts lacking such beliefs. These conclusions derived from both the qualitative and quantitative studies are congruent with the existing literature on student food choice (129,350,351) and models of preventive health behaviour (348,349).

It seems, therefore, that helping students to internalise the importance of consuming a healthful diet is necessary to improve food choice. However, in light of the multiple constraints to healthful food choice described by students in the qualitative study, changing attitudes should dovetail with improvements at an environmental level to facilitate healthier diets (e.g. better cooking and food storage facilities; improving access to more healthful food options; subsidised healthy food at university).

### 8.6.4 Stress, food choice and weight gain at university

Fourthly, two separate strands of this project provide evidence for a relationship between academic stress and risk of body weight gain at university. Specifically, the study involving student members of Slimming World identified academic stress as a key influence on weight gain. Similarly, interview data from students unveiled that usual healthful eating pursuits were abandoned in favour of consumption of energy-dense convenience, ‘junk’ or snack foods during examination periods and when meeting assessment deadlines. Such foods circumvented the need to spend time in the kitchen cooking, thus liberating time for study. Equally, some students described these consumption patterns as being used to invoke a hedonic response as an antidote to study-related boredom and negative affect. These twin findings support the substantial literature on food choice during academic stress and resultant influence of such stress on likelihood of weight gain at university (187,189,190,367,368). However, studies specifically examining the effect of stress on body weight change at university are less consistent (157,173,185). There is need for further prospective research to elucidate the relationship between academic stress and weight gain in this population.

### 8.6.5 Dietary patterns and weight gain at university

Finally, the study of students at Slimming World showed that a number of specific food groups were associated with weight gain at university: alcoholic beverages, fast foods, take-aways, ready meals and convenience foods. Dietary patterns analysis unveiled that the fourth pattern ('convenience, red meat & alcohol') popular amongst students was characterised by consumption of comparable food groups: alcohol, ready-made sauces, fried food, pizza and chips. It is thus conceivable that students favouring this type of diet at university may be at increased risk of weight gain.

Although preliminary analyses indicated that students classified as obese had higher scores on this pattern than those reporting a healthy BMI, no independent association was detected in multivariate models. However, limited variance in sample BMI may have reduced the ability to detect an association. Furthermore, the cross-sectional nature of this study precludes any inference of causation or examination of temporal effects.

The wider cross-sectional literature reports inconsistent findings between BMI and dietary patterns, however reverse causation is possible, blurring conclusions (381). Longitudinal studies are more consistent and indicate that adherence to a 'prudent' or 'Mediterranean' style diet may reduce risk of weight gain (382–384). Moreover, a 'western' diet, which is comparable to the current 'convenience, red meat & alcohol' pattern, has been associated with body weight gain among a large sample of North American women over an eight-year follow-up period (335). Despite the intense research interest in body weight gain among university students, the author is unaware of any prospective study that has assessed body weight change in relation to whole dietary patterns in this population. Since findings in this field of obesity research remain currently inconclusive and dietary patterns better reflect natural eating behaviour, such studies would be valuable.

# CHAPTER 9.
# SUMMARY AND CONCLUSIONS

## 9.1 Re-statement of research objectives

This project set out to explore the food choices of university students in the UK. It represents one of the first studies to provide detailed data on dietary adequacy and food intake patterns of British students, and to provide in-depth insight into the food choices and eating practices of this population. It has also provided information on the antecedents of body weight gain in young adults at university.

This project had five major research objectives:

i. To assess dietary adequacy among a UK university student population

ii. To identify dietary patterns that exist within a UK university student population

iii. To identify socio-demographic, lifestyle and other food-related behaviour characteristics of students favouring these dietary patterns

iv. To obtain an in-depth insight into the food choices and dietary practices of students at university

v. To identify eating behaviours associated with body weight gain among a UK university student population

These research objectives were achieved through four studies, which have been presented in this thesis. The overall conclusions and recommendations for both policy and future research from this project are outlined below. The methodological strengths and limitations of the current research have already been discussed in detail, and the reader is therefore referred back to Chapter 8 for this information.

## 9.2 Summary of findings

Intakes of a number of key nutrients and food groups were outside of recommendations as measured by the FFQ. A majority of students failed to consume the recommended intake of fruit and vegetables and there was also indication that intakes of oily fish (male and female students) and red and processed meat (male students) were disparate from recommendations. Reported energy intakes were significantly below theoretical requirements for both genders, but under-reporting of energy intake by 26% was estimated. Recommended intakes of free sugars, non-starch polysaccharides, total and saturated fat and vitamin D were not met by the majority of students, even following adjustment of absolute intakes for misreporting of energy intake. Low intakes of iron and selenium were particularly concerning among female students; high sodium intakes were of concern among both male and female students (for both reported and adjusted nutrient intake data). There was evidence of excessive alcohol consumption in over one-third of male students and approximately one in five female students. However, all these findings must be considered in the context of the limitations of FFQs in the calculation of absolute nutrient intakes.

Dietary patterns analysis revealed that students are a heterogeneous population in terms of food intake. Four major dietary patterns were identified which were labeled ‘vegetarian’, ‘snacking’, ‘health-conscious’ and ‘convenience, red meat & alcohol’. These patterns resonate with those identified among the general UK adult population. The fourth dietary component was characterised by foods that are congruent with popular beliefs about student food choice (fried foods, pizza, chips, pasta, ready-made sauces and alcohol). However, identification of ‘vegetarian’ and ‘health-conscious’ patterns provides evidence that not all students consume poor diets at university. The predominance of a ‘vegetarian’ pattern in this research likely reflects a selection bias towards a health- and/or environmentally- aware sub-population of university students, although a vegetarian pattern has been identified as a minor pattern in the wider population (22–24,73).

A number of key sociodemographic characteristics distinguished students favouring these dietary patterns. A gendered nature of food intake was evident, which is in keeping with the broader literature: male students favoured a ‘convenience, red meat & alcohol’ dietary pattern, whilst female students tended towards a ‘vegetarian’ diet. Older students and those with greater self-reported cooking ability adopted more healthful diets. Geographical differences in food choice were also evident, with students attending university in Northern Ireland consuming poorer diets than those who attended universities on the UK mainland.

Qualitative data on students' food choices and dietary practices revealed four substantive themes. These were identified as: 'Peer groups, diet and social integration'; 'The university experience'; 'Healthful eating at university?' and 'Becoming an autonomous consumer'. The transition to university represented a period when many students began their journey to dietary autonomy, and during this time both familial experiences and influences from newfound peers played an important role in determining dietary decisions. At the start of university life, food and drink choices assumed a key social function, enabling access and integration into new social groups. As students progressed through university, the priority placed on different areas of university life changed and dietary practices evolved accordingly. While food choices varied according to university schedules and academic demands there was evidence of an overall trajectory towards more independent and often more healthful dietary practices. Throughout university, dietary choices were determined by multiple, interrelated factors, which reflected social, familial, moral and nutritional tenets and understandings and, as such, dietary decisions were complex and multifaceted; no single determinant was responsible for food choice. Students were clearly aware of the need to consume a healthful diet, but a number of factors were described as barriers to achieving this whilst at university. Challenges of shared living, small budgets, intense periods of academic study and a prevailing norm of poor food choices and excessive alcohol consumption particularly interfered with students' abilities to make healthful dietary decisions during this time. The priority placed on healthful eating seemed especially important in determining whether or not students could overcome these constraints to maintain healthful choices at university.

Finally, a number of eating habits were significantly associated with body weight gain at university. Greater weight gain was associated with more frequent consumption of ready meals/convenience foods, and takeaways/fast food, and less frequent consumption of fruit and vegetables. Self-reported stress-related weight gain was also associated with greater body weight gain. Students who reported weight-stability at university reported least frequent consumption of alcohol; these students also reported more sophisticated cooking skills.

There were clear connections between the individual studies in this project. Both quantitative and qualitative analyses demonstrated that although snack and convenience foods appeared to fulfill important functions throughout university life, there was evidence of a trajectory towards more healthful choices as students progressed through higher educational study. There was also evidence for a primary role of health beliefs in consuming a healthful diet at university from both quantitative and qualitative studies. This research additionally highlighted that one of the major dietary patterns adopted by students may promote weight gain at university: the ‘convenience, red meat and alcohol’ pattern identified during the first phase of data collection was characterised by high intakes of food groups that were associated with weight gain in the Slimming World study.

### 9.3 Recommendations for future research

This project was exploratory: generalisation of findings to the wider student population is not possible due to low response rate and convenience sampling. However, a number of future research needs have been highlighted. Firstly, the identification of intakes of energy and key food groups and nutrients that differed substantially from recommendations in this population requires confirmation among a representative sample of the UK student population. Use of either multiple 24-hour dietary recalls or estimated dietary records to obtain more accurate information on absolute food and nutrient intakes would be informative. It would also be pertinent to undertake a contemporary relative validation study of the current FFQ amongst the young adult population, assessing food and nutrient intakes measured by the FFQ vs. those measured by an alterative form of dietary assessment (e.g. weighed or estimated diet records). Additionally, in light of low iron intakes of female students and popular emphasis to reduce meat consumption, assessment of biochemical iron status of female students would be enlightening.

Secondly, the consumption of poor diets at university has greatest public health impact if dietary patterns consumed during this time represent a blueprint for long-term dietary preferences and consumption patterns. Students adopting poor dietary habits at university described intentions to adopt healthier diets upon graduation, but it is not known if these intentions are translated into behaviour. Longitudinal research is needed to examine if dietary patterns consumed at university track forward into post-university working adult life.

Thirdly, the relationship between cooking skills, food choices and body weight gain identified in this project warrants further study, perhaps taking an interventional approach. Furthermore, in light of little evidence of commensality amongst students, alongside the constraints of inadequate kitchen space, time pressures and small budgets on healthful choices at university, a study to examine the effect of sharing meal responsibilities on food choices would be enlightening: research from North America indicates that such communal eating may address these constraints and improve food intake (361,372). If effective, such interventions could represent cost-effective and sustainable approaches to improving the diets of this population.

Finally, levels of body weight gain reported by almost 25% of students while at university (> 12.7kg) indicates that a sub-group of young adults may be at risk of clinically significant weight gain during this period. Prospective studies should now focus on this weight-gaining sub-group to further delineate the causes of such weight gain and identify those students most at risk. It would also be pertinent to assess body weight change in a comparable non-student, UK young adult population to examine the extent to which the university setting is responsible for such weight gain.

## 9.4 Recommendations for policy

This project has raised a number of issues that should be considered in a policy context, both at a university and societal level. Firstly, there is heterogeneity in eating behaviours among UK university students. There is evidence that some students favour poor diets at university, which may have implications for both health and body weight if adopted in the long-term. However, some students make healthful dietary choices at university. Any future health promotion messages or efforts in this population should therefore be targeted towards students most in need of dietary change for optimal effectiveness. Additionally, there was evidence of arguably dysfunctional relationships with food in a small minority of students pursuing healthful diets at university, confirming other studies (54,58,95,108).

Targeted interventions could also help ensure that any dietary intervention efforts do not serve to further damage relationships with food for these students. There are clear implications for university policy around provision of cooking facilities and canteen food, advice for students during examinations, and the construction of alcohol-independent social events for new students. The social meaning of dietary choices at university also needs to be considered during the development of any future health promotion efforts in this population.

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## Appendix A: Phase 1 web-survey

### PHASE 1 – WEB-SURVEY – PAPER VERSION

| | |
|---|---|
| Questionnaire No. | ❑ 9 |
| Group Code | ❑10 |
| Survey | ❑❑11-12 |
| Male / Female | ❑13 |
| **Date of Birth** ........................ | ❑❑14-15 |
| **Date of Survey** ........................ | ❑❑16-17 |

**SURVEY INSTRUCTIONS - PLEASE READ CAREFULLY BEFORE STARTING**

This survey is about the foods you USUALLY eat whilst studying at university (i.e. not during holidays).

When answering these questions, think about your USUAL/AVERAGE food intake during the MOST RECENT (SPRING) UNIVERSITY SEMESTER.

You will be asked to indicate the number of days per week that you eat each item ON AVERAGE:

> 7 indicates that you eat the food every day.
> 6 indicates that you eat the food 6 days/week
> 5 indicates that you eat the food 5 days/week.
> 4 indicates that you eat the food 4 days/week.
> 3 indicates that you eat the food 3 days/week.
> 2 indicates that you eat the food 2 days/week.
> 1 indicates that you eat the food once per week.
> F indicates that you eat the food once every 2-3 weeks / 1-2 times per month (NB: F does not mean frequently).
> R indicates that you rarely or never eat the food (i.e. less than once per month).

You can access these instructions during the survey by visiting the study website: http://sites.google.com/a/sheffield.ac.uk/student-diets/

Note: you can access further instructions using the 'help' button on the web-survey. You will not be able to go back to previous pages when completing the survey so please consider your answers carefully.

Are you currently following a medically prescribed diet (e.g.low protein/gluten-free)? Yes / No ❑30

➊ *If you answered yes to this question you are not eligible to complete this survey*

Are you a Home/EU student? Yes / No ❑31

➊ *If you answered no to this question you are not eligible to complete this survey*

## BREAD

**How often do you eat the following breads and how many slices?**

White bread 7 6 5 4 3 2 1 F R ❑32
How many slices do you have per ............................................ ❑33
What is the usual size of slice? ❑34

1. Large thick
2. Large medium
3. Large thin
4. Small thick
5. Small medium
6. Small thin

Brown, 50/50 or wheatgerm bread 7 6 5 4 3 2 1 F R ❑35
How many slices do you have per day? ....................................... ❑36
What is the usual size of slice? ❑37

1. Large thick
2. Large medium
3. Large thin
4. Small thick
5. Small medium
6. Small thin

Wholemeal bread or chapatis 7 6 5 4 3 2 1 F R ❑38
How many slices/chapatis do you have per day? ............................. ❑39
What size of slice do you have? ❑40

1. Large thick
2. Large medium
3. Large thin
4. Small thick
5. Small medium
6. Small thin
7. Chapatis only

Other bread: i.e. rolls, teacakes, croissants, crumpets, pitta, naan
7 6 5 4 3 2 1 F R ❑41
How many rolls/pieces do you have per day? .............................. ❑42

What type of other bread do you have? ❑43

1. White roll (e.g. with burger or hotdog)
2. Brown roll
3. Wholemeal roll
4. Teacake
5. Croissant
6. Crumpet
7. Pitta bread/wrap
8. Naan bread
9. More than one of these

Crispbread, Ryvita or cream crackers 7 6 5 4 3 2 1 F R ❑44
How many do you have per day? .......................................... ❑45

How often do you have jam/marmalade/honey on bread?
7 6 5 4 3 2 1 F R ❑46

## BREAKFAST CEREALS

**How often do you eat the following cereals?** ❑❑47-48
❑❑49-50

1. Cornflakes 7 6 5 4 3 2 1 F R
2. Frosties, Nut Cornflakes, Sugar
   Puffs, Ricicles, Coco Pops 7 6 5 4 3 2 1 F R
3. Rice Krispies or Special K 7 6 5 4 3 2 1 F R
4. Muesli, Fruit 'n' Fibre or Cheerios 7 6 5 4 3 2 1 F R
5. Weetabix, Wheatflakes or Shredded Wheat
   7 6 5 4 3 2 1 F R
6. Bran Flakes or Sultana Bran 7 6 5 4 3 2 1 F R
7. Porridge or Ready Brek 7 6 5 4 3 2 1 F R
8. All Bran 7 6 5 4 3 2 1 F R

How many teaspoons of sugar/honey do you have with each bowl of cereal?
.................... ❑51

How often do you have wheat bran? 7 6 5 4 3 2 1 F R ❑52

## MEATS

**How often do you have the following meats and meat dishes :**

Beef: roast, steak, stewed, burgers, lasagne, bolognese, chilli, curry
7 6 5 4 3 2 1 F R ❑53
Lamb: roast, chops, stewed, curry 7 6 5 4 3 2 1 F R ❑54
Pork: roast, chops, stewed, curry, sweet & sour
7 6 5 4 3 2 1 F R ❑55
Bacon 7 6 5 4 3 2 1 F R ❑56
Ham or gammon (include use in composite dishes)
7 6 5 4 3 2 1 F R ❑57
Chicken/other poultry: roast, casserole, curry, sweet & sour
7 6 5 4 3 2 1 F R ❑58
Canned meat (e.g. corned beef), pate or meat spread
7 6 5 4 3 2 1 F R ❑59
Sausages 7 6 5 4 3 2 1 F R ❑60

What type of sausages do you have? ❑61

1. Pork
2. Beef
3. Pork & Beef
4. Turkey
5. Low Fat
6. Frankfurters / Hot Dog

Meat pie/pastie, sausage roll, samosa - shop bought
7 6 5 4 3 2 1 F R ❑62

Meat pie/pastie, sausage roll, samosa - home made
7 6 5 4 3 2 1 F R ❑63

Liver, kidney or heart 7 6 5 4 3 2 1 F R ❑64

Do you usually eat the fat on meat? Yes / No ❑65

## FISH

**How often do you eat the following fish :**

White fish: cod, haddock, plaice, fish fingers, fish cakes
7 6 5 4 3 2 1 F R ❑66

Kipper, herring, mackerel, trout (including canned)
7 6 5 4 3 2 1 F R ❑67

Pilchards, sardines, salmon (including canned)
7 6 5 4 3 2 1 F R ❑68

Tuna (including canned) 7 6 5 4 3 2 1 F R ❑69

Shellfish, e.g. prawns 7 6 5 4 3 2 1 F R ❑70

## VEGETABLES & SAVOURY DISHES

**How often do you have the following vegetables or dishes :**

Boiled or mashed potatoes 7 6 5 4 3 2 1 F R ❑71

Jacket potatoes 7 6 5 4 3 2 1 F R ❑72

Shop bought chips, 'oven chips', hash browns
7 6 5 4 3 2 1 F R ❑73

Home-cooked chips 7 6 5 4 3 2 1 F R ❑74

Roast potatoes 7 6 5 4 3 2 1 F R ❑75

Peas 7 6 5 4 3 2 1 F R ❑76

Other green vegetables, salads or tomatoes
7 6 5 4 3 2 1 F R ❑77

Carrots 7 6 5 4 3 2 1 F R ❑78

Parsnips, swedes, turnips or sweetcorn
7 6 5 4 3 2 1 F R ❑79

Baked beans 7 6 5 4 3 2 1 F R ❑80

Butter beans, broad beans or red kidney beans
7 6 5 4 3 2 1 F R ❑81

Lentils, chick peas or dahl 7 6 5 4 3 2 1 F R ❑82

Onions (cooked/raw/pickled) 7 6 5 4 3 2 1 F R ❑83

Spaghetti, other pasta, noodles (e.g. with bolognese, tomato sauce, or in lasagne)
7 6 5 4 3 2 1 F R ❑84
Rice (e.g. with curry, chilli or other savoury dish)
7 6 5 4 3 2 1 F R ❑85
Quiche 7 6 5 4 3 2 1 F R ❑86
Pizza 7 6 5 4 3 2 1 F R ❑87
Vegetarian burgers/sausages 7 6 5 4 3 2 1 F R ❑88
Dishes made with TVP (soya mince) or Quorn
7 6 5 4 3 2 1 F R ❑89
Tofu 7 6 5 4 3 2 1 F R ❑90
Hummus 7 6 5 4 3 2 1 F R ❑91

## BISCUITS, CAKES & PUDDINGS

**How often do you eat the following items :**

Digestive biscuits/plain biscuits 7 6 5 4 3 2 1 F R ❑92
Other sweet biscuits 7 6 5 4 3 2 1 F R ❑93
Chocolate, e.g. Galaxy, Mars bar, Twix, Kit Kat
7 6 5 4 3 2 1 F R ❑94
Sweets, e.g. fruit gums, pastilles, mints
7 6 5 4 3 2 1 F R ❑95
Crisps/savoury snacks, e.g. Quavers, tortilla chips
7 6 5 4 3 2 1 F R ❑96
Nuts 7 6 5 4 3 2 1 F R ❑97
Ice cream, iced dessert, fool, mousse or trifle
7 6 5 4 3 2 1 F R ❑98
Low fat yogurt 7 6 5 4 3 2 1 F R ❑99
Low calorie yogurt, e.g. Shape 7 6 5 4 3 2 1 F R ❑100
Other yogurts/fromage frais, e.g. thick & creamy
7 6 5 4 3 2 1 F R ❑101
Fruit cake/sponge cake/sponge pudding - shop bought 7
7 6 5 4 3 2 1 F R ❑102
Fruit cake/sponge cake/sponge pudding - homemade
7 6 5 4 3 2 1 F R ❑103
Fruit tart/jam tart/doughnut/Danish pastry - shop bought
7 6 5 4 3 2 1 F R ❑104
Fruit tart/jam tart – homemade 7 6 5 4 3 2 1 F R ❑105
Milk pudding, e.g. rice/tapioca/macaroni
7 6 5 4 3 2 1 F R ❑106

What type of milk do you use for milk pudding? ❑107

1. Whole milk
2. Semi-skimmed milk
3. Skimmed milk
4. Canned milk pudding - ordinary
5. Canned milk pudding - low fat

## FRUIT

How often do you have fruit canned in syrup?
7 6 5 4 3 2 1 F R ❑108
How often do you have fruit canned in juice?
7 6 5 4 3 2 1 F R ❑109
How many apples do you have per week? ..................... ❑❑110-111
How many pears do you have per week? ..................... ❑❑112-113
How many oranges or grapefruit do you have per week?
..................... ❑❑114-115
How many bananas do you have per week? ..................... ❑❑116-117

How often do you have other fruit, e.g. peach/nectarine, grapes, kiwi, strawberries, melon?
7 6 5 4 3 2 1 F R ❑118

## EGGS & MILK PRODUCTS

How many eggs do you usually eat per week? ..................... ❑❑119-120

What type of milk do you usually have? ❑121

1. Whole milk
2. Semi-skimmed milk
3. Skimmed milk
4. Soya milk
5. Goats milk
6. More than one type
7. None

How much milk do you drink per day in tea/coffee/milky drinks/cereals?

1. None
2. Half a pint or less
3. Between half a pint and one pint
4. One pint or more

How much cream do you use per week (I tablespoon=20g; small carton=150g;large carton=300g)? .................... g ❑❑❑123-125

How much cheese (excluding cottage cheese) do you eat per week (average matchbox size portion = 30g)? ..................... g ❑❑❑126-128
How often do you have cottage cheese?
7 6 5 4 3 2 1 F R ❑129

## FATS

What do you usually spread on bread? ❑❑130-131

1. Butter
2. Polyunsaturated margarine/spread
3. Other soft margarine/spread (tub) (NOT olive spread)
4. Hard margarine (block)
5. Low fat spread - polyunsaturated
6. Low fat spread - other
7. Very low fat spread (25% fat)
8. Olive oil spread
9. Bread eaten dry

How much butter/spread (~7g per slice) do you have per week
..................... g ❑❑❑132-134

How often do you have food that is fried, e.g. fish/onions/mushrooms/tomatoes/eggs?
7 6 5 4 3 2 1 F R ❑135

What type/brand of fat do you use for frying? ........................... ❑136
What type/brand of fat do you use for chips? ........................... ❑137
What type/brand of fat do you use for roast potatoes? .................. ❑138
What type/brand of fat do you use for homemade cakes? .............. ❑139
What type/brand of fat do you use for homemade pastry? ............. ❑140

## DRINKS

How many cups of non-herbal/-green tea do you have per day?
.................... ❑❑141-142
How many cups of herbal/green tea do you have per day?
..................... ❑❑143-144
How many teaspoons of sugar/honey per cup?
..................... ❑145

How many cups of coffee do you have per day? ..................... ❑❑146-147
How many teaspoons of sugar/honey per cup? ..................... ❑148

How often do you have fruit juice?
7 6 5 4 3 2 1 F R ❑149
How often do you have fruit squash (NOT low calorie)?
7 6 5 4 3 2 1 F R ❑150
How often do you have fizzy drinks (NOT low calorie)?
7 6 5 4 3 2 1 F R ❑151

How often do you have low calorie squash or fizzy drinks?
7 6 5 4 3 2 1 F R ❑152

What sort of water do you usually drink? ❑153

1. Tap water
2. Still bottled water
3. Sparkling mineral water

How much water do you drink each day? ❑154

1. Less than 200ml (one glass)
2. Between 200ml and 500ml
3. Between 500ml and 1 litres
4. Between 1 litre and 1.5 litres
5. Between 1.5 and 2 litres
6. More than 2 litres

In a typical week, how often do you have the following drinks and, when you have them, how many do you drink?

Beer/lager/stout 7 6 5 4 3 2 1 F R ❑155

Amount per occasion ..................... Pints ❑❑156-157

Cider 7 6 5 4 3 2 1 F R ❑158

Amount per occasion .................... Half Pints ❑❑159-160

Wine 7 6 5 4 3 2 1 F R ❑161

Amount per occasion ..................... Glasses ❑❑162-163

Sherry/port/vermouth 7 6 5 4 3 2 1 F R ❑164

Amount per occasion ..................... Glasses ❑❑165-166

Spirits/liqueurs 7 6 5 4 3 2 1 F R ❑167

Amount per occasion ..................... Measures ❑❑168-169

## SOUPS & SAUCES

**How often do you have the following soups & sauces :**

Vegetable-based soups, e.g. vegetable/minestrone/carrot
7 6 5 4 3 2 1 F R ❑170

'Cream of' soups, e.g. chicken, mushroom, tomato
7 6 5 4 3 2 1 F R ❑171

Sauces such as curry, sweet & sour, etc.
7 6 5 4 3 2 1 F R ❑172

Mayonnaise, e.g. in coleslaw/potato salad/sandwiches
7 6 5 4 3 2 1 F R ❑173

Salad cream 7 6 5 4 3 2 1 F R ❑174

Other dressings, e.g. French/thousand island/blue cheese
7 6 5 4 3 2 1 F R ❑175

## OTHER FOOD-RELATED QUESTIONS

Which of the statements below best describes your cooking ability? ❑176

1. Can cook a wide range of meals from raw ingredients
2. Can cook a limited range of meals from raw ingredients
3. Can only cook using pre-prepared foods
4. Unable to cook at all

During the most recent semester, how often have you consumed self-cooked meals from raw ingredients? ❑177

1. Every day
2. Most days
3. Occasionally
4. Rarely / Never

During the most recent semester, how often have you eaten self-cooked meals from pre-prepared foods? ❑178

1. Every day
2. Most days
3. Occasionally
4. Rarely / Never

During the most recent semester, how often have you eaten ready-meals or take-aways? ❑179

1. Every day
2. Most days
3. Occasionally
4. Rarely / Never

During the most recent semester, how often have you eaten meals at University cafeteria? ❑180

1. Every day
2. Most days
3. Occasionally
4. Rarely / Never

During the most recent semester, how often, on average, have you skipped breakfast?

❑181

1. Every day
2. Most days
3. Occasionally
4. Rarely / Never

During the most recent semester, how often, on average, have you skipped lunch or dinner?

❑182

1. Every day
2. Most days
3. Occasionally
4. Rarely / Never

How much money do you usually spend on food each week?

❑183

1. Less than £20
2. £20 - £29
3. £30 - £39
4. £40 - £49
5. £50 or more

From where do you obtain/purchase most of your food? ❑184

1. Corner shops or small/express supermarkets
2. Large supermarkets
3. Local produce shops
4. Parents/gaurdians provide me with food
5. Take-away/fast food outlets
6. University cafeteria

Which best describes your consumption of animal foods? ❑188

1. Regular meat eater
2. Occasionally consume meat/poultry/fish
3. Avoid all meat/poultry/fish but consume eggs & dairy
4. Avoid all meat/poultry/fish/eggs but consume dairy
5. Avoid all animal-derived products including honey (vegan)

Do you regularly exclude any other foods from your diet (e.g. dairy)? Yes / No ❑189

Please provide details of the foods you exclude

……………………………………………………………………………………

……………………………………………………………………………………

Which of the following statements best describes how you feel about your body?
❑190

1. Far too thin
2. A little too thin
3. Just right
4. A little overweight
5. Very overweight

Are you currently dieting to lose weight? ❑191

1. Yes
2. No

Are you currently trying to bulk up / gain muscle mass? ❑192

1. Yes
2. No

Which, if any, (not medically prescribed) dietary supplements do you currently use?

1. Multi-vitamin supplements ❑❑❑❑❑❑193-198
2. Individual mineral supplements (e.g. calcium)
3. Individual vitamin supplements (e.g. vitamin C/vitamin B12)
4. Protein shakes
5. Other fitness-orientated supplements (e.g. creatine)
6. Other dietary supplements (e.g. ginseng)
7. None

Using the scale below, how happy are you with your food intake?

Very unhappy --------------------------------------- Very happy
❑❑❑199-201

Please list the two factors you give most priority when deciding what to eat (e.g. cost of food)

………………………………………………………………………………

………………………………………………………………………………

**DEMOGRAPHIC & LIFESTYLE-RELATED QUESTIONS**

What is your year of academic study? ❑202

1. First year undergraduate
2. Second year undergraduate
3. Third year undergraduate
4. Fourth or higher year undergraduate
5. Postgraduate
6. Other

Are you a full time or a part time student? ❑203

1. Full time
2. Part time

Which university do you attend? ❑204
……………………………………………. ❑205

What is your university faculty and degree programme of study?
…………………………………………. ❑206

Are you an active member of a university sports club? ❑207
Yes / No

What best describes your term-time (i.e. during university semesters) residence?
❑208

1. University catered accommodation
2. University self-catered accommodation
3. Private accommodation with other students/friends
4. Private accommodation on own
5. Living with parents/other relatives
6. Living with partner
7. Living with parents/partner and children
8. Living with children only
9. Other

What is the postcode of your family/parental home address (provide only the first part if preferred)

………………………………………………………………………………

What is your nationality? ❑209

1. British
2. Irish
3. Other North or Western European
4. Central or Eastern European

5. Southern European
6. Other

What is your ethnic background? ❑210

1. White British
2. White Irish
3. White Other Ethnicity
4. Mixed Ethnicity
5. Asian / Asian British
6. Black / African / Caribbean / Black British
7. Arab
8. Other
9. Would rather not say

What is your religion? ❑211

1. Christianity
2. Hinduism / Sikhism
3. Islam
4. Judaism
5. Buddhism
6. Atheism / Agnotism
7. Other
8. Would rather not say

During the most recent semester, have you excluded any foods from your diet for religious reasons? Yes / No ❑212

Which foods have you been excluding for religious purposes?

………………………………………………………………………………………

Which statement best describes your smoking habits? ❑213

1. Never-smoker
2. Ex-smoker
3. Social smoker
4. Regular smoker

**OTHER QUESTIONS RELATED TO THIS SURVEY**

Please list any foods that you regularly (>3 days/week) consume that were not listed in this survey

………………………………………………………………………………………

………………………………………………………………………………………

Would you be happy to be contacted regarding participation in further research about eating habits?

............................... ❑214

Would you like to be entered into the prize draw to win one of 20 £50 high street vouchers?

Yes / No ❑215

Please provide your name & contact email address/phone number

………………………………………………………………………………

………………………………………………………………………………

## HEIGHT, WEIGHT & ACTIVITY

**What is your height?** ......... ft .........ins **OR** ....................... cm

❑❑❑.❑216-219

**What is your weight?** ......... st .........lb **OR** ....................... kg

❑❑❑.❑220-223

**How physically active is your occupation?** ❑224

1 Not very active
2 Moderately active
3 Very active
4 Not working

**How physically active is your leisure time?** ❑225

1 Not very active
2 Moderately active
3 Very active

**Questions for women only**

Are you pregnant? Yes / No ❑226

Are you breast feeding? Yes / No ❑227

**Appendix B: Pilot study focus group protocol**

**To be read by the researcher at the start of the focus groups:**

*Participation in this focus group is voluntary. You have the right not to answer any question, and to stop the interview at any time or for any reason.*
*You will not be compensated for this interview.*

*The information you tell us will be confidential. Your name and title will be anonymised if you are quoted in any publications that may result from this research.*

*This interview will be recorded on a digital voice recorder so that it can then be transcribed in written format for analysis at a later date. If you do grant permission for this conversation to be recorded on audio voice recorder, you have the right to revoke recording permission at any time and stop the interview.*

**-----------------------------------------------------------------------------------------------**

**Questionnaire-specific questions**

- Length of questionnaire (would an incentive change their opinion on this?)
- Ambiguous questions
- Range of response options
- Missing foods

- Discuss suitability of questionnaire for international students

**Improvements to questionnaire**

- Are there any other questions that participants think should be included which might be relevant to our understanding of students' eating habits?

**Questions relating to the main study**

- Incentives for main study - division of £1000 prize draw (e.g. 10 x £100?)
- Discuss use of web page for promotion of study

**Appendix C: Participant recruitment email – Web-survey**

***Participate in an online survey about food intake and be entered into a prize draw for a chance to win one of 20 £50 Meadowhall vouchers***

Dear all,

I am a PhD student within the Human Nutrition collecting information for a study investigating **Home and EU** University students' food intake and eating habits. The survey involves completing an online survey about your food intake during this Autumn Semester. The survey should take approximately 20-25 minutes to complete. There are no right or wrong answers and please be as honest as you can. Participation is completely voluntary.

*If you complete this survey you can be entered into a prize draw to win one of 20 £50 Meadowhall vouchers.*

If you are willing to participate you will be required to tick a box on the first page of the survey site. This will allow you access to the full survey.

The online survey can be accessed via the following link:

**http://qbuilder.tinuvielsoftware.co.uk/Sheffield**

The following study website provides further information about the study as well as instructions on how to complete the survey:

**https://sites.google.com/a/sheffield.ac.uk/student-diets/**

If you are a **Non-EU/international/overseas** student or you are following a **medically prescribed diet** (e.g. low protein / gluten-free) or participated in the **pilot study** for this project then please do ***not*** complete this survey.

The Medical School Ethics Committee has approved this study and all responses will remain confidential at all times.

If you have any other questions regarding participation in this study then please don't hesitate to contact myself (efsprake1@sheffield.ac.uk), or my supervisors (m.e.barker@sheffield.ac.uk/p.grabowski@sheffield.ac.uk/ richard.cooper@sheffield.ac.uk).

Thank you in advance for taking the time to participate – it is very much appreciated.

Best wishes,

Ellie

Eleanor Sprake

## Appendix D: Foods consumed >3 times/week that participants reported as not listed in the FFQ

**Table D1: Foods addressed by the FFQ within a broader food group**

| Food item | Number of students | Food item | Number of students |
|---|---|---|---|
| Peppers | 18 | Wheaten bread | 1 |
| Specific cakes (homemade or otherwise) | 9 | Other veg (no specific items listed) | 1 |
| Spinach | 9 | Chorizo | 1 |
| Fruit smoothie | 8 | Lasagne | 1 |
| Berries | 8 | Beetroot | 1 |
| Broccoli | 6 | Parma ham | 1 |
| Frozen vegetables | 4 | Smoked salmon | 1 |
| Courgettes | 4 | Ciabatta bread | 1 |
| Celery | 4 | Bagels | 1 |
| Kale | 4 | Naan bread | 1 |
| Satsumas | 3 | Curry | 1 |
| Savoury biscuits | 3 | Rustlers' burger | 1 |
| Cucumber | 3 | Leeks | 1 |
| Casserole & stew | 3 | Beans | 1 |
| Tomato ketchup | 3 | Coca cola | 1 |
| Rye bread | 3 | Haribo | 1 |
| Crisps | 3 | Steamed cooked vegetables | 1 |
| Frozen fruit | 3 | Sweetcorn | 1 |
| Stir-fried vegetables | 3 | Mango | 1 |
| Green leafy vegetables | 3 | Plums | 1 |
| Sweet chilli sauce | 2 | Dairy | 1 |
| Soy sauce | 2 | Pudding | 1 |
| Green beans | 2 | Dry peas | 1 |
| Wraps | 2 | Melba toast | 1 |
| Gherkins | 2 | Pretzels | 1 |
| Cabbage | 2 | Toasties | 1 |
| Chilli chicken | 2 | Wedges | 1 |
| Chopped/tinned tomatoes | 2 | Oreos | 1 |
| BBQ sauce | 1 | Pineapple | 1 |
| Seeded rolls | 1 | Citrus fruits | 1 |
| Pork pies | 1 | Homemade meals | 1 |
| Granary/seeded bread | 1 | Turkey (mince) | 1 |
| Seeded wholemeal pittas | 1 | Smoked haddock | 1 |
| Mixed veg | 1 | Tomato based sauces | 1 |

**Table D2: Foods explicitly listed in the FFQ**

| Food item | Number of students | Food item | Number of students |
|---|---|---|---|
| Yogurts (specific varieties) | 13 | Tomatoes | 2 |
| Cheese (specific varieties) | 11 | Lentils & split peas | 2 |
| Chocolate | 11 | Bread | 2 |
| Noodles | 9 | Chickpeas | 1 |
| Salad | 9 | Bananas | 1 |
| Rice | 8 | Butter | 1 |
| Pasta (fresh or otherwise) | 8 | Fruit | 1 |
| Oats | 5 | Hummus | 1 |
| Breakfast cereals | 4 | Biscuits | 1 |
| Potatoes | 3 | Meat | 1 |
| Nuts | 3 | Eggs | 1 |
| Soya milk | 3 | Soup | 1 |
| Chicken | 3 | Quorn | 1 |
| Grapes | 3 | Low calorie soft drinks | 1 |
| Milk | 3 | | |

**Table D3: Foods not included in the FFQ**

| Food item | Number of students | Food item | Number of students |
|---|---|---|---|
| Dried fruit | 24 | Cooking spices | 2 |
| Cereal bars | 17 | Butternut squash | 2 |
| Peanut butter | 17 | Soy desserts | 1 |
| Seeds | 14 | Home-cooked frozen meals sent from home | 1 |
| Couscous | 13 | Protein shakes | 1 |
| Quinoa | 12 | Non-alcoholic wine/beer | 1 |
| Almond milk | 11 | Homemade lemonade | 1 |
| Avocado | 8 | Seaweed | 1 |
| Sweet potatoes | 8 | Pearl barley | 1 |
| Rice cakes | 7 | Polenta | 1 |
| Mushrooms | 7 | Protein cookies | 1 |
| Falafel | 6 | Malt extract | 1 |
| Granola | 6 | Bovril | 1 |
| Other nut butters | 5 | Biltong | 1 |
| Nutella/chocolate spreads | 5 | Microwave meals | 1 |
| Chilli peppers | 5 | Buckwheat | 1 |
| Pesto | 4 | Sushi | 1 |
| Olives | 3 | Diet bars | 1 |
| Marmite | 3 | “Fake coffee” | 1 |
| Aubergines | 3 | Breakfast drinks | 1 |
| Soya yogurt | 3 | Balsamic vinegar | 1 |
| Ginger | 3 | Barley green | 1 |
| Garlic | 3 | Kimchi | 1 |
| Hot chocolate | 3 | Kefir milk | 1 |
| Breakfast biscuits/bars | 3 | Probiotics | 1 |
| Gravy | 3 | Beef jerky | 1 |
| Popcorn | 3 | Vitamin supplements | 1 |
| Fish oil tablets | 3 | Dim sum | 1 |
| Coconut oil | 2 | Pumpkin | 1 |

| | | | |
|---|---|---|---|
| Chocolate flavoured milk | 2 | Nut milks | 1 |
| Sandwiches | 2 | Gluten free cereals | 1 |
| Pancakes | 2 | Aspartame sweetener | 1 |
| Low calorie cooking spray | 2 | Low calorie jelly | 11 |
| Herbs | 2 | Stevia | 1 |
| Cup-a-soup | 2 | Sugar free candy | 1 |
| Ice lollies | 2 | Chutneys | 1 |
| Dips (other than hummus) | 2 | Bouillon | 1 |
| Bulgar wheat | 2 | Custard | 1 |
| Specific vegan items | 2 | Fig rolls | 1 |
| Pickles | 2 | | |

**Appendix E:** Table of values used for the prediction of BMR using the Henry equation based on height and weight* (255,256)

| Gender | Age | BMR (MJ/day) | | | BMR (kcal/day) | | |
|---|---|---|---|---|---|---|---|
| | | Weight coefficient | Height coefficient | Constant | Weight coefficient | Height coefficient | Constant |
| Male | 18-30 | 0.0600 | 1.31 | 0.473 | 144 | 313 | 113 |
| Female | 18-30 | 0.0433 | 2.57 | -1.180 | 10.4 | 615 | -282 |

*BMR = (weight coefficient x weight (kg)) + (height coefficient x height (m)) + constant

**Appendix F:** Association between degree of misreporting of energy intake and dieting status (dieting to lose weight; dieting to bulk up; neither) – Results from One Way ANOVA

| **Intention with respect to dieting or weight gain** | **Number of subjects** | **Mean extent of misreporting of energy intake (%)** | **Standard Deviation (%)** |
|---|---|---|---|
| Dieting to lose weight | 235 | $-31.6^{ab}$ | 23.0 |
| Dieting to bulk up/gain muscle mass | 206 | $-24.7^{a}$ | 23.4 |
| Neither dieting to lose weight nor bulk up | 970 | $-24.8^{b}$ | 23.4 |

*$p<0.001$; $F = 8.463$; $df = 2$*

## Appendix G: Ethnic background and religion cross tabulation[Y]

| Ethnic background * Religion Crosstabulation | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Religion | | | | | | | | |
| | | Christianity | Hinduism/ Sikhism | Islam | Juddaism | Buddhism | Atheism/ Agnotism | Other | Total | |
| White British | Count | 372 | 1 | 1 | 6 | 3 | 377 | 70 | 830 | |
| | Expected Count | 395.1 | 8.2 | 18.4 | 4.4 | 3.8 | 332.3 | 67.2 | 830 | |
| | Adjusted Residual | -2.7 | -4.2 | -6.8 | 1.2 | -0.7 | 5.2 | 5.2 | | |
| White Irish | Count | 165 | 0 | 0 | 0 | 2 | 45 | 8 | 220 | |
| | Expected Count | 104.9 | 2.2 | 4.9 | 1.2 | 1.0 | 88.1 | 17.8 | 220 | |
| | Adjusted Residual | 8.9 | -1.6 | -2.4 | -1.2 | 1.1 | -6.5 | -2.7 | | |
| White Other | Count | 54 | 0 | 0 | 1 | 0 | 58 | 15 | 128 | |
| | Expected Count | 61.0 | 1.3 | 2.8 | 0.7 | 0.6 | 51.2 | 10.4 | 128 | |
| | Adjusted Residual | -1.3 | -1.2 | -1.8 | 0.4 | -0.8 | 1.3 | 1.6 | | |
| Mixed ethnicity | Count | 9 | 0 | 1 | 0 | 0 | 27 | 4 | 41 | |
| | Expected Count | 19.5 | .4 | .9 | .2 | .2 | 16.4 | 3.3 | 41 | |
| | Adjusted Residual | -3.4 | -.7 | .1 | -.5 | -.4 | 3.4 | .4 | | |
| Asian/Asian British | Count | 9 | 12 | 25 | 0 | 0 | 11 | 5 | 62 | |
| | Expected Count | 29.6 | .6 | 1.4 | 0.3 | 0.3 | 24.8 | 5.0 | 62 | |
| | Adjusted Residual | -5.2 | 14.9 | 20.8 | -.6 | -.6 | -3.6 | .0 | | |
| Black/African/ Carribbean/ Black British | Count | 12 | 0 | 0 | 0 | 0 | 0 | 1 | 13 | |
| | Expected Count | 6.2 | 0.1 | 0.3 | 0.1 | 0.1 | 5.2 | 1.1 | 13 | |
| | Adjusted Residual | 3.2 | -.4 | -.5 | -.3 | -.2 | -3.0 | -.1 | | |
| Other | Count | 3 | 0 | 2 | 0 | 1 | 6 | 3 | 15 | |
| | Expected Count | 6.2 | 0.1 | 0.3 | 0.1 | 0.1 | 5.2 | 1.1 | 15 | |
| | Adjusted Residual | -2.2 | -0.4 | 2.9 | -0.3 | 3.6 | 0.0 | 1.7 | | |
| Total | Count | 624 | 13 | 29 | 7 | 6 | 524 | 106 | 1309 | |

**Pearson's chi-square results: value = 800.238; df = 36; p < 0.001**

[Y]Participants reporting 'would rather not say' have been excluded from the analysis (n = 139)

**Appendix H: Eight principal components retained from the PCA of frequency of food intake data of 575 University of Sheffield students, which informed the sampling of the qualitative study.** Only factor loadings >0.1 are displayed.

| Food group (% variance) | Health-conscious (7.7%) | Vegetarian (5.3%) | Snacking (4.5%) | Convenience, red meat & alcohol (3.9%) | Budget cooking (3.4%) | Tea, coffee & spread (3.1%) | Eggs & full fat dairy (2.9%) | Bread, spread, jam & cheese (2.9%) |
|---|---|---|---|---|---|---|---|---|
| **Fatty fish & canned tuna** | 0.531 | -0.202 | 0.106 | | 0.186 | | 0.215 | |
| **Oat- & bran-based breakfast cereals** | 0.476 | | | | 0.159 | | | |
| **Nuts** | 0.460 | 0.304 | 0.226 | -0.120 | | -0.143 | | |
| **White bread** | -0.458 | -0.199 | 0.147 | 0.141 | | | | |
| **Fresh fruit** | 0.452 | | | | | | -0.141 | 0.295 |
| **Other green vegetables & salad** | 0.449 | 0.347 | -0.119 | 0.248 | 0.155 | | | 0.267 |
| **Pizza** | -0.395 | | 0.348 | 0.232 | | -0.241 | 0.143 | -0.143 |
| **Chips** | -0.386 | | 0.264 | 0.293 | 0.251 | -0.126 | 0.182 | -0.220 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Other breakfast cereals** | -0.354 | | | | 0.162 | 0.119 | | |
| **Herbal & green tea** | 0.339 | 0.262 | | | | | | -0.156 |
| **White fish & shell fish** | 0.326 | -0.246 | 0.251 | | 0.302 | | 0.191 | |
| **Tofu** | | 0.683 | | | | | | |
| **Meat alternatives** | -0.113 | 0.635 | | | 0.151 | | | |
| **Pulses, bean & lentils** | 0.257 | 0.589 | | 0.163 | 0.261 | | | 0.156 |
| **Processed meat** | -0.141 | -0.511 | 0.149 | 0.310 | 0.154 | | 0.166 | |
| **Hummus** | 0.239 | 0.479 | | | | | -0.164 | |
| **Red meat & offal** | | -0.469 | 0.172 | 0.388 | 0.137 | | | |
| **Biscuits, cakes & sweet pastries** | | | 0.565 | | 0.120 | 0.105 | | 0.192 |
| **Milk- & cream-based desserts** | | | 0.521 | -0.116 | 0.134 | | | |
| **Confectionery** | -0.125 | -0.108 | 0.490 | 0.171 | -0.118 | | -0.257 | |
| **Other yogurts** | 0.204 | | 0.435 | -0.142 | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Savoury snacks** | -0.209 | | 0.424 | 0.333 | -0.192 | | -0.141 | |
| **Fruit juice** | | | 0.359 | | | 0.104 | | |
| **Canned fruit** | | | 0.282 | | 0.236 | 0.161 | | |
| **Other bread** | -0.239 | 0.114 | 0.277 | -0.158 | 0.184 | | | |
| **Quiche** | | | 0.257 | -0.130 | 0.149 | | 0.238 | -0.209 |
| **Sauces** | -0.113 | | | 0.491 | | -0.101 | -0.170 | 0.130 |
| **Fried foods** | | | -0.132 | 0.454 | | | 0.295 | 0.104 |
| **Pasta & rice** | -0.117 | | | 0.429 | 0.218 | | | 0.367 |
| **Alcoholic drinks** | | | | 0.410 | | | 0.154 | -0.149 |
| **Chicken & poultry** | | -0.173 | | 0.364 | | 0.151 | | -0.152 |
| **Mayonnaise, salad cream & other dressings** | 0.160 | | 0.203 | 0.361 | | | | |
| **Fizzy drinks** | -0.320 | | 0.272 | 0.335 | | -0.101 | | -0.212 |
| **Fruit squash (full calorie)** | -0.194 | | 0.243 | 0.296 | | 0.221 | -0.224 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Peas** | | | | | 0.567 | | | 0.124 |
| **Root vegetables & sweetcorn** | 0.314 | 0.119 | | | 0.481 | | -0.119 | 0.111 |
| **Potatoes** | -0.147 | | 0.163 | 0.123 | 0.479 | | 0.167 | -0.122 |
| **Baked beans** | | 0.121 | | 0.103 | 0.459 | | 0.160 | 0.128 |
| **Soups** | | 0.206 | | | 0.413 | | -0.161 | -0.112 |
| **Wheat bran** | | | | | 0.296 | 0.135 | | |
| **Tea & coffee** | | | | | | 0.848 | | |
| **Other spread** | -0.128 | | 0.162 | | | 0.845 | | |
| **Eggs** | 0.363 | | -0.154 | 0.196 | | | 0.509 | |
| **Low calorie squash** | | | | | 0.184 | | -0.452 | -0.125 |
| **Butter** | | | 0.150 | 0.216 | -0.224 | -0.173 | 0.403 | |
| **Low calorie/low fat yogurts** | 0.344 | | | | 0.164 | | -0.377 | -0.122 |
| **Milk** | | | | | | | 0.329 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Crispbreads** | 0.170 | 0.147 | | | | | -0.298 | |
| **Cream** | | | 0.137 | | | | 0.210 | |
| **Low fat spread** | -0.105 | | -0.106 | | 0.144 | | | 0.593 |
| **Non-white bread** | 0.260 | | | | -0.102 | | 0.201 | 0.577 |
| **Jam, marmalade & honey** | | | 0.168 | -0.239 | | | 0.132 | 0.479 |
| **Cheese** | | 0.137 | 0.244 | | -0.147 | | 0.173 | 0.324 |

**Appendix I: Participant recruitment email – Phase 2 (qualitative interviews)**

Dear xxxxxxxxxxx,

Thank you for completing the online survey about food intake and eating practices towards the end of the Autumn Semester 2013, as part of my PhD project. At the end of this survey you indicated that you would be willing to be contacted regarding participation in follow-up research.

Following preliminary analysis of the online survey, I am now recruiting students to participate in a face-to-face interview about food choice and eating habits at university. Attached is an information sheet providing you with details about participation in this interview. If you are still interested in taking part, please read the attached information sheet and let me know whether you would like to participate; we can then arrange a time to meet. If you would like further information prior to deciding whether or not you would like to participate then please don't hesitate to contact me. Participation is completely voluntary.

If you participate in an interview you will receive a £20 Meadowhall voucher as a token of appreciation for your time and effort.

I'll look forward to hearing from you,

Many thanks and best wishes,

Ellie

Eleanor Sprake

## Appendix J: Participant recruitment email – Phase 2 (qualitative interviews) - Male students

Dear all,

Thank you for completing the online survey about food intake and eating practices towards the end of the Autumn Semester 2013, as part of my PhD project. At the end of this survey you indicated that you would be willing to be contacted regarding participation in follow-up research.
Following a number of interviews with female students, we are now in need of male students to participate in an interview about food intake and eating habits at university.

This interview could be face-to-face with the researcher, a telephone conversation, or a focus group discussion with other students.

Attached is an information sheet providing you with further details about participation. If you are interested in taking part, please read the attached information sheet and let me know whether you would like to participate, along with your preferred form of participation (i.e. face-to-face interview; telephone conversation; focus group discussion); we can then arrange a time to meet. If you would like further information prior to deciding whether or not you would like to participate then please don't hesitate to contact me. Participation is completely voluntary.

If you participate in an interview you will receive a £20 Amazon voucher as a token of appreciation for your time and effort.

I'll look forward to hearing from you,

Many thanks and best wishes,

Ellie

Eleanor Sprake

**Appendix K: Phase 2 - Interview protocol**

***To be read by the researcher at the start of the interview:***

*This interview is voluntary. You have the right not to answer any question, and to stop the interview at any time or for any reason.*

*You will receive a £20 Meadowhall voucher for participating in this interview.*

*The information you tell us will be confidential. Your name, title, and any other information you give that may enable your identification will be replaced with pseudonyms to ensure participant anonymity.*

*This interview will be recorded on an audio voice recorder so that it can then be transcribed in written format for analysis at a later date. If you grant permission for this conversation to be recorded on audio voice recorder, you have the right to revoke recording permission at any time and stop the interview.*

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--

Ok, so let's just start off by you telling me a bit about yourself – your course of study, what year you're in, any hobbies/activities outside of studying, and things like that.

__Questions related to the food diary and factors influencing food choices__

We're going to start the interview by having a look at your food diary you completed yesterday**.** Can you ***talk me through your food diary in as much detail as you'd like, focusing on ideas about why you chose to eat these particular foods*** (and if there is anything in particular you attribute to any of these foods)

> *Follow-up on points mentioned*
> *e.g. - if they say they ate something they didn't like, why did they eat this?*
> *- if they miss a meal, why did they miss the meal? Do they often skip meals?*
> *Is this something they started doing when they came to university or have they always skipped meals? Etc.*

Does this diary ***represent what you usually eat at university, or does your food intake differ a lot from day to day***? Tell me a bit about that.

*The next few questions are going to focus on a few specific things that might influence what you eat, and I'd like you to think and tell me about these factors both in terms of your one-day food diary we've got here, but also more generally in terms of what you more generally eat at university*.

First of all, thinking about your one-day food diary you've got here, how, if at all, do you feel your **peers** around you influenced what you ate **yesterday**?

And now **more generally** thinking about what you eat at university, how and to what extent do you feel your **peers** around you influence what you're eating?

And again back to your diary, how, if at all, did your access to **food preparation, storage** or **cooking facilities** influence your food choices **yesterday**?

And **more generally** in terms of what you eat at university, does your access to food preparation, storage and cooking facilities influence your food choices?

How does your **cooking/food set-up** work when you're at university – do you cook/eat with your friends, or on your own, for example?

> Could also cover: eating out; planning of meals; whether they like cooking with friends more than alone or not and why; do they enjoy cooking

And looking back at your food diary now, how, if at all, did **money** influence what you ate **yesterday**?

And **more generally** in terms of what you eat at university, does **money** influence your eating habits and food choices?

Now thinking about your **cooking ability**, how did this influence what you ate **yesterday**?

> *Discuss consumption of* ***takeaways, ready meals and convenience foods*** *if appropriate.*

And **more generally** at university, does your **cooking ability** influence your eating practices and food choices?

I'd now like to talk about the influence our food choices might have on our **health.** ***How, if at all, and to what extent, did your knowledge about the link between food and health influence your food choices yesterday/in your food diary?***

And **more generally** at university, how does the potential impact of your food choices on your **health** influence your eating habits and food choices at university?

*If applicable:* ***tell me about since when and why you started regulating your eating habits on the basis of the health implications of the food you eat.***

And when you look at your food diary, and perhaps also thinking more generally about what you usually eat, **are there foods you consider to be ‘good’ or ‘bad’**? Can you tell me a bit about this?

For example, why you think they are good/bad, and how this influences your food choices?

Do you feel that being on **exam/revision** time influenced what you ate **yesterday**?

If so, how/why?

And thinking **more generally** how, if at all, do **exams** affect your eating habits?

Now let’s talk a little bit about **alcohol and drinking habits** at university.

Can you **tell me about your drinking habits/alcohol intake at university**? (Why, when, how often etc)

If you drink – **do you feel that your drinking habits interact with your food choices and eating habits**?

If you don’t drink – do you have specific reasons as to why you don’t drink?

How about **vegetarianism** - do you have strong feelings about **vegetarianism** / following a vegetarian diet? Tell me about that.

**Overall, when you now think about your food diary here and your food intake and eating habits more generally at university, how happy are you with your eating habits**?

*If you’d like to change them in what way and why?*

*Why aren’t you eating how you would like to be eating at the moment?*

**Home food environment**

Thanks, that’s all been really interesting. I now want to move on to talk about the home food environment in relation to what you eat at university.

Can you start off by telling me a bit about **what your eating habits and food intake were like at home before you started university? How do they differ, or how are they similar?**

*(consider SES here)*

Tell me about **how, if at all, and to what extent your food habits at home have influenced your food/eating habits at university**

And **how, if at all, were you involved in the preparation of food at home** (e.g. menu planning; shopping; cooking).

How do you think this has influenced your food choices and eating habits at university?

Finally, now thinking about when, if you do, **go back to your family home for holidays or weekends, has being at university influenced how you eat, or feel about what is eaten / prepared at home?** [Does eating with your family at home now feel different?] Tell me a bit about that.

Can you start off by telling me about **what your eating habits and food intake were like before you started/came back to university?**

How, if at all, and to what extent do they differ (or are they similar)?

**Why do you think your eating habits have changed since returning to university**?

When you think back to the **first time you arrived at university**, how, if at all, do you think your **eating habits established in your family home/during your school years influenced what and how you ate when you were at university**.

**The transition to university life**

The final main part of the interview is now going to focus on the transition to university life.

I'd like you **to think about the transition from home/school to university life, and how, if at all, why and to what extent did the transition to university life impact upon your food intake and eating practices?** Tell me a bit about that.

*Possible focus points:*

- *dieting/bulking up*

- *consumption of take-aways/convenience foods/alcohol*
- *overall decreased food intake*
- *peer pressure*
- *living arrangements/food and storage facilities*
- *increased responsibility over cooking and food preparation*

**How does it feel to be completely responsible for your food intake at university** (compared to when at home)?

Tell me about your **eating-out-of-the-house behaviour at university**

- Do you often find yourself eating out of the house/student flat?
- Does this differ from when you were at home/school?
- What do you think about the university food outlets in terms of the food offered?

Have you ever been **aware of eating less or more since being at university**? Can you tell me about that? *(to be asked if not already covered in interview up to this point)*

Now spend some time thinking about **where you are living now at university**, for example in university accommodation or a shared house. **How, if at all, does that affect your food choices and eating habits?** *(to be asked if not already covered in interview up to this point)*

Finally, as you've **progressed through university life, tell me about whether, and how, your food intake and eating habits have changed**.

- Why do you think they have changed?

**Final questions about factors influencing food choice**

Firstly, when you think about the food you usually eat when you're at university, do you take the **quality of food – or its source, whether its organic or any ethics involved – into consideration** when you're choosing what you eat? Why/not? How does this affect your food intake/choices?

And secondly, do you think the **media** – whether that be what's on the **news around food and nutrition, or TV programmes about food** – influences your food choices when you're at university?

- If so, **in what way and why do you think it has an influence**?
- If not, why not?

***And finally, is there anything else that you'd like to talk about in relation to***

***your food intake and eating habits at university?***

## Appendix L: Phase 2 – Participant information sheet

**<u>Participant Information Sheet</u>**

**Dietary patterns among university students: a mixed-methods study examining factors underpinning nutrient intake and food choice**

**Qualitative interviews**

Thank you for expressing willingness to participate in this research study about food choices and eating practices among university students. Before you decide whether or not you would like to participate, please take the time to read this information sheet so that you understand why this research is being conducted and what participation will involve. Reading this information sheet does not mean that you are obliged to participate. If you do decide to participate you will be asked to sign the attached consent form, which you should also read prior to deciding.

**What are you being invited to do?**

You are being invited to participate in a face-to-face interview with the researcher about your food choices and eating practices whilst at university. It is envisaged that the interview will last approximately one hour.

**What is the purpose of this study?**

Following the online survey about food intake and eating habits, which you completed at the end of the Autumn Semester 2013, we now have information on what university students are eating. We are now interested in understanding why students eat what they do at university.

**Why have I been chosen?**

You have been invited to participate because you indicated that you would be willing to be contacted regarding participation in follow up research at the end of a survey about food intake and eating habits at university, which you completed towards the end of the Autumn Semester.

**Do I have to take part?**

Participation is completely voluntary. You are also free to withdraw from the study at any time and without giving a reason for doing so.

**What do I have to do if I participate?**

If you decide to participate in an interview, the researcher will ask you about the factors that drive and influence your food choices and eating habits whilst at university. You will also be asked how and why, if at all, coming to university affected your eating habits and how, if applicable, your eating habits have changed throughout the years of university life. On one of the days leading up to the interview, we will invite you to complete a 24-hour food diary to stimulate initial discussion about food choice and eating habits during the interview. The

researcher will provide you with detailed instructions on how to complete this diary if you decide to participate.
The interview will take place at a time and place convenient to us both, most likely in a university building, or other public place. There will be no right or wrong answers to any of the questions asked in the interview and you will not be judged on anything you say (and/or eat).

**Will I be recorded?**
Upon consent, your interview will be audio-recorded using a digital audio-recording device. Following the interview, this audio recording will be immediately transferred onto a password-protected computer and deleted from the original recording device. The audio will then be anonymously transcribed into written form to allow for detailed analysis and interpretation by the researcher. You can receive a copy of your transcript upon request if you so wish. Your transcript will be used only for the purposes of this research study; no other use will be made of them without your written permission. Only members of the project team will be allowed access to your original recording. The code linking your contact details to your anonymised transcript will be locked in a secure location, accessible only by the researcher. All audio-recordings will be deleted from the computer following completion of the thesis.

**Will my participation in this study be confidential?**
Yes. Following participation in an interview, your interview will be immediately transcribed and your recording will subsequently be deleted from the digital recording device. Your identification will be anonymised in the interview transcript through the use of pseudonyms and this anonymised transcript will be used in all analyses and reports. Only the researcher will have access to your contact details and the code linking your name with your pseudonym.

**Are there any possible disadvantages or risks of taking part?**
We do not envisage any risks or disadvantages of participating in this project and the University of Sheffield's Medical School Ethics Committee has approved this study. If, however, you do not wish to continue taking part in this study having begun participation then you are free to withdraw at any point and without giving a reason for doing so.

**Will there be any benefits of taking part?**
There are no immediate benefits of participating in this study. However, this study will be important for understanding why university students are eating the foods that they are eating and adopting certain eating habits, which could inform the development of initiatives to improve the dietary intake and eating habits of future students. If you participate in this study you will receive a £15 Meadowhall voucher as compensation for your time and effort.

**What if I have a complaint?**
If you are unhappy with any part of the research process, or would like to make a complaint, please contact Eleanor Sprake (efsprake@sheffield.ac.uk) or her supervisors, Dr Margo Barker (m.e.barker@sheffield.ac.uk), Dr Peter Grabowski (p.grabowski@sheffield.ac.uk) or Dr Richard Cooper (richard.cooper@sheffield.ac.uk), in the first instance. If you do not feel that your complaint has been satisfactorily resolved, further channels of redress are available through the Registrar and Secretary of the University.

**What happens if the research study stops earlier than expected?**
In the event that the study stops earlier than expected, the reasons for this, and how any already-collected data will be dealt with, will be explained to you.

**Has this study been approved?**
Yes. Ethical approval for this study has been obtained from the University of Sheffield's Medical School.

**What will happen to the results of this study?**
This study forms part of the researcher's PhD project investigating dietary patterns and factors underpinning nutrient intake and food choice among university students. Primarily, therefore, the results of this study will form part of the researcher's PhD thesis. We hope that the study will also be published in a peer-reviewed journal in due course.

**Who can I contact for further information?**
If you would like further information or require clarification on any of the above then please contact Eleanor Sprake, PhD student in the Human Nutrition within the Medical School at the University of Sheffield (efsprake1@sheffield.ac.uk; 01142711508) or her supervisors Dr Margo Barker (m.e.barker@sheffield.ac.uk), Dr Peter Grabowski (p.grabowski@sheffield.ac.uk) or Dr Richard Cooper (richard.cooper@sheffield.ac.uk). Please do not hesitate to contact us at any stage.

Thank you for taking the time to read this information sheet.

Eleanor Sprake

**Appendix M: Phase 2 – Consent form**

**Title of research project:** Dietary patterns among university students: a mixed-methods study examining factors underpinning nutrient intake and food choice

**Qualitative interviews**

**Name of Researcher:** Eleanor Sprake

**Participant Identification Number for this project:**

*Please initial box*

1. I confirm that I have read and understand the participant information sheet dated January 27th 2014 explaining the above research project and I have had the opportunity to ask questions about the project. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences. I am aware that I can contact the main researcher (Eleanor Sprake) on 0114 2711508 or efsprake1@sheffield.ac.uk if I have any further questions relating to my participation. ☐

3. I give permission for members of the research team to have access to my anonymised interview transcript. I understand that my name will not be linked with any research materials, and I will not be identified or identifiable in the report or reports that result from the research. I understand that my interview transcripts will be kept in a secure location. ☐

4. I agree to my interview being digitally recorded ☐

5. I agree to take part in the above research project as outlined in the participation information sheet. ☐

| | | |
|---|---|---|
| ------------------------------------------ | ---------------------- | ----------------- |
| Name of participant | Date | Signature |
| ------------------------------------------ | ------------------------ | ----------------- |
| Lead Researcher | Date | Signature |

*To be signed and dated in presence of the participant. The participant is to receive a signed and dated copy of this consent form alongside the participant information sheet. The researcher will retain a copy of this signed and dated consent form in the project's file, which will be kept in a secure location*

## Appendix N: Parallel analysis output

This table displays the output from the parallel analysis of the final dataset, used to guide the number of components retained for further analysis (261). Where eigenvalues from the random dataset are greater than the eigenvalues from the study dataset, these components can be considered as mostly noise. The current parallel analysis indicated retention of 11 components. Examination of the scree plot and component interpretability alongside this analysis resulted in the final retention of four major dietary components.

| **Component/Root**[γ] | **Initial Eigenvalues from PCA** | **Eigenvalues from Parallel Analysis** | **Initial total EV > Parallel analysis EV means?** |
|---|---|---|---|
| **1** | 4.625 | 1.396789 | TRUE |
| **2** | 3.13 | 1.363037 | TRUE |
| **3** | 2.313 | 1.334696 | TRUE |
| **4** | 1.881 | 1.311882 | TRUE |
| **5** | 1.687 | 1.293201 | TRUE |
| **6** | 1.596 | 1.274362 | TRUE |
| **7** | 1.468 | 1.256491 | TRUE |
| **8** | 1.377 | 1.240535 | TRUE |
| **9** | 1.313 | 1.225598 | TRUE |
| **10** | 1.277 | 1.209658 | TRUE |
| **11** | 1.221 | 1.196424 | TRUE |
| **12** | 1.174 | 1.182058 | FALSE |
| **13** | 1.159 | 1.168866 | FALSE |
| **14** | 1.111 | 1.154832 | FALSE |
| **15** | 1.077 | 1.140881 | FALSE |
| **16** | 1.075 | 1.129442 | FALSE |
| **17** | 1.059 | 1.116947 | FALSE |
| **18** | 1.041 | 1.103635 | FALSE |
| **19** | 1.029 | 1.091571 | FALSE |
| **20** | 1.023 | 1.08 | FALSE |
| **21** | 0.966 | 1.06737 | FALSE |
| **22** | 0.96 | 1.056292 | FALSE |
| **23** | 0.922 | 1.044119 | FALSE |
| **24** | 0.913 | 1.032964 | FALSE |
| **25** | 0.871 | 1.021448 | FALSE |
| **26** | 0.865 | 1.009811 | FALSE |
| **27** | 0.85 | 0.999647 | FALSE |
| **28** | 0.848 | 0.988853 | FALSE |
| **29** | 0.812 | 0.977158 | FALSE |
| **30** | 0.775 | 0.966094 | FALSE |

[γ] for simplicity, only the first 30 components are shown.

## Appendix O: Tables showing intakes of food groups across quintiles of distribution in dietary pattern scores

### Table O1: Component 1 – 'Vegetarian' dietary pattern

| | Percentile group of Component 1 – 'Vegetarian' dietary pattern | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Food/food group** | **Quintile 1** | | **Quintile 2** | | **Quintile 3** | | **Quintile 4** | | **Quintile 5** | | |
| | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | ***p* value** |
| **White bread (slices/day)** | 0.80 | 0.97 | 0.72 | 0.81 | 0.65 | 0.86 | 0.49 | 0.79 | 0.40 | 0.84 | **<0.001** |
| **Non-white bread (slices/day)** | 1.08 | 1.46 | 0.83 | 1.09 | 0.87 | 1.06 | 0.87 | 0.96 | 1.07 | 1.15 | **0.010** |
| **Other bread (slices or pieces/day)** | 0.16 | 0.23 | 0.18 | 0.28 | 0.18 | 0.27 | 0.23 | 0.35 | 0.25 | 0.50 | **0.003** |
| **Crispbread (number/day)** | 0.11 | 0.34 | 0.12 | 0.39 | 0.18 | 0.42 | 0.20 | 0.46 | 0.31 | 0.68 | **<0.001** |
| **Jam/marmalade/honey (days/week)** | 0.76 | 1.45 | 0.74 | 1.40 | 0.91 | 1.56 | 0.86 | 1.46 | 0.89 | 1.59 | 0.512 |
| **Oat/bran-based breakfast cereal (portions/week)** | 1.49 | 2.44 | 1.42 | 2.35 | 1.41 | 2.27 | 1.64 | 2.32 | 1.89 | 2.55 | 0.093 |
| **Other breakfast cereal (portions/week)** | 4.14 | 3.46 | 3.05 | 3.11 | 2.83 | 2.83 | 2.72 | 2.83 | 2.44 | 3.01 | **<0.001** |
| **Wheat bran (days/week)** | 0.68 | 1.77 | 0.39 | 1.24 | 0.44 | 1.30 | 0.35 | 1.13 | .52 | 1.36 | **0.039** |
| **Red meat & offal (days/week)** | 5.05 | 3.66 | 3.45 | 2.36 | 2.65 | 2.17 | 2.11 | 1.97 | 1.11 | 1.93 | **<0.001** |
| **Chicken/poultry (days/week)** | 4.17 | 1.96 | 3.20 | 1.73 | 2.73 | 1.62 | 2.34 | 1.84 | 1.34 | 2.03 | **<0.001** |
| **Processed meat (days/week)** | 5.19 | 3.71 | 3.63 | 3.07 | 2.76 | 2.14 | 2.27 | 2.09 | 1.03 | 1.85 | **<0.001** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **White fish & shell fish (days/week)** | 1.49 | 1.59 | 1.15 | 1.25 | 1.24 | 1.30 | 1.23 | 1.28 | .99 | 1.26 | **<0.001** |
| **Fatty fish & canned tuna (days/week)** | 1.68 | 2.10 | 1.33 | 1.63 | 1.28 | 1.57 | 1.44 | 1.90 | 1.20 | 1.76 | **0.018** |
| **Potatoes (days/week)** | 3.93 | 3.14 | 2.82 | 2.23 | 2.45 | 2.21 | 2.05 | 1.93 | 2.22 | 2.14 | **<0.001** |
| **Chips (days/week)** | 2.09 | 2.18 | 1.71 | 1.86 | 1.40 | 1.71 | 1.06 | 1.39 | 1.06 | 1.52 | **<0.001** |
| **Peas (days/week)** | 1.57 | 1.70 | 1.33 | 1.51 | 1.26 | 1.42 | 1.40 | 1.44 | 1.65 | 1.66 | **0.012** |
| **Other green veg/salad /tomatoes/onion (days/week)** | 5.16 | 3.69 | 5.86 | 3.26 | 6.89 | 3.46 | 7.63 | 3.40 | 9.34 | 3.45 | **<0.001** |
| **Root veg & sweetcorn (days/week)** | 3.11 | 2.90 | 3.20 | 2.76 | 3.57 | 2.83 | 3.93 | 3.12 | 5.03 | 3.09 | **<0.001** |
| **Baked beans (days/week)** | 1.19 | 1.41 | 0.90 | 1.12 | 0.94 | 1.19 | .90 | 1.20 | 1.21 | 1.55 | **0.003** |
| **Pulses/beans/lentils (days/week)** | 0.33 | 0.68 | 0.43 | 0.78 | 0.81 | 1.13 | 1.48 | 1.71 | 3.68 | 3.24 | **<0.001** |
| **Pasta & rice (days/week)** | 4.11 | 2.58 | 4.13 | 2.21 | 4.43 | 2.08 | 4.28 | 2.31 | 5.07 | 2.82 | **<0.001** |
| **Quiche (days/week)** | 0.09 | 0.22 | 0.13 | 0.30 | 0.16 | 0.36 | 0.23 | 0.53 | 0.30 | 0.80 | **<0.001** |
| **Pizza (days/week)** | 0.75 | 0.80 | 0.77 | 0.78 | 0.74 | 0.81 | 0.72 | 0.81 | 0.71 | 0.95 | 0.924 |
| **Meat alternatives (days/week)** | 0.08 | 0.31 | 0.23 | 0.81 | 0.26 | 0.78 | 0.91 | 2.03 | 3.59 | 3.71 | **<0.001** |
| **Tofu (days/week)** | 0.00 | 0.04 | 0.02 | 0.10 | 0.01 | 0.08 | 0.06 | 0.23 | 0.65 | 1.23 | **<0.001** |
| **Hummus (days/week)** | 0.06 | 0.24 | 0.13 | 0.35 | .26 | 0.53 | 0.64 | 1.04 | 1.86 | 2.02 | **<0.001** |
| **Biscuits, cakes & sweet pastries (days/week)** | 3.86 | 3.86 | 3.61 | 3.88 | 3.40 | 3.31 | 3.54 | 3.11 | 3.39 | 4.21 | 0.535 |
| **Confectionery (days/week)** | 4.50 | 3.72 | 3.75 | 2.90 | 3.29 | 2.82 | 3.25 | 2.83 | 2.69 | 2.63 | **<0.001** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Crisps/savoury snacks (days/week)** | 2.32 | 2.17 | 1.97 | 1.98 | 1.95 | 1.91 | 1.84 | 1.93 | 1.73 | 1.88 | **0.006** |
| **Nuts (days/week)** | 0.77 | 1.33 | 0.79 | 1.33 | 0.97 | 1.55 | 1.46 | 1.95 | 2.29 | 2.42 | **<0.001** |
| **Milk- & cream-based desserts (days/week)** | 0.83 | 1.23 | 0.81 | 1.18 | 0.72 | 1.06 | 0.92 | 1.25 | 0.83 | 1.22 | 0.400 |
| **Low fat/low calorie yogurts (days/week)** | 2.28 | 3.51 | 2.16 | 3.01 | 2.35 | 3.29 | 2.36 | 3.03 | 2.19 | 2.75 | 0.914 |
| **Other yogurts (days/week)** | 0.57 | 1.31 | 0.72 | 1.27 | 0.71 | 1.39 | 0.69 | 1.39 | 0.85 | 1.78 | 0.232 |
| **Canned fruit (days/week)** | 0.22 | 0.85 | 0.29 | 0.88 | 0.29 | 0.84 | 0.47 | 1.22 | 0.54 | 1.51 | **0.002** |
| **Fresh fruit (portions/ week)** | 6.79 | 6.57 | 6.27 | 6.27 | 6.28 | 6.89 | 6.88 | 7.42 | 9.25 | 9.25 | **<0.001** |
| **Eggs (number/day)** | 0.64 | 0.68 | 0.41 | 0.47 | 0.35 | 0.40 | 0.35 | 0.36 | .37 | 0.41 | **<0.001** |
| **Milk (glasses/day)** | 1.64 | 1.19 | 1.30 | 0.90 | 1.03 | 0.69 | 1.10 | 0.77 | 1.07 | 0.83 | **<0.001** |
| **Cream (servings/week)** | 0.08 | 0.42 | 0.06 | 0.35 | 0.06 | 0.29 | 0.14 | 0.54 | 0.17 | 0.62 | **0.010** |
| **Cheese (portions/week)** | 1.48 | 1.83 | 2.12 | 2.25 | 2.30 | 2.29 | 3.10 | 3.10 | 3.26 | 3.51 | **<0.001** |
| **Butter (portions/week)** | 3.04 | 4.17 | 1.75 | 2.86 | 1.41 | 2.65 | 1.45 | 2.86 | 1.15 | 2.68 | **<0.001** |
| **Low fat/olive/pufa spread (portions/week)** | 1.21 | 2.91 | 1.71 | 3.19 | 2.20 | 4.15 | 1.89 | 3.68 | 2.05 | 4.53 | **0.018** |
| **Other spread (portions/week)** | 0.59 | 1.92 | 0.47 | 1.79 | 0.56 | 1.65 | 0.44 | 1.86 | 0.57 | 1.92 | 0.840 |
| **Food that is fried (days/week)** | 1.96 | 1.77 | 1.82 | 1.75 | 1.87 | 1.58 | 2.07 | 1.76 | 2.03 | 1.86 | 0.373 |
| **Tea & coffee (cups/day)** | 1.58 | 2.56 | 1.38 | 1.94 | 1.49 | 1.97 | 1.58 | 1.84 | 1.94 | 2.70 | **0.036** |
| **Herbal/green tea (cups/day** | 0.32 | 0.68 | 0.32 | 0.67 | 0.57 | 1.05 | 0.83 | 1.18 | 1.51 | 2.03 | **<0.001** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Added sugar in tea/coffee/cereal (tsp)** | 0.79 | 1.15 | 0.58 | 1.11 | 0.59 | 0.99 | 0.47 | 0.88 | 0.43 | 0.86 | **<0.001** |
| **Fruit juice (days/week)** | 2.23 | 2.33 | 2.30 | 2.32 | 2.42 | 2.46 | 2.40 | 2.37 | 2.24 | 2.41 | 0.820 |
| **Fruit squash (not low calorie) (days/week)** | 1 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 0.056 |
| **Fizzy drinks (not low calorie) (days/week)** | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | **<0.001** |
| **Low calorie squash & fizzy drinks (days/week)** | 1.30 | 2.14 | 1.26 | 2.03 | 1.68 | 2.41 | 1.43 | 2.30 | 1.39 | 2.25 | 0.185 |
| **Water (glasses/days)** | 3.54 | 2.44 | 3.46 | 2.37 | 3.33 | 2.30 | 3.52 | 2.42 | 3.88 | 2.47 | 0.075 |
| **Alcoholic drinks (measures or glasses/day)** | .87 | 1.44 | 1.07 | 1.84 | .96 | 1.61 | 1.22 | 1.85 | 1.20 | 1.99 | 0.066 |
| **Soups (days/week)** | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | **<0.001** |
| **Ready-made sauces (days/week)** | 1.16 | 1.23 | .97 | 1.13 | 1.24 | 1.28 | 1.01 | 1.13 | 1.15 | 1.46 | **0.048** |
| **Mayo, salad cream & other dressings (days/week)** | 2.07 | 2.45 | 1.73 | 2.24 | 1.67 | 2.20 | 1.36 | 1.77 | 1.31 | 1.98 | **<0.001** |

## Table O2: Component 2 – 'Snacking' dietary pattern

| | Percentile group of Component 2 – 'Snacking' dietary pattern | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Food/food group** | **Quintile 1** | | **Quintile 2** | | **Quintile 3** | | **Quintile 4** | | **Quintile 5** | | |
| | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | ***p* value** |
| **White bread (slices/day)** | **0.17** | 0.36 | **0.44** | 0.66 | **0.60** | 0.79 | **0.76** | 0.87 | **1.09** | 8.00 | **<0.001** |
| **Non-white bread (slices/day)** | **1.00** | 1.29 | **0.99** | 1.08 | **1.01** | 1.15 | **0.94** | 1.23 | **0.78** | 8.00 | 0.114 |
| **Other bread (slices or pieces/day)** | **0.05** | 0.11 | **0.14** | 0.23 | **0.17** | 0.26 | **0.24** | 0.31 | **0.40** | 5.14 | **<0.001** |
| **Crispbread (number/day)** | **0.17** | 0.49 | **0.19** | 0.53 | **0.18** | 0.40 | **0.18** | 0.42 | **0.21** | 5.14 | 0.894 |
| **Jam/marmalade/honey (days/week)** | **0.32** | 0.84 | **0.63** | 1.15 | **0.75** | 1.33 | **1.04** | 1.61 | **1.42** | 7.00 | **<0.001** |
| **Oat/bran-based breakfast cereal (portions/week)** | **2.43** | 2.83 | **1.66** | 2.37 | **1.50** | 2.46 | **1.19** | 2.09 | **1.07** | 7.00 | **<0.001** |
| **Other breakfast cereal (portions/week)** | **1.97** | 2.65 | **2.95** | 3.00 | **3.37** | 3.25 | **3.06** | 2.92 | **3.83** | 14.00 | **<0.001** |
| **Wheat bran (days/week)** | **0.67** | 1.73 | **0.38** | 1.27 | **0.47** | 1.32 | **0.50** | 1.34 | **0.37** | 7.00 | 0.056 |
| **Red meat & offal (days/week)** | **2.30** | 2.54 | **2.74** | 2.94 | **2.77** | 2.52 | **3.06** | 2.78 | **3.51** | 21.00 | **<0.001** |
| **Chicken/poultry (days/week)** | **2.86** | 2.35 | **2.76** | 2.01 | **2.77** | 2.05 | **2.66** | 1.91 | **2.72** | 9.00 | 0.840 |
| **Processed meat (days/week)** | **1.75** | 2.30 | **2.79** | 2.84 | **2.87** | 2.47 | **3.31** | 3.11 | **4.15** | 22.00 | **<0.001** |
| **White fish & shell fish (days/week)** | **1.16** | 1.36 | **1.22** | 1.30 | **1.24** | 1.41 | **1.23** | 1.30 | **1.25** | 9.00 | 0.930 |
| **Fatty fish & canned tuna (days/week)** | **1.64** | 2.13 | **1.38** | 2.01 | **1.30** | 1.56 | **1.36** | 1.60 | **1.25** | 12.00 | 0.085 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Potatoes (days/week)** | **1.84** | 1.99 | **2.30** | 2.02 | **2.49** | 2.40 | **3.11** | 2.63 | **3.71** | 16.00 | **<0.001** |
| **Chips (days/week)** | **0.70** | 1.11 | **1.25** | 1.65 | **1.26** | 1.48 | **1.75** | 1.83 | **2.37** | 14.00 | **<0.001** |
| **Peas (days/week)** | **1.59** | 1.72 | **1.47** | 1.54 | **1.36** | 1.48 | **1.56** | 1.67 | **1.22** | 7.00 | **0.028** |
| **Other green veg/salad /tomatoes/onion (days/week)** | **8.84** | 3.34 | **7.04** | 3.55 | **6.76** | 3.74 | **6.63** | 3.76 | **5.61** | 16.00 | **<0.001** |
| **Root veg & sweetcorn (days/week)** | **4.55** | 3.21 | **3.58** | 3.07 | **3.39** | 2.87 | **3.59** | 2.85 | **3.71** | 14.00 | **<0.001** |
| **Baked beans (days/week)** | **0.84** | 1.28 | **0.97** | 1.18 | **0.90** | 1.21 | **1.14** | 1.42 | **1.29** | 7.00 | **<0.001** |
| **Pulses/beans/lentils (days/week)** | **1.93** | 2.71 | **1.36** | 2.26 | **1.09** | 1.67 | **1.18** | 1.94 | **1.15** | 10.00 | **<0.001** |
| **Pasta & rice (days/week)** | **4.39** | 2.62 | **4.44** | 2.48 | **4.46** | 2.39 | **4.35** | 2.36 | **4.38** | 14.00 | 0.984 |
| **Quiche (days/week)** | **0.08** | 0.34 | **0.12** | 0.28 | **0.14** | 0.30 | **0.22** | 0.51 | **0.35** | 7.00 | **<0.001** |
| **Pizza (days/week)** | **0.34** | 0.42 | **0.67** | 0.83 | **0.70** | 0.61 | **0.87** | 0.88 | **1.12** | 6.00 | **<0.001** |
| **Meat alternatives (days/week)** | **0.80** | 1.80 | **0.71** | 1.73 | **0.98** | 2.41 | **1.16** | 2.56 | **1.41** | 14.00 | **0.002** |
| **Tofu (days/week)** | **0.19** | 0.69 | **0.15** | 0.66 | **0.10** | 0.50 | **0.12** | 0.40 | **0.17** | 7.00 | 0.391 |
| **Hummus (days/week)** | **0.67** | 1.34 | **0.53** | 1.18 | **0.59** | 1.18 | **0.63** | 1.30 | **0.52** | 7.00 | 0.554 |
| **Biscuits, cakes & sweet pastries (days/week)** | **1.22** | 1.65 | **1.94** | 2.00 | **3.37** | 2.82 | **4.11** | 2.95 | **7.17** | 34.00 | **<0.001** |
| **Confectionery (days/week)** | **1.51** | 1.73 | **2.59** | 2.19 | **3.36** | 2.36 | **4.09** | 2.82 | **5.93** | 14.00 | **<0.001** |
| **Crisps/savoury snacks (days/week)** | **0.86** | 1.22 | **1.48** | 1.60 | **2.02** | 1.97 | **2.29** | 1.92 | **3.17** | 7.00 | **<0.001** |
| **Nuts (days/week)** | **1.64** | 2.25 | **1.00** | 1.59 | **1.14** | 1.78 | **1.15** | 1.73 | **1.35** | 7.00 | **<0.001** |
| **Milk- & cream-based desserts (days/week)** | **0.27** | 0.44 | **0.45** | 0.60 | **0.64** | 0.78 | **0.90** | 0.99 | **1.86** | 9.00 | **<0.001** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Low fat/low calorie yogurts (days/week)** | **2.06** | 2.92 | **2.24** | 3.16 | **2.16** | 2.96 | **2.36** | 3.10 | **2.52** | 14.00 | 0.430 |
| **Other yogurts (days/week)** | **0.22** | 0.66 | **0.41** | 0.97 | **0.56** | 1.23 | **0.96** | 1.71 | **1.39** | 7.00 | **<0.001** |
| **Canned fruit (days/week)** | **0.11** | 0.35 | **0.23** | 0.89 | **0.25** | 0.66 | **0.34** | 0.93 | **0.87** | 13.00 | **<0.001** |
| **Fresh fruit (portions/ week)** | **8.37** | 9.13 | **7.16** | 7.78 | **60.43** | 6.40 | **6.87** | 6.52 | **6.64** | 55.50 | **0.016** |
| **Eggs (number/day)** | **0.57** | 0.66 | **0.41** | 0.46 | **0.39** | 0.43 | **0.39** | 0.41 | **0.37** | 2.86 | **<0.001** |
| **Milk (glasses/day)** | **1.02** | 0.81 | **1.19** | 0.87 | **1.25** | 0.87 | **1.37** | 1.01 | **1.31** | 4.00 | **<0.001** |
| **Cream (servings/week)** | **0.05** | 0.31 | **0.05** | 0.33 | **0.07** | 0.38 | **0.15** | 0.54 | **0.19** | 4.00 | **<0.001** |
| **Cheese (portions/week)** | **1.78** | 2.29 | **2.11** | 2.22 | **2.61** | 2.78 | **2.84** | 2.78 | **2.94** | 17.63 | **<0.001** |
| **Butter (portions/week)** | **1.35** | 3.34 | **1.38** | 2.41 | **1.60** | 2.98 | **1.98** | 3.29 | **2.48** | 21.00 | **<0.001** |
| **Low fat/olive/pufa spread (portions/week)** | **1.57** | 3.43 | **1.63** | 2.91 | **2.04** | 3.84 | **1.95** | 3.82 | **1.88** | 53.00 | 0.480 |
| **Other spread (portions/week)** | **0.08** | 0.49 | **0.33** | 1.14 | **0.31** | 1.12 | **0.70** | 1.94 | **1.21** | 18.14 | **<0.001** |
| **Food that is fried (days/week)** | **2.16** | 2.07 | **1.92** | 1.67 | **1.91** | 1.63 | **1.79** | 1.68 | **1.97** | 7.00 | 0.134 |
| **Tea & coffee (cups/day)** | **1.20** | 1.67 | **1.46** | 2.05 | **1.44** | 1.99 | **2.01** | 2.75 | **1.85** | 15.00 | **<0.001** |
| **Herbal/green tea (cups/day** | **1.12** | 1.72 | **0.69** | 1.10 | **0.71** | 1.34 | **0.60** | 1.18 | **0.44** | 6.00 | **<0.001** |
| **Added sugar in tea/coffee/cereal (tsp)** | **0.24** | 0.57 | **0.41** | 0.80 | **0.64** | 1.08 | **0.58** | 0.95 | **0.99** | 7.00 | **<0.001** |
| **Fruit juice (days/week)** | **1.16** | 1.80 | **1.68** | 2.01 | **2.26** | 2.30 | **2.93** | 2.34 | **3.59** | 7.00 | **<0.001** |
| **Fruit squash (not low calorie) (days/week)** | **1** | 2 | **1** | 2 | **1** | 2 | **2** | 3 | **2** | 7 | **<0.001** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fizzy drinks (not low calorie) (days/week)** | **0** | 1 | **1** | 2 | **1** | 2 | **1** | 2 | **2** | 7 | **<0.001** |
| **Low calorie squash & fizzy drinks (days/week)** | **1.16** | 2.07 | **1.29** | 2.19 | **1.39** | 2.20 | **1.35** | 2.11 | **1.87** | 7.00 | **0.02** |
| **Water (glasses/days)** | **4.65** | 2.48 | **3.64** | 2.33 | **3.46** | 2.28 | **3.32** | 2.41 | **2.64** | 8.00 | **<0.001** |
| **Alcoholic drinks (measures or glasses/day)** | **1.07** | 1.54 | **0.99** | 1.62 | **1.26** | 2.21 | **1.13** | 1.83 | **0.86** | 9.43 | 0.076 |
| **Soups (days/week)** | **1** | 2 | **2** | 2 | **2** | 2 | **2** | 2 | **2** | 14 | **0.001** |
| **Ready-made sauces (days/week)** | **1.06** | 1.41 | **1.10** | 1.22 | **1.13** | 1.22 | **1.08** | 1.12 | **1.18** | 7.00 | 0.811 |
| **Mayo, salad cream & other dressings (days/week)** | **0.98** | 1.56 | **1.32** | 1.66 | **1.72** | 2.06 | **1.66** | 2.02 | **2.47** | 21.00 | **<0.001** |

**Table O3: Dietary pattern 3 – 'Health-conscious' dietary pattern**

| | Percentile group of Component 3 – 'Health-conscious' dietary pattern | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Food/food group** | **Quintile 1** | | **Quintile 2** | | **Quintile 3** | | **Quintile 4** | | **Quintile 5** | | |
| | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | ***p* value** |
| **White bread (slices/day)** | **0.86** | 1.04 | **0.70** | 0.84 | **0.65** | .88 | **0.50** | 0.81 | **0.34** | 0.61 | **<0.001** |
| **Non-white bread (slices/day)** | **0.79** | 1.13 | **0.87** | 1.20 | **0.97** | 1.14 | **1.01** | 0.98 | **1.08** | 1.30 | 0.026 |
| **Other bread (slices or pieces/day)** | **0.22** | 0.44 | **0.26** | 0.40 | **0.19** | 0.29 | **0.18** | 0.28 | **0.16** | 0.24 | 0.005 |
| **Crispbread (number/day)** | **0.09** | 0.25 | **0.14** | 0.39 | **0.16** | 0.48 | **0.27** | 0.63 | **0.27** | 0.52 | **<0.001** |
| **Jam/marmalade/honey (days/week)** | **0.55** | 1.21 | **0.85** | 1.53 | **0.92** | 1.48 | **1.01** | 1.63 | **0.84** | 1.55 | 0.004 |
| **Oat/bran-based breakfast cereal (portions/week)** | **0.38** | 1.16 | **0.96** | 1.78 | **1.48** | 2.22 | **2.13** | 2.64 | **2.89** | 2.90 | **<0.001** |
| **Other breakfast cereal (portions/week)** | **4.03** | 3.56 | **3.25** | 3.04 | **3.08** | 3.15 | **2.62** | 2.74 | **2.20** | 2.68 | **<0.001** |
| **Wheat bran (days/week)** | **0.28** | 1.09 | **0.33** | 1.17 | **0.38** | 1.21 | **0.71** | 1.67 | **0.70** | 1.61 | **<0.001** |
| **Red meat & offal (days/week)** | **2.53** | 2.83 | **2.64** | 2.44 | **2.74** | 2.46 | **2.95** | 2.69 | **3.51** | 3.50 | **<0.001** |
| **Chicken/poultry (days/week)** | **2.67** | 2.27 | **2.59** | 2.00 | **2.62** | 1.86 | **2.82** | 2.06 | **3.08** | 2.10 | **0.027** |
| **Processed meat (days/week)** | **2.87** | 2.99 | **2.86** | 2.57 | **3.07** | 3.00 | **3.08** | 3.06 | **3.01** | 3.35 | 0.832 |
| **White fish & shell fish (days/week)** | **0.46** | 0.62 | **0.82** | 0.95 | **1.01** | 1.01 | **1.54** | 1.31 | **2.27** | 1.76 | **<0.001** |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fatty fish & canned tuna (days/week)** | **0.33** | 0.64 | **0.79** | 1.06 | **1.07** | 1.08 | **1.71** | 1.42 | **3.04** | 2.69 | **<0.001** |
| **Potatoes (days/week)** | **2.41** | 2.16 | **2.61** | 2.52 | **2.78** | 2.38 | **2.94** | 2.59 | **2.72** | 2.60 | 0.114 |
| **Chips (days/week)** | **2.28** | 2.36 | **1.53** | 1.70 | **1.41** | 1.57 | **1.10** | 1.42 | **1.00** | 1.47 | **<0.001** |
| **Peas (days/week)** | **1.27** | 1.52 | **1.24** | 1.50 | **1.41** | 1.44 | **1.59** | 1.62 | **1.70** | 1.66 | **0.001** |
| **Other green veg/salad /tomatoes/onion (days/week)** | **4.99** | 3.72 | **5.91** | 3.53 | **7.32** | 3.54 | **7.56** | 3.27 | **9.11** | 3.25 | **<0.001** |
| **Root veg & sweetcorn (days/week)** | **2.65** | 2.79 | **3.08** | 2.76 | **3.54** | 2.52 | **4.39** | 3.09 | **5.17** | 3.20 | **<0.001** |
| **Baked beans (days/week)** | **1.13** | 1.42 | **0.93** | 1.23 | **1.04** | 1.34 | **0.97** | 1.19 | **1.07** | 1.36 | 0.407 |
| **Pulses/beans/lentils (days/week)** | **0.83** | 1.80 | **1.00** | 1.82 | **1.32** | 2.02 | **1.42** | 2.22 | **2.16** | 2.61 | **<0.001** |
| **Pasta & rice (days/week)** | **4.71** | 2.53 | **4.48** | 2.28 | **4.58** | 2.35 | **4.10** | 2.32 | **4.14** | 2.65 | **0.006** |
| **Quiche (days/week)** | **0.11** | 0.47 | **0.15** | 0.44 | **0.20** | 0.54 | **0.24** | 0.56 | **0.20** | 0.44 | **0.015** |
| **Pizza (days/week)** | **0.98** | 0.98 | **0.84** | 0.93 | **0.64** | 0.64 | **0.71** | 0.88 | **0.52** | 0.60 | **<0.001** |
| **Meat alternatives (days/week)** | **1.54** | 3.22 | **0.98** | 2.17 | **0.88** | 2.13 | **0.98** | 2.29 | **0.68** | 1.65 | **<0.001** |
| **Tofu (days/week)** | **0.16** | 0.73 | **0.12** | 0.56 | **0.09** | 0.35 | **0.15** | 0.60 | **0.21** | 0.75 | 0.165 |
| **Hummus (days/week)** | **0.36** | 1.02 | **0.45** | 1.17 | **0.53** | 1.05 | **0.64** | 1.31 | **0.97** | 1.55 | **<0.001** |
| **Biscuits, cakes & sweet pastries (days/week)** | **3.26** | 3.03 | **3.39** | 3.37 | **3.41** | 3.44 | **4.04** | 4.45 | **3.71** | 3.97 | 0.082 |
| **Confectionery (days/week)** | **3.88** | 3.24 | **3.51** | 2.97 | **3.62** | 3.05 | **3.41** | 3.07 | **3.07** | 2.91 | **0.029** |
| **Crisps/savoury snacks (days/week)** | **2.48** | 2.20 | **2.07** | 2.01 | **2.07** | 1.95 | **1.63** | 1.85 | **1.57** | 1.76 | **<0.001** |
| **Nuts (days/week)** | **0.37** | 0.78 | **0.65** | 1.09 | **0.93** | 1.37 | **1.48** | 1.89 | **2.84** | 2.48 | **<0.001** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Milk- & cream-based desserts (days/week)** | **0.52** | 0.80 | **0.70** | 0.97 | **0.82** | 1.13 | **0.99** | 1.32 | **1.09** | 1.51 | **<0.001** |
| **Low fat/low calorie yogurts (days/week)** | **1.02** | 2.14 | **1.55** | 2.57 | **1.94** | 2.63 | **2.75** | 3.22 | **4.09** | 3.85 | **<0.001** |
| **Other yogurts (days/week)** | **0.40** | 1.05 | **0.52** | 1.21 | **0.64** | 1.31 | **0.74** | 1.35 | **1.24** | 1.97 | **<0.001** |
| **Canned fruit (days/week)** | **0.22** | 0.62 | **0.21** | 0.60 | **0.34** | 0.95 | **0.49** | 1.45 | **0.54** | 1.48 | **<0.001** |
| **Fresh fruit (portions/ week)** | **3.28** | 3.80 | **4.51** | 4.99 | **6.50** | 6.14 | **8.95** | 7.30 | **12.22** | 9.75 | **<0.001** |
| **Eggs (number/day)** | **0.18** | 0.27 | **0.26** | 0.28 | **0.41** | 0.42 | **0.46** | 0.43 | **0.80** | .68 | **<0.001** |
| **Milk (glasses/day)** | **1.10** | 0.74 | **1.19** | 0.87 | **1.23** | 0.90 | **1.23** | 0.91 | **1.39** | 1.12 | **0.005** |
| **Cream (servings/week)** | **0.02** | 0.19 | **0.06** | 0.33 | **0.08** | 0.38 | **0.10** | 0.43 | **0.25** | .74 | **<0.001** |
| **Cheese (portions/week)** | **2.28** | 2.89 | **2.15** | 2.49 | **2.59** | 2.60 | **2.32** | 2.68 | **2.92** | 2.98 | **0.006** |
| **Butter (portions/week)** | **1.37** | 2.41 | **1.69** | 3.15 | **1.88** | 3.30 | **1.84** | 3.13 | **2.02** | 3.67 | 0.125 |
| **Low fat/olive/pufa spread (portions/week)** | **2.76** | 4.97 | **2.01** | 3.58 | **1.55** | 3.15 | **1.50** | 4.02 | **1.24** | 2.36 | **<0.001** |
| **Other spread (portions/week)** | **0.49** | 1.66 | **0.41** | 1.38 | **0.65** | 2.12 | **0.60** | 2.13 | **0.48** | 1.75 | 0.499 |
| **Food that is fried (days/week)** | **1.72** | 1.74 | **1.92** | 1.69 | **2.02** | 1.65 | **1.96** | 1.76 | **2.13** | 1.86 | 0.062 |
| **Tea & coffee (cups/day)** | **0.85** | 1.40 | **1.21** | 1.86 | **1.60** | 1.99 | **1.87** | 2.17 | **2.44** | 3.08 | **<0.001** |
| **Herbal/green tea (cups/day** | **0.15** | 0.44 | **0.37** | 0.79 | **0.68** | 1.26 | **0.83** | 1.25 | **1.52** | 1.85 | **<0.001** |
| **Added sugar in tea/coffee/cereal (tsp)** | **0.51** | 0.90 | **0.54** | 0.97 | **0.69** | 1.17 | **0.59** | 1.07 | **0.53** | 0.92 | 0.229 |
| **Fruit juice (days/week)** | **2.33** | 2.42 | **2.55** | 2.45 | **2.55** | 2.40 | **2.16** | 2.24 | **2.00** | 2.33 | **0.018** |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Fruit squash (not low calorie) (days/week)** | **2** | 3 | **1** | 2 | **2** | 2 | **1** | 2 | **1** | 2 | **<0.001** |
| **Fizzy drinks (not low calorie) (days/week)** | **2** | 2 | **2** | 2 | **1** | 2 | **1** | 2 | **1** | 1 | **<0.001** |
| **Low calorie squash & fizzy drinks (days/week)** | **1.35** | 2.25 | **1.82** | 2.41 | **1.30** | 2.22 | **1.29** | 2.10 | **1.29** | 2.13 | **0.015** |
| **Water (glasses/days)** | **2.75** | 2.20 | **2.87** | 2.16 | **3.66** | 2.42 | **3.72** | 2.30 | **4.72** | 2.41 | **<0.001** |
| **Alcoholic drinks (measures or glasses/day)** | **1.00** | 1.68 | **1.03** | 1.71 | **1.10** | 1.76 | **1.07** | 1.89 | **1.12** | 1.75 | 0.921 |
| **Soups (days/week)** | **1** | 1 | **1** | 2 | **2** | 1 | **2** | 2 | **2** | 2 | **<0.001** |
| **Ready-made sauces (days/week)** | **1.44** | 1.50 | **1.10** | 1.13 | **1.00** | 1.16 | **.97** | 1.18 | **1.03** | 1.21 | **<0.001** |
| **Mayo, salad cream & other dressings (days/week)** | **.94** | 1.42 | **1.34** | 1.80 | **1.70** | 2.01 | **1.77** | 2.20 | **2.40** | 2.83 | **<0.001** |

## Table O4: Component 4 – 'Convenience, red meat & alcohol' dietary pattern

| Food/food group | Quintile 1 | | Quintile 2 | | Quintile 3 | | Quintile 4 | | Quintile 5 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Percentile group of Component 4 – 'Convenience, red meat & alcohol' dietary pattern** | | | | | | | | | | |
| | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | ***p* value** |
| **White bread (slices/day)** | **0.41** | 0.77 | **0.49** | 0.68 | **0.58** | 0.78 | **0.63** | 0.89 | **0.95** | 1.07 | **<0.001** |
| **Non-white bread (slices/day)** | **0.88** | 1.14 | **0.92** | 1.09 | **0.89** | 1.12 | **1.00** | 1.21 | **1.03** | 1.22 | 0.436 |
| **Other bread (slices or pieces/day)** | **0.18** | 0.33 | **0.18** | 0.28 | **0.16** | 0.25 | **0.22** | 0.43 | **0.25** | 0.38 | **0.010** |
| **Crispbread (number/day)** | **0.32** | 0.73 | **0.20** | 0.44 | **0.18** | 0.43 | **0.14** | 0.34 | **0.09** | 0.29 | **<0.001** |
| **Jam/marmalade/honey (days/week)** | **1.22** | 1.97 | **0.89** | 1.42 | **0.75** | 1.34 | **0.67** | 1.25 | **0.63** | 1.31 | **<0.001** |
| **Oat/bran-based breakfast cereal (portions/week)** | **2.22** | 2.77 | **1.87** | 2.51 | **1.57** | 2.30 | **1.10** | 1.97 | **1.09** | 2.12 | **<0.001** |
| **Other breakfast cereal (portions/week)** | **3.13** | 3.32 | **3.18** | 3.12 | **2.99** | 3.12 | **2.79** | 2.86 | **3.08** | 3.10 | 0.588 |
| **Wheat bran (days/week)** | **0.89** | 1.90 | **0.57** | 1.49 | **0.31** | 1.12 | **0.26** | 0.98 | **0.36** | 1.12 | **<0.001** |
| **Red meat & offal (days/week)** | **1.91** | 2.29 | **2.35** | 2.22 | **2.78** | 2.33 | **2.82** | 2.45 | **4.53** | 3.82 | **<0.001** |
| **Chicken/poultry (days/week)** | **2.16** | 1.86 | **2.24** | 1.85 | **2.73** | 1.99 | **2.92** | 1.97 | **3.73** | 2.25 | **<0.001** |
| **Processed meat (days/week)** | **1.88** | 2.14 | **2.28** | 2.21 | **2.84** | 2.43 | **3.02** | 2.74 | **4.86** | 4.13 | **<0.001** |
| **White fish & shell fish (days/week)** | **1.14** | 1.24 | **1.09** | 1.11 | **1.28** | 1.46 | **1.18** | 1.25 | **1.41** | 1.62 | **0.040** |
| **Fatty fish & canned tuna (days/week)** | **1.21** | 1.63 | **1.32** | 1.54 | **1.38** | 1.64 | **1.24** | 1.58 | **1.79** | 2.44 | **0.001** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Potatoes (days/week)** | **2.37** | 2.14 | **2.62** | 2.44 | **2.80** | 2.54 | **2.62** | 2.18 | **3.06** | 2.87 | **0.015** |
| **Chips (days/week)** | **0.79** | 1.11 | **1.09** | 1.42 | **1.24** | 1.41 | **1.68** | 1.68 | **2.52** | 2.51 | **<0.001** |
| **Peas (days/week)** | **1.51** | 1.67 | **1.45** | 1.51 | **1.36** | 1.46 | **1.39** | 1.53 | **1.48** | 1.62 | 0.755 |
| **Other green veg/salad /tomatoes/onion (days/week)** | **6.42** | 3.64 | **6.54** | 3.59 | **7.10** | 3.66 | **7.23** | 3.89 | **7.59** | 3.82 | **<0.001** |
| **Root veg & sweetcorn (days/week)** | **4.27** | 3.30 | **3.40** | 2.81 | **3.68** | 2.87 | **3.53** | 2.94 | **3.95** | 3.10 | **0.004** |
| **Baked beans (days/week)** | **0.93** | 1.28 | **0.95** | 1.21 | **0.90** | 1.15 | **0.99** | 1.24 | **1.36** | 1.59 | **<0.001** |
| **Pulses/beans/lentils (days/week)** | **1.24** | 1.96 | **1.21** | 2.11 | **1.35** | 1.87 | **1.46** | 2.35 | **1.48** | 2.46 | 0.442 |
| **Pasta & rice (days/week)** | **2.93** | 1.94 | **3.83** | 2.04 | **4.51** | 2.20 | **4.73** | 2.09 | **6.01** | 2.72 | **<0.001** |
| **Quiche (days/week)** | **0.12** | 0.32 | **0.18** | 0.37 | **0.16** | 0.31 | **0.20** | 0.51 | **0.25** | 0.78 | **0.018** |
| **Pizza (days/week)** | **0.43** | 0.45 | **0.59** | 0.73 | **0.61** | 0.54 | **0.83** | 0.78 | **1.23** | 1.21 | **<0.001** |
| **Meat alternatives (days/week)** | **0.81** | 2.10 | **0.87** | 1.91 | **0.66** | 1.52 | **1.18** | 2.54 | **1.55** | 3.27 | **<0.001** |
| **Tofu (days/week)** | **0.10** | 0.45 | **0.09** | 0.40 | **0.09** | .36 | **0.18** | 0.69 | **0.26** | 0.96 | **0.002** |
| **Hummus (days/week)** | **0.55** | 1.26 | **0.50** | 1.07 | **0.66** | 1.29 | **0.66** | 1.41 | **0.58** | 1.21 | 0.414 |
| **Biscuits, cakes & sweet pastries (days/week)** | **4.59** | 5.15 | **3.36** | 3.12 | **3.28** | 3.28 | **3.19** | 3.05 | **3.38** | 3.28 | **<0.001** |
| **Confectionery (days/week)** | **3.45** | 3.07 | **3.15** | 2.82 | **3.54** | 3.19 | **3.45** | 2.98 | **3.89** | 3.19 | 0.071 |
| **Crisps/savoury snacks (days/week)** | **1.27** | 1.49 | **1.59** | 1.77 | **2.03** | 2.00 | **2.22** | 2.04 | **2.71** | 2.22 | **<0.001** |
| **Nuts (days/week)** | **1.37** | 2.13 | **1.35** | 1.98 | **1.21** | 1.71 | **1.11** | 1.69 | **1.22** | 1.73 | 0.419 |
| **Milk- & cream-based desserts (days/week)** | **1.14** | 1.52 | **0.63** | 0.88 | **0.76** | 1.03 | **0.75** | 1.15 | **0.83** | 1.20 | **<0.001** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Low fat/low calorie yogurts (days/week)** | **3.99** | 4.20 | **2.54** | 2.99 | **2.02** | 2.66 | **1.44** | 2.41 | **1.35** | 2.23 | **<0.001** |
| **Other yogurts (days/week)** | **1.11** | 1.89 | **0.63** | 1.29 | **0.63** | 1.31 | **0.54** | 1.15 | **0.63** | 1.38 | **<0.001** |
| **Canned fruit (days/week)** | **0.63** | 1.69 | **0.41** | 1.18 | **0.23** | 0.69 | **0.27** | 0.71 | **0.26** | 0.82 | **<0.001** |
| **Fresh fruit (portions/ week)** | **9.07** | 9.37 | **7.08** | 6.93 | **6.45** | 6.70 | **6.02** | 5.93 | **6.86** | 7.44 | **<0.001** |
| **Eggs (number/day)** | **0.23** | 0.29 | **0.33** | 0.34 | **0.41** | 0.38 | **0.43** | 0.45 | **0.72** | 0.72 | **<0.001** |
| **Milk (glasses/day)** | **1.10** | 0.75 | **1.23** | 0.91 | **1.20** | 0.85 | **1.20** | 0.88 | **1.41** | 1.15 | **0.001** |
| **Cream (servings/week)** | **0.02** | 0.19 | **0.02** | 0.12 | **0.06** | 0.23 | **.17** | 0.62 | **0.25** | 0.73 | **<0.001** |
| **Cheese (portions/week)** | **1.65** | 2.06 | **2.07** | 2.35 | **2.46** | 2.50 | **2.94** | 3.07 | **3.15** | 3.29 | **<0.001** |
| **Butter (portions/week)** | **0.57** | 1.47 | **1.16** | 2.13 | **1.62** | 2.62 | **2.15** | 3.42 | **3.29** | 4.54 | **<0.001** |
| **Low fat/olive/pufa spread (portions/week)** | **1.71** | 3.48 | **2.15** | 3.75 | **1.31** | 2.85 | **2.03** | 4.74 | **1.87** | 3.66 | 0.066 |
| **Other spread (portions/week)** | **0.80** | 2.44 | **0.50** | 1.58 | **0.42** | 1.30 | **0.47** | 1.66 | **0.44** | 1.96 | 0.081 |
| **Food that is fried (days/week)** | **0.87** | 1.16 | **1.37** | 1.33 | **1.82** | 1.47 | **2.34** | 1.55 | **3.35** | 1.97 | **<0.001** |
| **Tea & coffee (cups/day)** | **1.72** | 2.22 | **1.57** | 2.35 | **1.46** | 1.90 | **1.57** | 2.30 | **1.65** | 2.38 | 0.681 |
| **Herbal/green tea (cups/day** | **0.83** | 1.28 | **0.77** | 1.33 | **0.67** | 1.19 | **0.78** | 1.50 | **0.51** | 1.17 | **0.029** |
| **Added sugar in tea/coffee/cereal (tsp)** | **0.40** | 0.90 | **0.53** | 0.94 | **0.53** | 0.90 | **0.58** | 0.95 | **0.81** | 1.28 | **<0.001** |
| **Fruit juice (days/week)** | **2.25** | 2.53 | **2.21** | 2.43 | **2.24** | 2.31 | **2.33** | 2.24 | **2.57** | 2.36 | 0.364 |
| **Fruit squash (not low calorie) (days/week)** | **1** | 2 | **1** | 2 | **1** | 2 | **2** | 2 | **2** | 2 | **0.006** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fizzy drinks (not low calorie) (days/week)** | **1** | 1 | **1** | 1 | **1** | 2 | **2** | 2 | **2** | 2 | **<0.001** |
| **Low calorie squash & fizzy drinks (days/week)** | **1.55** | 2.43 | **1.40** | 2.21 | **1.29** | 2.14 | **1.48** | 2.27 | **1.32** | 2.10 | 0.597 |
| **Water (glasses/days)** | **3.47** | 2.36 | **3.28** | 2.34 | **3.57** | 2.40 | **3.50** | 2.40 | **3.90** | 2.49 | **0.038** |
| **Alcoholic drinks (measures or glasses/day)** | **0.42** | 0.74 | **0.74** | 1.26 | **0.85** | 1.35 | **1.30** | 1.83 | **2.02** | 2.58 | **<0.001** |
| **Soups (days/week)** | **2** | 2 | **2** | 1 | **2** | 2 | **2** | 2 | **2** | 2 | **0.046** |
| **Ready-made sauces (days/week)** | **0.54** | 0.75 | **0.75** | 0.81 | **1.01** | 1.08 | **1.31** | 1.35 | **1.93** | 1.57 | **<0.001** |
| **Mayo, salad cream & other dressings (days/week)** | **0.92** | 1.57 | **1.25** | 1.76 | **1.51** | 1.80 | **1.92** | 2.17 | **2.55** | 2.87 | **<0.001** |

**Appendix P: General Linear Model outputs - Independent associations between dietary pattern scores and non-nutrient variables.** *p* values < 0.05 are highlighted in bold. Common superscript letters indicate significant post-hoc differences between categories within each variable.

**Table P1: Model 1 (demographic variables only)**

| | **Vegetarian** | | **Snacking** | | **Health-conscious** | | **Convenience, red meat & alcohol** | |
|---|---|---|---|---|---|---|---|---|
| **Lack of fit** | *p* = 0.612 | | *p* = 0.330 | | *p* = 0.280 | | *p* = 0.012 | |
| **Demographic variable** | **Adjusted mean pattern score** | ***p* value** | **Adjusted mean pattern score** | ***p* value** | **Adjusted mean pattern score** | ***p* value** | **Adjusted mean pattern score** | ***p* value** |
| *Gender* | | | | | | | | |
| Male | **0.082** | **< 0.001** | -0.315 | 0.074 | 0.378 | 0.132 | **0.475** | **< 0.001** |
| Female | **0.304** | | -0.428 | | 0.469 | | **-0.117** | |
| *Age* | | | | | | | | |
| 17-21 | **0.133[a]** | | -0.326[a] | | **0.262[ab]** | | 0.228 | |
| 22-25 | **0.339[a]** | **0.020** | -0.429[a] | 0.424 | **0.434[a]** | **0.015** | 0.210 | 0.496 |
| 26-29 | **0.197** | | -0.361 | | **0.574[b]** | | 0.100 | |
| *Leisure-time physical activity* | | | | | | | | |
| Not very active | **0.184[a]** | | **-0.171[ab]** | | **0.029[ab]** | | **0.250[a]** | |
| Moderately active | **0.308 [a]** | **0.045** | **-0.356[ac]** | **< 0.001** | **0.383[ac]** | **< 0.001** | **0.097[a]** | **0.032** |
| Very active | **0.177** | | **-0.588[bc]** | | **0.857[bc]** | | **0.191** | |
| *BMI* | | | | | | | | |
| <18.5 | 0.292[ab] | | -0.281 | | 0.437 | | 0.139 | |
| 18.5-24.9 | 0.289[cd] | 0.221 | -0.436 | 0.391 | 0.407 | 0.055 | 0.073[ab] | 0.092 |
| 25-29.9 | 0.154[ac] | | -0.432 | | 0.574 | | 0.144[a] | |
| ≥30 | 0.156[bd] | | -0.339 | | 0275 | | 0.361[b] | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Smoking status* | | | | | | | | |
| Never | **0.086[a]** | | -0.333 | | 0.404 | | **-0.026[ab]** | |
| Ex | **0.421[a]** | **0.025** | -0.393 | 0.270 | 0.387 | 0.173 | **0.121[c]** | **< 0.001** |
| Social | **0.159** | | -0.254 | | 0.562 | | **0.311[ac]** | |
| Regular | **0.225** | | -0.507 | | 0.340 | | **0.310[b]** | |
| *Ethnicity* | | | | | | | | |
| White British | 0.214[a] | | -0.299 | | **0.263[a]** | | 0.206 | |
| White Irish | 0.364[abc] | 0.441 | -0.381 | 0.810 | **0.276[b]** | **0.004** | 0.254[a] | 0.585 |
| White Other | 0.182[b] | | -0.322 | | **0.545[ab]** | | 0.140[a] | |
| Mixed | 0.105 | | -0.352 | | **0.627** | | 0.297 | |
| Asian/Asian British | 0.281[c] | | -0.272 | | **0.309** | | 0.211 | |
| Black/Black British | 0.003 | | -0.274 | | **0.048** | | -0.041 | |
| Other | 0.103 | | -0.705 | | **0.882** | | 0.489 | |
| Rather not say | 0.531 | | -0.370 | | **0.437** | | -0.123 | |
| *Year of study* | | | | | | | | |
| $1^{st}$ year UG | 0.212 | | -0.240[a] | | **0.477[a]** | | 0.179 | |
| $2^{nd}$ year UG | 0.080[a] | 0.194 | -0.439 | 0.154 | **0.503** | **0.041** | 0.203 | 0.134 |
| $3^{rd}$ year UG | 0.090[b] | | -0.475 | | **0.614[a]** | | 0.139 | |
| $\geq 4^{th}$ year UG | 0.091 | | -0.431 | | **0.480** | | 0.410 | |
| Postgraduate | 0.177[ab] | | -0.374[a] | | **0.282** | | 0.309 | |
| Other | 0.687 | | -0.272 | | **0.182** | | -0.166 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Term-time accommodation* | | | | | | | | |
| Uni catered | 0.129 | | **-0.104**[a] | | 0.176 | | 0.374[a] | |
| Uni self-catered | 0.245[a] | 0.963 | **-0.517**[b] | < **0.001** | 0.236[ab] | 0.068 | 0.219[b] | 0.053 |
| Private with friends | 0.242[b] | | **-0.397**[a] | | 0.341 | | 0.201[c] | |
| Private on own | 0.324[c] | | **-0.265** | | 0.450[a] | | -0.275[abcd] | |
| Parents/relatives | 0.173[abcd] | | **-0.076**[bc] | | 0.524[b] | | 0.175[d] | |
| Partner | 0.269[d] | | **-0.306**[c] | | 0.456 | | 0.187 | |
| Parents/partner + children | 0.138 | | **-0.247** | | 0.290 | | 0.074 | |
| Children only | 0.218 | | **-0.555** | | 0.344 | | 0.254 | |
| Other | 0.268 | | **-0.879** | | 0.992 | | 0.402 | |
| *University* | | | | | | | | |
| Sheffield | **0.146**[abc] | | **-0.370**[a] | | **0.098**[abcd] | | 0.166 | |
| Ulster | **-0.376**[adef] | < **0.001** | **-0.214**[ab] | **0.003** | **0.318**[aef] | < **0.001** | 0.299[ab] | 0.270 |
| KCL | **0.398**[bd] | | **-0.569**[b] | | **0.541**[be] | | 0.237 | |
| Southampton | **0.227**[e] | | **-0.264** | | **0.584**[cf] | | 0.221[a] | |
| St Andrews | **0.719**[cf] | | **-0.442** | | **0.576**[d] | | -0.027[b] | |
| *Faculty* | | | | | | | | |
| Arts | 0.334[ab] | | -0.308 | | 0.456 | | 0.275[a] | |
| Social science | 0.180[acd] | 0.234 | -0.357 | 0.527 | 0.464[a] | 0.766 | 0.191 | 0.277 |
| Engineering | 0.123[bcef] | | -0.416 | | 0.400 | | 0.153[b] | |
| Science | 0.216[e] | | -0.453 | | 0.357[ab] | | 0.177 | |
| Medicine & health | 0.261[df] | | -0.324 | | 0.440[b] | | 0.099[ab] | |
| *Full-time vs. part-time student status* | | | | | | | | |
| Full-time | 0.183 | 0.582 | **-0.109** | **0.001** | 0.381 | 0.560 | 0.246 | 0.378 |
| Part-time | 0.263 | | **-0.634** | | 0.466 | | 0.113 | |

**Table P2: Model 2 (demographic & cooking/eating-related variables)**

| | **Vegetarian** | | **Snacking** | | **Health-conscious** | | **Convenience, red meat & alcohol** | |
|---|---|---|---|---|---|---|---|---|
| **Lack of fit** | $p = 0.001$ | | $p = 0.748$ | | $p = 0.426$ | | $p = 0.017$ | |
| **Demographic variable (n)** | **Adjusted mean pattern score** | ***p* value** | **Adjusted mean pattern score** | ***p* value** | **Adjusted mean pattern score** | ***p* value** | **Adjusted mean pattern score** | ***p* value** |
| *Gender* | | | | | | | | |
| Male | **1.119** | **< 0.001** | *Not entered into model* | | *Not entered into model* | *N/A* | **0.645** | **< 0.001** |
| Female | **1.304** | | | | | | **0.129** | |
| *Age* | | | | | | | | |
| 17-21 | **1.140**[a] | **0.020** | *Not entered into model* | *N/A* | **-0.047**[ab] | **0.049** | *Not entered into model* | *N/A* |
| 22-25 | **1.301**[a] | | | | **0.113**[a] | | | |
| 26-29 | **1.314** | | | | **0.161**[b] | | | |
| *Leisure-time physical activity* | | | | | | | | |
| Not very active | 1.258[a] | 0.183 | **0.270**[ab] | **0.012** | **-0.187**[ab] | **< 0.001** | 0.436[a] | 0.117 |
| Moderately active | 1.297[a] | | **0.208**[ac] | | **0.064**[ac] | | 0.327[a] | |
| Very active | 1.199 | | **0.034**[bc] | | **0.350**[bc] | | 0.399 | |
| *BMI* | | | | | | | | |
| <18.5 | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* | 0.110 | 0.215 | *Not entered into model* | *N/A* |
| 18.5-24.9 | | | | | 0.057 | | | |
| 25-29.9 | | | | | 0.173 | | | |
| ≥30 | | | | | -0.037 | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Smoking status* | | | | | | | | |
| Never | 1.190[a] | 0.292 | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* | **0.224[ab]** | **< 0.001** |
| Ex | 1.321[a] | | | | | | **0.272[c]** | |
| Social | 1.264 | | | | | | **0.520[ac]** | |
| Regular | 1.230 | | | | | | **0.532[b]** | |
| *Ethnicity* | | | | | | | | |
| White British | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* | **-0.107[ab]** | **0.016** | *Not entered into model* | *N/A* |
| White Irish | | | | | **-0.080[c]** | | | |
| White Other | | | | | **0.123[ac]** | | | |
| Mixed | | | | | **0.243** | | | |
| Asian/Asian British | | | | | **0.033** | | | |
| Black/Black British | | | | | **-0.081** | | | |
| Other | | | | | **0.370[b]** | | | |
| Rather not say | | | | | **0.106** | | | |
| *Year of study* | | | | | | | | |
| 1st year UG | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* | **0.048[a]** | **0.004** | *Not entered into model* | *N/A* |
| 2nd year UG | | | | | **0.069** | | | |
| 3rd year UG | | | | | **0.200[a]** | | | |
| ≥ 4th year UG | | | | | **-0.008** | | | |
| Postgraduate | | | | | **-0.158** | | | |
| Other | | | | | **0.304** | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Term-time accommodation* | | | | | | | | |
| Uni catered | *Not entered into model* | *N/A* | **0.427[ab]** | **0.033** | *Not entered into model* | *N/A* | **0.595** | **0.026** |
| Uni self-catered | | | **0.159[ac]** | | | | **0.495** | |
| Private with friends | | | **0.149[bd]** | | | | **0.469** | |
| Private on own | | | **0.218** | | | | **0.030[a]** | |
| Parents/relatives | | | **0.390[cde]** | | | | **0.431[a]** | |
| Partner | | | **0.248[e]** | | | | **0.378** | |
| Parents/partner + children | | | **0.378** | | | | **0.293** | |
| Children only | | | **-0.178** | | | | **0.430** | |
| Other | | | **-0.256** | | | | **0.364** | |
| *University* | | | | | | | | |
| Sheffield | **1.218[abc]** | **< 0.001** | **0.136[a]** | **0.029** | **-0.270[abcd]** | **< 0.001** | *Not entered into model* | *N/A* |
| Ulster | **0.894[adef]** | | **0.242[abc]** | | **0.069[aef]** | | | |
| KCL | **1.424[bd]** | | **0.036[b]** | | **0.196[be]** | | | |
| Southampton | **1.298[eg]** | | **0.337** | | **0.187[cf]** | | | |
| St Andrews | **1.424[cfg]** | | **0.103[c]** | | **0.197[d]** | | | |
| *Full-time vs. part-time student status* | | | | | | | | |
| Full-time | *Not entered into model* | *N/A* | **0.442** | **< 0.001** | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* |
| Part-time | | | **-0.101** | | | | | |
| **Cooking/eating-related variables** | | | | | | | | |
| *Cooking ability* | | | | | | | | |
| Wide range | **1.350[ab]** | **0.036** | 0.024[abc] | 0.190 | **0.257[ab]** | **0.002** | 0.261 | 0.297 |
| Limited range | **1.239[ac]** | | 0.015[ade] | | **0.065[ac]** | | 0.301 | |
| Pre-prepared only | **1.125[bc]** | | 0.151[bd] | | **-0.101[bc]** | | 0.527 | |
| Unable to cook at all | **1.292** | | 0.492[ce] | | **0.082** | | 0.459 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Animal food consumption* | | | | | | | | |
| Regular meat eater | **-0.171**$^{abcd}$ | **< 0.001** | 0.187$^{a}$ | 0.080 | **0.445**$^{a}$ | **< 0.001** | **0.500**$^{ab}$ | **< 0.001** |
| Flexitarian | **0.291**$^{aefg}$ | | 0.199$^{b}$ | | **0.488**$^{b}$ | | **0.185**$^{ac}$ | |
| Lacto-ovo | **1.635**$^{beh}$ | | 0.314$^{c}$ | | **0.101** | | **0.534**$^{c}$ | |
| Ovo | **1.707**$^{chi}$ | | 0.319 | | **-0.459**$^{ab}$ | | **0.201**$^{b}$ | |
| Vegan | **2.795**$^{dghi}$ | | -0.238$^{abc}$ | | **-0.196** | | **0.517** | |
| *Meals made from scratch* | | | | | | | | |
| Every day | 1.322$^{abc}$ | 0.136 | **-0.060**$^{abc}$ | **0.001** | **0.339**$^{abc}$ | **< 0.001** | **0.622** | **< 0.001** |
| Most days | 1.272$^{ad}$ | | **0.146**$^{ade}$ | | **0.198**$^{ade}$ | | **0.495** | |
| Occasionally | 1.172$^{bd}$ | | **0.246**$^{bd}$ | | **-0.034**$^{bd}$ | | **0.345** | |
| Rarely/never | 1.240$^{c}$ | | **0.350**$^{ce}$ | | **-0.200**$^{ce}$ | | **0.088** | |
| *Meals made from pre-prepared foods* | | | | | | | | |
| Every day | **1.302**$^{a}$ | **0.047** | **0.338**$^{a}$ | **< 0.001** | **0.178**$^{ab}$ | **0.002** | **0.591**$^{abc}$ | **0.040** |
| Most days | **1.151**$^{bc}$ | | **0.304**$^{bc}$ | | **0.046**$^{acd}$ | | **0.336**$^{a}$ | |
| Occasionally | **1.231**$^{bd}$ | | **0.143**$^{bd}$ | | **-0.069**$^{bce}$ | | **0.265**$^{b}$ | |
| Rarely/never | **1.321**$^{acd}$ | | **-0.102**$^{acd}$ | | **0.148**$^{de}$ | | **0.356**$^{c}$ | |
| *Ready-meals/take-aways* | | | | | | | | |
| Every day | 1.511 | | **0.584**$^{ab}$ | | **0.273** | | **0.552**$^{a}$ | |
| Most days | 1.222$^{a}$ | 0.257 | **0.290**$^{cd}$ | **< 0.001** | **0.025**$^{a}$ | **0.042** | **0.570**$^{bc}$ | **< 0.001** |
| Occasionally | 1.130$^{b}$ | | **-0.036**$^{bd}$ | | **-0.068**$^{b}$ | | **0.302**$^{cd}$ | |
| Rarely/never | 1.143$^{ab}$ | | **-0.155**$^{acd}$ | | **0.073**$^{ab}$ | | **0.125**$^{abd}$ | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Meals in university cafeteria* | | | | | | | | |
| Every day | 1.156 | 0.062 | 0.153[ab] | 0.547 | 0.141 | 0.922 | 0.375 | 0.336 |
| Most days | 1.253[a] | | 0.245[cd] | | 0.047 | | 0.485[ab] | |
| Occasionally | 1.311[b] | | 0.170[ace] | | 0.069 | | 0.372[a] | |
| Rarely/never | 1.286[ab] | | 0.115[bde] | | 0.046 | | 0.317[b] | |
| *Skipped breakfast* | | | | | | | | |
| Every day | 1.358 | 0.062 | 0.221[ab] | 0.101 | **-0.179[ab]** | **< 0.001** | **0.514[ab]** | **< 0.001** |
| Most days | 1.276 | | 0.257[cd] | | **0.066[c]** | | **0.609[cd]** | |
| Occasionally | 1.193 | | 0.114[ace] | | **0.126[ad]** | | **0.307[ace]** | |
| Rarely/never | 1.179 | | 0.091[bde] | | **0.290[bcd]** | | **0.119[bde]** | |
| *Skipped lunch/dinner* | | | | | | | | |
| Every day | 1.245 | 0.991 | 0.089 | 0.131 | 0.284 | 0.404 | **0.001** | **0.012** |
| Most days | 1.252 | | 0.236[ab] | | 0.066[a] | | **0.443** | |
| Occasionally | 1.261 | | 0.116[a] | | -0.031[b] | | **0.503** | |
| Rarely/never | 1.248 | | 0.241[b] | | -0.016[ab] | | **0.602** | |
| *Amount spent on food* | | | | | | | | |
| *<£20* | 1.278 | 0.268 | 0.101 | 0.534 | **-0.171[abcd]** | **< 0.001** | **0.162[abcd]** | **< 0.001** |
| *£20-29* | 1.269 | | 0.146 | | **-0.005[aef]** | | **0.344[aef]** | |
| *£30-39* | 1.251 | | 0.150 | | **0.138[beg]** | | **0.385[b]** | |
| *£40-49* | 1.333 | | 0.264 | | **0.096[eh]** | | **0.481[ce]** | |
| ≥£50 | 1.127 | | 0.192 | | **0.320[dfgh]** | | **0.564[df]** | |

**Table P3: Model 3 (demographic variables & satisfaction with eating and dieting behaviour)**

| | Vegetarian | | Snacking | | Health-conscious | | Convenience, red meat & alcohol | |
|---|---|---|---|---|---|---|---|---|
| **Lack of fit** | *p* < 0.001 | | *p* = 0.073 | | *p* = 0.185 | | *p* < 0.001 | |
| **Demographic variable (n)** | **Adjusted mean pattern score** | ***p* value** | **Adjusted mean pattern score** | ***p* value** | **Adjusted mean pattern score** | ***p* value** | **Adjusted mean pattern score** | ***p* value** |
| *Gender* | | | | | | | | |
| Male | **0.115** | **< 0.001** | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* | **0.663** | **< 0.001** |
| Female | **0.377** | | | | | | **0.101** | |
| *Age* | | | | | | | | |
| 17-21 | **0.165[a]** | **0.005** | *Not entered into model* | *N/A* | **0.268[ab]** | **0.003** | *Not entered into model* | *N/A* |
| 22-25 | **0.347[a]** | | | | **0.456[a]** | | | |
| 26-29 | **0.227** | | | | **0.603[b]** | | | |
| *Leisure-time physical activity* | | | | | | | | |
| Not very active | **0.180[a]** | **0.014** | **-0.232[ab]** | **0.001** | **0.129[ab]** | **< 0.001** | **0.490[a]** | **0.004** |
| Moderately active | **0.336[a]** | | **-0.345[ac]** | | **0.398[ac]** | | **0.298[a]** | |
| Very active | **0.222** | | **-0.562[bc]** | | **0.800[bc]** | | **0.359** | |
| *BMI* | | | | | | | | |
| <18.5 | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* | 0.472 | 0.436 | *Not entered into model* | *N/A* |
| 18.5-24.9 | | | | | 0.429 | | | |
| 25-29.9 | | | | | 0.523 | | | |
| ≥30 | | | | | 0.345 | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Smoking status* | | | | | | | | |
| Never | **0.104[a]** | **0.018** | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* | **0.144[ab]** | **< 0.001** |
| Ex | **0.407[a]** | | | | | | **0.290** | |
| Social | **0.221** | | | | | | **0.521[a]** | |
| Regular | **0.253** | | | | | | **0.573[b]** | |
| *Ethnicity* | | | | | | | | |
| White British | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* | **0.263[a]** | **0.004** | *Not entered into model* | *N/A* |
| White Irish | | | | | **0.301[b]** | | | |
| White Other | | | | | **0.518[ab]** | | | |
| Mixed | | | | | **0.664** | | | |
| Asian/Asian British | | | | | **0.299** | | | |
| Black/Black British | | | | | **0.162** | | | |
| Other | | | | | **0.828** | | | |
| Rather not say | | | | | **0.505** | | | |
| *Year of study* | | | | | | | | |
| 1st year UG | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* | **0.436[a]** | **0.014** | *Not entered into model* | *N/A* |
| 2nd year UG | | | | | **0.509** | | | |
| 3rd year UG | | | | | **0.624[a]** | | | |
| ≥ 4th year UG | | | | | **0.469** | | | |
| Postgraduate | | | | | **0.292** | | | |
| Other | | | | | **0.325** | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Term-time accommodation* | | | | | | | | |
| Uni catered | *Not entered into model* | *N/A* | **-0.103[a]** | **0.003** | *Not entered into model* | *N/A* | 0.538 | 0.068 |
| Uni self-catered | | | **-0.450[b]** | | | | 0.359 | |
| Private with friends | | | **-0.460[ac]** | | | | 0.364 | |
| Private on own | | | **-0.274** | | | | -0.036 | |
| Parents/relatives | | | **-0.149[bc]** | | | | 0.417 | |
| Partner | | | **-0.367** | | | | 0.360 | |
| Parents/partner + children | | | **-0.247** | | | | 0.304 | |
| Children only | | | **-0.588** | | | | 0.569 | |
| Other | | | **-0.776** | | | | 0.564 | |
| *University* | | | | | | | | |
| Sheffield | **0.131[abc]** | **< 0.001** | **-0.422[a]** | **< 0.001** | **0.093[abcd]** | **< 0.001** | *Not entered into model* | *N/A* |
| Ulster | **-0.359[adef]** | | **-0.207[abc]** | | **0.401[aef]** | | | |
| KCL | **0.489[bd]** | | **-0.520[b]** | | **0.577[be]** | | | |
| Southampton | **0.210[eg]** | | **-0.243** | | **0.590[cf]** | | | |
| St Andrews | **0.759[cfg]** | | **-0.505[c]** | | **0.552[d]** | | | |
| *Full-time vs. part-time student status* | | | | | | | | |
| Full-time | *Not entered into model* | *N/A* | **-0.125** | **< 0.001** | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* |
| Part-time | | | **-0.634** | | | | | |
| **Satisfaction with eating and dieting behaviour** | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *How feels about body* | | | | | | | | |
| Far too thin | 0.471 | 0.312 | **-0.344** | **0.040** | 0.484 | 0.214 | 0.468 | 0.487 |
| Little too thin | 0.159 | | **-0.180[a]** | | 0.436 | | 0.293 | |
| Just right | 0.125 | | **-0.393** | | 0.449 | | 0.345 | |
| Little overweight | 0.217 | | **-0.489[a]** | | 0.543 | | 0.305 | |
| Very overweight | 0.258 | | **-0.491** | | 0.301 | | 0.499 | |
| *Dieting status* | | | | | | | | |
| Yes | 0.239 | 0.810 | **-0.524** | **< 0.001** | **0.573** | **< 0.001** | **0.318** | **0.049** |
| No | 0.534 | | **-0.235** | | **0.312** | | **0.446** | |
| *Bulking-up status* | | | | | | | | |
| Yes | **0.161** | **0.013** | -0.423 | 0.202 | 0.483 | 0.221 | **0.456** | **0.036** |
| No | **0.332** | | -0.336 | | 0.402 | | **0.308** | |
| *Contentment with diet* | | | | | | | | |
| 0% content | 0.242[a] | < 0.001 | **-0.260[a]** | **< 0.001** | **0.409** | **< 0.001** | 0.398 | 0.795 |
| 20% content | 0.173[b] | | **-0.171[bc]** | | **0.308** | | 0.290 | |
| 40% content | 0.076[c] | | **-0.304[d]** | | **0.270** | | 0.367 | |
| 60% content | 0.122[d] | | **-0.388** | | **0.337** | | 0.384 | |
| 80% content | 0.267[e] | | **-0.434[b]** | | **0.560** | | 0.382 | |
| 100% content | 0.597[abcde] | | **-0.720[acd]** | | **0.772** | | 0.471 | |

**Table P4: Model 4 (demographic variables & supplement use)**

| | Vegetarian | | Snacking | | Health-conscious | | Convenience, red meat & alcohol | |
|---|---|---|---|---|---|---|---|---|
| **Lack of fit** | $p < 0.001$ | | $p = 0.877$ | | $p < 0.001$ | | $p < 0.001$ | |
| **Demographic variable (n)** | **Adjusted mean pattern score** | ***p* value** | **Adjusted mean pattern score** | ***p* value** | **Adjusted mean pattern score** | ***p* value** | **Adjusted mean pattern score** | ***p* value** |
| *Gender* | | | | | | | | |
| Male | **0.205** | **< 0.001** | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* | **1.013** | **< 0.001** |
| Female | **0.467** | | | | | | **0.407** | |
| *Age* | | | | | | | | |
| 17-21 | **0.246[a]** | **0.005** | *Not entered into model* | *N/A* | **0.792[ab]** | **0.004** | *Not entered into model* | *N/A* |
| 22-25 | **0.429[a]** | | | | **0.978[a]** | | | |
| 26-29 | **0.332** | | | | **1.118[b]** | | | |
| *Leisure-time physical activity* | | | | | | | | |
| Not very active | **0.286[a]** | **0.015** | **-0.415[ab]** | **< 0.001** | **0.615[ab]** | **< 0.001** | **0.827[a]** | **0.002** |
| Moderately active | **0.430[a]** | | **-0.579[ac]** | | **0.935[ac]** | | **0.629[a]** | |
| Very active | **0.291** | | **-0.824[bc]** | | **1.338[bc]** | | **0.674** | |
| *BMI* | | | | | | | | |
| <18.5 | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* | 0.966 | 0.220 | *Not entered into model* | *N/A* |
| 18.5-24.9 | | | | | 0.973 | | | |
| 25-29.9 | | | | | 1.078 | | | |
| ≥30 | | | | | 0.834 | | | |
| *Smoking status* | | | | | | | | |
| Never | **0.202[a]** | **0.031** | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* | **0.486[ab]** | **< 0.001** |
| Ex | **0.492[a]** | | | | | | **0.592** | |
| Social | **0.304** | | | | | | **0.832[a]** | |
| Regular | **0.345** | | | | | | **0.929[b]** | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Ethnicity* | | | | | | | | |
| White British | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* | **0.797[a]** | **0.007** | *Not entered into model* | *N/A* |
| White Irish | | | | | **0.817[b]** | | | |
| White Other | | | | | **1.054[ab]** | | | |
| Mixed | | | | | **1.189** | | | |
| Asian/Asian British | | | | | **0.863** | | | |
| Black/Black British | | | | | **0.651** | | | |
| Other | | | | | **1.287** | | | |
| Rather not say | | | | | **1.043** | | | |
| *Year of study* | | | | | | | | |
| 1st year UG | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* | **0.953 [a]** | **0.013** | *Not entered into model* | *N/A* |
| 2nd year UG | | | | | **1.045** | | | |
| 3rd year UG | | | | | **1.150 [a]** | | | |
| ≥ 4th year UG | | | | | **1.031** | | | |
| Postgraduate | | | | | **0.839** | | | |
| Other | | | | | **0.758** | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Term-time accommodation* | | | | | | | | |
| Uni catered | *Not entered into model* | *N/A* | **-0.252[a]** | **0.001** | *Not entered into model* | *N/A* | 0.864 | 0.070 |
| Uni self-catered | | | **-0.651[b]** | | | | 0.708 | |
| Private with friends | | | **-0.676[ac]** | | | | 0.720 | |
| Private on own | | | **-0.559** | | | | 0.293 | |
| Parents/relatives | | | **-0.368[bc]** | | | | 0.723 | |
| Partner | | | **-0.603** | | | | 0.707 | |
| Parents/partner + children | | | **-0.439** | | | | 0.671 | |
| Children only | | | **-0.939** | | | | 0.937 | |
| Other | | | **-0.969** | | | | 0.766 | |
| *University* | | | | | | | | |
| Sheffield | **0.296[abc]** | **< 0.001** | **-0.661 [a]** | **< 0.001** | **0.659[abcd]** | **< 0.001** | *Not entered into model* | *N/A* |
| Ulster | **-0.280[adef]** | | **-0.409[abc]** | | **0.899[aef]** | | | |
| KCL | **0.550[bd]** | | **-0.720 [b]** | | **1.051[be]** | | | |
| Southampton | **0.297[eg]** | | **-0.502** | | **1.161[cf]** | | | |
| St Andrews | **0.816[cfg]** | | **-0.739[c]** | | **1.044[d]** | | | |
| *Full-time vs. part-time student status* | *Not entered into model* | *N/A* | | | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* |
| Full-time | | | **-0.324** | **< 0.001** | | | | |
| Part-time | | | **-0.888** | | | | | |
| **Dietary supplements** | | | | | | | | |
| *Multivitamins* | | | | | | | | |
| Yes | **0.436** | **0.008** | -0.641 | 0.353 | 0.957 | 0.886 | 0.707 | 0.942 |
| No | **0.235** | | -0.571 | | 0.968 | | 0.713 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Mineral supplements* | | | | | | | | |
| Yes | 0.431 | 0.130 | -0.508 | 0.159 | 1.009 | 0.486 | 0.827 | 0.082 |
| No | 0.241 | | -0.704 | | 0.916 | | 0.593 | |
| *Vitamin Supplements* | | | | | | | | |
| Yes | 0.424 | 0.080 | -0.712 | 0.046 | 1.041 | 0.128 | **0.835** | **0.013** |
| No | 0.247 | | -0.501 | | 0.885 | | **0.585** | |
| *Protein shakes* | | | | | | | | |
| Yes | 0.275 | 0.318 | -0.616 | 0.870 | **1.127** | **0.007** | 0.821 | 0.067 |
| No | 0.397 | | -0.596 | | **0.798** | | 0.599 | |
| *Other fitness supplements* | | | | | | | | |
| Yes | 0.354 | 0.867 | -0.807 | 0.081 | **1.243** | **0.011** | 0.917 | 0.063 |
| No | 0.317 | | -0.406 | | **0.682** | | 0.503 | |
| *Other dietary supplements* | | | | | | | | |
| Yes | 0.295 | 0.599 | -0.658 | 0.523 | 1.092 | 0.103 | 0.603 | 0.173 |
| No | 0.376 | | -0.554 | | 0.833 | | 0.817 | |

**Table P5: Model 5 (demographic variables & factors driving food choices)**

| | Vegetarian | | Snacking | | Health-conscious | | Convenience, red meat & alcohol | |
|---|---|---|---|---|---|---|---|---|
| **Lack of fit** | *p* = 0.328 | | *p* = 0.440 | | *p* = 0.003 | | *p* = 0.043 | |
| **Demographic variable (n)** | **Adjusted mean pattern score** | ***p* value** | **Adjusted mean pattern score** | ***p* value** | **Adjusted mean pattern score** | ***p* value** | **Adjusted mean pattern score** | ***p* value** |
| *Gender* | | | | | | | | |
| Male | **0.114** | **< 0.001** | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* | **-0.321** | **< 0.001** |
| Female | **0.379** | | | | | | **-0.916** | |
| *Age* | | | | | | | | |
| 17-21 | **0.172**[a] | **0.020** | *Not entered into model* | *N/A* | **-0.797**[ab] | **0.010** | *Not entered into model* | *N/A* |
| 22-25 | **0.325**[a] | | | | **-0.627**[a] | | | |
| 26-29 | **0.241** | | | | **-0.502**[b] | | | |
| *Leisure-time physical activity* | | | | | | | | |
| Not very active | **0.216**[a] | **0.004** | **-0.909**[ab] | **0.002** | **-0.970**[ab] | **< 0.001** | **-0.571**[a] | **0.040** |
| Moderately active | **0.356**[a] | | **-0.996**[ac] | | **-0.690**[ac] | | **-0.701**[a] | |
| Very active | **0.166** | | **-1.188**[bc] | | **-0.267**[bc] | | **-0.582** | |
| *BMI* | | | | | | | | |
| <18.5 | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* | -0.606 | 0.073 | *Not entered into model* | *N/A* |
| 18.5-24.9 | | | | | -0.680 | | | |
| 25-29.9 | | | | | -0.519 | | | |
| ≥30 | | | | | -0.764 | | | |
| *Smoking status* | | | | | | | | |
| Never | **0.091**[a] | **0.004** | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* | **-0.856**[ab] | **< 0.001** |
| Ex | **0.449**[a] | | | | | | **-0.709**[c] | |
| Social | **0.179** | | | | | | **-0.477**[ac] | |
| Regular | **0.265** | | | | | | **-0.431**[b] | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Ethnicity* | | | | | | | | |
| White British | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* | **-0.804[ab]** | **0.018** | *Not entered into model* | *N/A* |
| White Irish | | | | | **-0.783[c]** | | | |
| White Other | | | | | **-0.583[ac]** | | | |
| Mixed | | | | | **-0.416** | | | |
| Asian/Asian British | | | | | **-0.776** | | | |
| Black/Black British | | | | | **-0.871** | | | |
| Other | | | | | **-0.345[b]** | | | |
| Rather not say | | | | | **-0.560** | | | |
| *Year of study* | | | | | | | | |
| 1st year UG | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* | **-0.668[a]** | **0.003** | *Not entered into model* | *N/A* |
| 2nd year UG | | | | | **-0.575** | | | |
| 3rd year UG | | | | | **-0.449[a]** | | | |
| ≥ 4th year UG | | | | | **-0.600** | | | |
| Postgraduate | | | | | **-0.798** | | | |
| Other | | | | | **-0.764** | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Term-time accommodation* | | | | | | | | |
| Uni catered | *Not entered into model* | *N/A* | **-0.750**[a] | **0.006** | *Not entered into model* | *N/A* | -0.534 | 0.187 |
| Uni self-catered | | | **-1.070**[b] | | | | -0.633 | |
| Private with friends | | | **-1.091**[ac] | | | | -0.633 | |
| Private on own | | | **-0.918**[bcd] | | | | -1.000 | |
| Parents/relatives | | | **-0.871**[d] | | | | -0.594 | |
| Partner | | | **-1.000** | | | | -0.641 | |
| Parents/partner + children | | | **-0.837** | | | | -0.665 | |
| Children only | | | **-1.330** | | | | -0.462 | |
| Other | | | **-1.467** | | | | -0.403 | |
| *University* | | | | | | | | |
| Sheffield | **0.169**[abc] | **< 0.001** | **-1.056**[a] | **0.006** | **-0.976**[abcd] | **< 0.001** | *Not entered into model* | *N/A* |
| Ulster | **-0.344**[adef] | | **-0.894**[abc] | | **-0.664**[aef] | | | |
| KCL | **0.477**[bd] | | **-1.156**[b] | | **-0.523**[be] | | | |
| Southampton | **0.195**[eg] | | **-0.916** | | **-0.464**[cf] | | | |
| St Andrews | **0.733**[cfg] | | **-1.133**[c] | | **-0.584**[d] | | | |
| *Full-time vs. part-time student status* | *Not entered into model* | *N/A* | | | *Not entered into model* | *N/A* | *Not entered into model* | *N/A* |
| Full-time | | | **-0.752** | **< 0.001** | | | | |
| Part-time | | | **-1.310** | | | | | |
| **Drivers of food choice** | | | | | | | | |
| *Cost* | | | | | | | | |
| Yes | **0.104** | **< 0.001** | -1.048 | 0.539 | **-0.766** | **< 0.001** | **-0.672** | **0.044** |
| No | **0.388** | | -1.014 | | **-0.519** | | **-0.564** | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Taste/preferences* | | | | | | | | |
| Yes | **0.123** | < **0.001** | -1.035 | 0.906 | **-0.742** | **0.001** | -0.639 | 0.511 |
| No | **0.369** | | -1.027 | | **-0.543** | | -0.597 | |
| *Health/nutritional value* | | | | | | | | |
| Yes | 0.240 | 0.852 | **-1.288** | < **0.001** | **-0.555** | **0.006** | **-0.757** | < **0.001** |
| No | 0.252 | | **-0.774** | | **-0.730** | | **-0.480** | |
| *Dieting value/calorie content* | | | | | | | | |
| Yes | **0.122** | **0.002** | **-1.223** | < **0.001** | -0.564 | 0.059 | **-0.818** | < **0.001** |
| No | **0.370** | | **-0.839** | | -0.721 | | **-0.419** | |
| *Vegetarianism/ veganism* | | | | | | | | |
| Yes | **0.916** | < **0.001** | -1.206 | 0.090 | **-1.005** | < **0.001** | -0.755 | 0.180 |
| No | **-0.424** | | -0.856 | | **-0.279** | | -0.481 | |
| *Quality/freshness* | | | | | | | | |
| Yes | **0.114** | **0.008** | -1.121 | 0.089 | -0.652 | 0.849 | -0.703 | 0.105 |
| No | **0.378** | | -0.941 | | -0.632 | | -0.533 | |
| *Convenience/ease of cooking* | | | | | | | | |
| Yes | **0.130** | **0.001** | -1.037 | 0.877 | **-0.788** | < **0.001** | -0.653 | 0.349 |
| No | **0.362** | | -1.025 | | **-0.496** | | -0.584 | |
| *Time available* | | | | | | | | |
| Yes | 0.151 | 0.202 | -1.023 | 0.914 | **-0.942** | < **0.001** | -0.740 | 0.112 |
| No | 0.341 | | -1.040 | | **-0.342** | | -0.497 | |
| *Ethical reasons* | | | | | | | | |
| Yes | **0.499** | **0.014** | -0.914 | 0.278 | -0.585 | 0.587 | -0.738 | 0.264 |
| No | **-0.007** | | -1.148 | | -0.700 | | -0.498 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Shelf-life of food* | | | | | | | | |
| Yes | 0.226 | 0.840 | -1.092 | 0.570 | -0.600 | 0.681 | -0.811 | 0.067 |
| No | 0.266 | | -0.971 | | -0.684 | | -0.426 | |
| *Hunger/cravings* | | | | | | | | |
| Yes | 0.133 | 0.170 | -1.189 | 0.068 | -0.756 | 0.174 | -0.650 | 0.712 |
| No | 0.359 | | -0.873 | | -0.528 | | -0.586 | |
| *Variety* | | | | | | | | |
| Yes | 0.074 | 0.068 | -1.105 | 0.457 | -0.812 | 0.073 | -0.542 | 0.440 |
| No | 0.418 | | -0.957 | | -0.472 | | -0.694 | |
| *Availability of food* | | | | | | | | |
| Yes | 0.200 | 0.512 | -1.017 | 0.852 | -0.721 | 0.284 | -0.706 | 0.235 |
| No | 0.292 | | -1.045 | | -0.563 | | -0.531 | |
| *Other* | | | | | | | | |
| Yes | **0.132** | **0.006** | -1.105 | 0.096 | **-0.742** | **0.020** | -0.685 | 0.127 |
| No | **0.361** | | -0.957 | | **-0.543** | | -0.552 | |

## Appendix Q: Final coding scheme - codes, sub-themes & themes

| Theme | Sub-theme 2 | Sub-theme 1 | Initial codes |
|---|---|---|---|
| **Peer groups, diet and social integration** | Diet as social facilitator and alignment of choices | | Peers – submitting to temptations |
| | | | Alcohol as a social facilitator |
| | | | Food as a social facilitator |
| | | | Social alignment – drinking |
| | | | Social alignment – eating |
| | | | Peer pressure - drinking |
| | Convergence | | Convergence of eating habits / food choices within peer groups |
| | | | Peers as a deterrent from poor choices |
| | Social eating, social drinking | | Social eating |
| | | | Social drinking |
| | | | Food and drink for celebration |
| | | | Food to display affection |
| | Resilience to peers' choices | | Association with like minded peers; |
| | | | Independent decision making (general); |
| | | | Independent decision making (age/self confidence) |
| | | | Independent decision making (special dietary requirements) |
| | Peers as a support network | | Peers – support network at university |
| **The university experience** | Daily schedules | | Schedule – cooking alone vs. sharing |
| | | | Schedule – time pressures |
| | | | Laziness - schedule |

| | | | |
|---|---|---|---|
| | | | Schedule – eating out vs. at home |
| | | | Schedule - lack of structure |
| | | | Unconventional meal times |
| | Shared student living | Communal living | Desires of community feel |
| | | | Family-type meals |
| | | | Peer diversity in food choices |
| | | | Fussy eating |
| | | Shared kitchens | Shared kitchen – trust issues |
| | | | Kitchen cleanliness |
| | | | Inadequate kitchen facilities |
| | | | Inadequate kitchen facilities |
| | Student budget | | Budget – good food as priority |
| | | | Budget – other priorities |
| | | | Budget – food choices |
| | | | Offers/deals on food |
| | | | Budget – desires-behaviour disconnect |
| | Access to food | Access to food – built environment | Access to fresh food |
| | | | Access to supermarkets |
| | | | Access to fast food |
| | | | Proximity to food |
| | Food, academic workload and studying stress | Study workload | Study workload – eating habits/food choices |
| | | | Study workload – drinking |
| | | Periods of academic pressure | Exams/revision – abandonment of pursuit of healthy diet |

| | | | |
|---|---|---|---|
| | | | Exams/revision – abandonment of usual eating routines/regulation |
| | | | Exams/revision – cooking |
| | | | Stability in habits |
| | | Food for coping | Eating as a distraction from study |
| | | | Food as a reward |
| | | | Emotional eating |
| | | | Bingeing |
| | Drinking culture | Drinking culture | Drinking culture – general |
| | | | Drinking culture – sports teams |
| | | | Expectations to conform - drinking |
| | | | Pre-university expectations (drinking habits) |
| | | Amount of alcohol consumption | Drinking enjoyment |
| | | | Lack of drinking enjoyment |
| | | | Drinking - past experiences |
| | | Alcohol & food choices | Pre-drinking altered food intake |
| | | | Hangover – disinhibition of usual eating regulation/routines |
| | | | Drunk munchies |
| **Healthy choices at university?** | Extrinsic motives for consuming a healthful diet | | Diet-health – personal experiences (health) |
| | | | Diet-health – weight gain |
| | | | K-B disconnect (perceived protective factors) |
| | | | Food choices to complement fitness/sporting goals |
| | | | Food as fuel |

| | | | |
|---|---|---|---|
| | | | Food choices to optimise study success |
| | Intrinsic motives for consuming a healthful diet | | Identity in food choices |
| | | | Taste/preferences |
| | | | Feeling good through food purchases |
| | Obtaining dietary knowledge | | Diet-health knowledge – degree programme |
| | | | Diet-environment knowledge – degree programme |
| | | | Diet-health knowledge – media |
| | | | Diet-environment knowledge – media |
| | | | Detachment from the media |
| | | | Knowledge-behaviour disconnect – media cynicism |
| | Pre-occupations with food intake and body weight | Slim-ideal at university | Slim ideal - peers |
| | | | Slim ideal - media |
| | | Dietary restriction | Dieting |
| | | | Fad diets |
| | | | Strategies to control intake – food/energy restriction |
| | | | Strategies to control intake – removal of choice |
| | | | Strategies to control intake – fluid intake |
| | | Relationship with food | Calorie pre-occupation |
| | | | Dietary misconceptions – media |
| | | | Food anxiety |
| | | | Guilt – poor choices |
| **Becoming an autonomous** | Learning independence | Routines or not | Establishment of routines at university - |

| | | | |
|---|---|---|---|
| **consumer** | | | initial transition |
| | | | Establishment of routines at university - general |
| | | | Exceptions to normal routines |
| | | | Pre-planning of meals |
| | | | Impulse eating |
| | | | What is in the fridge |
| | | From dependent to autonomous | Enjoying independence |
| | | | Desire for control |
| | | | Becoming an autonomous consumer |
| | | | Default meals |
| | | | Acceptance of personal responsibility |
| | | | Cooking – trial & error/ experimentation/ online recipes |
| | | | Cooking skills – media |
| | | | Learning from peers |
| | | | Decreased food intake at university |
| | Tracking from home to university | | Tracking home-university: food choices/meals/eating habits |
| | | | Tracking home-university: shopping habits |
| | | | Tracking home-university: cooking habits |
| | | | Tracking home-university: core values |
| | | | Food familiarity |
| | Cooking or not? | Cooking skills/ability | Cooking ability - home influence |

| | | | |
|---|---|---|---|
| | | | Cooking ability – food variety |
| | | | Cooking ability – vegetarianism/meat consumption |
| | | | Cooking ability – convenience foods |
| | | | Cooking-for-one - benefits |
| | | | Cooking-for-one - challenges |
| | | | Perception of easy |
| | | | Laziness (general) |
| | | Cooking enjoyment (or not) | Cooking enjoyment |
| | | | Lack of cooking enjoyment |
| | Parental involvement | An opportunity for new choices | Freedom over/rejection of home food choices |
| | | | Permanent changes to diet |
| | | Changing views of food at home | Increased food intake at home |
| | | | Increased appreciation of home food |
| | | | Newfound disapproval of home habits |
| | | Parental influence (or not) at university | Parental provision of food at university |
| | | | Parental concerns |
| | | | Parental desires on food intake at university |
| | | | Absence of parental influence at university |
| | Changes over time throughout university life | | University novelties – drinking |
| | | | University drinking – cooking |
| | | | Growing up |

## Appendix R: Series of tables displaying results from the chi-square analyses of the Slimming World dataset

### Table R1: Category of weight gain vs. frequency of ready meal & convenience food consumption

| | | Category of weight gain at university | | | | |
|---|---|---|---|---|---|---|
| **Consumption of ready meals & convenience foods** | | **0kg** | **<3.2 kg** | **3.2 – 6.4 kg** | **6.4-12.7 kg** | **>12.7 kg** |
| **0-1 times/week** | **Count** | 12 | 9 | 18 | 15 | 5 |
| | **% within category of weight gain** | **30.8** | **36.0** | **28.6** | **15.8** | **8.8** |
| | **Adjusted residual** | 1.6 | 1.9 | 1.6 | -1.6 | -2.6 |
| **1-3 times/week** | **Count** | 15 | 9 | 24 | 29 | 11 |
| | **% within category of weight gain** | **38.5** | **36.0** | **38.1** | **30.5** | **19.3** |
| | **Adjusted residual** | 1.0 | 0.5 | 1.3 | -0.3 | -2.2 |
| **3-5 times/week** | **Count** | 8 | 4 | 15 | 35 | 20 |
| | **% within category of weight gain** | **20.5** | **16.0** | **23.8** | **36.8** | **35.1** |
| | **Adjusted residual** | -1.3 | -1.5 | -1.1 | 2.0 | 1.1 |
| **>5 times/week** | **Count** | 4 | 3 | 6 | 16 | 21 |
| | **% within category of weight gain** | **10.3** | **12.0** | **9.5** | **16.8** | **36.8** |
| | **Adjusted residual** | -1.3 | -0.8 | -2.0 | -0.3 | 4.2 |
| **Total** | **Count** | 39 | 25 | 63 | 95 | 57 |
| | **% within category of weight gain** | **100** | **100** | **100** | **100** | **100** |

*$\chi^2 = 37.08$; $df = 12$; $p < 0.001$*

**Table R2: Category of weight gain vs. frequency of take away and fast food consumption**

| | | Category of weight gain at university | | | | |
|---|---|---|---|---|---|---|
| **Consumption of take aways & fast foods** | | **0kg** | **<3.2 kg** | **3.2 – 6.4 kg** | **6.4-12.7 kg** | **>12.7 kg** |
| **0-1 / week** | **Count** | 29 | 17 | 33 | 39 | 19 |
| | **% within category of weight gain** | **76.3** | **68.0** | **52.4** | **41.1** | **33.3** |
| | **Adjusted residual** | 3.6 | 2.0 | 0.6 | -2.0 | -2.7 |
| **'A few' or more per week** | **Count** | 9 | 8 | 30 | 56 | 38 |
| | **% within category of weight gain** | **23.7** | **32.0** | **47.6** | **58.9** | **66.7** |
| | **Adjusted residual** | -3.6 | -2.0 | -0.6 | 2.0 | 2.7 |
| **Total** | **Count** | 38 | 25 | 63 | 95 | 57 |
| | **% within category of weight gain** | **100** | **100** | **100** | **100** | **100** |

*$\chi^2 = 23.232$; $df = 4$; $p < 0.001$*

**Table R3: Category of weight gain vs. frequency of fruit and vegetable consumption**

| | | Category of weight gain at university | | | | |
|---|---|---|---|---|---|---|
| **Consumption of fruit & vegetables** | | **0kg** | **<3.2 kg** | **3.2 – 6.4 kg** | **6.4-12.7 kg** | **>12.7 kg** |
| **0-1 times/week** | **Count** | 8 | 6 | 20 | 30 | 27 |
| | **% within category of weight gain** | **20.5** | **24.0** | **31.7** | **31.6** | **48.2** |
| | **Adjusted residual** | -1.8 | -1.0 | -0.2 | -0.3 | 2.8 |
| **2-3 times/week** | **Count** | 10 | 5 | 15 | 35 | 15 |
| | **% within category of weight gain** | **25.6** | **20.0** | **23.8** | **36.8** | **26.8** |
| | **Adjusted residual** | -0.5 | -1.0 | -1.0 | 2.1 | -0.4 |
| **4-5 times/week** | **Count** | 4 | 3 | 10 | 15 | 6 |
| | **% within category of weight gain** | **10.3** | **12.0** | **15.9** | **15.8** | **10.7** |
| | **Adjusted residual** | -0.7 | -0.3 | 0.6 | 0.7 | -0.7 |
| **Everyday** | **Count** | 17 | 11 | 18 | 15 | 8 |
| | **% within category of weight gain** | **43.6** | **44.0** | **28.5** | **15.8** | **14.3** |
| | **Adjusted residual** | 2.9 | 2.3 | 0.8 | -2.5 | -2.0 |
| **Total** | **Count** | 39 | 25 | 63 | 95 | 57 |
| | **% within category of weight gain** | **100** | **100** | **100** | **100** | **100** |

*$\chi^2 = 26.587; df = 12; p < 0.01$*

**Table R4: Category of weight gain vs. frequency of alcohol consumption**

| | | Category of weight gain at university | | | | |
|---|---|---|---|---|---|---|
| **Consumption of alcohol** | | **0kg** | **<3.2 kg** | **3.2 – 6.4 kg** | **6.4-12.7 kg** | **>12.7 kg** |
| **0-1 nights/week** | **Count** | 19 | 10 | 15 | 27 | 14 |
| | **% within category of weight gain** | **48.7** | **40.0** | **24.2** | **28.4** | **24.6** |
| | **Adjusted residual** | 2.7 | 1.1 | -1.2 | -0.6 | -1.1 |
| **1-2 nights/week** | **Count** | 14 | 10 | 30 | 27 | 18 |
| | **% within category of weight gain** | **35.9** | **40.0** | **48.4** | **28.4** | **31.6** |
| | **Adjusted residual** | 0.0 | 0.5 | 2.4 | -1.8 | -0.7 |
| **≥3 nights/week** | **Count** | 6 | 5 | 17 | 41 | 25 |
| | **% within category of weight gain** | **15.4** | **20.0** | **27.4** | **43.2** | **43.9** |
| | **Adjusted residual** | -2.6 | -1.5 | -1.2 | 2.4 | 1.8 |
| **Total** | **Count** | 39 | 25 | 63 | 95 | 57 |
| | **% within category of weight gain** | **100** | **100** | **100** | **100** | **100** |

$\chi^2 = 21.419; df = 8; p = 0.006$

**Table R5: Category of weight gain vs. body weight status at the start of university**

| | | Category of weight gain at university | | | | |
|---|---|---|---|---|---|---|
| **Baseline body weight status** | | **0kg** | **<3.2 kg** | **3.2 – 6.4 kg** | **6.4-12.7 kg** | **>12.7 kg** |
| **Underweight** | **Count** | 0 | 0 | 0 | 1 | 0 |
| | **% within category of weight gain** | **0.0** | **0.0** | **0.0** | **1.1** | **0.0** |
| | **Adjusted residual** | -0.4 | -0.3 | -0.5 | 1.4 | -0.5 |
| **Healthy weight** | **Count** | 1 | 10 | 15 | 30 | 23 |
| | **% within category of weight gain** | **2.6** | **40.0** | **23.8** | **31.6** | **40.4** |
| | **Adjusted residual** | -3.8 | 1.4 | -0.9 | 0.9 | 2.3 |
| **Overweight** | **Count** | 24 | 12 | 41 | 52 | 29 |
| | **% within category of weight gain** | **61.5** | **48.0** | **65.1** | **54.7** | **50.8** |
| | **Adjusted residual** | 0.7 | -0.9 | 1.5 | -0.5 | -1.0 |
| **Severely overweight** | **Count** | 13 | 2 | 7 | 12 | 5 |
| | **% within category of weight gain** | **33.3** | **8.0** | **11.1** | **12.6** | **8.8** |
| | **Adjusted residual** | 3.8 | -0.9 | -0.7 | -0.5 | -1.3 |
| **Don't know** | **Count** | 1 | 1 | 0 | 0 | 0 |
| | **% within category of weight gain** | **2.6** | **4.0** | **0.0** | **0.0** | **0.0** |
| | **Adjusted residual** | 1.5 | 2.0 | -0.8 | -1.0 | -0.7 |
| **Total** | **Count** | 39 | 25 | 63 | 95 | 57 |
| | **% within category of weight gain** | **100** | **100** | **100** | **100** | **100** |

*$\chi^2$ = 37.530; df = 16; p = 0.002*

**Table R6: Category of weight gain vs. perceived ability to 'shop, eat and cook healthily on a student budget'**

| | | Category of weight gain at university | | | | |
|---|---|---|---|---|---|---|
| **Perceived ability to shop, cook & eat healthily** | | **0kg** | **<3.2 kg** | **3.2 – 6.4 kg** | **6.4-12.7 kg** | **>12.7 kg** |
| **Easy / very easy** | **Count** | 11 | 12 | 5 | 8 | 5 |
| | **% within category of weight gain** | **32.4** | **20.8** | **19.4** | **8.4** | **8.8** |
| | **Adjusted residual** | 3.0 | 0.8 | 1.1 | -2.2 | -1.5 |
| **Neither easy nor difficult** | **Count** | 5 | 3 | 17 | 19 | 8 |
| | **% within category of weight gain** | **14.7** | **12.5** | **27.4** | **20.0** | **14.0** |
| | **Adjusted residual** | -0.7 | -0.9 | 1.9 | 0.3 | -1.1 |
| **Difficult** | **Count** | 15 | 8 | 23 | 48 | 22 |
| | **% within category of weight gain** | **44.1** | **33.3** | **37.1** | **50.5** | **38.6** |
| | **Adjusted residual** | 0.2 | -1.0 | -1.0 | 1.9 | -0.7 |
| **Very difficult** | **Count** | 3 | 8 | 10 | 20 | 22 |
| | **% within category of weight gain** | **8.8** | **33.3** | **16.1** | **21.1** | **38.6** |
| | **Adjusted residual** | -2.1 | 1.2 | -1.5 | -0.6 | 3.1 |
| **Total** | **Count** | 34 | 24 | 62 | 95 | 57 |
| | **% within category of weight gain** | **100** | **100** | **100** | **100** | **100** |

*$\chi^2$ = 30.262; df = 12; p = 0.002*

**Table R7: Category of weight gain vs. 'eating unhealthily due to stress relating to studies' as a perceived reason for weight gain**

| | | Category of weight gain at university* | | | |
|---|---|---|---|---|---|
| **Did student perceive 'stress relating to studies' as a reason for weight gain?** | | **<3.2 kg** | **3.2 – 6.4 kg** | **6.4-12.7 kg** | **>12.7 kg** |
| **Yes** | **Count** | 17 | 45 | 86 | 41 |
| | **% within category of weight gain** | **68** | **71.4** | **90.5** | **71.9** |
| | **Adjusted residual** | -1.4 | -1.7 | 3.6 | -1.4 |
| **No** | **Count** | 8 | 18 | 9 | 16 |
| | **% within category of weight gain** | **32.0** | **28.6** | **9.5** | **28.1** |
| | **Adjusted residual** | 1.4 | 1.7 | -3.6 | 1.4 |
| **Total** | **Count** | 25 | 63 | 95 | 57 |
| | **% within category of weight gain** | **100** | **100** | **100** | **100** |

*$\chi^2 = 13.202$; $df = 3$; $p = 0.004$*

*** 0kg of weight gain not included in this analysis**

**Table R8: Category of weight gain vs. cost as a major driver of food choice at university**

| | | Category of weight gain at university* | | | | |
|---|---|---|---|---|---|---|
| **Did student report cost of food as a major driver of food choice at university?** | | **0kg** | **<3.2 kg** | **3.2 – 6.4 kg** | **6.4-12.7 kg** | **>12.7 kg** |
| **Yes** | **Count** | 23 | 23 | 51 | 83 | 50 |
| | **% within category of weight gain** | **59** | **92** | **81** | **87.4** | **87.7** |
| | **Adjusted residual** | -4.2 | 1.3 | -0.4 | 1.6 | 1.2 |
| **No** | **Count** | 16 | 2 | 12 | 12 | 7 |
| | **% within category of weight gain** | **41** | **8** | **19** | **12.6** | **12.3** |
| | **Adjusted residual** | 4.2 | -1.3 | 0.4 | -1.6 | -1.2 |
| **Total** | **Count** | 39 | 25 | 63 | 95 | 57 |
| | **% within category of weight gain** | **100** | **100** | **100** | **100** | **100** |

*$\chi^2$ = 19.198; df = 4; p = 0.001*

**Table R9: Category of weight gain vs. self-reported physical activity levels at university**

| | | Category of weight gain at university | | | | |
|---|---|---|---|---|---|---|
| **Physical activity participation** | | **0kg** | **<3.2 kg** | **3.2 – 6.4 kg** | **6.4-12.7 kg** | **>12.7 kg** |
| **Not at all active** | **Count** | 4 | 5 | 7 | 11 | 13 |
| | **% within category of weight gain** | **10.5** | **20** | **11.1** | **11.6** | **22.8** |
| | **Adjusted residual** | -0.7 | 0.8 | -0.8 | -1.0 | 2 |
| **Rarely active (<30 mins/week)** | **Count** | 7 | 4 | 17 | 32 | 24 |
| | **% within category of weight gain** | **18.4** | **16** | **27** | **33.7** | **42.1** |
| | **Adjusted residual** | -1.7 | -1.6 | -0.6 | 0.9 | 2.2 |
| **Sometimes active (30-60 mins/week)** | **Count** | 11 | 4 | 12 | 29 | 15 |
| | **% within category of weight gain** | **28.9** | **16** | **19** | **30.5** | **26.3** |
| | **Adjusted residual** | 0.5 | -1.1 | -1.3 | 1.4 | 0.2 |
| **Fairly active (60-90 mins/week)** | **Count** | 4 | 4 | 16 | 15 | 3 |
| | **% within category of weight gain** | **10.5** | **16** | **25.4** | **15.8** | **5.3** |
| | **Adjusted residual** | -0.8 | 0.1 | 2.6 | 0.2 | -2.3 |
| **Active or Very active (>90 mins/week)** | **Count** | 12 | 8 | 11 | 8 | 2 |
| | **% within category of weight gain** | **31.6** | **32** | **17.5** | **8.4** | **3.5** |
| | **Adjusted residual** | 3.1 | 2.6 | 0.7 | 8 | -2.7 |
| **Total** | **Count** | 39 | 25 | 63 | 95 | 57 |
| | **% within category of weight gain** | **100** | **100** | **100** | **100** | **100** |

*$\chi^2$ = 43.227; df = 16; p = <0.001*

**Table R10: Category of weight gain vs. effect of alcohol consumption on consumption of takeaways and fast food**

| | | Category of weight gain at university* | | | | |
|---|---|---|---|---|---|---|
| **Did student report drinking alcohol to increase consumption of takeaways & fast food?** | | **0kg** | **<3.2 kg** | **3.2 – 6.4 kg** | **6.4-12.7 kg** | **>12.7 kg** |
| **Yes** | **Count** | 13 | 16 | 40 | 61 | 32 |
| | **% within category of weight gain** | **33.3** | **64.0** | **63.5** | **64.2** | **56.1** |
| | **Adjusted residual** | -3.4 | 0.6 | 1.0 | 1.5 | -0.3 |
| **No** | **Count** | 26 | 9 | 23 | 34 | 25 |
| | **% within category of weight gain** | **66.7** | **36.0** | **36.5** | **35.8** | **43.9** |
| | **Adjusted residual** | 3.4 | -0.6 | -1.0 | -1.5 | 0.3 |
| **Total** | **Count** | 39 | 25 | 63 | 95 | 57 |
| | **% within category of weight gain** | **100** | **100** | **100** | **100** | **100** |

$\chi^2 = 12.481; df = 4; p = 0.013$

**Table R11: Category of weight gain vs. ability to cook a number of different meals at university**

| | | | Category of weight gain at university* | | | | |
|---|---|---|---|---|---|---|---|
| | **Did student report being able to cook the meal?** | | **0kg** | **<3.2 kg** | **3.2 – 6.4 kg** | **6.4-12.7 kg** | **>12.7 kg** |
| **Curry** | **Yes** | **Count** | 27 | 13 | 38 | 42 | 26 |
| | | **% within category of weight gain** | **69.2** | **52.0** | **60.3** | **44.2** | **45.6** |
| *$\chi^2$ = 9.619; df = 4; p = 0.048* | | **Adjusted residual** | 2.3 | 0.0 | 1.4 | -2.0 | |
| | **No** | **Count** | 12 | 12 | 25 | 53 | 31 |
| | | **% within category of weight gain** | **30.8** | **48.0** | **39.7** | **55.8** | **54.4** |
| | | **Adjusted residual** | -2.3 | 0.0 | -1.4 | 2.0 | 1.1 |
| | **Total** | **Count** | 39 | 25 | 63 | 95 | 57 |
| | | **% within category of weight gain** | **100** | **100** | **100** | **100** | **100** |
| **Stir-fry** | **Yes** | **Count** | 36 | 21 | 55 | 65 | 42 |
| | | **% within category of weight gain** | **92.3** | **84.0** | **87.3** | **68.4** | **73.7** |
| *$\chi^2$ = 14.244; df = 4; p = 0.006* | | **Adjusted residual** | 2.3 | 0.7 | 1.9 | -2.9 | -1.0 |
| | **No** | **Count** | 3 | 4 | 8 | 30 | 15 |
| | | **% within category of weight gain** | **7.7** | **16.1** | **12.7** | **31.6** | **26.3** |
| | | **Adjusted residual** | -2.3 | -0.7 | -1.9 | 2.9 | 1.0 |
| | **Total** | **Count** | 39 | 25 | 63 | 95 | 57 |
| | | **% within category of weight gain** | **100** | **100** | **100** | **100** | **100** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Homemade burger** | **Yes** | **Count** | 28 | 12 | 40 | 44 | 27 |
| | | **% within category of weight gain** | **71.8** | **48.0** | **63.5** | **46.3** | **47.4** |
| ***$\chi^2$ = 10.889; df = 4; p = 0.029*** | | **Adjusted residual** | 2.4 | -0.6 | 1.7 | -1.9 | -1.1 |
| | **No** | **Count** | 11 | 13 | 23 | 51 | 30 |
| | | **% within category of weight gain** | **28.2** | **52.0** | **36.5** | **53.7** | **52.6** |
| | | **Adjusted residual** | -2.4 | 0.6 | -1.7 | 1.9 | 1.1 |
| | **Total** | **Count** | 39 | 25 | 63 | 95 | 57 |
| | | **% within category of weight gain** | **100** | **100** | **100** | **100** | **100** |
| **Soup** | **Yes** | **Count** | 30 | 15 | 45 | 52 | 27 |
| ***$\chi^2$ = 12.994; df = 4; p = 0.012*** | | **% within category of weight gain** | **76.9** | **60** | **71.4** | **54.7** | **47.4** |
| | | **Adjusted residual** | 2.3 | -0.1 | 2.0 | -1.4 | -2.3 |
| | **No** | **Count** | 9 | 10 | 18 | 43 | 30 |
| | | **% within category of weight gain** | **23.1** | **40.0** | **28.6** | **45.3** | **32.6** |
| | | **Adjusted residual** | -2.3 | 0.1 | -2.0 | 1.4 | 2.3 |
| | **Total** | **Count** | 39 | 25 | 63 | 95 | 57 |
| | | **% within category of weight gain** | **100** | **100** | **100** | **100** | **100** |
| **Casserole/stew** | **Yes** | **Count** | 29 | 13 | 38 | 37 | 28 |
| ***$\chi^2$ = 16.230; df = 4; p = 0.002*** | | **% within category of weight gain** | **74.4** | **52.0** | **60.3** | **38.9** | **49.1** |
| | | **Adjusted residual** | 3.0 | 0.0 | 1.5 | -3.1 | -0.5 |
| | **No** | **Count** | 10 | 12 | 25 | 58 | 29 |
| | | **% within category of weight gain** | **25.6** | **48.0** | **39.7** | **61.1** | **50.9** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Adjusted residual** | -3.0 | 0.0 | -1.5 | 3.1 | 0.5 |
| | **Total** | **Count** | 39 | 25 | 63 | 95 | 57 |
| | | **% within category of weight gain** | **100** | **100** | **100** | **100** | **100** |
| **Full English breakfast** | **Yes** | **Count** | 37 | 18 | 58 | 77 | 45 |
| | | **% within category of weight gain** | **94.9** | **72.0** | **92.1** | **81.1** | **78.9** |
| ***$\chi^2$ = 10.970; df = 4; p = 0.025*** | | **Adjusted residual** | 2.0 | -1.8 | 1.9 | -1.0 | -1.2 |
| | **No** | **Count** | 2 | 7 | 5 | 18 | 12 |
| | | **% within category of weight gain** | **5.1** | **28.0** | **7.9** | **18.9** | **21.1** |
| | | **Adjusted residual** | -2.0 | 1.8 | -1.9 | 1.0 | 1.2 |
| | **Total** | **Count** | 39 | 25 | 63 | 95 | 57 |
| | | **% within category of weight gain** | **100** | **100** | **100** | **100** | **100** |

**Appendix S: Association between energy intake and year of study – results from ANOVA**

| ***Year of study (n)*** | ***Energy intake (kcal)*** |
|---|---|
| **First year (489)** | 1762 |
| **Second year (301)** | 1755 |
| **Third year (264)** | 1741 |
| **Fourth year or higher (136)** | 1759 |
| **Postgraduate (245)** | 1651 |
| **Other (13)** | 1751 |

***p = 0.106 (Welch); F = 1.863; df 1 = 5; df 2 = 121***

**Appendix T: Association between level of meat consumption and iron intake – results from ANOVA**

| | ***Iron intakes** (mg day$^{-1}$)* | |
|---|---|---|
| ***Consumption of animal products (n)*** | **Females** | **Males** |
| Regular meat eater | 9.943$^{a}$ (579) | 11.560$^{a}$ (299) |
| Occasional meat eater | 9.454$^{b}$ (364) | 10.504$^{b}$ (57) |
| Non meat eater | 11.063$^{ab}$ (121) | 13.379$^{ab}$ (28) |
| | ***$p < 0.01$; $F = 10.874$; $df = 2$*** | ***$p < 0.05$; $F = 5.152$; $df = 2$*** |

**Appendix U: Association between level of meat consumption and selenium intake – results from ANOVA**

| | ***Selenium intakes (µg day$^{-1}$)*** | |
|---|---|---|
| ***Consumption of animal products*** | **Females (n)** | **Males (n)** |
| Regular meat eater | $58.73^{ab}$ (579) | $69.25^{ab}$ (299) |
| Occasional meat eater | $51.80^{ac}$ (364) | $59.58^{a}$ (57) |
| Non meat eater | $40.64^{bc}$ (121) | $54.29^{b}$ (28) |
| | ***$p < 0.01$; $F = 44.919$; $df = 2$*** | ***$p < 0.01$; $F = 6.466$; $df = 2$*** |

## Appendix V: Maternal education and university cross tabulation [γ]

| University * Maternal Education Crosstabulation | | | | | | |
|---|---|---|---|---|---|---|
| Maternal Education | | University | | | | |
| | | Ulster | KCL | Southampton | St. Andrews | **Total** |
| CSE | Count | 43 | 18 | 10 | 1 | 72 |
| | Expected Count | 35.1 | 25.6 | 6.8 | 4.5 | 72.0 |
| | Adjusted Residual | 2.0 | -2.0 | 1.4 | -1.8 | |
| Vocational | Count | 30 | 19 | 8 | 1 | 58 |
| | Expected Count | 28.3 | 20.6 | 5.5 | 3.6 | 58.0 |
| | Adjusted Residual | 0.5 | -0.5 | 1.2 | -1.5 | |
| O Level | Count | 112 | 35 | 19 | 7 | 173 |
| | Expected Count | 84.4 | 61.5 | 16.3 | 10.9 | 173.0 |
| | Adjusted Residual | 4.8 | -4.8 | 0.8 | -1,4 | |
| A Level | Count | 42 | 41 | 4 | 1 | 88 |
| | Expected Count | 42.9 | 31.3 | 8.3 | 5.5 | 88.0 |
| | Adjusted Residual | 4.8 | -4.8 | 0.8 | -1.4 | |
| Degree | Count | 115 | 136 | 25 | 34 | 310 |
| | Expected Count | 151.2 | 110.1 | 29.2 | 19.5 | 310.0 |
| | Adjusted Residual | -5.5 | 4.1 | -1.1 | 4.6 | |
| **Total** | Count | 342 | 249 | 66 | 44 | 701 |

**Pearson's chi-square results: value = 69.050; df = 12; p < 0.001**

[γ] Participants from the University of Sheffield (n = 567) and those reporting 'would rather not say' have been excluded from the analysis (n = 180)

## Appendix W: Data on social class across participating sites

**Table W1**: Data on the percentage of students from manual occupational backgrounds at each of the participating universities, 2008/09 (246)

| | **Total full-time first degree entrants** | **Number of students from manual occupational backgrounds** | **% of students from manual occupational backgrounds** |
|---|---|---|---|
| **Sheffield** | 4,185 | 760 | 22.6 |
| **Ulster** | 5,125 | 1570 | 49.4 |
| **KCL** | 2,780 | 480 | 24.2 |
| **Southampton** | 3,685 | 625 | 22.1 |
| **St Andrews** | 1,190 | Data unavailable | Data unavailable |

**Table W2**: Data on mother's level of education across participating sites[γ]

| **Maternal Education** | **University of Ulster (%)** | **KCL (%)** | **University of Southampton (%)** | **University of St Andrews (%)** |
|---|---|---|---|---|
| **CSE** | 12.6 | 7.2 | 15.2 | 2.3 |
| **Vocational** | 8.8 | 7.6 | 12.1 | 2.3 |
| **O Level** | 32.7 | 14.1 | 28.8 | 15.9 |
| **A Level** | 12.3 | 16.5 | 6.1 | 2.3 |
| **Degree** | 33.6 | 54.6 | 37.9 | 77.3 |

[γ] Data on maternal education was not collected at the University of Sheffield