Dietary habits and nutrient intake of South Asian children (1-3 years) living in the UK

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Abstract

This cross-sectional study is the first study to be carried out in the UK that explored and assessed the dietary habits and nutrient intakes of pre-school South Asian (SA) children (1 to 3 years old) living in the UK.

A cohort of SA mothers completed a questionnaire with questions about their children dietary habits, sleeping habits and mothers' nutritional knowledge (n=160). Food intake information was gathered by three 24-hour multiple pass recalls (MPRs). Household measurements and a newly developed food photograph booklet for SA food were used to estimate food portion sizes. All foods were analysed for nutrient composition using the WinDiets software and the latest available data on SA foods generated by the FSA and EuroFIR. A questionnaires regarding factors influencing SA mothers' weaning practices was administered through in-depth interviews (n=30).

The results suggest that there were various dietary habits and practices to be found amongst SA children. These habits were found to be influenced by the mother's religion, culture and beliefs. In addition, the study has shown that milk and milk products was the largest food group that contributed towards the daily diet. SA children have energy intakes significantly lower than the EAR when compared to the UK recommendations, both amongst boys (1126.4 kcal/d ±197.75) and girls (1106.2 ± 225.86). They are most likely to have adequate intakes of most nutrients except for vitamin A, vitamin D, Fe and Zn; mean intakes were found to be below the RNI (96%, 18.7%, 89.5% and 95.5% of the RNI, respectively). Furthermore, it was found that a 24-hour MPR was an appropriate tool to be used with SAs and that participants can enhance their estimation of portion sizes using food photographs. These findings enhance our understanding of SA dietary habits and can serve as a basis for future studies.

Contribution to PhD thesis

The candidate confirms that the work submitted is her own, except where work which has formed part of jointly-authored publications has been included. The contribution of the candidate and the other authors to this work has been explicitly indicated below. The candidate confirms that appropriate credit has been given within the thesis where reference has been made to the work of others.

Ethical Approval

Applications for Ethics for the study were prepared by the researcher Wafaa Husain.

Recruitment and data analysis

All the data collection, coding and data entry and statistical analysis were carried out by the researcher Wafaa Husain.

Development and validation of portion sizes

Validation process of the food photographs booklet was jointly carried out by the researcher, Mrs. Fatemah Ashkanani and Dr. Sara Garduño Diaz.

Food consumption and average food portion sizes

Data entry for the food portion sizes by meal times was carried out by the MSc student Ms. Huimin Huo under the supervision of the researcher Wafaa Husain

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Abbreviations

MEEC	Mathematics and physical sciences & Engineering Ethics Committee
ESRC	Economic Social Research Council
HSE	Health Survey of England
NHS	National Health Service
SACN	Scientific Advisory Committee on Nutrition
WHO	World Health Organisation
COMA	Department of Health Committee Based on Medical Aspects of Food and Nutrition Policy
NDNS	National Diet and Nutrition Survey
EuroFIR	European Food Information Resources
NCMP	National Children Measurement Programme
ONS	Office for National Statistics
FSA	Food Standards Agency
USDA	US Department of Agriculture
ICMR	Indian Council for Medical Research
CHD	Coronary Heart Disease
CVD	Cardiovascular Disease
HDL	High Density Lipoprotein
LDL	Low Density Lipoprotein
T2DM	Type 2 Diabetes Mellitus
NCDs	Non-Communicable Diseases
FFQ	Food Frequency Questionnaire
24-hour MPRs	24- hour Multiple Pass Recalls
DRVs	Dietary Reference Values
EARs	Estimated Average Requirements
RNIs	Reference Nutrient Intakes
LRNIs	Low Reference Nutrient Intakes
DLW	Doubly Labelled Water technique
BMR	Basal Metabolic Rate
EI	Energy Intake
PAL	Physical Activity Level
BMI	Body Mass Index
TV	Television
UV	Ultraviolet radiation

Chapter 1: Literature review

1.1 Introduction

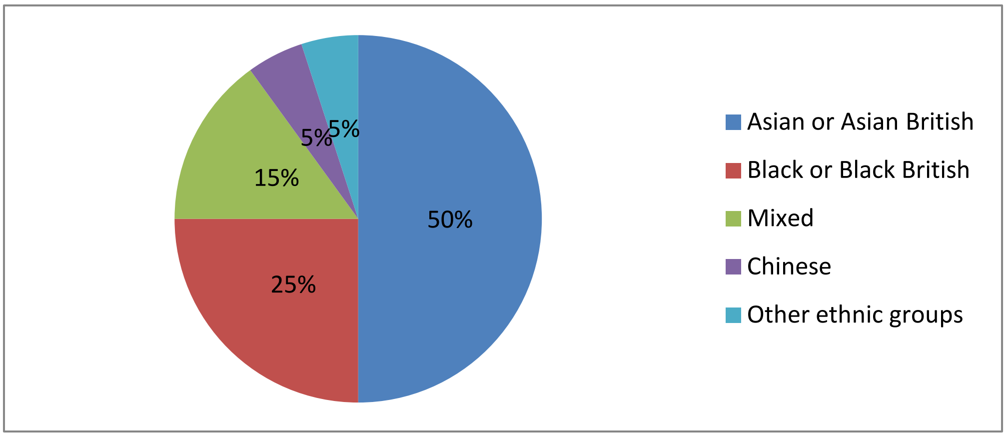
“ Nutrition is a fundamental pillar of human life, health and development across the entire life span. From the earliest stages of fetal development, at birth through infancy, childhood, adolescence, and on into adulthood and old age…” (WHO, 2000).

Recently it has been suggested that childhood nutrition reflects the health of an individual throughout his or her life-course (Baker-Henningham and Grantham-McGregor, 2004). Since children’s nutritional needs are high relative to their body weight and they do not have the same degree of control over their diets as adults, development of deficiencies is more likely to occur than in adults (Thomas and Bishop, 2007). Therefore, parents should ensure that their children are provided with a balanced diet, along with encouraging them to partake in physical activities. In the case of South Asian children, previous studies have emphasised that South Asian children can be at risk of iron, zinc, folate, vitamin A and vitamin D deficiencies (Lawson et al., 1998; Lawson et al., 1999b; Hakeem et al., 2002). Linked to this, South Asians are reported to be a high risk group for developing obesity and obesity related non-communicable diseases, such as insulin resistance, type 2 diabetes, metabolic syndrome, and coronary heart disease (Misra and Khurana, 2008). South Asian children in Western societies are at a crossroads between the majority (host) culture and minority (immigrant) culture (Kumar et al., 2004), in particular the different dietary regimes. For all these reasons, in this study attention will be focused on a sample of South Asian pre-school children to better understand their dietary habits and nutrient intakes.

1.1.1 Ethnic group in the UK

The population of the United Kingdom has become more diverse due to a recent rise in immigration. Migration into the UK of non-white minority ethnic groups represents a total of 4.6 million people, or 8.7 percent of the total population of England and Wales According to the latest census (Census, 2001). According to the UK’s Economic Social Research Council (ESRC), an ‘ethnic group’ is made up of "people of the same race or nationality with long shared history and a distinct culture" (ESRC, 2005). South Asian populations represent the largest minority ethnic community in the UK (see Figure 1.1). 'South Asian' is a term usually used in Britain to refer to people originating from the Indian subcontinent, although it may also refer to people from South East Asia and Japan (Kassam-Khamis, 1996). However, in this thesis the term 'South Asian' will be used to refer to people of Indian, Pakistani or Bangladeshi origin.

Figure 1.1: The non-white population of the UK by ethnic group as of April 2001.



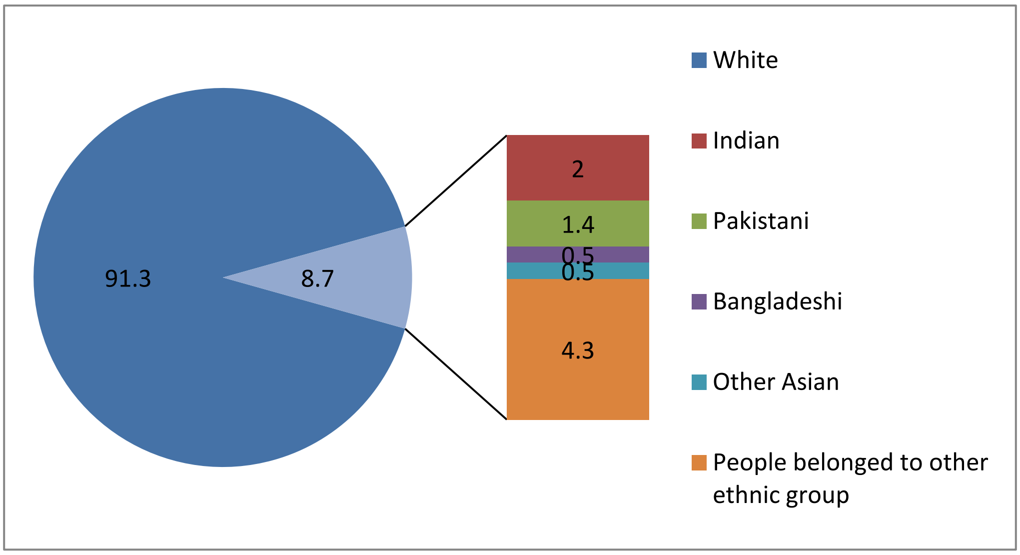
1.1.2 Demographics of South Asian population in the UK

There are various reasons that lead people to migrate from their native countries to other places. One of the main reasons is to escape from poor living conditions to have a better quality of life. The highest rates of immigration from the Indian subcontinent occurred in the 1960s and 1970s; from Bangladesh came Muslims, from west India came mainly Hindus and some Muslim Gujaratis, from the north came Sikh Punjabis, and from Pakistan migrants included rural Punjabis and Kashmiris (Landman and Cruickshank, 2001).

1.1.2.1 Geographic distribution

The 2001 Census indicates that South Asians represent a total of 4.4% of the national population of England and Wales. Indians make up 2%, followed by Pakistanis at 1.4%, Bangladeshis at 0.5%, and other Asians at 0.5% (see Figure 1.2) these ethnic groups have generally settled in large cities (their point of arrival) (ONS, 2005; Gilbert and Khokhar, 2008). South Asian sub-groups have diverse clustering in different areas in the UK (see Table 1.1). This diversity can be a hindrance to many researchers since it causes difficulties in implementing a research sampling technique. This is especially true if the research findings need to generalise within the groups. Yorkshire and the Humber is one of the counties that have a high number of South Asians particularly Pakistani (see Table 1.1). Although other parts of the UK may have a higher number of South Asians, Yorkshire and the Humber was chosen based on the availability of resources and the timescale of the present study. More information regarding the sample technique will be given in Chapter 2.

Figure 1.2: Ethnic groups' distribution of England and Wales by percentage, 2001



Note: White refer to British, Irish, Other White

Table 1.1: Percentages of South Asians by county and Government Office region as of April 2001.

	Indians	Pakistanis	Bangladeshis
North East	1	2	2
North West	7	16	9
Yorkshire and the Humber	5	20	4
East Midlands	12	4	2
West Midlands	17	21	11
East of England	5	5	7
London	42	19	54
South East	9	8	5
South West	2	1	2
England	98	95	97
Wales	1	1	2
Scotland	1	4	1

(Source: Adapted from Office for National Statistics (2006))

In general, there has been a rapid increase in the proportion of ethnic minority groups in the UK (ONS, 2011). Based on projections (Lievesley, 2010), South Asian groups who made up 4.4% of the total population in 2001 will make up 7.2% by 2016, 8.6% by 2026, and 12.1% by 2051 (see Table 1.2). Since South Asians have a high risk of non-communicable diseases and these diseases have a high cost for treatment, the future size of the South Asian ethnic minority population is a source of concern for health and economic sectors in the UK. More details on this are provided in section 1.1.9.

Table 1.2: Future projections of the South Asian population living in the UK.

	2001	2016	2026	2051
	% of total population			
British White	88.2	78.5	74.2	63.9
Indian	1.8	3.1	3.6	4.5
Pakistani	1.3	2.3	2.8	4.1
Bangladeshi	0.5	1.0	1.2	2.1
Other Asian	0.4	0.8	1.0	1.4

(Source: Adapted from Lievesley (2010))

1.1.2.2 Birth rate

Although the proportion of the UK-born population aged under 15 is in decline, ethnic minority groups have a younger age profile (ONS, 2011; Lievesley, 2010). The Bangladeshi and Pakistani ethnic groups show high fertility rates and a young age structure, with many in those groups being under the age of 15 years. The Indian ethnic group shows the lowest fertility rate of all South Asian groups, with the characteristic of an old age structure. The White British group has an older age structure than the South Asian group as a whole, and this is reflected in the fertility trends among South Asians when compared with White British people (see Table 1.3). Since there is an established relationship between nutritional status in early childhood and long term future health outcomes, understanding South Asian pre-school children’s dietary habits and lifestyle, especially considering their high proportion of young people in the UK will help to evaluate their health status and will allow development of intervention studies to improve their future health and wellbeing.

Table 1.3: Age structure of South Asian ethnic groups compared to White British people, England and 2Wales, 2007

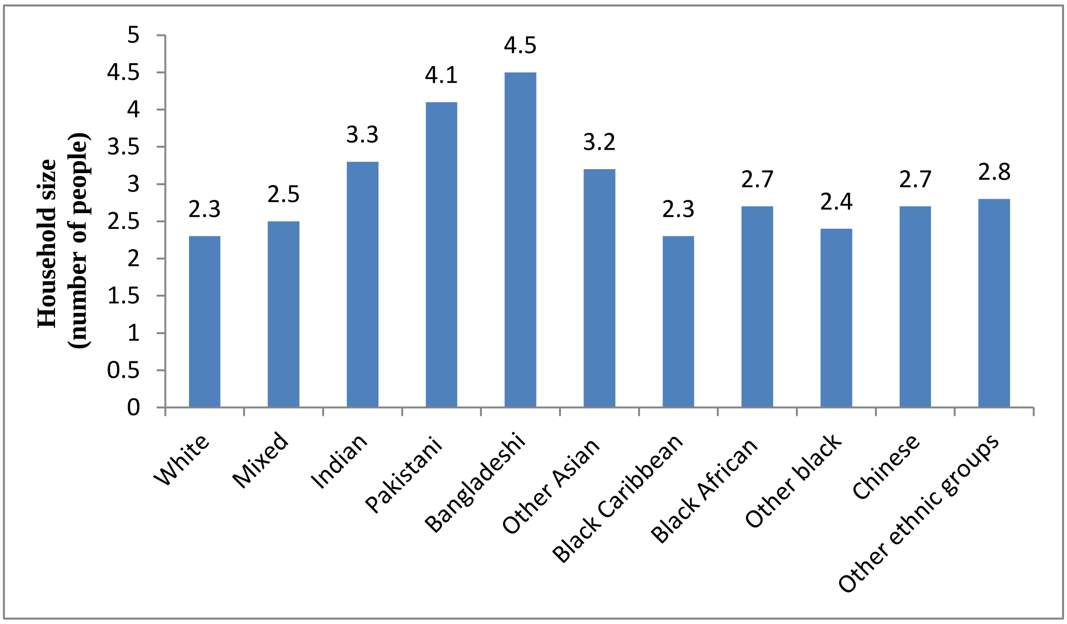
Ethnic group	population	% of total population	% aged 65 and over	% aged 50 and over	% aged under 15
White British	45,559,900	84.26	17.59	36.70	17.14
White Irish	586,00	1.08	31.16	57.47	5.17
Other White	1,830,600	3.39	8.79	21.33	12.13
Mixed- White/ Black African	117,600	0.22	1.96	7.82	41.24
Mixed- White/ Black Caribbean	290,600	0.54	2.13	5.09	46.15
Mixed- White/ Asian	268,00	0.50	3.10	8.47	42.31
Mixed- Other	217,600	0.40	3.17	9.74	39.15
Indian	1,329,600	2.46	7.27	21.21	17.13
Pakistani	916,700	1.70	4.65	13.02	28.59
Bangladeshi	360,400	0.67	4.25	10.63	30.24
Other Asian	344,100	0.64	5.49	18.28	19.44
Black African	736,600	1.36	2.72	10.39	23.38
Black Caribbean	602,900	1.11	13.44	26.39	16.27
Other Black	118,500	0.22	3.29	8.95	31.98
Chinese	408,800	0.76	4.33	15.22	12.08
Other	384,100	0.71	3.10	14.40	13.30
Total		100			

(Source: Adapted from Lievesley (2010))

1.1.2.3 Family setting (household size)

The UK 2001 Census found that South Asian households were the largest of all other ethnic groups. Bangladeshi people had the largest of all, followed by Pakistani and Indian households, with an average of 4.5 people, 4.1 people and 3.3 people, respectively (Figure 1.3.). Seventy-four percent of Bangladeshi households contain at least one dependent child (0-15 years), followed by Pakistani households (66%), and Indian households (50%), compared with 28% of White British households (ONS, 2005). A large household is well documented as a risk factor for children's nutritional status in developing countries, in particular for young children. Some studies have emphasised that family size has an impact on South Asian pre-school children's nutritional status in their home countries (Dwivedi et al., 1993; Iram and Butt, 2006). However, Luthra and Parvan (2010) found no relationship between them. Therefore, it is interesting to explore this relationship and find out whether or not this association applies to South Asian pre-school children living in the UK.

Figure 1.3: Average household size by ethnic group in Great Britain as of April 2001.



1.1.2.4 Description of religious groups

South Asians are a religiously diverse group. The majority of South Asians in the UK are Hindu, Sikh or Muslims. It has been reported that 92% of both Pakistanis and Bangladeshis living in the UK are Muslim, 45% of Indians are Hindu, 29% of Indians are Sikh, and 13% of Indians are Muslim (Census, 2001). Indians originating from Gujarat are mostly Hindus, although there are also some Muslims from this region, whereas the Punjab is home to many Sikhs, although Hindu Punjabis can also be found in Britain. Pakistanis are mainly of Punjabi descent (and Muslims), and most Bangladeshis are from Sylhet district (and also Muslims) (Kassam-Khamis, 1995). Peoples' religious differences influence their dietary habits, further details are provided in section 1.1.5.1.

1.1.3 Food Consumption and Lifestyle of the South Asian Community

1.1.3.1 Food consumption

Food is a crucial aspect of culture, and particularly so for the South Asian community for whom it signifies religion, caste and occasion (Fieldhouse, 1995). Given the imperative associations between food and their identity, there is a practice of retention of dietary habits as an aspect of culture even after migration, as well as among future generations of the South Asian immigrant population (Joshi and Lamb, 2000). The South Asian diet is traditionally healthy because of the high content of grains, legumes and fruits and vegetables that indicate a fairly high fibre and moderate to low fat intake (Landman and Cruickshank, 2001). Nevertheless, frying vegetables may limit or damage potentially ‘protective’ nutrients, including anti-oxidants (Joshi and Lamb, 2000).

South Asians are often seen to represent a homogenous group of people sharing a common culture. However, they have wide diversity in terms of religion, origin, language and dietary practices. The dietary customs among South Asian sub-groups are mainly based on regional and religious differences.

1.1.3.1.1 Indian diet

Indians are a diverse group, with each sub-group having a distinctive identity. In the UK, Indian migrants mainly originate either from Gujarat (Hindu and some Muslim) or Punjab (Sikh). The Indian diet is influenced by religion. Gujaratis (Hindu) are basically lacto-vegetarians, as they do not eat beef or beef products due to their religion. In addition, orthodox Hindus also exclude eggs from their diet. Although animal products tend to be proscribed, some Gujaratis include meat, fish and alcohol in their diet (Jethma et al., 2012). Amongst Gujaratis in the UK the breakfast menu is varied, comprising convenience foods such as breakfast cereal (to which milk is added) or toast (white bread mostly) and spreads such as butter. Indian tea is the favoured beverage (Jethma et al., 2012). Ready-to-eat, fried, savoury snacks or Gujarati bread are also commonly eaten (Joshi and Lamb, 2000). *Roti*, rice, *dhal*, cooked vegetables or vegetables with pulses, sliced vegetables, pickles and *chutneys*, along with plain yoghurt make up a typical Gujarati meal.

Indians from Punjab (Sikh), on the other hand, are omnivores. The main food restrictions for Punjabi Sikhs are that they are not allowed to eat halal or kosher meat. They are unlikely to eat pork and beef is forbidden. Alcohol, smoking and taking recreational drugs are also prohibited, although in practice, alcohol consumption by men can sometimes be excessive (Thomas and Bishop, 2007). Amongst Punjabis in the UK the breakfast menu consists of cereal or porridge with milk or toast with eggs (Jethma et al., 2012). Chapatti is the most commonly eaten food in both groups, but many more Gujaratis have been reported to eat rice (72% compared to 30%). *Paranthas* are commonly consumed by Punjabis, but less often by Gujaratis (Simmons and Williams, 1997). In terms of nutrient composition, Guajaratis were found in one study to have diets with higher fat content than the Punjabi group (Kassam-Khamis, 1995), which may be due to their use of homemade *ghee* and yoghurt, which has been reported to be higher amongst Gujaratis (Patel et al., 2006).

1.1.3.1.2 Pakistani diet

Pakistanis consume more ‘roti/ chappatis’ (unleavened bread) than rice as a staple food. A usual traditional meal is chappatis and a *salan*. A *salan* is a curry which may include vegetables, meat, poultry, fish or pulses cooked in a specific way. The cooking of *salan* closely resembles stewing or casseroling; it also involves the use of the hob, with extensive frying of spices, onions, and ghee. Items like kebabs, samosas, salads, and tikkas are considered accompaniments to a proper meal (Jamal, 1998). Frequent consumption of sweet dishes like *kheer*, *sevian*, and *mithai* has also been noticed (Kassam-Khamis, 2000). Abstention from alcohol is common, and Pakistanis are less likely to eat vegetables, homemade ghee and yoghurt in comparison with other ethnic South Asian sub-groups (Simmons and Williams, 1997).

1.1.3.1.3 Bangladeshi diet

The staple for Bangladeshis is rice and fish, the latter being a very important part of their diet. They often consume *dhals* or stir fried vegetables (*bhajis*), or add vegetables to meat and chicken. Chewing of ‘paan’, which reportedly has a diabetogenic effect (Obeid et al., 1998), is very common among this ethnic sub-group. The nutrient composition of their diet illustrates that traditional recipes have high fat content (Kassam-Khamis, 2000). This can be explained by the justification given by Fieldhouse (1995), that commodities such as cooking oil and meat probably become more desirable and more affordable after migration. Consumption of red meat and fried foods has been reported to be highest among South Asian (Barasi, 2003).

1.1.4 Inter-generational differences

An important aspect of the diet of this migrant population is the increasingly reported intergenerational differences, in particular the acculturation[1] of the diets of younger generations. Nutritional transition is a major factor responsible for the development of many lifestyle disorders (Patel et al., 2006). The dietary 'acculturation' in the migrant South Asian community has been gradual, depending on the length of residence in the adopted country, age group and whether the subject is a first or subsequent generation migrant (Anderson et al., 2005). More signs of acculturation were found in the second generation (2G) compared to the first generation (1G) by Parsons et al. (1999). The UK National Child Development Study of 1985 reported differences in the dietary intakes of 1G and 2G migrants and found that people born in the UK were more likely to include European foods in their diet than those who had migrated recently (Parsons et al., 1999). First generation British-Pakistani informants were keener on eating traditional Pakistani food cooked in a traditional way on a regular basis. They preferred eating Pakistani traditional meals because these were perceived as tasty, spicy, traditional, original and filling. The eating of traditional meals which involved eating chappatis with some kind of *salan* (a curry) was considered an essential part of their "proper meal" (Jamal, 1998). English foods were perceived by the informants belonging to the young generation as convenient and as a way to conform to the mainstream culture. Such consumption practices reflected adventurism on their part and an independence from parental control. Most of the younger generation perceived their traditional food to be tastier and spicier, but heavier than mainstream English food (Jamal, 1998). This dietary acculturation includes decreased vegetarian status and use of South Asian ethnic foods, uptake of Westernised food items, and alteration in meal patterns (Higgins, 2008). Recent studies have identified a converging dietary pattern comprising high calories, saturated fat, simple sugars, and low intakes of dietary fibre, fruits and vegetables (Misra and Ganda, 2007).

The food items consumed most frequently by younger South Asians are crisps, sandwiches, pasties, baked potatoes and pizza (Gilbert and Khokhar, 2008). All of these foods are predominantly rich in fat and sugar, and lower in dietary fibre than

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[1] Acculturation can be defined as "a process of cultural changes as a result of contact with the dominant culture" (Redfield et al., 1935).

the legumes and grains of the traditional diet, as well as being linked to an unhealthy diet (Gilbert and Khokhar, 2008). Sheikh and Thomas (1994) reported a decline in the practice of religious abstention by the younger generation, which was attributed to either the rejection of the cultural practices of their religious upbringing or to an increase in their degree of identification with the Caucasian population, who do not practice food abstentions as a result of religion. Kumar et al. (2004) also reported a low consumption of fruit and vegetables among young ethnic adolescents, deviating from the traditional diet abundant in vegetables and fruits, suggesting post-migration changes. According to them, the 2G are in danger of persisting with unhealthy habits from their minority culture and acquiring unhealthy habits from the majority culture. They illustrated this well with the example of boys from the Indian subcontinent who can have a high consumption of both full fat milk and cola/soft drinks.

1.1.5 Lifestyle factors affecting South Asians' food consumption

1.1.5.1 Socio-cultural trends

Various dietary practices can be found among the South Asian community and these practises are influenced by religious dietary laws (Leung and Stanner, 2011). It has been found that a majority of Asians of both sexes avoid certain foods due to religious or ethical conviction. The majority of food abstentions come from the Hindu group where there is a form of vegetarianism practiced, ranging from lacto-vegetarianism to avoiding only beef, as the cow is regarded as sacred. Hindus fast on special occasions as a respect to gods or as part of their penance. Sikhs avoid any food and drinks that may harm their body such as alcohol, or ritually slaughtered meat such as halal meat; and they fast during full moon or specific feast days (Leung and Stanner, 2011). Muslim abstentions range from eating halal meat only to avoiding pork products but still consuming non-halal meat (Sheikh and Thomas, 1994). Muslims fast during Ramadan[2]. Fasting is one of the five pillars of Islam and during Ramadan eating, drinking and smoking is forbidden from sunrise to sunset. However, there are exceptions and exemptions for people such as children, pregnant and lactating women, the elderly and those who have serious sickness (Leung and Stanner, 2011).

There is also great variation in food preparation (recipes, fat content and portion sizes of foods) between and within South Asian groups according to regional origin

[2] Ramadan: The ninth month of Islamic calendar.

(Khokhar et al., 2001; Kassam-Khamis et al., 1995). However, generally speaking, it is South Asian custom for women to be responsible for food preparation in the household (Bush et al., 1997; Bush et al,, 1998; Simmons and Williams, 1997) and this may be divided or shared between female members (Anderson and Lean, 1995). Therefore, it is important to focus on women's education level, nutritional knowledge, customs and beliefs as factors which may affect the dietary habits of this community. Further details on the level of education of South Asian women are provided in section 1.1.5.2.

Food is usually prepared from primary ingredients (Anderson and Lean, 1995) and prolonged cooking is a common practice (Begum, 1979; Abraham, 1982). The most common methods used to prepare food are pan-frying, deep-frying or preparing food in the form of a curry (Lip et al., 1995). Left over curries are often reheated and consumed the next day (Kalka, 1988). Foods such as meat, rice, vegetables and pulse dishes are usually served in a large communal pot and people are expected to serve themselves throughout the meal (Abraham, 1982a; Wharton et al., 1984). Different traditional food serving practises are applied within South Asian households. Men and older boys in Muslim households often eat first, separated from women and smaller children (Wharton et al., 1984), whereas in Hindu and Sikh households, men and women generally eat together. However, in some extended Hindu families, women eat with children after the men have eaten (Abraham, 1982).

1.1.5.2 Socio-intellectual trends - level of household education and nutritional knowledge

Among non-white ethnic groups in the UK, Indians are the most likely to have degrees, whereas Pakistanis and Bangladeshis, especially women, are less likely when compared to White British people (ONS, 2005). Among Bangladeshis, 48% of women and 40% of men have no qualifications, among Pakistanis, 40% of women and 28% of men have no qualifications, and among Indians, 18% of both gender have no qualifications (ONS, 2005).

The relationship between education and health is a controversial topic (Cutler and Lleras-Muney, 2006). The general hypothesis in Western countries is that an increased level of education relates positively to improved diet and health, including lower saturated fat and red meat intakes and a higher consumption of fruits and vegetables (Irala-Estevez et al., 2000; Hulshof et al., 2003). Picker (2010) stresses the importance of education and explains that a lack of education is a defining factor in the increase in risk of diseases and health complications. He notes: “An additional four years of education lowers five-year mortality by 1.8 percentage points; it also reduces the risk of heart disease by 2.16 percentage points and the risk of diabetes by 1.3 percentage points” (Picker, 2010).

Notwithstanding, the association between education level and diet among migrant groups varies; both positive and negative associations have been observed (Guendelman and Abrams, 1995; Lv and Cason, 2004; Nicolaou et al., 2006).

Typically, as in many cultures, among South Asians the matriarch is responsible for selecting and preparing food for the children and the rest of the family and therefore it is from the mother that the children learn the skills of food selection. Consequently, children are more inclined to adopt those dietary habits learned from their family. A number of studies confirm that parental feeding practices have an important role in the development of children’s eating behaviors (Birch and Fisher, 2000; Faith et al., 2004; Birch, 2006). Many factors may influence mothers' food choices and dietary practices, including beliefs, culture, experiences and nutritional knowledge. As nutrition plays a vital role in children's growth and development, mothers should strive to make the right food and lifestyle choices during early childhood, as this can prevent chronic and nutrition-related diseases later on in adulthood. Therefore, mothers' awareness regarding their children's health and dietary practices is essential.

Unfavorable dietary practices among Asian infants in the UK were explored by Williams and Sahota 1990. They found that while Asian mothers favour breastfeeding, there seems to be a lack of knowledge regarding weaning practices. For example, the research remarks that sugar is used to assist with feeding practices as “…it ensured that more milk would be consumed, or because it was considered to be intrinsically beneficial” (Williams and Sahota, 1990). The research also notes that a large number of mothers did not firmly control their children's dietary intake, and some admitted to allowing their children to make their own selections when it came to food (Williams and Sahota, 1990). Further details on this subject can be found in section 1.1.7.

A survey carried out on behalf of the Department of Health on infant feeding practices of mothers of Bangladeshi, Indian, or Pakistani origin living in England found that rickets, which is a condition related to a lack of vitamin D or calcium, has been identified as a problem in the children of Asian immigrants since the 1960s (Thomas and Avery, 1997). However, various education campaigns have reduced the incidence of this disease. This would seem to suggest that education plays a role in developing an understanding of the relationship between diet and health (Lawson and Thomas, 1999a). Glewwe (1999) suggested that the mother's health knowledge is an important factor for increasing child health and he showed how the mother's education is linked to child health. Glewwe emphasized that basic schooling skills (literacy and numeracy) increase a mother's capability to identify problems (illnesses) and help to solve problems (seek treatment for their child). Moreover, educated mothers are more able to read and follow medical instructions for their children. Increasing the number of years in school makes women more interested in modern medicine (Glewwe, 1999).

One must also take into account the role of language in the understanding and application of educational knowledge that is obtained by the health workers. Language has been identified as a major barrier to accessing health services in the South Asian community. In a 1997 survey of infant feeding in Asian families, South Asian mothers reported that they did not attend antenatal classes due to language difficulties. Therefore, having information in the language of the community is important and it can be done by using professionals from the same community or speaking the same language. This was confirmed by Stockley, 2009 in a review prepared for the Food Standard Agency Wales of dietary intervention models for Black and minority groups.

Lee and Garvin (2003) note that adequate knowledge is not necessarily translated into correct action. Therefore, there is a need to investigate the factors that help South Asian mothers to have positive action regarding their children's diet and health.

1.1.5.3 Socio-economic trends

In 2002/03, the unemployment rates for Bangladeshi and Pakistani men were 18% and 14%, respectively. They had much higher unemployment rates than White British men, whose rate was 5%. As for Indian men, the unemployment rate was 7%. However, Pakistanis were most likely to be self-employed and the self-employment rate for Pakistanis was around 23%, compared with 12% for White

British men. When it comes to professional occupations, Indians were the most likely to be employed compared to other non-British groups. Indian men were more likely to be working as doctors, whereas Pakistani men were more likely to be working as cab drivers or chauffeurs, and Bangladeshi men were usually either cooks or waiters. Among South Asian women, the majority of Pakistanis and Bangladeshis were looking after their family or home, with 68% and 77%, respectively, being economically inactive (ONS, 2005).

In general, occupation is often used to define social class. Although sometimes it does not reflect real economic status, it is a better reflection than education level. In the case of South Asians, British social classification cannot reflect economic status since they may rely on other sources of income such as properties owned in their countries of origin, or they may have a financial responsibility in their country and may send money to their families (Kassam-Khamis, 1995).

Poverty rates also vary among South Asians. Bangladeshis and Pakistanis were found to have the highest poverty rates of 65% and 55%, respectively, whereas Indians had the lowest rate at 25%, compared with White British at 20%. Around 60% of Bangladeshis, 40% of Pakistanis, and 10-15% of Indians and White British are in income poverty. Almost half of all children from minority ethnic groups are in poverty (Palmer and Kenway, 2007).

Food choices and food quality may be limited in low income groups. This may make them more susceptible to a multitude of diseases usually found in poor income circumstances (Low Income Project Team, 1996) (further details about diseases will be provided in section 1.1.9). For instance, they tend to buy cheaper cuts of meat (more fat than lean meat), consume less fruit and vegetables, or buy more processed foods (Gilbert and Khokhar, 2008). This trend has been reported in South Asian groups living in the UK. Lip et al. (1995), in a survey on the dietary fat purchasing habits of whites, blacks and Asian people in Birmingham, reported that low income households of South Asians in the UK were more likely to buy foods high in fat content, and consumption of butter, eggs, milk, ghee and the use of frying were greater than white and black groups in the UK. Moreover, Landman and Cruickshank (2001) found that poorer South Asian families in the UK reuse cooking fat, which may form trans fatty acids and lead to the development of heart diseases. However, low income is not necessarily associated with poor quality diet among minority ethnic groups; for instance, they maintain traditional food habits and purchase traditional foods even at high cost (Bush et al., 1997). In addition, income can also influence the type and location of food supermarket chosen for purchasing food. Low income families are not able to reach out-of-town food supermarkets which offer lower prices, greater choice and higher quality foods due to transportation issues, since they usually walk or use public transportation (Bush et al., 1997).

There is a well-established association between unhealthy lifestyles and factors such as social class, education, deprivation and income (Marmot et al., 1991; Pill et al., 1995; Wardle and Steptoe, 2003). However, when illustrating the relationship between ethnicity and health, Smith et al. (2000) found that once the standardisation for class differences in the immigrant mortality data was completed, the ethnic variations in health remained more or less unchanged. Therefore, this relationship is either not present for minority ethnic groups or is much more complicated (Saxena et al., 2004; Dawson et al., 2005; Kumar et al., 2004). For instance, Saxena et al. (2004) found that poor physical fitness rather than social class and lifestyle factors is significant when it comes to obesity. More investigations need to be conducted to better understand this relationship among ethnic minority groups.

1.1.5.4 Additional factors influencing food choices and food intake of South Asians living in the UK

1.1.5.4.1 Availability of culturally appropriate food

Availability plays an important role in influencing food choices. It is associated with the social context of migration, living conditions, and new social networks (Fieldhouse, 1995). In general, traditional foods are not regularly available and they may only be available in local ethnic supermarkets in some regions in the UK (Leung and Stanner, 2011). The size of a migrant community verifies the availability of their foods (Chan, 1991). In the case of South Asians, they represent the largest minority group in the UK (section 1.1.1). Douglas (1993) reported that South Asian foods have become more widely available but are still expensive due to importation costs. Moreover, Landman and Wyke (1995) found in a survey of South Asians in Central Scotland that availability and cost did not affect South Asians’ food choices. However, seasonality has an effect on the availability of foods. Kassam-Khamis et al. (2000) reported that some types of traditional dishes were consumed more in the summer than in the winter due to the seasonal availability of certain foods. For example, Bangladeshis imported a type of frozen fish (bual, illish) in the summer more than in the winter, which led to them replacing it with pabda (sardines) in the winter.

1.1.5.4.2 Foods beliefs

There are several traditional food beliefs among some ethnic groups which may influence their food choices (Leung and Stanner, 2011). For instance, the concept of 'hot' and 'cold' food classification is common among South Asian subgroups (Rapport et al., 1992; Sivaramakrishnan and Patel, 1993). It is related to beliefs on how food affects the body (not the temperature or spiciness of food). 'Hot' foods such as onions, garlic, mango, papaya, dates, meat, eggs, tea, coffee and honey are considered to increase the body temperature and increase activity, whereas 'cold' foods such as wheat, rice, milk yogurt, all type of nuts, butter, ghee and white sugar are considered to reduce the body temperature, giving strength to the body (McArthur et al., 2012). In addition, Indian subgroups believe that some foods have medicinal properties or health benefits, therefore they consume them frequently. They include certain types of vegetables such as karela, banana leaf, tamarind (Gilbert and Khokhar, 2008) and fenugreek (Kelleher and Islam, 1994). They also include herbs and spices (dishes with extra chillies), fatty foods and sweets (halwa) made from gram flour, ghee and sugar, which are believed to treat a sore throat overnight (Gilbert and Khokhar, 2008). Hindus believe that ghee has a purification quality in that it is a cooling, soothing, source of strength which helps enhance nutrient absorption (Khajuria and Thomas, 1992).

All the above factors, including culture, religion, education, income, availability and food beliefs need to be taken into account when we assess South Asian dietary intake and food practices. This will help to find the best ways to alter the diets and health outcomes of South Asians.

1.1.6 Effect of migration on meal patterns

When people move from one culture to another their meal patterns, times and content are adjusted to their new lifestyle. In terms of meal patterns, snacking patterns are the first adaptations to occur, as snacks are not considered to be real food. Next is breakfast, the least culturally important meal, followed by lunch, as it is the time when migrants may come into contact with the host society and its cultural norms (Anderson and Lean, 1995). The evening meal is most likely to persist as this occasion is used to strengthen families' cultural identity by the serving of traditional foods. In terms of meal content, the change begins with accessory foods (such as oils, herbs, spices, sweets, nuts, fruits and drinks) which are not considered 'real food'. On the other hand, the substitution of complementary foods (legumes, meat, fish, eggs, vegetables or milk/cheese) takes place over a longer period of time, as cultural identification with these foods is stronger, and the staples (bread in the form of chapatti, parantha and naan) may remain the same for generations (Mellin-Olsen and Wandel, 2005).

South Asian studies have noticed similar trends in terms of transition, fewer hot meals, concentration of energy intake later in the day, a shift in complementary foods to more meat, and a decline in the use of legumes and vegetables (Mellin-Olsen and Wandel, 2005), together with retention of many features of a traditional diet, particularly main meal components (Anderson and Lean, 1995). A reduction in consumption of accessory foods such as pickles, chutneys, fresh sliced vegetables, and plain yoghurt and buttermilk (considered cooling foods, so of less use in cold climates such as the UK) in the main meal has been observed.

Lunch for children now increasingly comprises hamburgers or fish fingers, pasta and omelettes (Simmons and Williams, 1997). Novel sweet items were found to be notably introduced to children's diets in Bradford (e.g., breakfast cereals and fizzy drinks), whereas traditional items (chapatti, curry) persisted (Edwards et al., 2006). Whincup et al. (2002) found that South Asian children consumed less fresh fruit and vegetables than white children and comparatively lower amounts than their counterparts in their native country (Hakeem et al., 2002). Children were significantly more likely to consume meat, sugars, fizzy drinks, and fast food, and were significantly less likely to eat vegetables, root vegetables, fish, dairy products, tea, or spices than either of their counterparts in Pakistan (Edwards et al., 2006). Hakeem et al., 2002 observed in their study that urbanization had influenced children's dietary pattern. Higher dietary energy intakes, together with higher fat % energy and protein % energy content in the diet with lower intakes of carbohydrate as percentage of energy (sugars), Ca, Fe, vitamin C and D has been found in Bangladeshi children settled in Britain (Brock et al., 2009) compared to their counterparts in their native country (Hakeem et al., 2002; Edwards et al., 2006).

Researchers have attributed this to increased urbanization in their diets, including consumption of commercially-processed and Western-style foods.

Another important consideration is that immigration can be highly stressful and include challenges related to communication barriers, social isolation, financial insecurity, and conflict in relation to immigrants retaining the values and culture of their home country and adapting to those in their new country. Importantly, psychological stress and low self-esteem among migrants can lead to increased frequency in smoking, alcohol consumption, unhealthy dietary practices, and physical inactivity, which may lead to metabolic disturbances (Misra and Ganda, 2007). Factors such as stress and depression have been linked to increased risk of CVD (Lear et al., 2009).

Migration may also have an effect on obesity prevalence within ethnic groups (Popkin and Udry, 1998). According to Goel et al. (2004) and Mellin-Olsen and Wandel (2005), migration to a more affluent society may result in a change of lifestyle which in turn may lead to increased body weight. Patel et al. (2006) noticed more alcohol consumption, higher total energy intakes, higher percentage of energy derived from fat and consequently a marked increase in the incidence of obesity amongst Gujaratis settled in the UK in comparison to their counterparts in India.

1.1.7 Effect of custom on maternal and pre-school age children's food intake

1.1.7.1 Women during pregnancy

Evidence suggests that mothers' dietary habits and lifestyles can influence their children's health. In South Asian society there are many myths and traditional diet beliefs that are practiced during the pregnancy/post pregnancy period, some of which are still followed, particularly by Pakistani migrants in the UK (Ahmad et al., 2012). South Asians believe in the concept of 'hot' and 'cold' foods, as explained in section 1.1.5.4.2. Pregnant women avoid 'hot' foods since they consider pregnancy to be a 'hot' condition. Therefore, fish, meat, eggs and some fruits such as mangos and papayas are not recommended during this period, and milk, yogurt, butter and ghee are eaten instead (Caplan, 1997). Moreover, they believe that there is an association between diet and the physical features of the child, such as skin colour (mainly Pakistanis). Having a child with fair skin is associated with drinking light-coloured drinks such as water, milk and fruit juices, while dark-coloured drinks such as tea coffee or cola are believed to lead to having a child who is dark skinned. Furthermore, iron supplements may be avoided by some South Asian women, as they believe that the dark stool which results from taking iron supplements may affect the skin tone of the child (Ahmad et al., 2012). In addition, the prolonged cooking processes of vegetables which is common practice among South Asians may result in the loss of certain vitamins, such as vitamin C, which can inhibit iron absorption in the body (Alvi et al., 2003), and folate content (Chambers et al., 2000).

Pakistani women believe that the diet following pregnancy should be high in sugar, fat, protein and calcium to help with breast milk secretion, provide energy during lactation, and aid recovery from child birth (Ingram et al., 2003). Special traditional foods such as *gur* (made of almonds, dried fruits, spices and ghee) and *punjiri* (made of whole wheat flour or semolina, sugar, dried fruits, nuts, ghee and herbal gums) are recommended for daily consumption by delivered mothers (Ingram et al., 2003; Laroia and Sharma, 2006). Furthermore, dishes made from chickpeas or prawns are believed to upset babies’ stomachs (Ingram et al., 2003). The main dietary advice heeded by South Asians during pregnancy and while raising children has been found to mainly come from family and friends and their experience or knowledge, not from scientific resources (Sarwar, 2002; Ahmad et al., 2012).

1.1.7.2 Infant feeding practices

It is recommended to start feeding within the first hour after birth, and the current guideline is 6 months of exclusive breastfeeding (WHO, 2002; DH, 2004). However, the WHO recommends breastfeeding continues up to two years of age or beyond. Many South Asian mothers do not follow these recommendations due to a variety of reasons. South Asian women differ in terms of breastfeeding rates (Ingram et al., 2003; Bolling et al., 2005). Commonly grandmothers (their mother or mother-in-law) have an important influence on breastfeeding practices in this community (Thomas and Avery, 1997; Ingram et al., 2003; Laroia and Sharma, 2006).

In the past, grandmothers advised mothers to dispose of colostrum[3] as it was considered to be old milk stored in the breast for a long time, but due to health

[3] Colostrum: pre-milk liquid that mothers produce after delivering a baby; it is high in protein, low in fat content and has anti-infective properties (Barger, 2011).

campaigns, Bangladeshi and Indian grandmothers have been aware of the importance of colostrum and have agreed for it to be fed to babies. However, Pakistani grandmothers are less happy to do so as they still think that it should be thrown away (Haider et al., 1999). A number of studies have confirmed that some South Asian women delay breastfeeding due to cultural tradition that views colostrum as harmful to babies' health (Morse et al., 1990; Littler, 1997; Twamley et al., 2011). In addition, Asian Muslims have reported insufficient privacy in hospital for breastfeeding (Hartley, 2003; Ingram et al., 2003). Therefore, honey and water are used as a substitute for breastfeeding in the first few days after birth (Aukett and Wharton, 1989; Ingram et al., 2003).

Religious beliefs have been found to influence breastfeeding among Muslims but not Hindus or Sikhs. In Islam, the Quran states that mothers should feed their child for two years due to the benefit of breastfeeding for both the child and the mother, and this happens to be in line with what the WHO recommendation states, whereas Hindus or Sikhs do not have any religious reference to encourage mothers to breast feed (Ingram et al., 2003).

Acculturation has been found to have a significant impact on breastfeeding. Hawkins et al. (2008) found that there is a negative effect on breastfeeding practices when moving from a culture of high breastfeeding to low breastfeeding; for every 5 years a woman spends in the UK, there is a 5% decline in the 4 month period of breastfeeding. Sarwar (2002) found that 73% of Pakistani mothers in Pakistan were breastfeeding their children compared to 24% of Pakistani mothers in the UK. A national survey of infant feeding in Asian families by Thomas and Avery, 1997 reported that the incidence of breastfeeding among South Asian mothers (90% among Bangladeshi, 82% among Indian and 76% among Pakistani mothers) was higher than white mothers (62%); however, South Asian mothers, particularly Pakistanis and Bangladeshis, were more likely to stop breastfeeding earlier than Indian or white mothers. In addition, the infant feeding survey[4] of Bolling (2005) found that between 2000 and 2005, breastfeeding increased among both Asian mothers (87% to 94%) and white mothers (68% to 74%); however, South Asians

[4] Feeding surveys in the UK started in 1975 and have been conducted every 5 years. The aims are to provide information on the incidence, prevalence and duration of breastfeeding and other feeding practices adopted by mothers from birth up to 9 months in the UK. In addition, information on mothers' behaviours before, during and after pregnancy is gathered.

had lower rates of breastfeeding duration (at 4 weeks) when compared to White mothers. Furthermore, Griffiths et al. (2005) noted that Bangladeshi, Pakistani and white mothers were more likely to stop breastfeeding before 4 months. Many South Asian mothers in the UK adopt the habit of formula feeding instead of breastfeeding. The reasons behind this are many and include the fact that South Asians often live in joint family households which may not provide the privacy that the mother needs to breastfeed. In addition, many other responsibilities, such as housework and caring for other members, rest on the mothers of the family and therefore they tend to consider breastfeeding as a time-consuming process (Twamley et al., 2011; Ahmad et al., 2012). Moreover, anecdotal evidence suggests that there is a lack of family support, since the pressure to introduce formula to the baby comes from the parents and in-laws (Ingram et al., 2003; Twamley et al., 2011). Williams and Sahota (1989) found that in inner city Leeds, South Asian infants fed from a bottle for up to 2 years, and that two-thirds of the milk feeds were sweetened. Moreover, many mothers refused to stop feeding their infants from a bottle by 12 months, thus rejecting advice from health professionals because of the concern that this may stop their children from drinking milk (Williams and Sahota, 1990).

There is a need to understand South Asian mothers' perceptions of feeding their children and to understand their needs so that they can be better informed about the right practices of breastfeeding by health professionals.

1.1.7.3 Weaning food

Weaning is the process of starting to introduce solid foods to babies. The Department of Health originally (1994) considered 4-6 months to be the ideal age to start with solid food. However, WHO recommendations (2002), adopted by the UK Department of Health in 2004, state that exclusive breastfeeding (and/or infant formula, if used) should continue to 6 months and introduction of complementary foods should begin at 6 months of age (26 weeks). On the other hand, the UK Scientific Advisory Committee on Nutrition (SACN) reported that although there is sufficient evidence that exclusive breastfeeding for 6 months is nutritionally adequate, flexibility in the advice is recommended since early introduction of complementary foods is normal practice among UK mothers. Therefore, complementary foods should be introduced by 6 months (26 weeks) but not before 4 months of age (16 weeks). According to the infant feeding surveys of 2005 and

2010, in the UK in 2000, 85% of mothers introduced solid foods to their babies by 4 months of age, by 2005 the figure had fallen to 51%, and by 2010 it had reached 30% (Bolling et al., 2005; McAndrew et al., 2010).

In the case of South Asians, Thomas and Avery (1997) noted that 90% of all South Asian groups had started weaning their children by 4 months of age. However, other studies have showed that there is late weaning in some cases and also weaning that is earlier than recommended in other cases (see Table 1.4). In both early and late weaning there are health implications that may affect the child in his/her current and later life. In the case of early weaning, the child may have an increased risk of respiratory illness (Wilson et al., 1998), allergy and infection (Thomas and Clayton, 2001). On the other hand, delayed weaning increases the risk of energy and nutrient deficiency of protein, iron, zinc, and vitamin A and D, faltering growth, delayed development of eating behaviour and feeding skills such as chewing, swallowing and speech development (Department of Health, 1994; Thomas and Bishop, 2007). Further information about certain nutrient deficiencies among South Asian children are given in section 1.1.8.3.2.

Table 1.4: The age that South Asian mothers introduce solid food to their babies.

Reference	Location	Study group	Age of weaning
Harris et al., 1983	London Borough of Tower Hamlets	Bangladeshi	Between the age of 2 months and 2 years, but in general by 6 months.
Griffiths, 1983	Birmingham	- Indian	7 ½ months on average.
		- Pakistani	9 ½ months.
Williams and Sahota., 1989	Leeds	- Pakistani and Indian (Punjabi and Gujarati)	Between the age of 4-5 months.
		- Bangladeshi	6-7 months.
Shahjahan, 1991	Newcastle	Bangladeshi	In general 3-5 months; however, 6-8 months were also found.
Sahota, 1991	Bradford	South Asian	In general 2-6 months; however, 1-2 months were also found and a few between 6-9 months.
Sarwar, 2002	Nottingham in the UK and Channu in Pakistan	Pakistani	In general between 3-4 months of age; however, 7 months or later were also found.

(Source: Cited in Bush et al. (1997))

In spite of the fact that South Asian mothers started to offer solid foods to their babies, milk remained the main food source that was relied on until the age of two years (Harbottle and Duggan, 1992). Thane et al. (2000) and Cowin et al. (2001) reported that the dependence of young children on milk increases the risk of iron deficiency. This explains the prevalence of iron deficiency anaemia among South Asian babies. Moreover, South Asian mothers tend to introduce cow's milk at an early age (Lawson et al., 1998). A number of studies have also described an increased risk of iron deficiency in children who receive cow's milk before one year of age (Mills, 1990; Kim et al., 1996; Male et al., 2001). During the weaning period, milk consumption should be part of a balanced diet comprising all food groups (section 1.1.8.1) to avoid the risk of poor iron intake. Common first weaning foods among South Asians babies were found to be baby rice, cereal, boiled eggs, rice and yogurt (Ahmad et al., 2012). In the infant feeding survey of 2010, McAndrew et al. (2010) reported that Asian mothers were the most likely to give pulses (beans, lentils and chickpeas), sweets, chocolate and biscuits to their babies compared to all other mothers. Furthermore, they were found to be the least likely to give any type of meat (chicken, fish and beef), with the exception of lamb. Moreover, offering Asian tea to children (tea made with water and milk) was a common practice in this community (Lilly, 1995; Parsons et al., 1999). It has been reported that phenolic compounds (tannins) in tea have an inhibitory affect on non-haem iron absorption (Watt et al., 2000; Khokhar and Apenten, 2003). It is recommended that tea and coffee should not be given to young children due to their tannic acid content (Watt et al. 2000).

It has been shown that at the age of 15 months, 73% of Pakistani children, 55% of Indian children, and 2% of Bangladeshi children eat chapatti[5] (Lawson et al., 1999b). Chapatti has a high content of phytate which has been found to interfere with vitamin D metabolites (Clements, 1989; Lawson et al., 1999b). Lawson et al. (1999b) reported that there was a significant association between poor vitamin D status and chapatti consumption among Pakistani children, but this association did not reach significance among Indian children and there were insufficient numbers of Bangladeshis to run the analysis. However, levels of vitamin D were higher among Bangladeshi children compared to Pakistani and Indian children. In addition, it has

[5] Chapatti: Traditional flatbread referred to as 'roti' or 'chapatti'. The main ingredient is '*Atta'* which is whole wheat/wholemeal flour that has a high gluten content and is rich in dietary fibre, starch, protein, vitamins and minerals. *Atta* is available in the UK (Jethma et al., 2012).

been shown that a high intake of phytates in the daily diet decreases the availability[6] of certain minerals, including Fe, Zn and Ca (Pushpanjali and Khokhar, 1996; Lopez et al., 2002).

Poor weaning practices can be found among South Asians living in the UK. Many factors such as the mother's dietary knowledge, dietary customs, cultural values, religion, and cooking methods can effect this important period of life. Not only do South Asian mothers need to know which nutrients are important to their children's health, it is crucial for them to know how to maintain a balanced diet and learn how to increase the absorption of some important nutrients, such as how to increase iron absorption during a meal. Therefore, special attention should be given to gaining good knowledge about their lifestyle to ensure appropriate recommendations and advice are provided which suit the beliefs, religions and cultures of this community.

1.1.8 Pre-school age children's nutrient intake

1.1.8.1 Nutritional requirements and dietary guidelines for pre-school children

Childhood is a critical period of life. It is the period when dietary habits are formed that will be the foundation for the diet in later life (Weaver et al., 2008). Pre-school children (toddlers 12-36 months) change their food intake by moving from a milk-central diet to the typical diet of their family (Barasi, 2003). At this age children are totally dependent on others for their food. Therefore, it is important to maintain healthy eating guidelines during this period. They need an energy-dense diet since the energy and nutrient requirements for pre-school children per kilogram of their body weight are much higher than those of older children and adults (Thomas and Bishop, 2007). Although the UK's Eatwell plate model is suitable for most people, including vegetarians and people from various ethnic origins, it does not apply directly to children under two years old due to their different nutritional needs (FSA, 2007). Pre-school children's diet should be a combination of foods from all food groups to meet their nutrient requirements, considering the differences between toddlers as some eat more and some eat less than average (Weaver et al., 2008).

[6] Bioavailability of minerals: It is hard to calculate the exact level of bioavailability of minerals only by using the phytate content in food. Other factors may affect this, including types of food consumed (nature of the phytate type) by individuals and the cooking methods used (soaking, fermenting, boiling, etc.) which play a role in the mineral availability value (Khokhar and Pushpanjali, 1994; Frontela et al., 2011).

Table 1.5 illustrates the dietary guidelines for pre-school children aged 1 to 3 years old. Children under 5 with a weak appetite need to have vitamins A, D and C supplementation (FSA, 2007).

Table 1.5: A summary of dietary guidelines for pre-school children aged 1-3 years old.

Food groups	Recommendation	Extra information
Bread cereals and potatoes	• One food item at least should be offered at each meal and snack times. • A mixture of white and wholegrain foods should be offered.	Examples of food items: breakfast cereal, pancakes, bread, pasta, chapatti, rice, cakes and biscuits.
Fruit and vegetables	• Five small servings each day is recommended. • Offered at each meal and snack times.	Parents should set a good example for their children and encourage them to eat a variety of fruit and vegetables.
Milk and milk products	• Serve about three times per day. Examples of one serving are about: - 120 ml, 4 oz glass or cup of milk - 120 g pot of yogurt or fromage frais - Cheese in a sandwich or slice of pizza	• In this period less milk is needed. • Milk and yogurt should be full fat for those under two years old. • Children who eat well can be served semi-skimmed products after 2 years old, but not skimmed before 5 years. • Butter and cream not included due to low content of protein and calcium.
Meat, fish and alternatives	• Children who eat meat and fish, offered once or twice per day. • Children who eat only eggs, nuts and pulses, offered two or three times per day in addition to foods or drinks high in vitamin C to enhance the absorption of non-heme iron.	• The Food Standard Agency (FSA) recommended 2 servings of fish per week; one should be oily fish. • Oily fish such as sardines, mackerel and tuna (not canned) are limited to 4 servings per week for boys and 2 for girls. • Precaution against accumulating toxin levels which will remain into the childbearing years. • Fish such as shark, marlin and swordfish may contain mercury so should be avoided.

Continued

Food groups	Recommendation	Extra information
Foods high in fat, sugars and salts	Should be served in addition to, not instead of foods from the other food groups.	• Processed foods, which are high in salt, should be limited. • Salty snacks such as crisps should be offered occasionally.
Fluids	• Recommended to have 6-8 drinks per day from beaker or cup. • May need more in hot weather, or when the child is very active.	• Milk and water are the best drinks between meals and snacks. • Sweetened drinks such as diluted fruit juice should only be consumed with meals rather than between meals to avoid the risk of dental caries. • Sugar-free fizzy of fruit-based drinks are not recommended.

(Source: Adapted from Infant and Toddler Forum; (Weaver et al., 2008))

Energy and nutrient requirements are varied according to age, gender and activity level. In 1991, a Department of Health committee based on Medical Aspects of Food and Nutrition Policy (COMA) and the Scientific Advisory Committee on Nutrition (SACN) published Dietary Reference Values (DRVs) for energy and nutrients. DRVs are defined as "the amount of energy and nutrients that would meet the daily needs of most people in the UK." DRVs for energy are described as Estimated Average Requirements (EARs). Other nutrients have EARs, Reference Nutrient Intakes (RNIs) and Low Reference Nutrient Intakes (LRNIs). All these terms are defined below:

- *Estimated Average Requirments (EAR)*: the average amount of energy or protein or vitamin or mineral needed by a group of people. About half will need greater than the EAR, and half below this amount.
- *Reference Nutrient Intake (RNI)*: the amount of protein or vitamin or mineral which is enough, or more than enough to meet the daily requirements of about 97.5% of a group of people. If average intake of a group is at the RNI, then the risk of deficiency is very small.
- *Lower Reference Nutrient Intake (LRNI)*: the amount of protein or vitamin or mineral which is sufficient for only a few people (2.5%) in a group with the smallest needs.

Table 1.6: Current recommendations for energy and other nutrients for pre-school children (1-3 years) in the UK

Nutrient	Recommendation	Nutrient	Recommendation
Energy kcal/day Boys	1230	Vitamin D µd/d	7
Energy kcal/day Girls	1165	Ca mg/d	350
Protein g/d	14.5	Mg mg/d	85
Fat (% of energy)[7]	35-50	Na mg/d	500
Vitamin A µg/d	400	K mg/d	800
Thiamin B_1 mg/d	0.5	Cl mg/d	800
Riboflavin mg/d	0.6	P mg/d	270
Niacin mg/d	8	Fe mg/d	6.9
Vitamin B_6 mg/d	0.7	Zn mg/d	5
Vitamin B_{12} µg/d	0.5	Cu mg/d	0.4
Folate µg/d	70	Se µg/d	15
Vitamin C mg/d	30	I µg/d	70

(Source: Adapted from Department of Health (1991))

[7] Dietary fat provides a high source of energy, carries fat soluble vitamins and helps in the absorption of these vitamins. It is recommended that total fat should contribute an average of 35% of food energy. However, this recommendation is appropriate only for the entire population over the age of 5 years. Therefore, for children under the age of 5 years the energy obtained from fat should be around 50%, similar to infants breast feeding or on formula to 35%, depending on individual factors.

1.1.8.2 Pre-school children's dietary intake in the UK

It is necessary to assess children's dietary patterns in order to reduce the risk factors of diseases during adulthood, since there is an established relationship between both. The National Diet and Nutrition Survey (NDNS) is a survey carried out to assess the dietary habits and nutritional status of high quality nationally representative data in the UK. Ethnic minorities and low-income groups are part of the sample population in the NDNS; however, their numbers are not large enough to allow separate analysis.

Since 1968 no data on pre-school children aged 1.5 to 4.5 years have been collected. Therefore, in 1995 there was a need to focus on this groups. The NDNS carried out a cross-sectional survey covering children aged between 1.5 and 4.5 years[8]. Four-day weighed records were used including two weekdays and two weekend days. Energy and nutrient intakes were calculated to express a seven-day daily average intake. A total of 1675 children participated and the mean intakes of children were compared to the DRVs.

In the survey, Gregory et al. (1995) reported that the mean energy intakes were below the EARs, and boys had a higher intake than girls. However, anthropometric measures showed that energy intakes were adequate since children's heights and weights were increasing. Eveleth and Tanner (1976) stated that "A child's growth reflects, better than any other single index, his state of health and nutrition." The low levels of energy intakes were found to be due to a poor dietary recording methodology. Cereals and cereal products followed by milk and milk products were the largest contributions to energy intake. Average daily intake of protein was well above the RNI, and milk and milk products followed by cereals and cereal products were the main contributors. Carbohydrate and total fat accounted for 51% and 36% of the food energy intake, respectively. Cereals and cereal products were the main sources of carbohydrate, whereas milk and milk products followed by cereals and cereal products and meat and meat products were the three main sources of fat. In the case of vitamins, most of the vitamin intakes were well above the RNI, except for vitamins A, C and D, as 50% and 38% of the children had average intakes of

[8] The NDNS programme does not cover children under 18 months of age.

vitamins A and C, respectively, below the RNI. The average intakes of vitamin D from foods were low, at about 18% of the RNI. The mean intakes of most minerals were above the RNI, except for iron (84%) and zinc (72%) where children had average intakes below the RNI.

In 2008 a new rolling programme started for people aged 18 months and over. It is an ongoing programme. In this survey the four-day estimated weights records are used for collecting data. To date, the results show that there is no difference between this rolling programme and the previous survey conducted in 1995.

In the case of South Asian children, some representative surveys are available, such as the infant feeding in Asian families survey (Thomas and Avery, 1997), and the 1999 and 2004 health surveys of England (Erens et al., 2001; Sproston and Mindell, 2006) which are relating to the health of children from ethnic minority groups (but not their dietary intakes). In addition, some studies have been conducted among South Asian school aged children such as the study of Hakeem (1997), who studied the differences in the patterns of activity, diet and risk of coronary heart disease between groups of children aged 10-12 years old from Pakistan, children of South Asian migrants, and Caucasians in the UK. The study found differences between children in terms of dietary habits and nutrient intakes. However, differences between children in Pakistan and in the UK were more noticeable than the differences within children living in the UK. In addition, low intakes of Fe, Ze, folate, and vitamin A were found among all groups.

The Child Heart and Health Study in England (CHASE) by Donin et al. (2010) studied the differences in nutrition composition of the diets of children from different ethnic backgrounds including South Asians, Black African-Caribbeans and White Europeans aged between 9-10 years old. Donin et al. (2010) noted that South Asian children have a higher mean total energy intake (their intake of total fat, polyunsaturated fat and protein as proportions of total energy intake) and a lower carbohydrate as a proportion of energy intake, vitamins C, D, calcium, and heme-iron than White European children in the UK. Furthermore, a study made by Edwards et al. (2006) looked at the changes in the diets of South Asians over the last 40 years. The study included three groups, including South Asian children (9-11 years old) in Bradford, UK, and their counterparts in Pakistan, as well as adults in Bradford, UK. Significant differences in the diets between the groups were demonstrated in the study. Total food intake and energy intake were noted to be increased among the transmigratory population.

When it comes to South Asian preschool children in the UK, there is a lack of representative data for obtaining their dietary patterns and nutrient intakes (SACN, 2008). This study is the first study investigating the dietary habits and nutrient intake of preschool South Asian children (1-3 years old) living in the UK using 24-hour MPRs with a newly developed food photographs booklet to enhance estimation of food portion sizes. This has provided a clearer picture of the dietary status of South Asian pre-school children which may contribute towards their health outcomes in adult life and will help with the development of strategies to prevent nutritional related diseases at an early stage.

1.1.8.3 The health of South Asian children

1.1.8.3.1 Low birth weight

Low birth weight is common among babies of Indian subcontinent descent in the UK (Margetts et al., 2002). Recently, South Asian children were reported to have worse biological risk factors than European children, and lower weight for height and ponderal index (kg/m^3) (Chinn et al., 1992; Nightingale et al., 2010). A number of studies showed that low birth weight is associated with increased risk of developing insulin resistance, dyslipidemia, hypertension coronary heart disease and type 2 diabetes (Barker et al., 1989; Barker et al., 1993; Valdez et al., 1996). However, other studies have found a weak or no relationship in regard to this issue (Williams et al., 1992; Falkner et al., 1998; Wilkin et al., 2002; Huxley et al., 2002). A recent genome-wide association meta-analyses conducted by Freathy et al. (2010) identified two genes associated with low birth weight (ADCY5 and CDKAL1). ADCY5 has been implicated in type 2 diabetes susceptibility (Dupuis et al., 2010), thereby indicating a genetic link between low birth weight and a risk of diabetes. Furthermore, another genome-wide association meta-analyses conducted by Horikoshi et al. (2012) confirmed the link between ADCY5 and CDKAL1 and type 2 diabetes, and also identified a further 5 loci linking birth weight with growth and metabolism. Both studies were carried out using the genetic information of participants of European descent; no genetic information is currently available for the South Asian population. However, the meta-analyses clearly indicate a genetic link and leads to the hypothesis that South Asians may carry loci associated with low birth weight and a risk of disease.

1.1.8.3.2 Important nutrient components and their implications for South Asian children

Some important dietary components for South Asian pre-school children, such as dietary iron and vitamin D, have been linked with health outcomes. In 1994, a survey on infant feeding in Asian families was conducted on a nationally representative group of South Asian infants in the UK (Thomas and Avery, 1997). Information about feeding practices and their effect on the growth of babies was obtained. The children who took part in the survey were then followed up in 1996 when they were 2 years old. A sample of blood was taken to measure iron and vitamin D levels. Lawson et al. (1998) used this survey to assess iron levels, reporting that about 29% of Pakistani, 25% of Bangladeshi, and 20% of Indian 2 year old children had haemoglobin concentrations below 110.0 g/l[9] compared to 12% of 1.5 to 2.5 year olds in the NDNS of 1995. It has been found that South Asian infants who have late weaning (Williams and Sahota, 1989, 1990), and children who are given foods high in sugar but few savoury and meat based foods are more likely to have iron deficiency (Thomas and Avery, 1997). Those children who regularly eat breakfast cereal are less likely to be anaemic (Lawson et al., 1998). In addition, Lawson and Thomas (1999a) used the same data to assess 25-hydroxycholecalciferol (vitamin D) concentrations. It was found that 34% of Pakistani, 25% of Indian, and 20% of Bangladeshi 2 year old children had vitamins D values below 25 nmol/l[10] compared to 1% of 1.5 to 2.5 year olds in the NDNS. A strong relationship between iron deficiency anaemia and vitamin D deficiency among South Asian toddlers has been previously reported (Grindulis et al., 1986). Lawson and Thomas (1999a) confirmed this, reporting that 50% of children with low vitamin D had low haemoglobin levels when compared with children with normal vitamin D levels. This may be explained by lifestyle factors and dietary habits and practices which lead to deficiencies in both nutrients.

[9] According to the WHO (1972), the definition of anaemia is a haemoglobin level below 110.0 g/l.
[10] According to Arnaud et al. (1976), a value of vitamin D below 25 nmol/l is considered to indicate deficiency.

Low vitamin D status among the South Asian immigrant population has been attributed to reduced intake of vitamin D, increased skin pigmentation (Huh and Gordon, 2008), female gender (Ford et al., 2006), consumption of a vegetarian diet, and limited exposure to sunlight (Awumey, 1998; Dunnigan and Henderson, 1997). The main source of vitamin D is ultraviolet irradiation of the skin through sunlight exposure. However, there is no appropriate wavelength (290-310 nm) during the months of October until March in the UK. Although a lack of sunlight exposure is important it is not the only probable factor as Asian men also have high prevalence of vitamin D deficiency (Shaw and Pal, 2007).

Previous studies have suggested cultural and dietary habits and the infrequent use of supplementation are factors responsible for development of vitamin D deficiency in Asian women (Ford et al., 2006). Furthermore, Dunnigan and Henderson (1997) found that there are religious differences between the aetiological factors in the presentation of vitamin D deficiency. They carried out a case control study in a setting of restricted UV exposure and demonstrated that amongst Muslim children, chapatti and fibre intake and intake of lower amounts of milk than normal are risk factors dominating the 'severe' rickets risk model, while for the 'mild' rickets food class model this was absent and common among mostly Sikh and Hindu children adhering to a lacto-vegetarian diet. Lawson et al. (1999b) also confirmed this stance, reporting intake of chapatti before 15 months of age to be a risk factor amongst Muslim children. Other foods which are considered a good dietary source of vitamin D - meat, fish, fortified spread and breakfast cereal - were found not to be related (Lawson et al., 1999b).

Low plasma 25 hydroxyvitamin D [25(OH)D] levels in animals are associated with higher glucose concentrations and reduced insulin sensitivity and may also be associated with an increased risk of developing type I diabetes mellitus (Tai et al., 2008; Ford et al., 2006). Vitamin D status has also been shown to relate inversely to the severity of hypertension and hypertriacylglycerolaemia, an increased risk of myocardial infarction in Caucasian populations (Boucher, 1998). Moreover, ambient low temprature has been attributed as a risk factor for arterial occlusion, as blood pressure, serum triacylglycerol and fibrinogen concentrations have been found to be higher in the winter months when compared with months having higher ambient temperatures. However, the finding that ischaemic heart disease becomes less prevalent at increasing altitude, as temperatures drop but UV radiation increases, supports the suggestion that vitamin D status may be more important than ambient temperature in determining the long term circulatory risk (Boucher, 1998). Conversely, higher body fat and abdominal obesity have been related to the increased sequestration of vitamin D in adipose tissue, resulting in lower serum vitamin D levels that lead to the above mentioned disorders (Huh and Gordon, 2008). Studies regarding the relationship between vitamin D deficiency and adiposity among children are limited (Reinehr et al., 2007).

1.1.8.3.3 Long term health implications

Being overweight and obese in childhood are worldwide problems which may lead to the development of serious health implications in later life (Reilly et al., 2003). de Onis et al. (2010) reported that in 2010 there were 43 million overweight and obese pre-school children (under 5 years) in developing and developed countries. In the case of the UK, levels of obesity are rising, especially among children. In 2009 Health Survey of England[11], 31% of boys and 28% of girls aged between 2 and 15 years were classified as either overweight or obese (Craig and Hirani, 2010).

Some minority groups believe that overweight children are healthy and that it is a sign of affluence (Leung and Stanner, 2011). In the UK, ethnic differences in the prevalence of children being overweight and obese have been reported (Chinn et al., 1992; Saxena et al., 2004; DH, 2010). The obesity prevalence is significantly higher in ethnic groups than the general population for children and young adults. Table 1.7 shows the percentage of children and young adults who are obese and overweight in England by ethnic group. British Afro-Caribbean and Pakistani girls have been found more likely to be obese and Indian and Pakistani boys were more likely to be overweight than the general population (Saxena et al., 2004).

[11] Health Survey of England (HSE): part of a programme of surveys which provide regular information concerning public health and factors that may affect health, assigned by the Department of Health.

Table 1.7: Prevalence of being overweight and obese among male and female children in England by ethnic group.

	Male					Female				
		Overweight		Obese			Overweight		Obese	
	n	n	%	n	%	n	n	%	n	%
Age 2-4 years	489	91	19.2	30	6.9	476	117	22.4	25	4.7
Ethnic group 2-20 years										
General population	950	206	21.7	54	5.8	916	204	22.3	54	5.8
Indian	304	84	29.6	23	7.9	267	64	24	8	2.1
Pakistani	436	110	26.2	36	9	458	119	25.7	38	8
Bangladeshi	377	66	14.2	15	2.8	335	77	20.7	23	5.8
Afro-Caribbean	322	68	22.6	16	5.1	373	119	33.3	47	13
Chinese	160	23	14.4	8	4.7	150	18	13	2	1.2

(Source: Adapted from Saxena et al. (2004)); Note: All survey percentages are calculated using sample weights

There is evidence to suggest that obesity is linked to type 2 diabetes in childhood (Sinha et al., 2002; Higgins, 2008; Ghergherechi and Tabrizi, 2010). Asian children were found to have a higher incidence of type 2 diabetes when compared with white children in the UK (around 3.5 times higher) by Ehtisham et al. (2000). Whincup et al. (2002) found that a tendency of insulin resistance is apparent in both British South Asian adults and children, which may suggest that they have an increased sensitivity to adiposity. Two of the most important environmental influences on insulin resistance are dietary energy intakes and physical activity (McKeigue et al., 1993; Dhawan and Bray, 1997). A 1999 report on the Health of Minority Ethnic Groups Survey, which compared physical activity levels in children from different ethnic groups, found that Bangladeshi, Pakistani and Indian boys tended to be less active than other boys, and that girls from all groups were less likely to take part in sport and exercise than boys, but particularly South Asian girls (rates ranging from 27% of Bangladeshi girls to 34% of Indian girls (Fischbacher et al., 2004). Wincup et al. (2002) also found higher mean heart rate and triglyceride and fibrinogen concentrations in South Asian children, which reflect the lower level of physical fitness among these children.

Obese children are more likely to become obese adults (Guo and Chumlea, 1999). Moreover, Moriarty-Kelsey and Daniels (2010) reported that the prevalence of childhood obesity is associated with an increased risk of obesity in adulthood, which therefore may lead to an increased risk of obesity related non-communicable diseases. These health implications cause a great health burden on the patient, and also a financial burden on the government since the cost of medication is very high (see section 1.1.9). Thus, prevention of childhood obesity is crucial since it will minimise the risk of certain adulthood diseases (Moriarty-Kelsey and Daniels, 2010).

1.1.9 The implications of non-communicable diseases and their cost

According to the WHO (2010), non-communicable diseases (NCDs) were the major cause of two thirds of all deaths in the world in 2008. The increasing trend of NCDs is associated with the increasing incidence of obesity in both adults and children (Misra and Khurana, 2008). Rates of obesity are very high in the UK and are associated with many health complications, such as type 2 diabetes, hypertension, coronary heart disease, and other health conditions. According to Foresight[12] (2007), by 2050 it is predicted that obesity will affect 60% of men, 50% of women, and 25% of children (McPherson et al., 2007). Tables 1.8 and 1.9 illustrate how obesity continues to increase in the UK among different age groups and the resulting increase in costs of associated health complications.

Table 1.8: Predicted percentage of population that is obese for 2006 and 2050.

Age group	Male (%)		Female (%)	
	2007	2050	2007	2050
1-20	7	26	10	26
21-30	15	42	13	30
31-40	28	65	22	47
41-50	26	55	23	52
51-60	32	65	27	49

(Source: Adapted from McPherson et al. (2007))

Table 1.9: Estimated future NHS costs of diseases related to BMI, 2007-2050 (£ billion per year).

	2007	2015	2025	2050
NHS cost Diabetes	2.0	2.2	2.6	3.5
CHD	3.9	4.7	5.5	6.1
Obesity	2.3	3.9	5.3	7.1
Total NHS cost attributable to elevated BMI (overweight and obese)	4.2	6.3	8.3	9.7

(Source: Adapted from McPherson et al. (2007))

[12] Foresight is the UK Government's Office for Science. It conducts in-depth studies looking at major issues 20-80 years in the future based on scientific evidence and helps to provide challenging visions of the future to help inform government strategies, policies and priorities. The programme started in 1994.

South Asians are at higher risk of developing obesity and obesity related non-communicable diseases, such as insulin resistance, type 2 diabetes, metabolic syndrome, and coronary heart disease, than Whites (Misra and Khurana, 2011).

In some cultures, including among South Asians, obesity is considered a symbol of attractiveness, wealth, and success (Grace et al., 2009). Obesity has been endemic for a generation among women of South Asian origin, although it is less among men than in the White population. Mean BMIs of 25-26 kg/m^3 for the whole middle-aged population have now been recognized as too high, as South Asian men have higher waist-hip circumference ratios than adults from the general population (Dhawan and Bray, 1997; Cappuccio et al., 1997; McKeigue et al., 1991, 1993, 1996). Age adjusted prevalence rates of obesity were found to be higher among Muslims compared to Hindus of South Asian descent (Cappuccio et al., 1997).

Central obesity is associated with the failure of insulin to suppress the release of non-esterified fatty acids from intra-abdominal fat cells; this failure can lead to increased synthesis of very-low-density lipoprotein triglyceride (McKeigue et al., 1991). A significantly higher BMI is associated with an increase in the length of stay in an adopted country, which may reflect acculturation and consequently a sedentary lifestyle and poor dietary patterns (Goel et al., 2004). McPherson et al. (2007) reported that in 2006, Indian, Pakistani and Bangladeshi men in the UK had obesity percentages of 12%, 16%, and 26%, respectively, and it is predicted that by 2050 Indian and Pakistani men's obesity percentages will change to 23% and 50%, respectively, while Bangladeshi men appear to be becoming less obese, at 17%. Indian, Pakistani and Bangladeshi women in 2006 had obesity percentages of 16%, 22%, and 24%, respectively, and by 2050 their obesity percentages will increase to 18%, 50%, and 30%, respectively.

Diabetes is a global disease. In the UK there are 2.5 million people who have been diagnosed with diabetes; of these people it is estimated that 90% have type 2 diabetes (Khunti et al., 2009). It is estimated that by 2025, 4 million people will be affected with diabetes, most of them type 2 diabetes (Diabetes UK[13], 2008).

[13] Diabetes UK is an organisation for people with diabetes. Its work involves providing information and support services for people with diabetes to better manage their condition, campaigning on their behalf and funding research to improve treatment.

Reports and financial statements of Diabetes UK (2011) showed that last year, the NHS spending on all diabetes conditions was around £10 billion. Watkins (2003) reported that 20% of the South Asian community (143,000[14]) has been diagnosed with type 2 diabetes compared to 3% of the general population. Data from HSE (2004) shows that compared with women in the general population, Pakistani women are 5 times more likely to be diagnosed with diabetes, while Bangladeshi women are 3 times more likely. Moreover, Bangladeshi men are 4 times more likely and Pakistani and Indian men are 3 times more likely to be diagnosed with diabetes compared with men in the general population. The NHS (2010) reported that "…many South Asians are unaware of how much greater the risk of diabetes and heart disease is for their ethnic group. Only 34 percent knew that as a South Asian they were much more likely to suffer diabetes and only a quarter understood the increased risks of heart disease". This finding is even more alarming if we take into consideration research that has established that "South Asian children in the UK are 13 times more likely to have Type 2 diabetes than white children" (Ehtisham et al., 2004).

Coronary heart disease in the UK causes more deaths than any other single disease. In 2010, around 38,000 men and 27,000 women died from this condition (British Heart Foundation, 2012). HSE (2004) data shows the highest prevalence of CHD is in South Asian men, particularly Pakistani (8%) and Indian (6%) men. Whereas, CHD was found to be lower in all women from minority ethnic groups when compared to women in the general population (Sproston and Mindell, 2006). According to the British Heart Foundation (2006), the total annual cost of CHD is estimated to be over £7.9 billion a year.

The UK Census of 2001 that ethnic minority groups made up 8.7 percent of the total population of England and Wales (section 1.1.1), and by 2051 it is predicted that they will make up around 20% of the population of the UK. The growth of the South Asian community in the UK is predicted to be rapid (Wohland et al., 2010). Taking into account the growth of ethnic minority groups and the associated health implications from which they suffer, the economic burden on the National Health Service will increase. Therefore, understanding South Asian lifestyles and dietary

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[14] In total, 143,000 South Asians have been diagnosed with type 2 diabetes, including 89,000 Indians, 42,000 Pakistanis and 12,000 Bangladeshis.

habits is key to reducing the risk factors of several health implications in this community.

1.1.10 Health and dietary habits, lifestyle and genetic predisposition

Population studies have previously reported that ethnic minority populations are varied; some groups may have greater health needs than others (Barnett et al., 2006). For instance, the 2004 Health Survey for England[15] reported that the prevalence of being overweight, including obesity, was higher among Black Caribbean, Black African and Pakistani women than among the general population. However, prevalence was lower among Chinese women. Moreover, mortality from coronary heart disease among South Asians born in the Indian subcontinent is 50 percent higher than among the general population, whereas among African–Caribbeans it is 50 percent lower (Wild and McKeigue, 1997). South Asians have 40% higher incidence of coronary heart disease compared with Europeans (Chambers et al., 2000). The risk of death from circulatory disease and from ischemic heart disease is twice as high in middle-aged South Asians than in Europeans (aged 30-64 years at baseline), and about 1.5 times greater in the 65-75 years age group (Mather et al., 1998).

These differences in health outcomes may be partially explained by dietary habits, lifestyles and genetic predisposition of these ethnic minority groups. The dietary habits of these groups can be affected by various factors, such as socio-economic status (including income, education level and occupation), religion, food beliefs, availability and access to food, generation, and gender (Leung and Stanner, 2011). For instance, differences in religious practises may have an impact on health. It has been found that the risk factors of CHD, including smoking rates, high blood pressure and levels of total cholesterol and HDL cholesterol, differ substantially among Sikhs, Hindus and Muslims; these findings are consistent with differences in diet and alcohol intake (McKeigue et al., 1991). Smoking is much less common among Sikhs than Hindus. The reverse applies to drinking alcohol (Erens et al., 2001).

[15] The 2004 survey is the second health survey focussing on the health of minority ethnic groups in the UK, building on the information obtained in the 1999 survey.

In addition, rapid transitions in diet, lifestyle and environmental factors seen in migrant populations and during transition from poverty to affluence may influence heritability of the various phenotypes that are dependent on the nutrient environment for their expression (Misra and Ganda, 2007). It has also been suggested that South Asians have smaller coronary artery size than the Caucasian population and this could contribute towards higher mortality from CHD. However, Zindrou et al. (2006) reported that South Asian and Caucasian men with comparable demographic and clinical characteristics have similar coronary artery size. Similarly, Lipoprotein A is a genetically determined risk factor, especially when accompanied by increased concentrations of LDL, and has been found to be higher in the British South Asian population. This capacity of the migrating population to rapidly acquire raised LDL cholesterol owing to changes in dietary patterns and/or lifestyle shows how a genetically determined CHD risk factor can be transformed into a more potent risk factor (Barnett et al., 2006). Evidence shows that genes are involved in determining enzymes, receptors, cofactors, and structural components involved in the metabolism of lipids, lipoproteins, and proteins involved in inflammation and coagulation. Genetic risks modulate the relations between dietary factors and adiposity.

Obtaining information on the dietary habits and lifestyles of ethnic groups is important to better understand the impact ethnicity on the risks of obesity and obesity related non-communicable diseases, such as, diabetes, cardiovascular disease, cancer, and deficiency diseases, and to find effective approaches to assist these groups. Dietary habits and lifestyles of South Asians in the UK are discussed in detail in section 1.1.3.

1.1.11 Overview of research methods that can be used in dietary assessment of pre-school children

Since there is an established relationship between diet and diseases, it is essential to assess people’s food and understand their dietary habits. In order to achieve these goals, the need for analytical methods that are accurate, simple and do not cause a burden on the respondents are vital. Two main research methods can be applied: a quantitative approach or a qualitative approach (Tritter, 2007). In general, quantitative research provides data on a given research issue in the form of numbers (how much..?, how often..?) and is suitable for statistical analysis and quantify measures and estimates. To provide these estimates with an acceptable degree of confidence one which can be generalised to a broader population of interest a large sample size is needed. In contrast, qualitative research involves exploratory studies which provide data in the form of words, give detailed information on people's behaviour, beliefs and experiences in real life, and focus on 'what', 'how' and 'why' questions regarding a given research issue. A small sample of participants is required (Hennink et al., 2012). Although both methods differ from each other, integrating both techniques can enhance and complement the findings of the research in different ways, instead of using only one of the methods independently (Bamberger, 2000). In this study, quantitative methods (a 24-hour multiple pass recall and a structured questionnaire) were used alongside a qualitative method (in-depth interviews) to gain a better understanding of the diet of South Asian pre-school children living in the UK.

1.1.11.1 Quantitative research methods in nutritional studies

The measurement of dietary intake is complex. Several dietary methods are available and are categorized in one of two groups:

- Recalling: typically belonging to the retrospective methods category, such as single or multiple 24 hour recall, a food frequency questionnaire or diet history.
- Recording: belonging to the prospective methods category, focusing on quantitative schemes of data collection such as quantitative food recording (weighed food intake) and semi quantitative recording of food (estimated food intake) (Willett, 1998; Thompson and Subar, 2001; Thomas and Bishop, 2007).

Each of these methods has proved to be strong and beneficial techniques; however, they also have their limitations during research. Table 1.10 provides a more detailed description of the capabilities and limitations of the aforementioned methods.

When choosing the most appropriate dietary assessment method, many factors need to be taken into account, such as the objectives of the study, the type of data and information of interest, the characteristics of the target group, and the resources available (Roberts and Flaherty, 2010). In addition, the validity (or accuracy) and reliability of the dietary assessment method need to be considered. Validity of the dietary assessment method refers to the ability to estimate the ‘true’ value of the actual intake throughout the study period. For instance, if the dietary assessment method influences what is eaten then the method is not valid (MacIntyre, 2009). Reliability refers to the method which is most likely to give consistent outcomes (Martínez and Martínez-Gonzále, 2009). It is important to know that the method has reliability; however, it may not necessarily give a valid estimate of intake. For validation to be verified, the presence of external markers is required (MacIntyre, 2009). These include observational techniques, comparison with other methods, biochemical markers to assess the reported protein (urinary nitrogen excretion) and energy intake (doubly labelled water (DLW) technique) (Thompson and Subar, 2001). Moreover, other biomarkers can be used to assess components which do not contribute to protein or energy intake, such as urinary sodium or potassium, creatinine excretion, serum vitamin C, carotenoids, and ferritin (Nelson, 2000).

A biochemical biomarker such as DLW gives independent and objective means of validating data (Livingstone et al., 1990). DLW gives a robust measurement in free-living subjects when used to assess their total energy expenditure. This method is based on the principal of energy balance whereby total energy expenditure measured by DLW is assumed to be equal to energy intake under the condition of weight stability (Livingstone et al., 1992a). However, it is expensive and complex method to conduct (Livingstone et al., 1990).

In the case of the South Asian population within the UK, several dietary assessment techniques have been used to assess their dietary habits and the strengths and limitations of using these methods have been reported (Khokhar et al., 2001). A weighed food record is one of the methods used among South Asians. Although a weighed food record provides actual weights of food consumed, South Asians have been reported to be too invasive, demanding and complicated (Khokhar et al., 2001). In addition, Eaton et al. (1984) noted that illiteracy and language barriers limits cooperation and the number of weighed diets. A food frequency questionnaire (FFQ) and a 24-hour recall have been used as well. An FFQ was modified in some studies in order to make the tool more suitable for use among the South Asian population (Jain, 1999; Sevak et al., 2004; Merchant et al., 2008; Wandel et al., 2008). Kassam-khamis et al. (1999) developed a FFQ that considered the geographical and religious differences of South Asians and used an interview-administered questionnaire with the help of interviewers fluent in a range of South Asian languages. A 24-hour recall was used by Parsons et al. (1999), Kassam-Khamis et al. (2000), and Edwards et al. (2006), the latter reporting that the 24-hour recall was chosen due to its ease of application, low respondent burden, and no requirement for participant literacy. Johnson et al. (1998) confirmed that a 24-hour recall is appropriate for use with low-income and low-literacy populations, since it is not necessary for respondents to read or write in order to complete the recall. Moreover, Donin et al. (2010) found that a single structured 24-hour recall provides valid information more than an FFQ among South Asian children aged between 9 and 10 years old. Furthermore, Ngo et al. (2009) reported that in general, the most frequently used methods to assess dietary intake for European immigrant groups are interview administered food frequency questionnaires and repeated 24-hour recalls.

As discussed earlier, validation of the method being used is an important issue. The ‘multiple pass’ 24-hour recall method has been previously validated in children as young as 4 years old (Johnson et al., 1996). Therefore, this method was used in this study to obtain the most accurate data possible. Further details on the methodology are given in Chapter 2.

1.1.11.2 Qualitative methods

Qualitative studies are needed to facilitate a better understanding of some of the phenomena related to nutrition and food studies (Harris et al., 2009; Swift and Tischler, 2010). A number of nutritional studies have used this approach in their research, examples being Neumark-Sztainer et al. (1999), Auld et al. (2002), FAO (2004), Strolla et al. (2006), FSA (2010a), and FSA (2010b). This approach can provide a rich source of information which helps to improve dietetics and nutrition health promotion (FAO, 2004). The most common qualitative methods are observation, focus groups, and in-depth interviews (Hennink et al., 2012). All these methods have strengths and limitations when used in research; these issues are summarised in Table 1.11.

In this study, in-depth interviews were used as part of the research techniques (complementary methods) in order to achieve a holistic understanding of the factors that may affect mothers’ food choices and dietary practices with their children. More details are provided in (Chapter 7).

Table 1.10: Strengths and limitations of different quantitative dietary assessment methods

Name of method	Definition	Strength of method	Limitation of method
Single or multiple 24-hour recall	Quantitative information on all foods and drinks consumed the previous day. This method usually involves a face to face interview or and interview via telephone using household measures and visual aids such as food models or photographs.	• Cost effective and quick • Suitable for large scale surveys • Low respondent burden • Does not affect eating habits • Can be administered by telephone	• Requires trained interviewer • Relies on memory • Intake usually underreported
Food frequency questionnaire	A list of foods and beverages used to assess the frequency of consumption and portion size of these items over a specific period of time (e.g. the previous week, month or year).	• Cost effective and easy for person to complete • Suitable for large scale surveys • Estimates usual intake over long time period • Can be computer based • Does not affect eating habits	• Intake usually misreported • May be difficult to match food intake to the available list • Possible over-reporting of 'healthy' foods such as fruit and vegetables
Quantitative food record	A method in which the person weighs all food eaten and any waste over a period of time, approximately 3-7 days.	• Most accurate measurement • Does not rely on memory	• High respondent burden • Time consuming • Requires high level of motivation • May effect eating habits • Requires trained interviewer • Expensive to carry out • Misreporting
Semi quantitative food record	A method in which the person estimates food consumption over a period of time using household measurements, food photographs or food models.	• Does not rely on memory • Lower respondent burden than weighed record method	• Needs appropriate conversion data • May effect eating habits • Requires trained interviewer

(Source: Adapted from Willett (1998), Thompson and Subar (2001), and Thomas and Bishop (2007))

Table 1.11: Strengths and limitations of different qualitative research methods

Name of method	Definition	Strength of method	Limitation
Observation	A method by which the observer systematically watches, listens, questions and records physical and verbal behaviours and interactions in social settings.	• Provides reliable data • An insight into people's interactions (behaviours and language)	• Needs skilled observers • Time consuming • Does not study opinion • Observer bias; easily influenced by the researcher's personal biases and idiosyncrasies
Focus groups	A small group of people who have certain characteristics in common interact with each other to generate discussion and produce information on a topic of interest.	• Data collected in a group • Large amount of information with different perspectives	• Needs skilled moderator
In-depth interview	A one-to-one discussion between the researcher and the participant, exploring individual experiences on a topic of interest.	• Great communication between the interviewer and the interviewee • Comprehensive and detailed data • Provides information on personal experiences, feelings, beliefs and personal stories • Flexibility with the questions	• Needs skilled interviewer • No feedback from others • A lot of transcription is needed • Data analysis is time consuming

(Source: Adapted from Pope and Mays (1995), Morgan and Krueger (1998), Krueger and Casey (2000), Patton (2002), and Hennink et al. (2012))

1.1.12 Sources of errors and difficulties in dietary studies with children and minority ethnic groups

Livingstone and Robson (2000) report that assessing children's food intakes and dietary patterns is often quite challenging because several considerations (respondent/observer) may appear which should be taken into account to make an accurate assessment. Young children (< 7 years old) do not have the ability to recall their food intakes (Livingstone and Robson, 2000). Therefore, parents or guardians are responsible for reporting children's food intakes. The parents' and guardians' abilities, including literacy skills, time, attention, memory, knowledge and parental influence, are important issues that need to be considered when choosing the assessment methodology.

1.1.12.1 Quantification of portion sizes in dietary studies

An individual's and a population's dietary intake can be quantified accurately if the reliability of information obtained about the individual food items and portion sizes are accurately described and measured. Food portions are a paramount part of any dietary analysis, therefore it is essential that portion sizes are considered. Depending on the dietary assessment tool being used in the study, portion sizes of food consumed can be assessed by either weighing or estimating. A weighed record is the optimum method to estimate food intake; however, it is not the most appropriate method for large dietary surveys as it relies entirely on each subject's compliance (Lucas et al., 1995; Robinson et al., 1997; Robson and Livingstone, 2000; Turconi et al., 2005). Further details on the disadvantages of this method can be found in Table 1.10. Apart from the weighed record method, estimation of food portion sizes can be carried out using a variety of different tools, including real food samples, standard portions, household measures, food models, and food photographs (Huybregts et al., 2008; Ovaskainen et al., 2008). It has been found that participants can enhance their estimation of portion sizes via food photographs (Lucas et al., 1995; Nelson et al., 1996; Venter et al., 2000; Turconi et al., 2005; Foster et al., 2006). However, food photographs should be modified according to the users. For example, Foster et al. (2006) found that the accuracy of portion size estimation by children increases when the photographs show age-appropriate portions. Moreover, food photographs have the benefit of being easy to use, portable, can include a large variety of foods, and are particularly cost-effective in large epidemiological studies; in addition, it has been demonstrated that the use of photographs improves the estimation of portion sizes of foods consumed when compared to studies not employing any visual aid (Nelson, et al., 1996; Huybregts et al., 2008).

There are three main skills involved in the estimation food portion sizes. Perception involves a subject's ability to relate an amount of food which is present in reality to an amount depicted in a photograph, conceptualization concerns a subject's ability to make a mental construct of an amount of food which is not present in reality, and relate that to a photograph; memory will affect the precision of the conceptualization (Nelson et al., 1994, 1996).

In the estimation of portion sizes, errors can occur (underestimation/overestimation) frequently. This is apparent in some foods more than others. The error can be considered small if it is <10% or moderate if it is 10-25% when employing food photographs (Lucas et al., 1995; Venter et al., 2000). These errors occur at different frequencies according to the type of food, amount of food, and size of container. In terms of the type of food, some studies have reported that amorphous foods[16], semi-liquid foods (Faggiano et al., 1992; Weber et al., 1997; Venter et al., 2000), and butter/margarine on toast tend to be hard to estimate (Venter et al., 2000). As for the amount of food, subjects are most likely to overestimate small portions and underestimate large portions (Faggiano et al., 1992; Nelson et al., 1994; Lucas et al., 1995; Venter et al., 2000). The size of the container may influence the estimation of portion sizes, as Yuhas et al. (1989) reported that using large containers makes it more difficult to estimate portion size. However, Lansky and Brownell (1982) found that there were no differences relating to container size.

In 1997 the Food Standards Agency in the UK published a photographic food atlas for adults (Nelson et al., 1997). A series of 78 different photographs of foods/meals were included. For each food, eight portion sizes were included. Foster et al. (2010), through the FSA, produced a photographic food atlas specifically for children. One hundred foods frequently consumed by children were included in the food atlas. The photographs were divided into 3 separate age groups: 18 months to 4 years, 4 to 11 years, and 11 to 16 years. A series of 7 portions as served and 7 leftover portions were included for each food. However, the application of these food atlases on ethnic minority groups has not yet been tested.

[16] Amorphous food: food that is shapeless or lacking a definite form such as rice, spaghetti, etc.

In order to obtain the highest accuracy of information and gain the advantages of using food photographs as visual aids to estimate food intake among South Asian children in this study, a food photograph booklet was developed. Further information on this is provided in Chapter 2 and 4.

1.1.12.2 Under-reporting

One of the common errors appearing in dietary assessment studies is under-reporting (Nelson, 2000). This occurs when people report food intakes that are lower than the true intake. In studies of children, age may affect the food intake reported (Livingstone et al., 2004). In the case of young children, parents, guardians and other care-givers such as childminders are involved in the reporting process. This may lead to misreporting of children's food intakes in some cases. However, some studies have reported that parents can be reliable reporters for their children's food intake in the home setting (Eck et al., 1989; Basch et al., 1990; Baranowski et al., 1991). Mothers in a study by Baranowski et al. (1991) under-reported their children's intake by 18% and over-reported by 10%, which appears to give an acceptable estimation of mean energy and nutrient intake. This misreporting was mainly due to the difficulty of estimating food portion sizes. Moreover, parental weight status has been a topic of concern in terms of how it affects the parents' reporting of the food intake of their children. However, previous studies have not found that parental adiposity status undermines the reliability of the reporting of food intakes of lean children (Johnson et al., 1996; Bandini et al., 1997; McGloin et al., 2002).

The under-reporting of food intake is a documented phenomenon in many dietary studies and researchers need to be aware of this. Data for any study should be subjected to critical examination for any evidence of bias. DLW is considered to be the gold standard method which can detect the misreporting of food intake (Livingstone and Black, 2003). However, due to the high cost of this application, a ratio of reported energy intake to basal metabolic rate (EI:BMR) is often used to evaluate self-reported energy intake against estimated energy requirements (Goldberg, 1991). Energy requirements can be determined by BMR and energy expenditure from physical activity with an additional requirement for growth in the case of children. BMR is defined as "the minimal rate of energy consumption necessary to support all cellular functions and accounts for 50-70% of total energy expenditure in humans" (Wong et al., 1996). It can be affected by different factors such as body weight, gender, age, disease, genetics, and ethnicity (Barasi, 2003). In order to estimate the BMR, age and sex appropriate equations based on the measurements of the child's weight can be used (Schofield et al., 1985). The physical activity level (PAL) is expressed as a multiple of BMR; this is then compared with the ratio of EI:BMR to assess whether the energy reported is a true reflection of actual intake. This ratio is compared with a specific cut-off value. Torun et al. (1996) provided age and sex specific cut-offs as reasonable estimates of energy requirements for use with children:

- Males and females aged 1-5 years cut-off points:
  Lower cut-off point=1.28 x BMR
  Upper cut-off point=1.79 x BMR

However, caution should be taken when using standard equations based on BMR to estimate the under-reporters due to inaccurate estimations of BMR. Shetty et al. (1996) noted that equations tend to overestimate BMR in adults and Torun et al. (1996) found this applied to children and adolescents as well.

1.1.12.3 Ethnic food composition data sources

European countries such as the UK have a long history of immigration. As a result, a diverse society has been established (see section 1.2.1). Immigrants have brought along their own culture, including their religion, beliefs and traditional foods. Moreover, with the globalisation of food supply, the consumption of ethnic foods has increased for not only migrants but also the mainstream population (Khokhar et al., 2010). Therefore, reliable information on the composition of ethnic foods is vital. Food composition databases are the key reference tool, providing detailed information on the nutritional value of foods; they can therefore be used in different areas. For example, they can be used in clinical practices to provide accurate dietary advice on health outcomes and can help in epidemiological research, public health education and in the food industry (Church, 2006a).

According to Church et al. (2006b), ethnic food is defined as "food from countries other than the home market contributing to a different food culture than traditional cuisine of the host country. The food may be adapted by combining local and imported ingredients and prepared at home". Currently, information and food composition data regarding ethnic foods in Europe is available through the European Food Information Resource (EuroFIR)[17]. In the UK, one of the main ethnic minority groups originates from the Indian subcontinent (see section 1.2.2). Consumption of South Asian foods is growing. South Asian foods make up around 25% of the total UK food market (Leatherhead Food International, 2007). Although there is some data on South Asian food composition in the UK (Tan et al., 1985; Food Standards Agency, 2002; Moyle and Khokhar, 2008), some important nutrients need to be analysed together with dishes that have recently been identified as being of high consumption among South Asians in the UK (Khokhar et al., 2012). Therefore, it is essential to regularly update information on current South Asian food composition to fill gaps in the available data, since a lack of reliable food composition data is one of the major challenges affecting dietary assessment studies.

From the literature it has been found that South Asian children living in the UK are a vulnerable to nutritional inadequacies; however, little is known about what they eat or how efficiently their nutrient intake meets dietary recommendations. It is necessary to develop efficient tools to assess their nutritional intake, taking into account all the factors that are discussed in literature.

1.2 **Key findings**

- South Asians represent the largest ethnic minority group in the UK.
- South Asians are a heterogeneous group as there is significant diversity in their cultures, religions, customs and beliefs which may affect their dietary habits and the characteristics of their lifestyles.
- Different factors can affect the dietary intakes of South Asians, such as socio-cultural trends, socio-intellectual trends, socio-economic trends and other factors.
- South Asian children can be at risk of iron, zinc, vitamin A and vitamin D deficiencies due to poor weaning practices.
- Assessing children's diet has been previously reported as challenging.

[17] EuroFIR, the world-leading European Network of Excellence on Food Composition Databank systems (www.eurofir.net) is including 21 countries. Aims to develop and integrate a comprehensive and validate databank of food composition data for Europe.

- Investigating South Asian preschool children habitual consumption of food and drink is vital to better understand their needs and to develop nutritional and health policies which meet their requirements.
- Lack of data available on preschool South Asian children's dietary intake.

1.3 Aim and objectives of the study

The aim of this project is to assess the dietary habits and nutrient intakes of pre-school South Asian children (aged 1 to 3 years old) living in the UK. In order to achieve this aim, the objectives of the study are:

Chapter 3

- To describe the socio-demographic characteristics of South Asian cohort of children in the UK and explore differences in children's dietary habits, sleeping habits and mothers' nutritional knowledge among different ethnic groups.

Chapter 4

- To test the feasibility of a newly developed food photographs booklet of foods commonly consumed by South Asian children in the UK and improve the accuracy of estimated portion sizes.
- To identify whether the demographic characteristics of the participant influence their food portion size estimations

Chapter 5

- To identify the most commonly consumed foods and assess the average portion sizes among South Asian preschool children (1-3 years old) in terms of food groups and meal time.
- To provide information on the nutrient composition of traditional dishes most commonly consumed by South Asian children in terms of food groups.

- To assess the energy, macro- and micro-nutrient contribution in terms of meal times of preschool South Asian children.

Chapter 6

- To assess the average nutrient intake of South Asian preschool children (1-3 years old) living in West Yorkshire, UK, compared with national recommendations and the National Diet and Nutrition Survey, the new rolling programme (2008/2009 - 2009/2010).
- To describe the association between the socio-demographic factors on average nutrient intake of these young children.

Chapter 7

- To identify and investigate factors influencing South Asian mothers' food choices and weaning practices concerning their children.

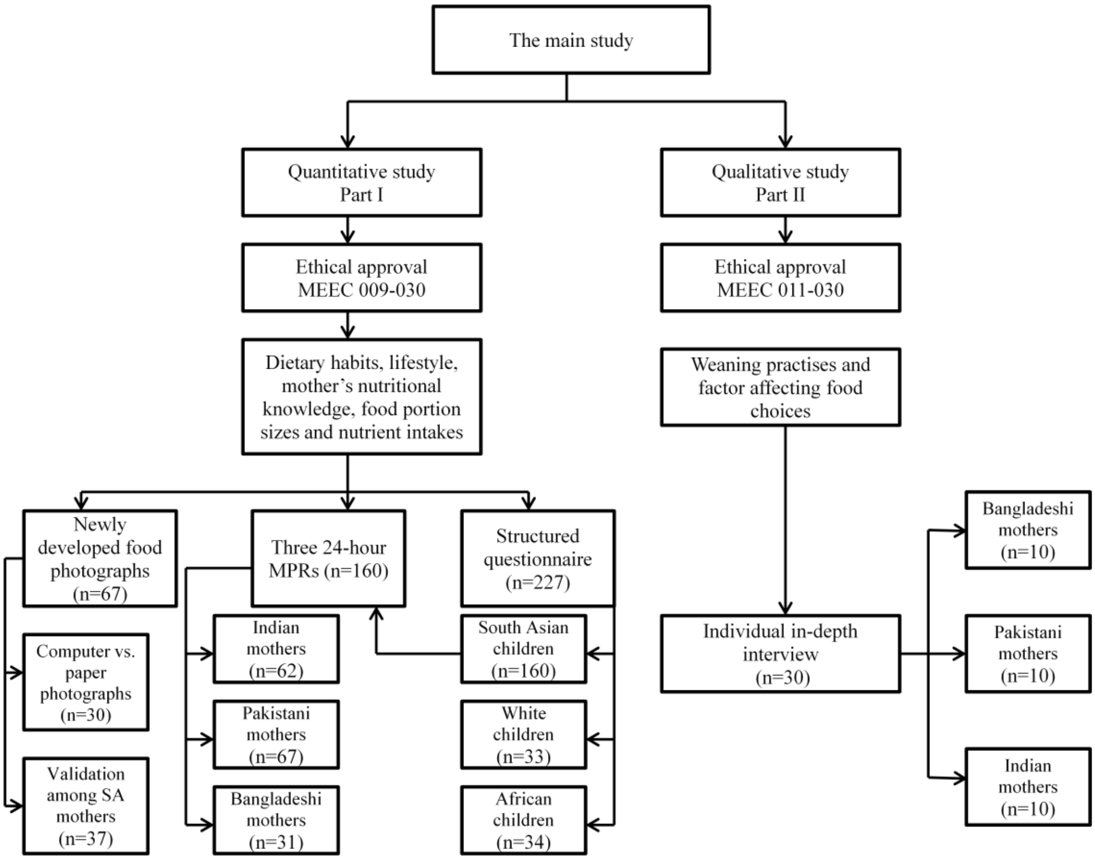
The results from this study will therefore provide essential information for understanding the dietary habits of South Asian pre-school children which can help to develop future health policies to meet their needs.

Chapter 2: Methodology

2.1 Introduction

This cross-sectional research was designed to give the researcher a holistic understanding of various aspects related to the dietary habits and nutrient intake of South Asian preschool children living in the UK. Like many other studies, it was found that assessment of the dietary habits and nutrient intake of children is complex and challenging, particularly among migrant groups. For the research to achieve its principle aim and better understand the nutritional needs of South Asians, the methodology chosen took into account the study objectives, the characteristics of the study population and the available resources. In order to obtain maximum information from South Asian mothers, it was determined that a combination of quantitative and qualitative techniques would be used that complemented each other. This chapter explains in detail the procedures used to perform this research. It is segmented into two parts. The first part describes the quantitative approach and methodology (structured questionnaire and 24-hour MPRs, in combination with household measurements and a newly developed food photograph booklet) used to obtain descriptive information on socio-demographic status, dietary habits, lifestyle, mothers' nutritional knowledge, food portion sizes and nutrient intakes of South Asian children. The second part describes the qualitative approach (in-depth interview) used to investigate factors that may influence the nutritional knowledge of South Asian mothers that may subsequently impact the mothers' food choices and food practices for their children. Figure 2.1 shows an overview of the methodological approach of the research. All methodological tools in this study were subjected to pilot studies. The main aims of the pilot studies were to modify the methodology tools where necessary in order to improve the reliability of the collected data for the main study. All the barriers and challenges encountered during the pilot studies were taken into account, and lessons learned will be used to make the recruitment for the main study faster and easier.

Figure 2.1: Overview of the methodological approach of the study



2.2 Part I (quantitative approach)

The study protocol was performed in adherence with guidelines of the Declaration of Helsinki and all procedures involving participants were reviewed and approved by the University of Leeds Research Ethics Committee (MEEC 009-030) Appendix (A).

2.2.1. Dietary habits, sleeping habits and mothers' nutritional knowledge questionnaire

A structured questionnaire was designed by the researcher, based on a closed-ended questions format, in order to explore the dietary habits and sleeping habits of South Asian preschool children, as well as the nutritional knowledge of their mothers. The questionnaire began by collecting socio-demographic information on the parents and their child. This was followed by three sections covering the child's dietary habits, the child's sleeping habits, and the nutritional knowledge of the child's mother.

Socio-demographic information

In this part of the questionnaire, a number of demographic questions were included in order to obtain information on gender, age, ethnic origin, religion, the parent's level of education, the annual household income, and the number of children, adults and elderly people living in the home with the child. In addition, the child's height and weight were measured by the researcher. Moreover, the self-reported weight status of the mother was obtained as well. All this information was then used for the statistical analysis with variables for the study categorised as shown in Table 2.1.

Table 2.1: The classification of the socio-demographic characteristics

Socio-demographic factors	Categorized as
Ethnicity	Indian, Pakistani, Bangladeshi, White and African
Religion	-Muslim - other which include(Hindu, Sikh, and Christian)
Parent's education level for each the father and the mother	- Low (Primary and secondary school) - Medium (High school and training course) - High (Undergrad and post-grad)
Household annual income	- $\leq$ than 20,000 - Between 21,000-40,000 - $\geq$ than 41,000
The number of children	- One child - Two children - Three children - More than three
Type of family	- Nuclear family - Joint family
Mothers self-reported weight classification	- Normal weight - Over or obese

Dietary habits

This section had a total of 11 questions related to various topics, as described below:

- **Early feeding practices**: (1 question; 8 sub-questions) this question was designed to investigate the feeding method (breast fed/ formula fed) used by the mother when the child was born and for how long it was used.

- **Frequency of consumption**: (4 questions; 17 sub-questions) these questions were asked to identify how often a particular food item was consumed on a daily bases, including fruits, vegetables, starchy food (rice, pasta, chapatti, breakfast cereal, etc.) milk, fruit juice, fruit drinks, and fizzy (diet) soft drinks. In addition, the questions ascertained the weekly consumption of some other foods, such as chicken, red meat, white fish, oily fish, cheese, yogurt, flavoured yogurt, eggs, and legumes (dhal, peas, beans, etc.). Each response was divided by seven to get an average consumption per day for each food item. Questions on the frequency of consumption of crisps and other confectionery were raised.

Eating habits: (6 questions) these questions were designed to explore the eating habits of the children, in particular those related to the type of milk consumed, the type of fat used in cooking, the intake of dietary supplements, the description of the child's appetite, the reasons to avoid food (if applicable), and the reaction of the mother if the child refuses to eat certain food. At the end of this section, the mother was asked if she would like to change anything about her child's eating habits.

Sleeping habits

This section contained 5 questions and aimed to investigate the child's sleeping habits, including the time the child normally goes to bed, the time the child wakes up, and the amount of time the child spends sleeping during the day (if applicable). In addition, the time spent viewing TV/video minute per day was also recorded.

Mother's nutritional knowledge

The nutritional knowledge section consisted of eleven questions aimed at testing the level of the mother's knowledge about nutrition. The first question enquired about the source of the mother's dietary information. For ten of the questions below a score was assigned, with 1 for a correct answer and 0 for an incorrect answer. Then the total score was divided into tertiles, where the lowest referred to 'insufficient nutritional knowledge', the medium referred to 'moderate nutritional knowledge', and the highest referred to 'good nutritional knowledge' using a methodology similar to that used by Turconi et al. (2008).

- Q26 asked which macronutrient provided the most energy. A selection of fat was scored as 1, otherwise 0.

- Q27 asked which nutrient was responsible for the child's growth and formation of new tissue. Only the selection of protein was marked as 1, otherwise 0.

- Q28 asked about the richest source of iron amongst a given list of foods. Only the selection of red meat scored 1, otherwise 0.

- Q29 asked about the amount of calcium present in different types of milk. The option equal was scored 1, otherwise 0.

- Q30 asked about the most suitable age to provide the child with cow's milk. The option of 12 or 18 months got a score of 1, otherwise 0.

- Q31 asked about the most suitable age to feed a child honey. A selection of 12 or 18 months scored 1, otherwise 0.

- Q32 asked about the portions of fruit and vegetables that a child should eat every day. A selection of 5 or more was marked as 1, otherwise 0.

- Q33 was divided into 3 sub-questions about beliefs, with 4 response categories: 'yes', 'no', 'maybe', and 'I don't know', as follows:

  - Ghee and butter gives strength to your child. A negative answer was scored as 1, otherwise 0.
  - Margarine contains less fat than butter. A negative answer was scored as 1, otherwise 0.
  - If the label says 'low fat' the food will be healthy. If the answer was 'maybe' a score of 1 was given, otherwise 0.

2.2.1.1. Piloting of the methodological tool

The questionnaire was first subjected to a pilot study amongst researchers, colleagues and experts in the same field to identify any ambiguities, any lack of clarity or any gaps in the questions. The questionnaire was amended where appropriate to address all comments, and then re-piloted with 10 South Asian mothers. From this pilot it was noted that South Asian mothers did not like to complete the questionnaire by themselves; seven out of ten mothers preferred to complete the questionnaire with the researcher. The reason behind this was a lack of time on the side of the participants. In addition, it was found that some of the questions were not clear in some sections. For instance, in the lifestyle section there was a question that asked how active the child is on a daily basis. Four responses were provided as follows:

- Plays actively outdoors for 2 or more hours
- Plays actively indoors and outdoors for 2 hours
- Plays actively indoors for 1 to 2 hours
- Plays mostly indoors

This question caused some confusion for the mothers, since the time the child plays outside depends on the weather and on the child's mood. Therefore, this question was removed from the questionnaire. Another question was not clear enough for the participants in the nutritional knowledge part. Mothers had difficulty answering Q27: 'Which of the following is good for the child's growth?' The question was too vague for the participants to choose the right answer. Therefore, it was changed to: 'Which of the following is responsible for the growth and formation of new tissue?' (Please refer to Appendix (B) for the final draft of the questionnaire).

2.2.1.2. The main study

Study population

Table 2.2 illustrates the inclusion and exclusion criteria which were used to determine the appropriateness of the subject to participate in the study.

Table 2.2: Inclusion and exclusion criteria for the first part of the study

Inclusion criteria	exclusion criteria
• Parent resident in West Yorkshire • Children from different ethnic background (Indian, Pakistani, Bangladeshi, White & African) • Boys and girls aged 1-3 years • Ability of parent to consent, speak & write in English • Time of recruitment Aug. 2010 – January 2012	• Children with special dietary needs such as food allergy or lactose intolerance...

Sample size

In this part it was decided to recruit people from different ethnic groups, including South Asian, African and White children.

South Asian participants

The 2009 Census from the Office for National Statistics (Office for National Statistics, 2011) was used to identify geographical areas with a high proportion of subjects from groups that were to be studied. The number of South Asian children aged 0-15 years living in Yorkshire and the Humber, UK, was used to calculate the sample size. The sample size of participants was estimated by the following equation (Koh and Owen, 2000):

$n = (z/e)^2(p)(1-p)$

where:

n is the sample size;

z is the standard score corresponding to a given confidence level, 1.96 for 95%;

e is the margin of error, 0.05 = ± 5%;

p is the estimated value for the proportion of South Asian children (Indian, Pakistani and Bangladeshi) in Yorkshire and the Humber (p=82200).

In total, 382 participants were needed to cover the age range 0-15 years, because as MacIntyre (2009) states: “when resources are limited it is probably more useful to collect limited data of high quality than to attempt to collect comprehensive dietary data with inadequate resources.” This study employed a convenient sample of children aged 1-3 years due to the timescale and the available resources. The minimum postulated sample size was fixed at 120 participants by analogy with the National Diet and Nutrition Survey (NDNS), the new rolling programme (2008/2009). In total, the NDNS collected data from 583 children that year aged 1.5-18 years. Of these, 122 (21%) of the sample were children aged 1.5-3 years.

This number (n=120) was then increased by 30% to 156 participants to compensate for dropouts. A positive response rate allowed recruitment of 160 participants, which was the final sample size for the study.

White and African children

Regarding White and African children, the researcher made an effort to recruit the maximum number in each group to allow correct performance of the statistical analysis, considering the time and resources available for the PhD research and the difficulties in recruiting children. All recruitment activity was undertaken by the researcher.

Recruitment strategy

Letters were sent to a variety of pre-school play groups and mother and toddler groups with additional information on the project Appendix (C), requesting their assistance to distribute the questionnaire to the parents/guardians of the children attending their group. If they were willing to help, a bundle consisting of an information sheet Appendix (D), a consent form Appendix (E), the questionnaire Appendix (B) and a pre-paid envelope per child were sent to them for distribution. Moreover, to increase the participation rate of South Asian and African subjects, places of worship, local community centres and ethnic food stores were canvassed and a ‘snowball’ sampling technique was used as well. In all cases, the researcher’s assurance of confidentiality of all information was given to the participants. At the end of the process, all mothers received a £5 gift voucher as appreciation for their time. More details regarding the recruitment of South Asian children provided in section 2.2.3.2.

2.2.2. Development and validation of food photograph booklet

In this study there was a need to develop a food photograph booklet for the most commonly consumed foods among preschool South Asian children in the UK, not only to enhance the estimation of the food portion sizes during the data collection but also for the researcher to identify unfamiliar traditional foods consumed among the South Asian community, since there was no such booklet available. The researcher was aware of the need to follow robust guidelines set by previous studies during this phase to ensure the accuracy of the development of the food photographs (Nelson *et al*, 1994; Nelson and Haraldsdóttir, 1998; Robson and Livingstone, 2000). In addition, in order to reduce data collection bias and ensure the suitability of using this tool in the main study, validation sessions were carried out after the development of the food photographs booklet (chapter 4)

2.2.2.1. Development and piloting of the food photograph booklet

A pilot study was carried out to find a suitable technique for the development of the food photograph booklet (size of the images, the range of the portion sizes, identifying the best angle for the image capture and the appropriateness of the background and the use of reference objects) all these elements were tested according to Nelson and Haraldsdóttir (1998).

Size of the image and the range of the portion sizes

From previous studies it was found that the sizes and the numbers of portion sizes used for the food photographs ranged from 20x29 cm (single image) to 6x8 cm (eight images) on each A4 page (Nelson and Haraldsdóttir, 1998), however, one portion is not recommended (Nelson et al., 1994). According to Nelson and Haraldsdóttir (1998), an even number of photographs is recommended (either four, six or eight). In our case, South Asian mothers had difficulty with estimation when eight portions were used. Therefore, each A4 page in the booklet presented a single food in four different portions shown in images 6x8 cm in size. Options for less than the smallest portion and more than the largest portion were included. Each food was named and coded by a number, and each portion identified by alphabetical letters (B, D, F, and H) Figure 2.2.

Figure 2.2: Example of some foods in the food photograph booklet

Sweet rice


B


D


F


H

Chicken curry


B


D


F


H

From the previously conducted pilot study on South Asian children by a PhD student at the School of Food Science and Nutrition at the University of Leeds, 15 food items considered to be commonly consumed by South Asian children which cover a range of morphologies were chosen (Ashkanani, 2013). Initially, four portion sizes were prepared for each food item chosen, the typical food portion sizes for children of different ages in Great Britain (Wrieden *et al*, 2008) were used as the starting point and the basis for the development of the food portion size booklet.

Experimental food photographs that included these foods were pre-tested in the pilot study (Table 2.3), by 10 participants to find out whether the chosen portion sizes in the booklet were appropriate or not. Mothers were asked which photograph most closely resembled the typical portion size of their child for each of the identified foods. It was concluded that the smallest portion of some foods does not reflect the right portion to start with. For that reason, some portions were modified, including those for rice, porridge, breakfast cereal, soup, mint sauce and mixed vegetables. The researcher observed that the majority of mothers claimed that their child's portion of some foods was one tablespoon. It was therefore decided that the smallest portion size of some foods would be one tablespoon with an equal increase in increment for the rest of the portion sizes. This was thought to be the best way to cover a different range of portion sizes from smallest to largest.

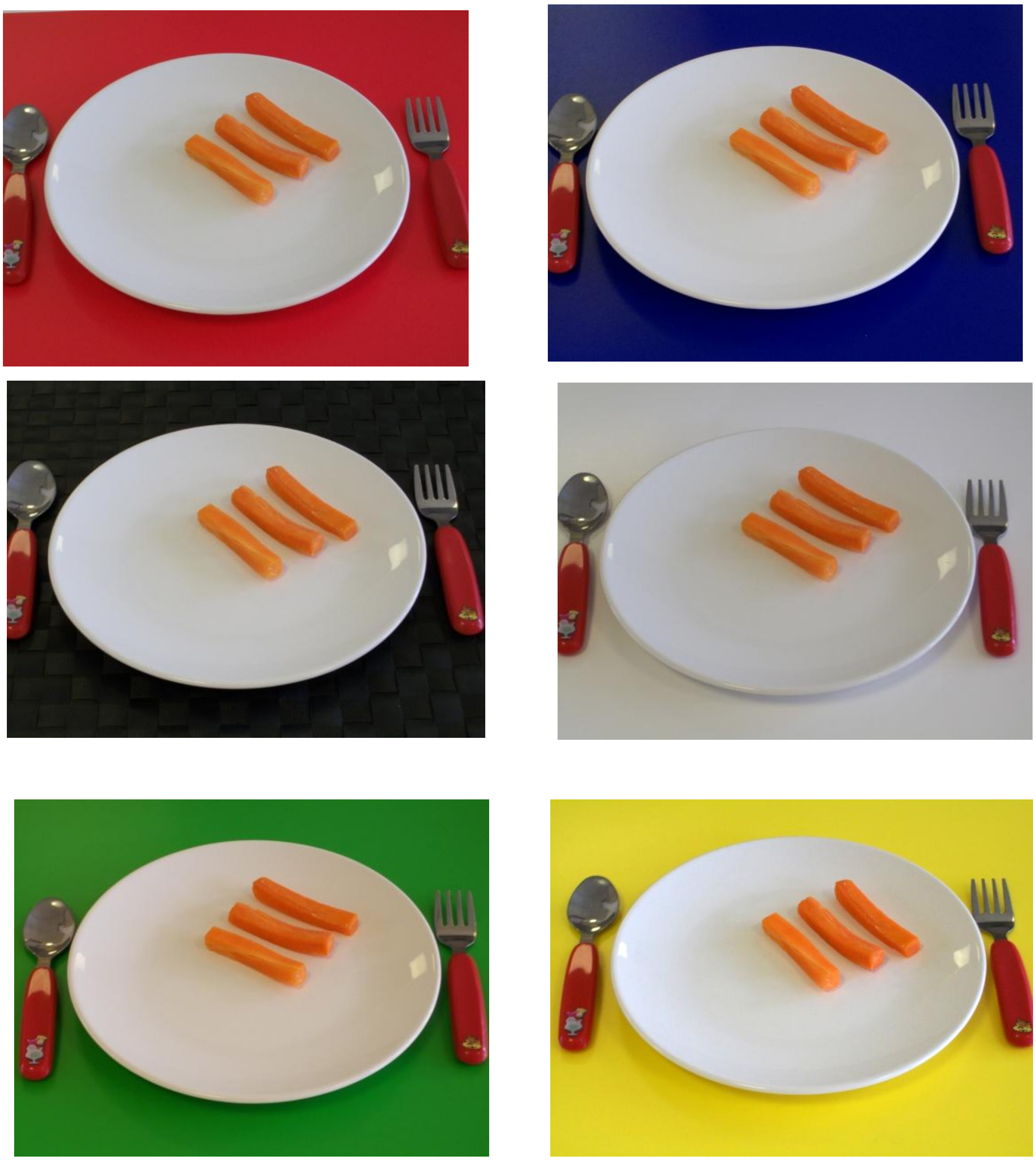
Table 2.3: Suitability of food portion sizes

Type of food	Initial portion based on the reference (g)	Less than the reference	Match the reference	More than the reference
Rice	30	√		
Pasta	30		√	
Breakfast cereal	10			√
Porridge	80	√		
Chicken curry	30		√	
Tuna	15		√	
Soup	60	√		
Mint sauce	4			√
Mixed vegetable	10			√
Potato chips	30		√	
Potato, mashed	30		√	
Banana	20		√	
Grapes	20		√	
Fruit salad	30		√	
Peanuts	10		√	

Background and use of reference objects

Different photo backgrounds were experimented with in order to choose the most appropriate one to be used in the booklet. A professional photographer suggested using a neutral background, since it would prevent any reflection of the light affecting the colour or clarity of the image. Reference objects were also used within the images in addition to the plate, such as a spoon and a fork, to help the participants to get an idea of the scale when relating the portion sizes to something present in the reality (Nelson and Haraldsdóttir, 1998) (Figure 2.3).

Figure 2.3: Different backgrounds tested for the photographs of food



Food photography technique

How to best capture the images of food was also a consideration. The angle and the lighting conditions need to be considered so both the depth and height of the food can be clearly shown in the photographs. Different angles were tested to check the clarity of the photographs (Figure 2.4), and different types of cutlery were also tested to see how they affected the photographs (Figure 2.5).

Figure 2.4: Different angles tested for the food photography

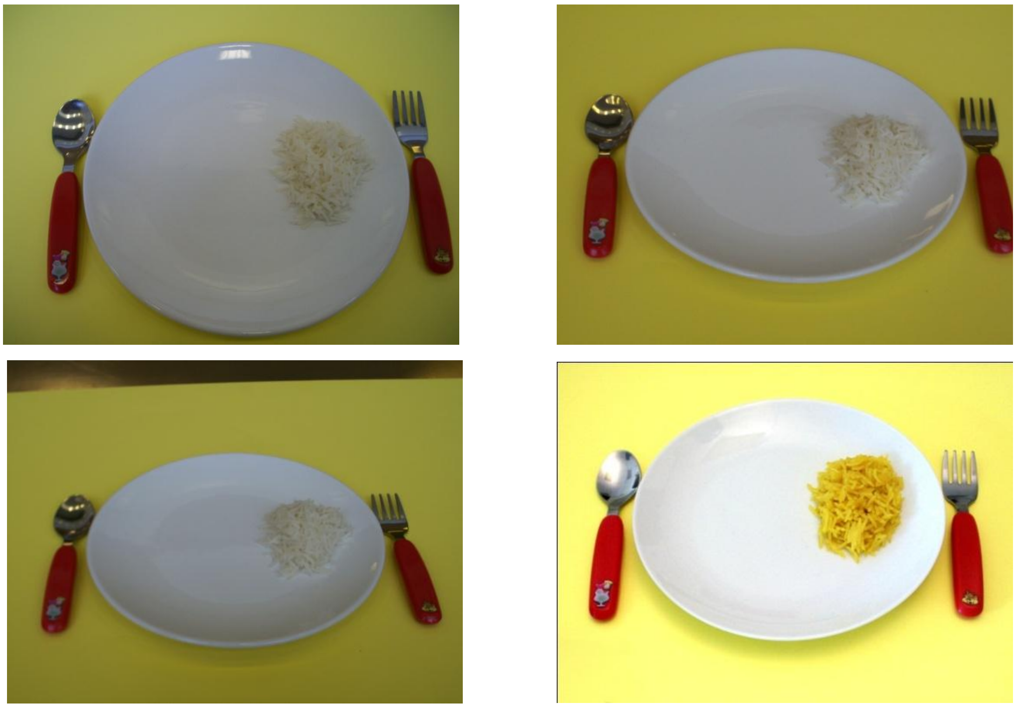
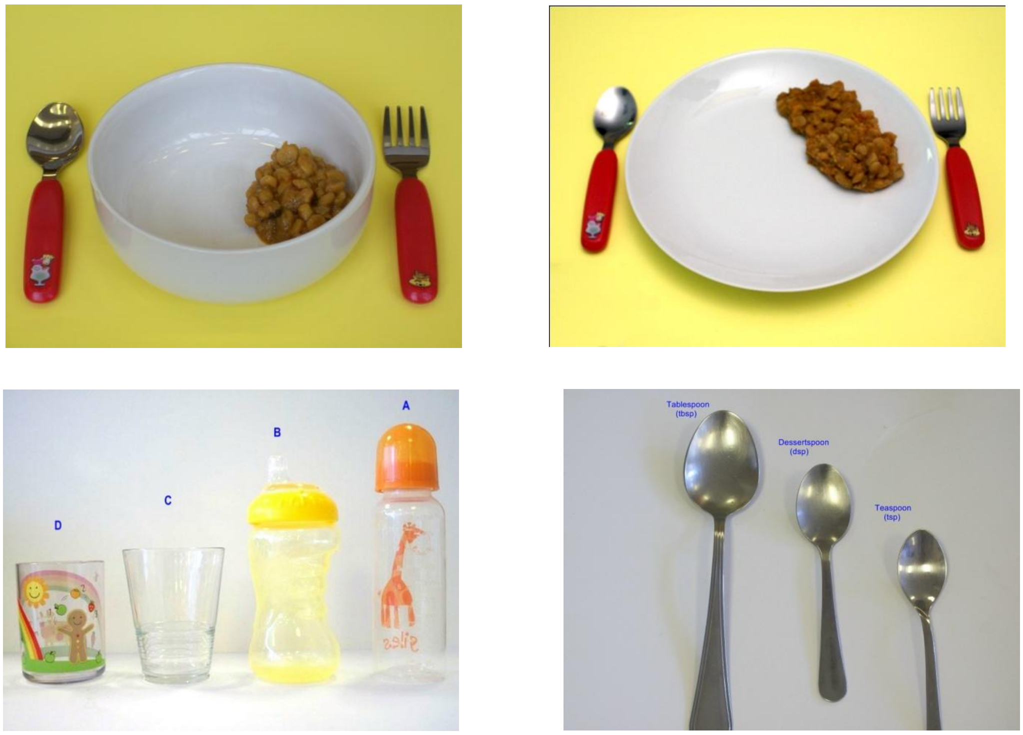


Figure 2.5: Different cutlery used in the food photography



Final draft of the food photograph booklet

In total, 89 foods were chosen and samples were then collected from volunteers, in the form of home-made foods, food from local Indian/Pakistani restaurants and ready-to-eat meals from local/South Asian supermarkets in Leeds and Bradford. The portion sizes were prepared according to the typical food portion sizes for children of different ages in Great Britain (Wrieden *et al*, 2008) in addition to anecdotal evidence obtained from South Asian mothers from the pilot study previously conducted by the researcher.

For each food, colour photographs were taken of four portion size ranging from smallest to largest showing equal increments. All pictures were captured under standardised conditions (distance and lighting) from an angle of 42°, which was considered to be the best angle for photographing food in terms of showing both depth and height (Nelson *et a*l, 1994; Robson and Livingstone, 2000). All food portions were presented on a white 7 inch diameter plate except cereal, muesli, chicken curry, *Palak panner* and soup, which owing to their semi-liquid consistency, were presented in a 6 inch diameter bowl. Final version of the food photographs booklet available in Appendix (F).

2.2.2.2. The main study (Validation of food photograph booklet)

After the researcher had developed the final draft of the food photographs booklet there was a need to check the validity of the tool before it could be used in the main study since incorrect information may lead to misleading the results of the study. The validation in this study was the comparison of results from using the tool against the true value. Two phases of validation of the food photographs were applied. In the first phase, the researcher contemplated whether it was better to show the participants the food photographs on a computer screen or to show them on paper, since we live in a technological age. Therefore, the use of the food photographs on a computer screen vs. hardcopy coloured photographs on paper was tested and a comparison between both methods took place, considering clarity and the degree of errors that occurred. Based on the results of the first phase of the validation, the second phase was carried out using hardcopy coloured photographs on paper focusing only on South Asian mothers, the target group of the main study, to assess errors in the perception of quantities of food using the photographs.

Study population

For the validation study the inclusion and exclusion criteria shown in Table 2.4 were applied.

Table .2.4: Inclusion and exclusion criteria for the validation of the food photograph booklet

Inclusion criteria	Exclusion criteria
First phase of validation Men and women Second phase of validation South Asian mothers Able to consent, speak & write in English	The only exclusion criterion was self reported visual limitations that may inhibit their ability to see well.

Sample size

For this study, effort was made to recruit a convenient sample size that allowed the performance of statistical analysis of each session of the validation. In total, 67 participants were recruited for both the first and second stage of validation (n=30 and n=37, respectively).

Recruitment strategy

For the first phase of the validation sessions, the researcher invited volunteers from the University of Leeds to take part in the study and the participants included those of different ethnic backgrounds and age groups. For the second phase of the validation, the researcher approached South Asian mothers who attended various places of worship to take part in the study, such as the Hanafi Masjid in Huddersfield, the Hindu Mandir temple in Leeds and the Sikh temple in Leeds, as well as community centres such as Woodsley Community Centre and Apna Centre in Leeds. In all validation sessions the participants were interviewed individually by the researcher and the purpose of the session and the procedure of what would be done were explained. An information sheet about the study was provided and a consent form signed by each participant. The form of the validation sheet provided in Appendix (G).

Study procedure

Foods and portion sizes were randomly assessed to measure the accuracy of perceptions when estimating food portion sizes using the food photographs and a similar protocol used by previous studies (Lucas et al., 1995; Venter et al., 2000).

Perception, in this case, concerned measuring a participant's ability to compare a single portion of food served on a plate to the portions shown in the photographs of similar foods (Nelson et al., 1994). In this study a set of four portion sizes of each food was shown to reflect a large range of consumption weights. Each participant's response was indicated by them pointing to one of the photographs. Options for less than the smallest portion and more than the largest portion were included as well. This procedure was repeated for each individual food item. The foods presented on the plates were similar to the foods presented in the photographic booklets.

In each phase of the validation, a total of 10 different foods were chosen for testing. These foods could not be quantified by using the food item's brand information and represented a range of morphologies. Foods that are easy to describe in household measures and come in discrete units such as biscuits, bread, fish fingers, etc., were excluded (see Table 2.5). In the first phase of the validation 30 participants took part and in the second phase 37 participants took part. Thus, a total of 300 portion size estimations in the first part and 370 portion size estimations in the second part were completed.

Average estimated portion sizes were calculated for each individual foodstuff. Percentage accuracy and the proportion of correct estimations in the sample were calculated using the following formulas:

- **% degree of accuracy** = ((average estimated portion - actual portion)/ actual portion) x 100

- **% correct estimation** = (number of successful estimation/total number of participants) x 100

The smaller the percentage difference between the average and actual portion size, the higher the degree of accuracy (Venter et al., 2000). Successful estimation was considered to be when the portion size identified by the participant fell between ±10% of the actual portion size (Venter et al., 2000).

Table 2.5: Foods selected for the validation sessions in Phase 1 and 2

Selected food	Food description	Phase of validation
Aloo matter	Potato and peas cooked with onions and spices, served as a stew	1 & 2
Breakfast cereal	Cornflake-type breakfast cereal, served without milk	2
Chicken bryani	A rice and chicken dish in which both ingredients are cooked together in a sealed container	2
Chicken curry	Chunks of chicken cooked in a mixture of spices, onions, ginger and tomatoes fried and thickened	1 & 2
Dhal	Any type of dried split pea, bean or lentil cooked with onions, tomatoes and spices	1 & 2
Fruit salad	Homemade fruit salad including grapes, apple, oranges, pineapple and melon	2
Keema matter	Dry minced-meat curry cooked with peas, onions and spices	1 & 2
Kheer	Indian version of rice pudding, rich and creamy with cardamom and almonds (sultanas optional)	1
Mashed potato	Boiled/baked potato mashed with butter, cream, salt and paper	1
Mixed vegetable	Mixed vegetables (seasonal vegetables such as aubergine, sweet corn, green beans, peas, carrots, broccoli, potato and cauliflower) cooked with spices, onions and tomatoes	1
Palak paneer	Palak (spinach) and paneer (un-ripened cheese made by coagulating milk with lemon juice) cooked with onions, tomatoes and spices	1 & 2
Rice	White rice boiled	1 & 2
Soup	Tomato soup, thick without chunks	1 & 2

The source of the food descriptions were obtained from Moyle and Khokhar (2008); Lowe et al., (2008)

2.2.3. The 24 hour Multiple Pass Recall (24 hour MPRs)

A 24-hour MPR was chosen as a dietary assessment method for this study. The method was adapted from the US Department of Agriculture (USDA) five-step multiple pass method (Moshfegh et al., 2008), which is described in Table 2.6.

Table 2.6: Description of the US Department of Agriculture (USDA) 5-step multiple pass method for the 24-hour MPRs

Step	Pass	Purpose
1	Quick list	Obtain a list of food and drink items consumed the previous day
2	Add forgotten food items	Prompt for any foods that may have been forgotten
3	Time and occasion	Ask about the time and the eating occasion for each food
4	A detailed pass review	Collect detailed information on each food consumed including: Brand name of the food item if available Portion sizes using newly developed food portion photographs for South Asians and household measurements Recipe for South Asian foods Duration of each breastfeeding period only when necessary Total volume of formula before and after feeding only when necessary
5	Final review probe	Collect additional foods not remembered earlier

(Source: Moshfegh et al., 2008)

2.2.3.1. Piloting of the methodological tool

Piloting of the 24-hour MPR was kept to a minimum, since it was adapted from the USDA and it is well documented that it is a valid method for use among children (Johnson et al., 1996; Reilly et al., 2001). The purpose of conducting the pilot study was for the researcher to practise the technique and test the data collection method on South Asian mothers, after failing to convince mothers to adopt the weighed method. It was also an opportunity for the researcher to became familiar with the South Asian community.

Different locations were used as target centres for potential participants, including children’s activity groups, local community centres, places of worship, and ethnic food stores. A number (n=15) of South Asian mothers agreed to participate and use the 24-hour MPR in combination with a photographic food atlas for adults (Nelson et al., 1997). The researcher encountered several problems during this phase of the study, the most important being a poor response rate which was addressed in the main study (more details provided below in the recruitment section) and difficulty in the estimation of food portion sizes during the 24-hour MPRs using the photographic food atlas for adults (Nelson et al., 1997).

2.2.3.2. The main study

Study population

Similar inclusion and exclusion criteria as described in section 2.2. were used eliminating White and African children. Moreover, this cross-sectional study was designed so that no more than one child was selected from a single household to take part.

Recruitment strategy

Similar to previous studies of ethnic minority groups, the researcher decided to recruit people by using the "door to door" technique (Kassim Khamis, 1996) and a 'snowball' sampling technique, since the snowball method has been suggested as the best method to use for difficult-to-access populations such as ethnic minority groups (Hughes et al., 1995; Rankin and Bhopal, 2001; Renzaho et al., 2006a; Renzaho et al., 2006b; Renzaho et al., 2008).

Mothers of 160 South Asian preschool children aged 1-3 years old from West Yorkshire took part in this cross sectional study. Data were collected in the participant's home by direct contact from the researcher between August 2010 and January 2012, with no data collected in Ramadan, Christmas and the Easter holidays, or during school breaks.

During the pilot study, several steps were found to be necessary to address the recruitment process and achieve the required sample size, as described below:

(i) Initially, the researcher contacted respected members of the community (group leaders/organisers, religious leaders, or employers) in different places, such as children's activity groups, places of worship, local community centres, and ethnic food stores;

(ii) The study was explained to them and then they were asked about the possibility of meeting at the location that they were responsible for;

(iii) If given approval, a day was set to introduce the researcher to the community members and then the researcher explained the background and the potential benefits of the study. Assurance of confidentiality of information was given and it was clarified that there was no link between the study and the local authority or Home Office. It was an important step to let the participants feel more confident and more willing to engage in the study, this was suggested by Kassam-Khamis 1996.

(iv) All participants were given an information sheet and a consent form accompanied by prepaid envelopes (Appendixes H and E) if they met the criteria (see Table 4.1). The information sheet gave details of the study and explained what would be required of the participants.

(v) Two weeks were given for the participants to choose whether to take part in the study or not.

(vi) Appointments were then set up individually between the researcher and the participants. The sessions were appointed on three separate occasions, one of which was to take place during a weekend. To reach more people, flyers regarding the importance of the study and how to contact the researcher were distributed. In addition, a snowball sampling technique was used as well. At the end of the interview, participants were asked if they knew other people who might be willing to participate in the study (names and addresses of up to three people were provided from each participant).

Dietary information

Dietary data were collected using a face-to-face 24-hour MPR technique Appendix (I). For each participant three MPRs were conducted on non-consecutive days over a 2 week study period, one of which was a weekend day; some photos are provided in Appendix (J). Portion sizes were estimates using household measurements and the newly developed South Asian food photographs. Furthermore, actual portions on the food labels were used as well when mothers provided the food's brand name for items such as fruit yogurts, chocolate, etc. In the case of breastfeeding, because of the difficulty of estimating the quantity of breast milk consumed by young children, mothers were asked about the duration of each breastfeeding period. Based on Medical Research Council data, a feed of at least 10 minutes duration amounted to approximately 100g (Paul et al., 1988; Mills & Tyler, 1992). When feeding duration was less than 10 minutes, consumption was estimated proportionally. When infant formula was given, mothers were asked about the total volume after the addition of formula powder to water and the volume not consumed after feeding. Moreover, mothers were asked if they followed the instructions on the label and if there was anything added to the formula such as sugar or honey. At the end of the interviews, to show appreciation for their time, each child received a gift voucher of £15.

Nutrient composition calculation

Figure 2.6 describes the methodological tools used for nutrient analysis. All foods were analysed using WinDiet software (2008), which includes the UK database of McCance and Widdoson's 6th edition and all currently available supplements. WinDiet allows the addition of new foods to its database, therefore the latest available data on South Asian foods generated through the Food Standard Agency and European Food Information Resource Network were added by the researcher to the existing database (Moyle and Khokhar, 2008; EuroFIR Project no.FP6-513944, 2010; Khokhar et al., 2012). Moreover, information from packaging (manufacturers' food labels) was used. In addition, when composition data was not available in the previously stated references, the USDA database (n=5 foods) via WinDiets, and the Indian database (n=1 food item) through the National Institute of Nutrition (Gopalan et al., 2007) were utilised. The nutrient dataset for these foods in this case are provided in Appendix (K). Different food composition datasets adopted in the analysis are a possible source of error. The different analytical methods used for some nutrients such as CHO and dietary fibre do not always provide comparable nutrient value which may result in an incorrect estimation of the nutrient intake. However, in this study the use of the USDA and the Indian database was kept to a minimum (only 6 out of 368 food items) to eliminate the possibility of errors from such variations.

In some cases the food did not match data in any existing food databases, therefore recipe calculation was needed. This was used for *chicken bryani* and *soji*. Creation of 'recipes' was possible in WinDiet. The researcher was able to enter individual ingredients to create recipes for cooked dishes that were not available in the database using participants' recipes or a standard recipe book.

Figure 2.6 Description of the methodology used for nutrient analysis in the present study

The nutrient composition analysis

1. WinDiet including EuroFir database, McCance and Widdoson's 6th edition and Food packaging were used (n=360)

When composition data was not available

2. USDA database was employed (n=5)

When composition data was not available

3. Indian database was employed (n=1)

When composition data was not available

4. Recipe calculation was employed (n=2)

Handling, screening and cleaning the data

Upon completion of the data entry in the SPSS PASW statistical software and before starting the analysis it was essential to check the data for errors. Data cleaning took place by checking the outliers which may occur due to typing mistakes; for example, weighing of 100g of mayonnaise instead of 10g. In addition, unexpected values for nutrients were further investigated in order to identify whether the reason was due to a typing mistake or not.

Commonly consumed foods

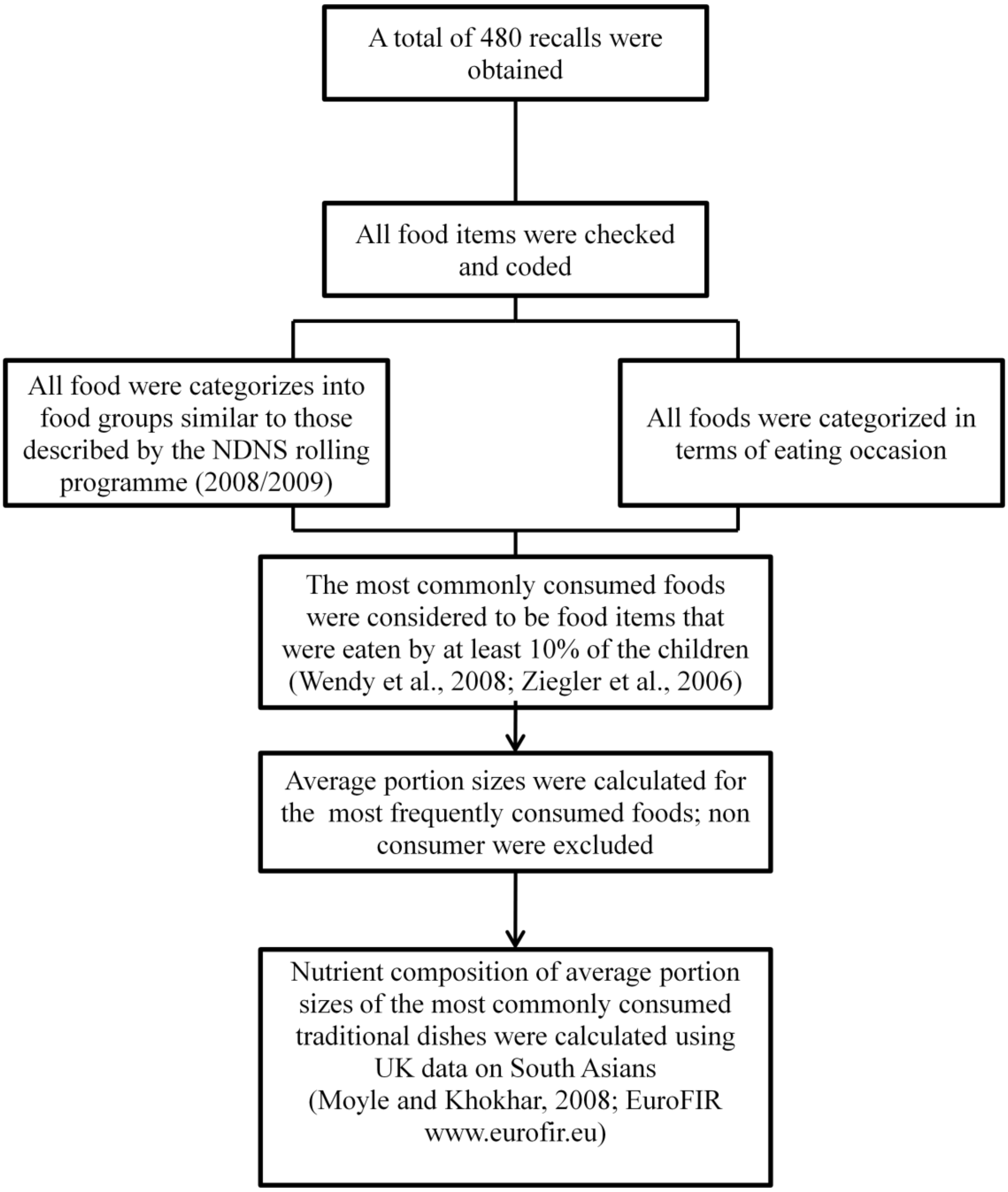
Most frequently consumed foods were assessed in terms of food groups and eating occasions (Figure 2.7). All foods consumed and recorded for each individual recall were checked and coded using Microsoft Excel before the data were exported to the SPSS PAWS statistical software. Similar foods were merged together into 13 food groups based on the National Diet and Nutrition Survey rolling programme 2008/9-

2009/10 (Department of Health, 2011). The food groups included cereal and cereal products, milk and milk products, eggs and egg dishes, meat and meat dishes, fish and fish dishes, fats and spreads, vegetables and vegetable dishes, fruits, sugars and confectioneries, savoury snacks, beverages, miscellaneous and baby foods.

A high frequency of eating large or small portions of food items may have skewed the results. Therefore, the mean portion size of each food item was calculated to have a single portion contributed by each child. Regarding the analysis in terms of eating occasions, they were categorised as breakfast, lunch and dinner as main meals and snacks, the latter being further categorised into morning snack, afternoon snack and evening snack. Night feeding was considered another eating occasion. However, due to the low frequencies (less than 10%) of night feeding among the study population it was decided not to include them in this analysis.

The most commonly consumed foods, which were defined as those foods consumed by at least 10% or more of the children, were obtained (Wrieden et al., 2008). Then, average portion sizes were calculated and transferred to SPSS PASW Statistics 19 for further analysis. In order to identify the main sources of nutrients in the most commonly consumed traditional dishes in South Asian preschool children's diets, nutrient compositions of ethnic-specific portion sizes were calculated.

Figure 2.7: Assessment of the most commonly consumed foods among South Asian preschool children in terms of food groups and eating occasions.



Assessment of child's anthropometric measurements

The children's length instead of height for children from 1 year up to 2 years, height for children ≥ 2 years, and weight were measured in the presence of the mothers. In general, length or height was measured and reported to the nearest 0.1 cm using a portable seca Leicester stadiometer height measure. Weight was measured and reported to the nearest 0.1 kg using an electronic digital Hanson scale, which allows tared weighing[18].

In order to obtain consistent measurements, the World Health Organization (WHO) protocol for height and weight measurement was used (WHO, 2008) (see Table 6.1). In addition, body mass index (BMI) was calculated to define the weight status for children.

Assessing the BMI of children differs from assessing the BMI of adults when defining underweight/overweight or obesity. With children, both the age and gender of the child should be taken into account. Height in meters and weight in kilograms were measured using the WHO (2008) standardized protocol. BMI was calculated as (weight (kg)/height (m^2)) for children 2-3 years old; 1 year olds were excluded. The BMI-for-age charts of the WHO for both girls and boys were used. According to the NDNS rolling programme (2008/9-2009/10), children > 85^{th} and ≤ 95^{th} percentile were classified as 'overweight' and those >95^{th} percentile were classified as 'obese', since it is the standard UK government practice for population monitoring. The New UK-World Health Organisation (WHO) growth charts from birth to four years recently used in the UK classify being overweight as above the 91^{st} but on or below the 98^{th} percentile, and obesity as above 98^{th} percentile. However, this is for clinical purposes (SACN/RCPCH, 2012; Dinsdale et al., 2011). In addition, 75^{th} and 97^{th} percentiles of Indian (Khadilkar and Khadilkar, 2011) were used to observe the differences between UK and Indian classification of weight status for children.

Table 2.7: World Health Organization height and weight measurement protocol

Weight measured:	Height measured
If the child was under 2 years and unable to stand: ● First, the mother was weighed alone, and then tared weighing was undertaken. ● The child was held in the mother's arms on the scale for weighing. ● The child's weight was determined.	**If the child was under 2 years:** ● When measured, a standing height of 0.7 cm was added to convert it to length (length measurement was applied). ● In some cases the measurement from the red book was used if available.
If the child was 2 years or older: Child was weighed standing alone on the scale.	**If the child was 2 years or older:** Standing height was measured.

Note: Scales were calibrated on each day of use. During the measurement each child was measured in light, indoor clothing without shoes and socks to avoid upsetting the child.

[18] Tared weighing means the scale can be re-set to zero with the person being weighed still on it.

Assessment of under-reporting/over-reporting

A common problem in dietary surveys is the under-reporting of food intake (Nelson, 2000). This occurs when people report food intakes that are lower than their true intake. In order to identify misreporting in this study, standard equations were used to estimate Basal Metabolic Rate (BMR). These were age and gender appropriate equations based upon the measurement of the child's weight (Schofield et al., 1985).

Standard equations which estimate BMR for children under 3 years:

- Male BMR(MJ/day)= 0.249 x wt-0.127
- Female BMR(MJ/day)=0.244 x wt-0.130

Standard equations which estimate BMR for children 3-10 years:

- Male BMR(MJ/day)=0.095 x wt+2.110
- Female BMR(MJ/day)=0.085 x wt+2.033

The BMR for each individual was then multiplied by lower and upper cut-off points which are recommended for use with children (Torun et al., 1996) to provide estimates of minimum and maximum total energy expenditure. For each individual the results were compared with the child's reported energy intake, as calculated from the 24 hour recall (MPR).

- Males and females aged 1-5 years cut-off points 1.28-1.79xBMR

The ratio of reported energy intake (EI) to BMR (EI:BMR) was calculated for each individual; if found to be < 1.28, children were identified as under-reporters, whereas those with EI:BMR > 1.79 were identified as over-reporters. Children were classified as normal-reporters if EI:BMR was > 1.28 and < 1.79. Participants identified as under- or over-reporters were included in the main analysis.

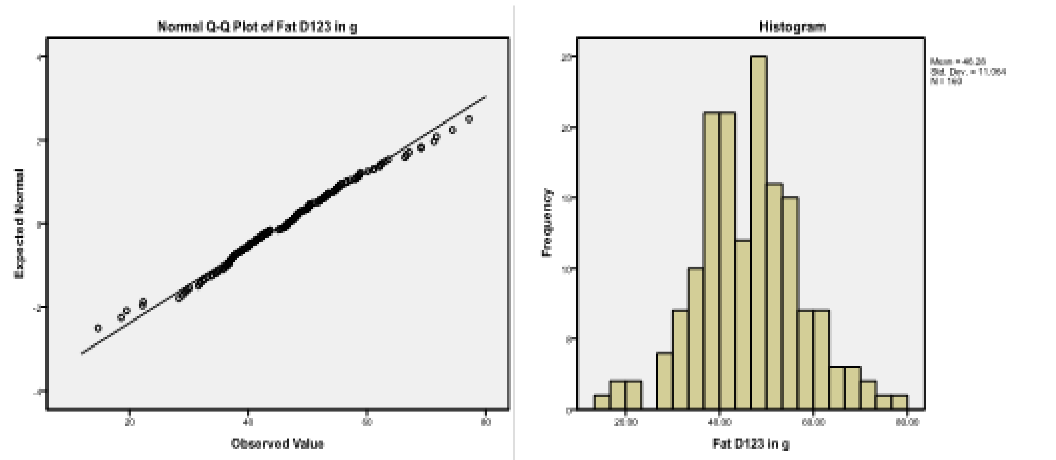
2.2.4. Statistical analysis

Statistical analysis software (IBM Corp. released 2010. IBM SPSS Statistics for Windows, version 19.0, Armonk, NY:IBM Corp) was used.

Test for normality, data transformation and descriptive analysis

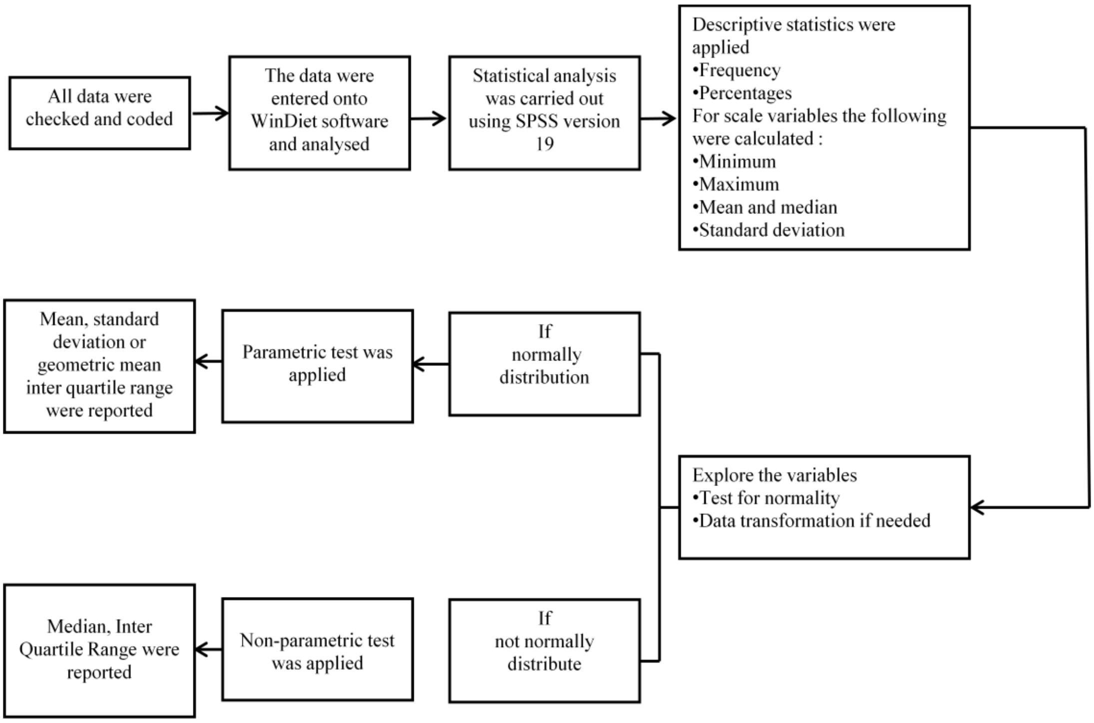
It is important to check the normality of data, to present appropriate descriptive statistics and test for adequacy statistical tests. Three different statistical techniques were used to assess the normality of the nutrient intake data; numerical methods such as Shapiro Wilk test and graphical methods such as Normal Q-Q plots and histogram plots. In the Shapiro Wilk test, if the p value > 0.05, normality was accepted. In the Normal Q-Q plot, normally distributed data are highly correlated with a line of best fit. In the case of the histogram plot, normality was indicated by having a bell shape (Figure 2.8). If the data was not normally distributed, log transformation was conducted to improve the scatter toward a homogeneous distribution and normality assessed. If the data was normally distributed, descriptive statistics mean and standard deviation was reported. If the data was transformed, the geometric mean and inter quartile range of the data were calculated, normally distributed data enable appropriate use of parametric tests. When data were not normally distributed, equivalent non-parametric tests were used and the median and inter quartile range were reported. Figure 2.9 summarises the statistical procedure outlined in this study. Further details regarding the statistical analysis will be given below.

Figure 2.8: : Assessment of normality using Normal Q-Q plots and histogram



Note: FatD123: average fat intake of 3 days

Figure 2.9: Summary of the statistical procedure outlined in this study



Chapter 3: Dietary habits, sleeping habits and mothers' nutritional knowledge among children from different ethnic groups

Descriptive analyses and comparisons were performed to describe the demographic characteristics of the participants and their responses. As most categorical variables are not normally distributed, a non-parametric chi-squared test was used to test the differences within and between the ethnic groups. For continuous variables, to test the differences between ethnic groups, a Mann-Whitney U test and Kruskal Wallis test were used.

Chapter 4: Validation of food photographs booklet

Descriptive statistics were used to describe the demographic characteristics of the participants and their responses. The mean estimated weight and a 95% confidence interval were calculated for each food and each portion size. Wilcoxon's test was employed to compare between the actual and the estimated portions for each food. The number and percentages of correct, underestimation and overestimation of the food portion sizes were calculated for each food and each participant (section

2.2.2.2). The percentages were then compared for age, ethnicity, mothers' BMI, and education level, using an independent-sample t-test or the one-way analysis of variance (ANOVA) test and the post-hoc Tukey test to obtain honest significant differences. A *p* values less than 0.05 were considered to be statistically significant.

Chapter 5: Food consumption and average food portion sizes

Descriptive analysis (frequency, percentage) was used to describe the demographic characteristics of the study participants. The characteristics considered were gender, religion, ethnicity, income, parental education level, number of children, and type of family.

The number and percentage of consumers, average portion sizes, median, standard deviation, minimum and maximum portion sizes of the most commonly consumed foods were obtained. A Mann-Whitney U test (non-parametric test) was used to assess religion and gender diffrences in average potion sizes of the most commonly consumed foods to find out if there was a need to report the results in terms of gender or relegion. A p-value <0.05 was considered to be significant. No statistical differences in average portion sizes were assessd for South Asian sub-groups, since there were no valid cases for some food items to be computed in the statistical analysis.

Chapter 6: Assessment of dietary intake

Anthropometric characteristics of the study participants were compared between boys and girls by t-test (independent-sample t-test), a significance level of $p <0.05$ was selected. Statistical comparisons were then made for average energy and nutrient intakes with the UK Dietary Reference Values (DRVs) (Department of Health, 1991), Indian recommendations (ICMR, 2009), and World Health Organisation (WHO) recommendations (FAO/WHO/UNU, 1985; FAO/WHO/UNU, 1998). A one-sample t-test was used for normally distributed data, otherwise a Wilcoxon Signed Rank test was used, a p-value <0.05 was considered to be significant. Statistical analyses of socio-demographic differences in the nutrients intake among South Asian preschool children were performed; using an independent-sample t-test or one-way analysis of variance (ANOVA) and a Tukey's post hoc test for normally distributed data, otherwise a Mann-Whitney U test or a Kruskal Wallis test were used, a p-value <0.01 was considered to be significant due to multiple comparison. Intakes of micronutrients reported in this study were from food only; dietary supplements (vitamins and minerals) were not considered in the analysis due to the small number of children 20% who reported that they consumed them, and most of them not include supplements in the 24-hour recalls (only 4 reported their intake of vitamins during the 24-hour recall).

2.3 Part II (qualitative approach)

For this part ethical approval was obtained. The study protocol was reviewed and approved by the University of Leeds Research Ethics Committee MEEC 011-030 Appendix (L).

2.3.1 Individual in-depth interview

A qualitative method helps the study of lifestyle, behaviour and attitudes. Therefore, due to the exploratory nature of the study, a qualitative methodology of individual in-depth interviews was adopted. The researcher was able to develop a semi-structured questionnaire based on open questions to guide the interview discussion. The questionnaire was divided into sections to allow for easier analysis. Questions regarding background information were asked, including years of residence in the UK, ethnic origin, religion, the mother's education level, the annual household income and the number of children, adults and elders living in the home (type of family). This was followed by eight sections concerning the mothers' weaning practices and their food choices for their children Table 2.8.

Table 2.8: The sections of the questionnaire

Section	What to investigate
Section 1 (Q1-Q3)	Mother's weaning practices
Section 2 (7 statements)	Mother's opinion regarding some statements made by the researcher
Section 3 (Q4-Q8)	Child's dietary habits
Section 4 (Q9 & Q10)	Factors that influence the child's eating habits
Section 5 (Q11-Q17)	Maternal nutrition awareness
Section 6 (Q18)	Difficulties during the weaning period
Section 7 (Q 19)	Outdated weaning practices
Section 8 (Q 20)	Food fallacies and taboos among South Asians

2.3.1.1. Piloting of the methodological tool

The first draft of the questionnaire was piloted on some colleagues and friends (n=5) of the researcher to check the clarity of the questions. Some amendments were made and then the questionnaire was tested again with South Asian mothers (n=3). During the interviewing, some answers were recorded that were not expected from the mothers. As a result, modification on some of the questions was made. This allowed for exploration of different issues during the interviews. For instance, with Q20, 'Are there any food fallacies and taboos?', the researcher was concerned about the food fallacies and taboos related to children's foods. However, unexpectedly and interestingly, answers related to the pregnancy/post-pregnancy period were given. Therefore, the researcher made the question broader instead of limiting it to children. The pilot study gave the researcher an indication of how long the interview would take (around 25-30 minutes) and how many interviews could be managed per day, taking into account transportation times. The final version of the questionnaire is available in Appendix (M).

2.3.1.2.The main study

Study population

Since mothers provide food for their household they have huge influence on their children's diets and eating habits. This is why mothers were chosen to be interviewed. The inclusion and exclusion criteria presented in Table 2.9 were used to determine the appropriateness of the mother's participation.

Table 2.9: Inclusion and exclusion criteria

Inclusion criteria	exclusion criteria
South Asian mothers resident in West Yorkshire	Inability of mother to speak & write in English
Has child aged between 1-3 years	
Ability of mother to speak & write in English	Inability of mother to consent
Ability of mother to consent	
Time of recruitment March 2012-May 2012	

Sample size

According to Curry et al. (2009), "Qualitative sampling is based on purposeful or theoretical sampling principles. The aim is to identify rich information. Adequacy of the sample size is determined by the principle of theoretical saturation. Theoretical saturation refers to the point at which no new concepts emerge from the review of successive data from a sample that is diverse in pertinent characteristics and experiences." It is not possible to define the number of participants in advance; however, a range of 20 to 30 interviews may achieve saturation (Patton, 2002). Convenience sampling was used in this research and in total, 30 South Asian mothers (Indian n=10, Pakistani n=10 and Bangladeshi n=10) participated in the individual in-depth interviews.

Recruitment strategy

A list of all participants in the first part of the study was drawn up by the researcher. The participants for this part were then randomly selected from this list, with every participant having an equal chance of being selected using the procedure below. The researcher wrote out the numbers 1-160 (number of participants from the first part); each number was written on a separate piece of paper. Each piece of paper was then folded so that the numbers could not be seen. These were then placed in a box and mixed together. The researcher drew 30 of these folded papers from the box. The participant with the corresponding number was included in this part of the study. Mothers were given an information sheet about the study and consent form Appendix (N) and (E). They were also given the opportunity to ask the researcher questions and seek further clarification. The participants were given two weeks to decide if they wanted to take part in the study. After reading the information sheet and having their questions answered by the researcher, those who expressed interest in taking part were asked to sign a consent form. However, not all the randomly selected participants agreed to take part in this study, therefore, a snowball sampling technique was used.

Description of the in-depth interview and analysis

The mothers were visited at their respective homes on an agreed date and time to complete the interview. Each interview lasted about 25-30 minutes. Recommendations for successful interviews by Hennink et al. (2012) were kept in mind. These included being acquainted with the interviewee, creating a comfortable environment and establishing a rapport with the interviewee, posing questions in a friendly manner, listening, showing interest when listening, motivating and responding to the interviewee by asking follow-up questions and probing, taking notes during the interview, and respecting the interviewee's beliefs, culture and lifestyle. At the end of the interview, mothers were given a gift voucher as a sign of appreciation for their time. All interviews were audio-recorded using an OLYMPUS digital voice recorder VN-711PC.

Table 2.10 shows the strategy used for data analysis. Initially, the thirty recordings were transcribed and double-checked for accuracy. Similar to Fitzgerald et al. (2010), each interview was analysed using the inductive thematic analysis approach for identification of key concepts. This method provides rich and detailed data which allow for the emergence of themes during analysis; a theme is an important element related to the overall research question (Hayes, 2000; Braun and Clarke, 2006). Qualitative data is rarely quantified; however, it can be done to indicate the magnitude of the trend (Singleton et al., 1992). The data were categorised and the themes emerging from the data were created and organized by the researcher.

Table 2.10: Phases of thematic analysis

Phase	Description of the process
1. Familiarising with the data	• First the data were transcribed into written form in order to conduct a thematic analysis. • Reading and re-reading the data searching for meanings and start taking notes marking ideas for the coding.
2. Generation initial codes	• A systematic approach was adopted for the coding to organise the data into meaningful groups regarding the research question. • Due to the small sample size, manual coding using highlighters to identify segments of data was preferred to be used giving full and equal attention to each data item.
3. Searching for themes	• After all data have been initially coded, different codes were sorted into themes. • Some coded belongs to main themes, others may classified into sub-themes, whereas others may not belong anywhere and create new theme called miscellaneous. • At this stage themes may still need to be combined, separated or discarded.
4. Reviewing themes	• In this phase the themes were reviewing and refining in two levels: - First, if the themes work in relation to the coded extracts - Second, if the themes work in relation to the entire data set • Generating a thematic ‘map’ of the analysis.
5. Defining and naming themes	• Define and refine each theme individual and generating clear definitions and name for them. • Conduct and write a detailed analysis and identifying the story that each theme tells in relation to the research question.
6. Producing the report	• Final analysis and write-up of the report • Give vivid examples which capture the essence of the point demonstrating. • Make an argument in relation to the research question and literature.

Source: Derived from text in Braun and Clarke (2006)

2.3.2 Statistical analysis

Descriptive analysis was carried out to provide a profile of the sample (demographic and socio-economic characteristics) using software (IBM Corp. released 2010. IBM SPSS Statistics for Windows, version 19.0, Armonk, NY:IBM Corp).

2.4 Key finding

- Different research strategies need to be considered by the researcher when working with ethnic groups respecting their culture and beliefs.
- Using the snowball sampling technique is vital to improving the participating rate. This is similar to other studies in the same field working with ethnic groups.

Chapter 3: Dietary habits, sleeping habits and mothers’ nutritional knowledge among children from different ethnic groups

3.1 Introduction

Ethnic groups are diverse in the UK. Each ethnic group has its own dietary customs, lifestyle, food knowledge and beliefs which can affect their dietary habits. It is important to have good knowledge about nutrition-related cultural variations so as to appropriately assess their dietary needs. In this study the target group was South Asian preschool children. Literature shows that the South Asian community is very diverse in aspects of region of origin and religion. As a result, an attempt has been made to provide dietary information on each South Asian sub-group. This chapter will provide an overview of the socio-demographic status, dietary habits, sleeping habits and mothers’ nutritional knowledge among the different ethnic groups involved in this study, together with the similarities and differences found.

3.2 Aim

The aim of this study To describe the socio-demographic characteristics of South Asian cohort of children in the UK and explore differences in children’s dietary habits, sleeping habits and mothers’ nutritional knowledge among different ethnic groups.

3.3 Results

3.3.1 Response level

Five hundred questionnaires were distributed, of which 47% were completed and returned. If the consent form was not signed then the questionnaire was excluded. In total, 227 questionnaires (45.4%) were analysed.

3.3.2 The study participants: demographic and socio-economic characteristics

The initial sample for this part consisted of 227 participants, of whom 67 did not complete the other parts of the study, as the other parts were adapted especially for

South Asian children. Table 3.1 shows the general demographic information of all participants together and Table 3.2 presents the demographic information separately for each ethnic group. All participants were aged between 1 and 3 years old, with an average age of 2.3 years ± 0.78. The sample consisted of Indian (27.3%), Pakistani (29.5%), Bangladeshi (13.7%), Black African (15%), and White (14.5%) children.

All Pakistani and Bangladeshi participants were reported to be Muslims. The percentage of Muslims was lower among Indians (29%). Seventy one percent of Indians reported that they followed a religion other than Islam, including Hinduism (57%), Sikhism (11%), and Christianity (3%). Only 9% of Black African children were Muslims while the others were Christians (91%). As for the White group, no Muslims were observed, 55% were Christians, 9% Catholics, and 36% were Atheist.

From the data in Table 3.2 it is apparent that Bangladeshis had the highest number of children and joint family type than other groups. An average household size among Bangladeshis was 5.65 ± 0.26, followed by Pakistanis at 5.15 ± 1.67, Indians at 4.32 ± 2.00, Whites at 3.88 ± 0.161, and Black Africans at 3.76 ± 0.16.

Educational background varied among the ethnic groups. Black Africans had the highest parental education levels, followed by Whites. Among the South Asians, Indians were better educated than Pakistanis and Bangladeshis. The lowest parental education levels were found among Bangladeshis, with low education levels among fathers and mothers being 22.5% and 25.8%, respectively.

In regards to household income, White children were found to be in families with the highest incomes (39.3%), at ≥ £41,000 and above, followed by Indians (20.9%), whereas more than three-quarters of Pakistani (86.5%) and Bangladeshi (83.8%) children were in families with an income of ≤ 20,000 per year.

Table 3.1: General demographic information for all participants

Characteristic	Sample size	Percentage of sample
Gender		
Boys	119	52.4
Girls	108	47.6
Average children's age		
1 years	76	33.5
2 years	95	41.9
3 years	56	24.7
Child's origin		
Indian	62	27.3
Pakistani	67	29.5
Bangladeshi	31	13.7
Black African	34	15
White	33	14.5
Religion		
Muslim	119	52.4
Other	108	47.6
Number of children in the family		
1 child	63	27.8
2 children	82	36.1
3 children	50	22
More than 3 children	32	14.1
Type of family		
Nuclear family	198	87.2
Joint family	29	12.8
Father's education level		
Low	16	7
Medium	70	30.8
High	141	62.1
Mother's education level		
Low	18	7.9
Medium	78	34.4
High	131	57.7
Household income		
≤ £ 20,000	134	59
£21,000-£40,000	60	26.4
£41,000 and above	33	14.5

Table 3.2: Demographic information based on ethnic group

Characteristic	Indian Sample size n=62	%	Pakistani Sample size n=67	%	Bangladeshi Sample size n=31	%	Black African Sample size n=34	%	White Sample size n=33	%
Gender										
Boys	30	48.39	43	64.18	15	48.39	17	50	14	42.42
Girls	32	51.61	24	35.82	16	51.61	17	50	19	57.58
Average children's age										
1 years	23	37.09	21	31.34	12	38.71	10	29.41	10	30.30
2 years	26	41.94	29	43.28	12	38.71	16	47.06	13	39.39
3 years	13	20.97	17	25.37	7	22.08	8	23.53	10	30.30
Religion										
Muslim	18	29.0	67	100	31	100	3	8.8	0	0
Other	44	70.97	0	0	0	0	31	91.18	33	100
Number of children in the family										
1 child	25	40.32	10	14.92	3	9.68	14	41.18	11	33.33
2 children	24	30.71	24	35.82	8	25.81	13	39.40	13	39.39
3 children	6	9.68	20	29.85	10	32.26	6	17.65	8	24.24
More than 3 children	7	11.29	13	19.40	10	32.26	1	2.94	1	3.03
Type of family										
Nuclear family	56	90.32	54	80.60	22	70.97	33	97.06	33	100
Joint family	6	9.68	13	19.40	9	29.03	1	2.94	0	0
Father's education level										
Low	2	3.23	5	7.46	7	22.58	2	5.88	0	0
Medium	13	20.97	31	46.27	14	45.16	1	2.94	11	33.33
High	47	75.81	31	46.27	10	32.26	31	91.18	22	66.66
Mother's education level										
Low	0	0	10	14.93	8	25.81	0	0	0	0
Medium	20	32.26	33	49.25	18	58.06	1	2.94	6	18.18
High	42	67.74	24	35.82	5	16.13	33	97.06	27	81.81
Household income										
≤ £ 20,000	25	40.32	58	86.57	26	83.87	17	50	8	24.24
£21,000-£40,000	24	38.71	7	10.45	4	12.90	13	38.24	12	36.36
≥ £41,000 above	13	20.97	2	2.99	1	3.23	4	11.76	13	39.39

3.3.3 Dietary habits

Starting with the feeding practices among mothers with young children from different ethnic backgrounds, Figure 3.1 shows the proportion of mothers who used breastfeeding, formula feeding, or both methods. Significant differences were found between the groups (p= 0.003). The incidence of breastfeeding in the South Asian group was the highest (32%) compared to Black African (29%) and White mothers (27%). When the South Asian group was separated into its constituent subgroups, the incidence of breastfeeding was higher among Indian mothers (44%) compared to other ethnic groups, whereas the incidence of formula feeding was higher among Bangladeshi mothers (29%) compared to other ethnic groups. In all groups, more than half of the mothers used both methods for feeding their children. It was found that there was highly significant differences between the groups in terms of breastfeeding duration (p=0.007). Indian mothers stopped breastfeeding after 10 months and 2 weeks, Black African mothers stopped after 8 months and 2 weeks, while Pakistani, Bangladeshi and White mothers stopped breastfeeding much sooner than Indian and Black African mothers, stopping after 6 months. When asked about formula feeding, no significant differences were found between groups in terms of the period spent feeding (p=0.126). However, Bangladeshi mothers stopped feeding their children formula milk after a period of 9 months, whereas Pakistani and Black African mothers stopped using formula milk after a period of 8 months. Indian and White mothers stopped feeding their children formula milk after a period of 6 months.

Figure 3.1: Percentage of mothers using different methods for feeding their children

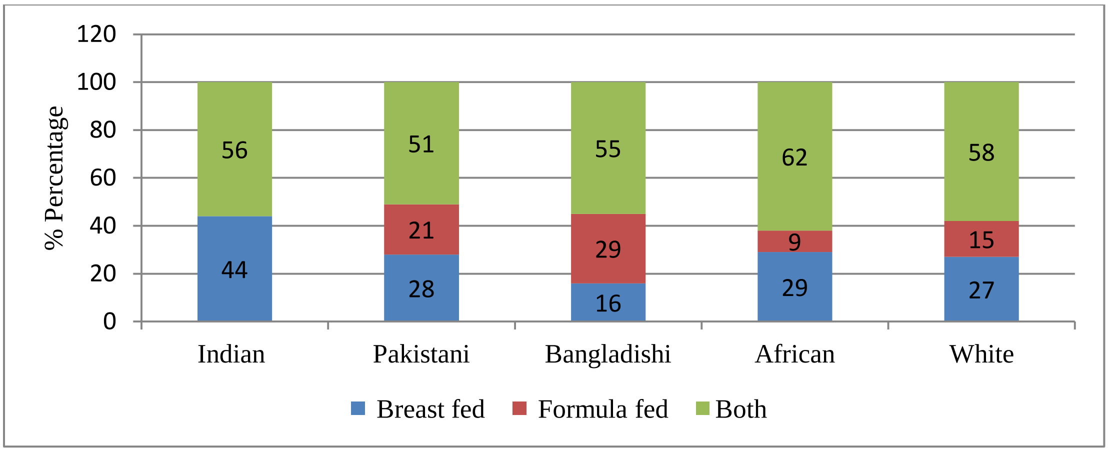


Table 3.3 shows the consumption of certain food items on a daily and weekly basis. No significant differences were observed between groups in regards to the daily consumption of starchy foods, milk, fruit drinks/squash, and diet fizzy soft drinks (p=0.500, p=0.174, p=0.123, and p=0.524, respectively). Nevertheless, Black African and White children consumed significantly higher amounts of fruits, vegetables and fresh fruit juice than Indian, Pakistani and Bangladeshi children (p<0.001). A small number of mothers reported that their children consumed fizzy soft drinks and it was found that there were highly significant differences in the frequency of consumption between groups (p<0.001). Of the 62 Indian children only 1 child (2%) consumed fizzy soft drinks, out of the 67 Pakistani children 14 (21%) consumed fizzy soft drinks, out of the 31 Bangladeshi children 8 (25%) consumed fizzy soft drinks, and out of the 34 Black African children 10 (29%) consumed fizzy soft drinks. As for the White children, none of them consumed fizzy soft drinks.

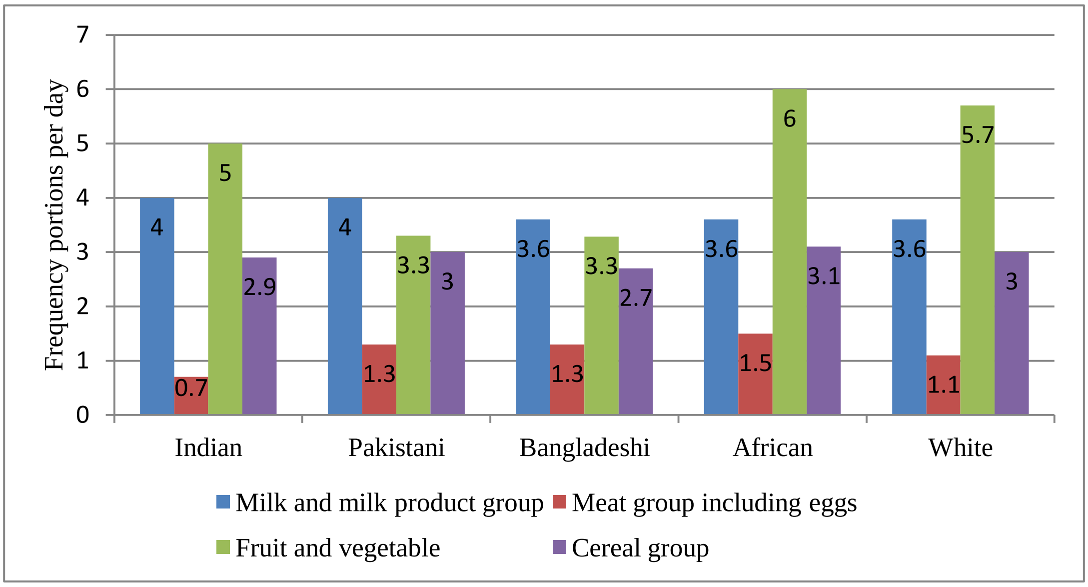
In regards to the weekly frequency of consumption of certain types of foods, it was found to vary among ethnic groups. Generally, all children consumed chicken, red meat, white fish, oily fish, cheese, yogurt, flavoured yogurt, eggs and legumes on a weekly basis. However, highly significant differences were found between them (p<0.001) in terms of the frequency of their consumption. Black African and Bangladeshi children consumed more chicken and red meat than all other groups, followed by Pakistani children for chicken. White and Pakistani children consumed more white fish than all other groups, whereas Bangladeshi children consumed more oily fish, followed by Black African and White children, than Indian and Pakistani children. White children consumed significantly more cheese, while Black African children consumed significantly more yogurt than all other groups. The highest frequency of consumption of flavoured yogurt was found among Pakistani children. Pakistani and Black African children consumed more eggs than Bangladeshi, Indian and White children. Interestingly, for legumes the highest frequency of consumption was found among Indian children, higher than all other ethnic groups. When these foods were classified into food groups and differences between ethnic groups were measured using Kruskal Wallis test (Figure 3.2), no significant differences in the frequency of consumption of cereal and cereal products, and milk and milk products were found among all children (p=0.407 and p=0.298, respectively). However, significance differences in the frequency of consumption of meat group including eggs, and fruit and vegetables were found, for both (p<0.001).

Table 3.3: Frequent consumption of certain types of foods on a daily and weekly basis

	Consumption of food on daily basis										
Food items	Indian (n=62)		Pakistani (n=67)		Bangladeshi (n=31)		Black African (n=34)		White (n=33)		
	mean±SD	Median	mean±SD	Median	mean±SD	Median	mean±SD	Median	mean±SD	Median	*p* value*
Starchy foods	2.87±0.87	3	3.01±0.87	3	2.74±0.89	3	3.06±1.49	3	3.00±0.79	3	0.500
Fruits	2.16±0.89	2	1.88±0.84	2	1.61±0.91	2	2.88±1.34	3	2.88±0.96	3	<0.001
Vegetables	2.11±0.70	2	1.07±0.87	1	1.45±0.72	1	2.76±1.37	3	2.55±0.97	3	<0.001
Milk	2.42±1.06	2	2.66±1.21	3	2.52±1.09	2	2.59±1.45	2	2.15±1.20	2	0.174
Fresh fruit juice	0.55±0.64	0	0.63±1.02	0	0.48±0.76	0	2.15±1.52	2	0.97±1.18	1	<0.001
Fruit drink/squash	1.10±1.06	1	1.60±1.45	1	1.35±1.14	1	1.82±1.42	2	1.33±1.47	1	0.123
Fizzy soft drink	0.02±0.12	0	0.33±0.72	0	0.42±0.92	0	0.35±0.59	0	0	0	<0.001
Diet fizzy soft drink	0.05±0.28	0	0	0	0.03±0.18	0	0.03±0.17	0	0	0	0.524
	Consumption of food on weekly basis										
Chicken	1.56±1.46	1	2.87±1.24	3	3.06±1.67	3	3.15±1.45	3	2.55±1.06	2	<0.001
Red meat	0.53±0.76	0	1.39±1.16	1	1.52±1.45	2	2.06±1.92	2	1.76±0.90	2	<0.001
White fish	0.79±1.01	0	1.16±1.03	1	0.94±1.50	0	1.00±1.41	0	1.42±1.00	1	0.005
Oily fish	0.35±0.65	0	0.33±0.72	0	1.90±2.28	1	1.32±1.40	1	1.09±0.76	1	<0.001
Cheese	2.92±2.29	3	2.40±2.25	2	2.45±2.27	2	1.59±2.11	1	3.85±2.07	4	<0.001
Yogurt	3.02±2.67	3	1.84±2.40	1	0.90±1.53	0	3.82±2.56	5	2.70±2.74	3	<0.001
Flavoured yogurt	4.82±2.41	5	4.90±2.49	7	3.90±2.86	4	1.76±2.25	1	3.82±2.72	4	<0.001
Eggs	1.66±1.98	1	3.01±2.35	3	1.81±1.90	2	2.71±1.50	3	1.27±1.06	1	<0.001
Legumes	4.61±2.39	5	2.58±1.91	2	2.61±1.87	2	2.65±2.05	3	2.36±1.29	2	<0.001

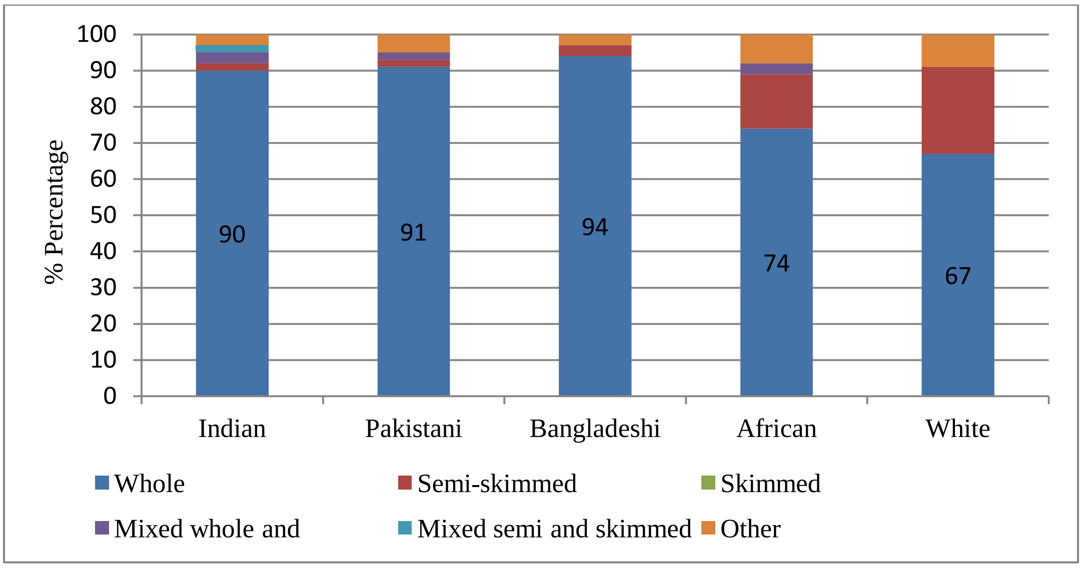
* Kruskal Wallis test were used to test the differences between ethnic groups

Figure 3.2: Frequency of food group consumption among preschool children from different ethnic groups



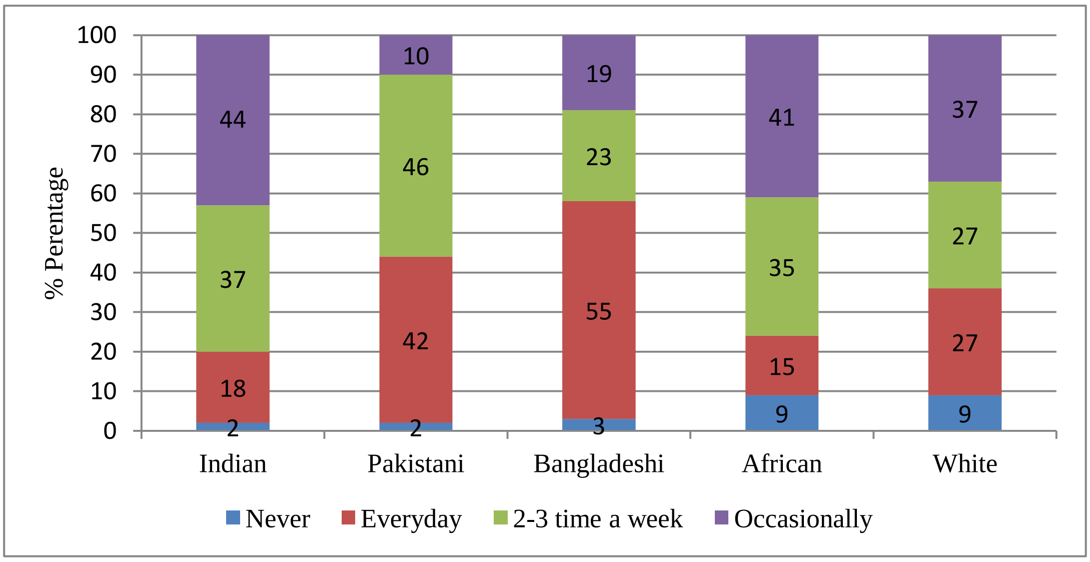
Information on the type of milk consumed by children is provided in Figure 3.3. In general, most of the children consumed whole milk. However, the Chi-square test did show significant differences between children regarding the type of milk they consumed (p=0.009). The majority of South Asian children consumed whole milk, in contrast to Black African and White children. The highest proportion of children consuming semi-skimmed milk was among the White children (24%). The term ‘other’ referred to formula milk, the consumption of which was found to be highest among Black African and White children compared to South Asian children. In addition, habitual intake of crisps and confectionary among children is shown in Figure 3.4. Highly significant differences were found in terms of the children’s consumption habits (p<0.001). Over half of Bangladeshi children (55%) consumed crisps and confectionary on a daily basis, in contrast to other ethnic groups, followed by Pakistani children (42%) and White children (27%).

Figure 3.3: Percentage of children consuming different types of milk based on ethnic group



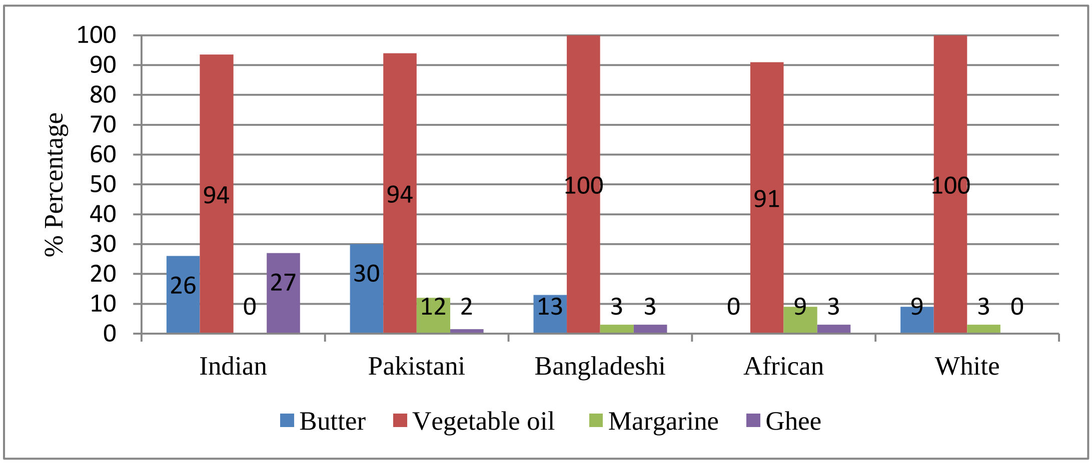
Note: Other refer to formula milk

Figure 3.4: Percentage of children consuming crisps and confectionary based on ethnic group



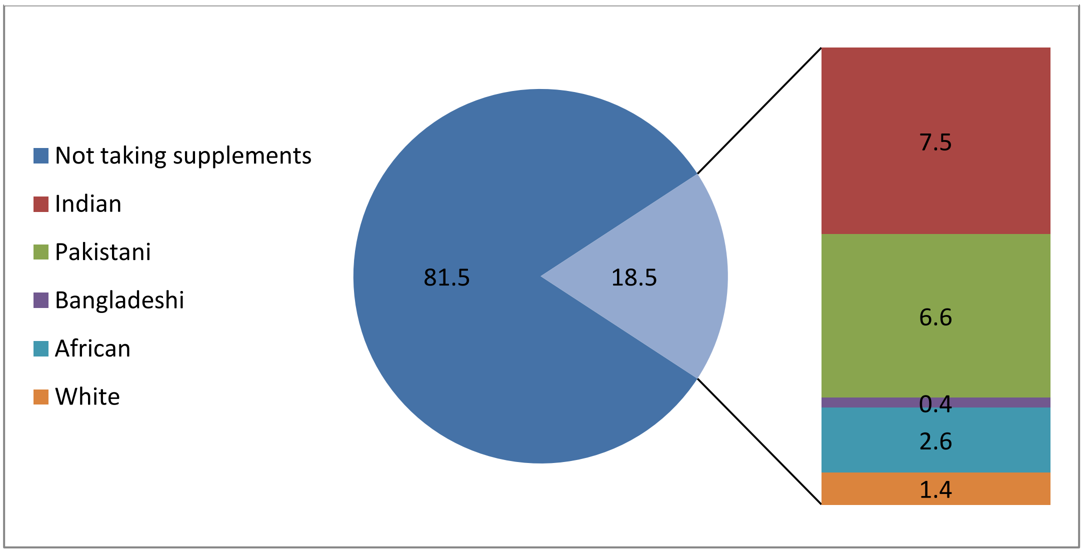
All participants were asked about the type of fat they commonly used for cooking (Figure 3.5). The Chi-square test did not show any significant differences between groups regarding the use of vegetable oil. However, there were significant differences between groups regarding the use of butter, margarine and *ghee* (p<0.001, p=0.041, and p<0.001, respectively). The highest consumption of butter and margarine was found among Pakistanis (30% and 12%, respectively), whereas the highest consumption of *ghee* was found among Indians (27%) compared to other ethnic groups.

Figure 3.5: Percentage of mothers using different types of fat for cooking based on ethnic group



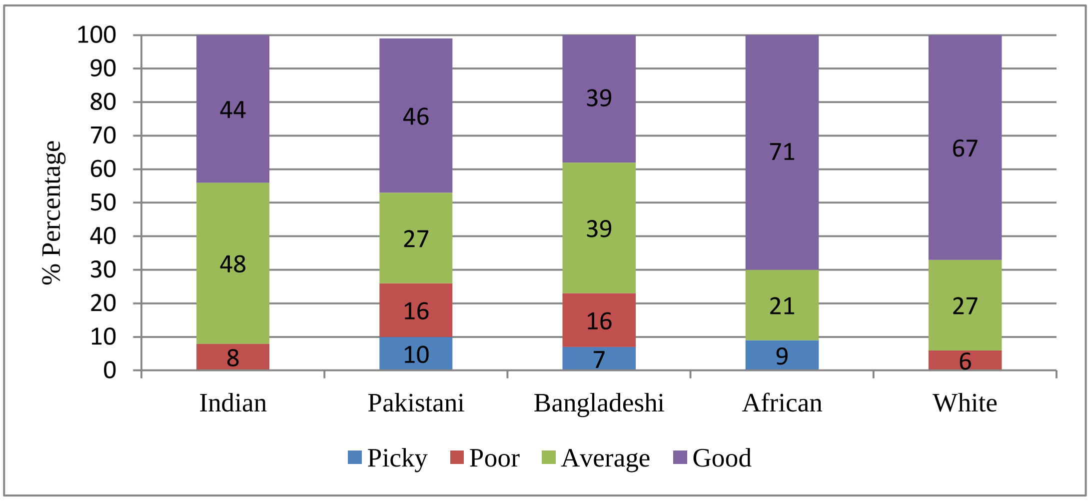
The questionnaire revealed that 81.5% of children did not use any dietary supplements, with only 18.5% of children doing so. Significant differences were apparent in the use of supplementation among children (p=0.030). The highest use of supplementation was found to be among Indian children (7.5%), whereas the lowest was found to be among Bangladeshi children (0.4%) (Figure 3.6).

Figure 3.6: Proportion of children consuming dietary supplements based on ethnic group



When questioned about children's appetites, mothers were varied in their responses. As shown in Figure 3.7, significant differences were apparent (p=0.002); 71% of Black African mothers indicated that their children had 'Good' appetites, followed by White mothers (67%). The highest proportion of mothers who reported 'Average' appetite among their children was among Indian mothers (48%). While 16% of Pakistani and Bangladeshi mothers reported their children had 'Poor' appetites, none of the Black African mothers did so. 'Picky' eaters which define as a child with many food dislike were reported by Pakistani, Bangladeshi and Black African mothers (10%, 7%, and 9%, respectively), but not by Indian or White mothers.

Figure 3.7: Percentage of mothers reporting their children's appetite characteristics



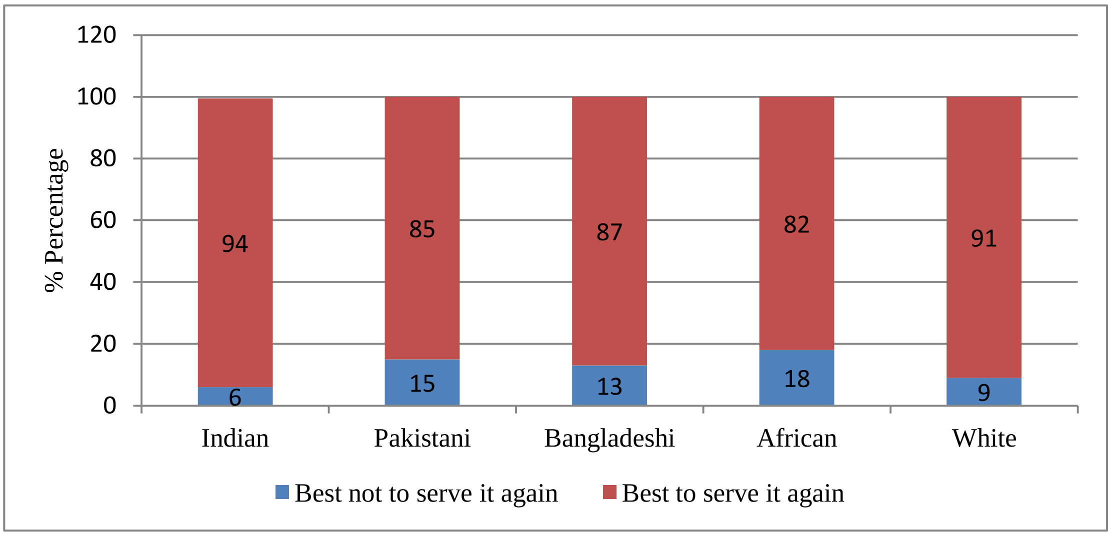
Differences between ethnic groups regarding food avoidance and their reasons for avoiding foods are presented in Table 3.4. The prevalence of food avoidance differences among ethnic groups was highly significant (p<0,001). Among South Asian children, 100% of Bangladeshis followed by 94% of Pakistanis and 87% of Indian children avoided foods, compared to 9% of Black African and White children. Religious influence was the major factor leading to South Asians avoiding certain foods. Muslims reported not eating pork, non-halal meat and certain foods containing animal gelatine or alcohol such as sweets, jellies and some readymade salad dressings. Hindus reported not eating beef and not eating any type of meat if they were vegetarians.

Table 3.4: Percentage of children who avoid foods in their diet and their reasons for avoidance based on ethnic group

	Indian (n=62)	Pakistani (n=67)	Bangladeshi (n=31)	African[Ø] (n=34)	White (n=33)	*p* value
% of children avoiding food (n)	87 (54)	94 (63)	100 (31)	9 (3)	9 (3)	<0.001
Reasons						
% Religion (n)	82 (51)	93 (62)	100 (31)	9 (3)	0 (0)	<0.001
% Culture (n)	5 (3)	0 (0)	0 (0)	0 (0)	0 (0)	0.088
% Health (n)	5 (3)	0 (0)	7 (2)	0 (0)	9 (3)	0.099
% Don't like (n)	7 (4)	16 (11)	10 (3)	0 (0)	0 (0)	0.013

Mothers were asked about their reaction if their child refused to eat a certain kind of food. No significant differences were found between mothers regarding their reactions (*p*=0.449). The majority of respondents agreed that it is best to serve the food again if the child refuses to eat it (Figure 3.8).

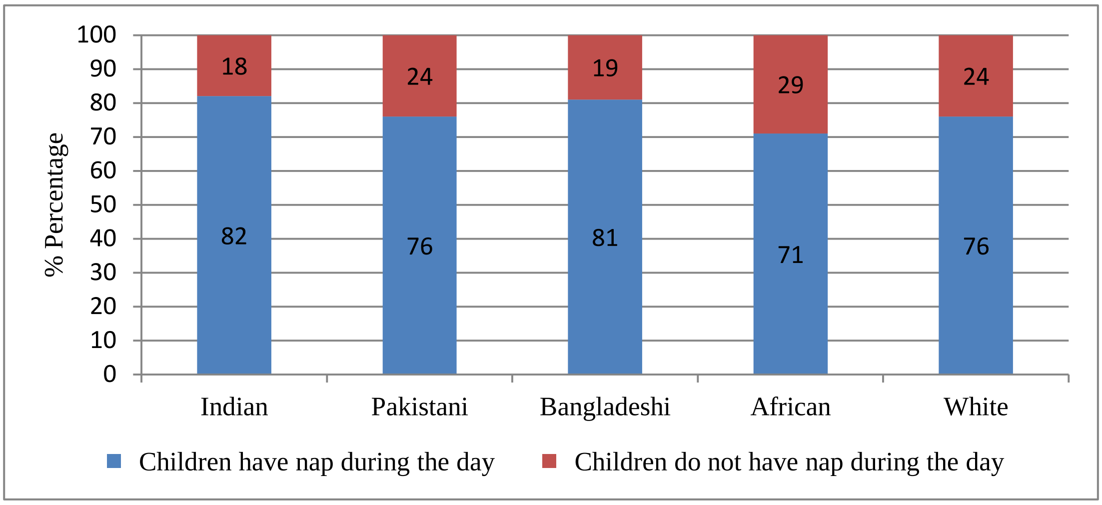
Figure 3.8: Mothers' reactions to their children refusing to eat certain kinds of food



3.3.4 Lifestyle

The results shown in Figure 3.9 reveal that children from all ethnic groups had a nap during the day, although at different proportions. No significant differences were found between the groups (*p*=0.758). However, Indian and Bangladeshi children had slightly higher proportions than other groups (82% and 81%, respectively).

Figure 3.9: percentage of children who have a nap during the day



The results in Table 3.5 show the average hours children spend sleeping at night and for their nap period during the day. The Kruskal Wallis test showed significant differences between groups in terms of night sleeping period and the nap during the day (*p*=0.006 and *p*=0.036, respectively). Differences were found between White children and children from other groups.

Table 3.5: Average hours children spend sleeping at night and for their nap period during the day

	Night sleeping period		Nap sleeping period	
	Mean hour/day ± SD	Median hour/day	Mean hour/day ± SD	Median hour/day
Indian	13.3±0.98	13.30	1.9±0.87	2.0
Pakistani	13.0 ±1.90	13.0	1.8 ±0.85	2.0
Bangladeshi	13.0 ±1.04	13.0	2.1±0.88	2.0
Black African	13.3 ±0.84	13.0	1.9 ±0.78	2.0
White	12.5 ±0.98	12.30	1.5 ±1.0	1.30

Figure 3.10 compares the percentages of children in different ethnic groups in terms of their TV/video watching during the day. It was found that the majority of children from all ethnic groups watch TV/video during the day. The highest percentages were found among White and Bangladeshi children (91% and 90%, respectively). However, no significant differences were found between the groups (*p*= 0.233). Children's usual TV/video viewing habits based on ethnic group (min/day) are presented in Table 3.6. Although no significant differences were found between children's TV/video viewing habits in terms of ethnic group (*p*= 0.286), the average

mean time among White children aged 1-3 years was the lowest when compared with other ethnic groups, whereas Bangladeshi children had the longest period of time watching TV/video.

Figure 3.10: Percentage of children watching TV/video based on ethnic group

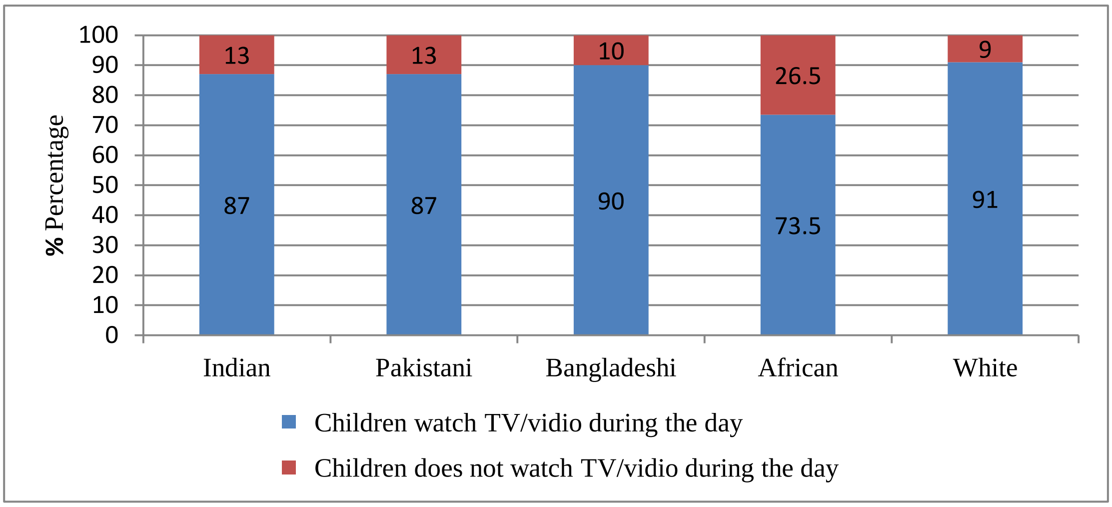


Table 3.6: Children's usual TV/video viewing habits minutes per day based on ethnic group

Age	1 years		2 years		3 years	
	Mean ± SD	Median	Mean ± SD	Median	Mean ± SD	Median
Indian	60.8 ± 91.5	30	106.7± 92.0	90	133.8 ± 74.1	120
Pakistani	61.1 ± 140.4	30	89.3± 89.6	60	102.9 ± 77.9	120
Bangladeshi	102.0 ± 112.6	75	102.0 ± 86.4	60	158.5 ± 86.1	180
Black African	68.0 ± 93.5	35	101.8 ±102.2	105	142.5 ± 84.4	150
White	51.0 ± 70.4	25	63.4 ± 37.0	60	63.5 ± 30.5	60

3.3.5 Mothers' nutritional knowledge

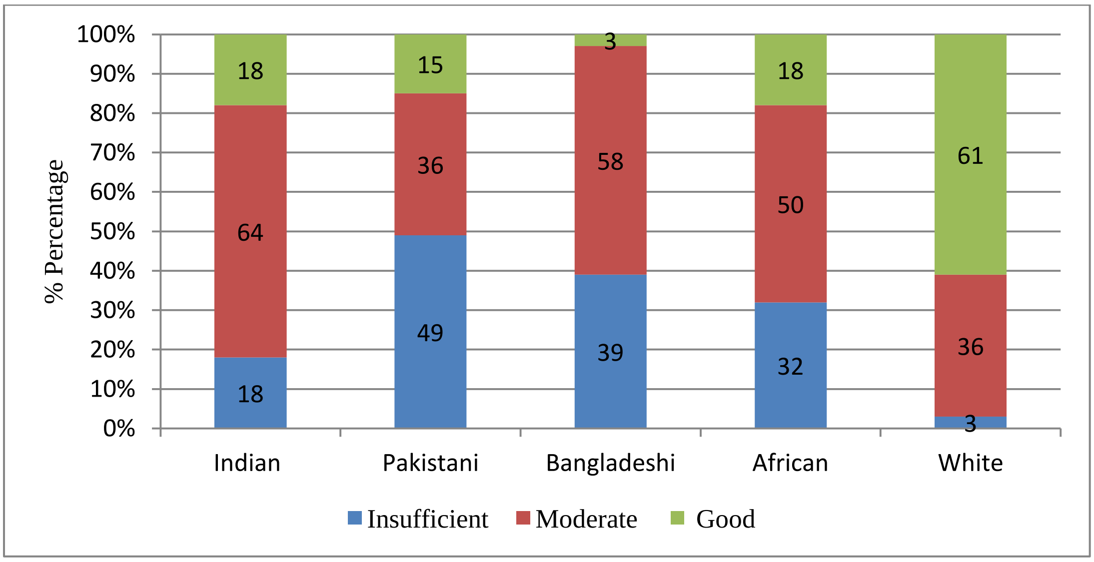
The major sources of nutritional information among the different ethnic groups are presented in Table 3.7. It is apparent from this table that sources of nutritional information varied among the groups. Although TV was an important source of information for Pakistani (44%) and Bangladeshi mothers (30%), it was not a source of information for Black African mothers (0%). The main source of information for Black African mothers was a nutritionist (29%), followed by magazines (28%). The major source of nutrition information for Indian mothers was the internet (39%), followed by family (30%), whereas for White mothers it was magazines (33%).

Table 3.7: Sources of nutrition information for different ethnic groups

Source of information	%Indian	%Pakistani	%Bangladeshi	%African [Ø]	%White	*p* value
TV	13	44	30	0	13	0.013
Friend	23	37	20	17	3	0.301
Doctor	28	35	9	19	9	0.604
Nutritionist	19	29	7	29	16	0.136
Magazine	17	11	11	28	33	0.040
Internet	39	11	5	23	23	<0.001
Family	30	29	16	10	15	0.109
Other	22	34	19	3	22	0.179

There were highly significant differences in the average scores for mothers' nutritional knowledge between ethnic groups ($p<0.001$). The average score achieved by Indian mothers was 5 ± 1.90, for Pakistani mothers it was 4 ± 2.10, for Bangladeshi mothers it was 4 ± 1.85, for Black African mothers it was 5 ± 1.63, and for White mothers it was 7 ± 1.79. While 61% of White mothers had good nutritional knowledge, only a small number of mothers from other ethnic groups had such nutritional knowledge. Almost two-thirds of the Indian mothers (64%) had moderate nutritional knowledge. Pakistani mothers had the highest proportion of insufficient nutritional knowledge (49%) compared to other groups (Figure 3.11).

Figure 3.11: Mothers' nutritional knowledge scores based on ethnic group



Note: the classification of the score was:

- Insufficient ≤ 3, Moderate between 4-6, and Good ≥ 7

3.4 Discussion

The United Kingdom is an ethnically diverse country. According to the 2001 UK Census, the various ethnic groups living in the UK differ in both demographic and socioeconomic characteristics. In this study, ethnicity was self-assigned by the mothers and the current chapter has disclosed the differences between the ethnic groups and explored the impact of ethnicity on children's dietary habits, lifestyle and mothers' nutritional knowledge.

3.4.1 Demographic and socioeconomic characteristics

The findings of the current study are consistent with those found nationally the UK census as well as those described by Kassam-Khamis (1996) and Hakeem (1997). In the 2001 UK Census, the majority of Pakistanis and Bangladeshis were Muslim. Indians were the group with the greatest religious diversity, with the highest proportion being Hindu (45%) followed by Sikh (29%), and then Muslim (13%). A similar trend was noted in the sample of this study.

In addition, in the current study it was found that Bangladeshi households were the largest of all groups and children were more highly represented among them, followed by Pakistani and Indian households. This finding mirrored the 2001 UK Census data on these communities. According to ONS (2005), Asian households are larger than any other ethnic group, with Bangladeshis largest of all with an average size of 4.5 people (as of April 2001), followed by Pakistani households at 4.1 people and Indian households at 3.3 people. The smallest households were found among White Irish at 2.1 people and White British at 2.3 people.

The Bangladeshi and Pakistani ethnic groups have populations with a young age structure, under the age of 15 (ONS, 2005; Lievesley, 2010). Moreover, the results in this study show that Bangladeshis had the highest proportion of joint family types (29%), higher than any other ethnic group. This finding is in agreement with ONS (2005), which found that households containing more than one family made up 2% of all households in Great Britain, whereas among the Bangladeshi community they made up 17% of households.

In regards to education level, the data in the current study indicates that Black Africans (both parents) had the highest level of education compared to other ethnic groups. This finding was unanticipated and it may be explained by the fact that most of the sample were PhD students recruited by snowball sampling techniques. This finding among such a small sample size of Black Africans, which did not mirror Black Africans nationally, must be considered with caution, as the finding might not be representative of this group in general. However, when South Asian groups were compared, Indian parents had the highest education level compared to Pakistanis and Bangladeshis. Bangladeshis had the highest proportion of those with a low education level (fathers' education 22.5% and mothers' 25.8%) when compared to other ethnic groups. Among non-white ethnic groups in the UK, Indians were the most likely to have degrees, whereas Pakistani and Bangladeshi groups, especially women, were less likely when compared to White British (ONS, 2005).

Kenway and Palmer (2007) reported that on average, ethnic minority groups are more likely to be in income poverty than White British; 60% of Bangladeshis and 40% of Pakistanis are in income poverty when compared to 10-15% of Whites, Indians and Black Caribbeans. This matches the current study, which found that Pakistanis and Bangladeshis had the highest proportion of low household income ≤ 20,000 per year when compared to other groups, which may be a reflection of their low education level compared to others. Regarding South Asian groups, Kassam-Khamis (1996) identified that Pakistanis and Bangladeshis are Muslims and have on average 5 people in their household, compared to the Ismaili group which reflects the Indian community. Hakeem (1997) reported that Pakistanis have a lower education level than Indians and a high proportion have a low household income.

In terms of the demographic and socioeconomic characteristics of South Asians (Indians, Pakistanis and Bangladeshis), the present study appears to be representative and to reflect the national data (Census, 2001) on these communities. More detail regarding demographic and socioeconomic trends among South Asians is presented in Chapter 1.

3.4.2 Dietary habits

Starting with feeding practices, significant differences were found in the feeding methods used by different ethnic groups. Bolling et al. (2005) have noted that the rate of breastfeeding varies according to ethnic group. In the current study, the prevalence of breastfeeding in the South Asian group was the highest compared to Black African and White mothers. This supports the finding of a previous national survey of infant feeding in Asian families by Thomas and Avery (1997), who reported that the incidence of breastfeeding among South Asian mothers was higher than among White mothers. However, when the South Asian group was separated into its constituent subgroups and compared to other ethnic groups, it was found that Indians had the highest prevalence of breastfeeding, followed by Black Africans then Pakistanis. Bangladeshi mothers had the lowest prevalence of breastfeeding and the highest prevalence of formula feeding compared to the other ethnic groups and White mothers. This finding contradicts the finding of Thomas and Avery (1997), who found that 90% of Bangladeshi mothers breastfed their children compared to 62% of White mothers. This finding of the current study was unexpected. However, this may be related to the high proportion of joint family households found among Bangladeshi families. A possible explanation for this result may be that stated in other research (Twamley et al., 2011; Ahmad et al., 2012), that many South Asian mothers in the UK adopt the habit of formula feeding because they live in joint family households which may not provide the privacy that the mother needs to breastfeed, in addition to the other responsibilities she may have such as housekeeping which may lead to breastfeeding being considered a time-consuming process.

Regarding the rate of breastfeeding duration, the national survey of infant feeding in Asian families of 1997 noted that Pakistani and Bangladeshi mothers stopped breastfeeding earlier than Indian or White mothers. A similar trend was found in this study. However, when Pakistani and Bangladeshi mothers were compared with White mothers, no differences were found between them (all stopped after 6 months, which is in agreement with WHO recommendations). A high prevalence of formula feeding was observed among Bangladeshi and Pakistani mothers when compared to other ethnic groups. Sarwar (2002) has explained different factors that are associated with choosing bottle feeding in this community in the UK. For instance, formula feed is more widely available and well promoted in the UK when compared to their home country, where breastfeeding is considered to be a better option due to limited income as it is cheap. In addition, peer pressure and social acceptance make it easier for the mother to use formula feeding. Moreover, South Asian mothers in the UK who feel restricted at home in terms of privacy may find breastfeeding to be difficult, as mentioned previously.

Regarding the foods, drinks and dietary supplements consumed by preschool children from different ethnic groups, some difference were found between them. Weaver et al. (2008) notes that there are differences between toddlers regarding the amounts of food they eat and these differences need to be considered; some eat more and some eat less than average but yet they all grow normally. It is important to maintain healthy eating guidelines during this period since their need for energy and nutrients is much higher than that of older children and adults (Thomas and Bishop, 2007). Although the UK's Eatwell plate model is suitable for most people, it does not apply directly to children under two years old due to their different nutritional needs (FSA, 2007). Therefore, a diet including a combination of foods from all five food groups is needed for preschool children to meet their nutrient requirements (Weaver et al., 2008).

In this study, starting with starchy foods which reflect foods in the cereal group, children from all groups did not reach the recommended guideline. The guideline states that food from the cereal group should be served at each meal and some should be offered as snacks. Looking at the milk and milk products group, all children were in line with the serving guideline that it is served three times a day, except Indian and Black African children who exceeded the recommendation. The meat and meat alternative group includes chicken, red meat, white and oily fish, eggs and legumes. Although all children reached the recommended guideline of once or twice a day, it is interesting to note that the lowest consumption of foods in the meat group was found among Indian children. A possible explanation for this result may be the preference of consumption of vegetable dishes compared to red meat, as well as fish among this community. Joshi and Lamb (2000) reported that *dhal*, cooked vegetables, vegetables with pulses and sliced vegetables were commonly eaten among Indians. In addition, the researcher observed during the interviews with Indian mothers (Hindus) that for their children, mothers cooked chicken, fish and sometimes lamb (but not beef as the cow is considered sacred within their culture/religion) once every two weeks. As for the rest of the family, their diet consisted of vegetarian/mainly vegetarian food items due to religious dietary restrictions. Moreover, this confirmed the result obtained from the question on the frequency of consumption of fruit and vegetables. Among South Asian sub-groups, Indians had the highest frequency of consumption of fruit and vegetables when compared with Pakistani and Bangladeshi children. However, both Black African and White children reached the recommended guideline of 5 portions a day of fruit and vegetables. The possible reason for this might be the high level of mothers' education among these groups. Rasmussen et al. (2006) reported in their review on fruit and vegetable consumption among children that there is a positive relationship between the mother's education level and the frequency of intake of fruit and/or vegetables.

Type of milk consumed, frequency of consumption of crisps and confectionery, and type of fat used in cooking were assessed as well. Generally, most children from all ethnic groups consumed whole milk; however, semi-skimmed milk was also consumed. The highest consumption of semi-skimmed milk was found among White children (24%), followed by Black Africans (15%). Fifty-five percent of Bangladeshi children, followed by 42% of Pakistani children consumed crisps and confectionary on a daily basis. Moreover, it was found that the lowest consumption of butter was among White children, whereas the highest consumption of *ghee* was among Indian children. According to Laitinen et al. (1995), children who belong to a higher socioeconomic status consume more fruit and low fat milk and less high fat milk and butter than children from a lower socioeconomic status. It can therefore be assumed that the high consumption of semi-skimmed milk and the low consumption of butter among White children are due to the higher socioeconomic status of these children. According to the guidelines, all children should drink full fat milk until the age of two years due to the fat and vitamin A content, which is less in semi-skimmed milk. However, after two years of age children who are good eaters can switch to semi-skimmed milk (Weaver et al., 2008). The high consumption of *ghee* among Indians seems to be consistent with other research, such as Patel et al. (2006) who found a high consumption of *ghee* among Indian families. Hindus (Indians) believe that *ghee* has a purifying feature and that it can cool, sooth, and give strength to the body (Khajuria and Thoms, 1992). This provides a possible explanation for the high consumption of *ghee* among this community. In regards to the high consumption of crisps and confectionary among Pakistani and Bangladeshi children, one possible explanation may be the low education level and low nutritional knowledge found among these groups. Studies done by North and Emmett (2000) and Northstone and Emmett (2005) have noted that a diet rich with sweets, biscuits and confectionary is associated with the mother's low education level.

Significant differences in children's consumption of dietary supplements and children's appetite characteristics as reported by their mothers were found between children (p=0.003 and p=0.002, respectively). Children under 5 years with a weak appetite are recommended to have vitamins A, D and C as supplements (FSA, 2007). Surprisingly, out of all 227 cases of the study only 18.5% of the children consumed dietary supplements. Although Bangladeshi children were one of the groups that had the highest levels of poor appetite as reported by their mothers, they had the lowest consumption of dietary supplements. Dwyer et al. (2013) found that high parental education level and high household income were associated with higher intake of dietary supplements. This may also apply to the Bangladeshi group in this study.

In regards to food avoidance, the most popular reason chosen for it was religion and it was most common among South Asians. The findings of this study are consistent with those of Kassam-Khamis (1996), who found that religion has an influence on food choices and dietary habits among South Asians (Muslims and Hindus); most Muslims eat only halal meat and pork is forbidden, whereas Hindus do not eat beef, as mentioned above.

Children sometimes refuse to eat certain kinds of food and the mothers in this study were asked to express their reaction regarding this action, meaning do they serve the food again or not. The majority of mothers reported that they did serve the food again to their children. This finding is in agreement with the guidance presented in the manual of dietetic practice by Thomas and Bishop (2007), which states that children need to try new foods since food preferences are developed during this period. If the child refuses to eat a certain food the parent should wait and offer it again on another occasion. The reason behind this is that children may be reluctant to eat for different reasons. For instance, they may be tired, distracted by TV or toys, they may not be hungry or they may be feeling unwell.

3.4.3 Sleeping habits

In this part of the study, differences between preschool children in regards to their sleeping duration at night and their nap during the day were assessed and compared by ethnicity. Although significant differences were found between children in terms of sleep duration at night, all children from the various ethnic groups sleep around 12.5-13.3 hours per day, which is in line with the value given by the National Sleep Foundation, which is 12-14 hours per day for children aged 1-3 years (http://www.sleepfoundation.org/article/sleep-topics/children-and-sleep).

Most preschool children take a nap during the day. In the current study, nap duration was found to last around 1.5-2.1 hours per day. These results (night sleep and day nap duration) are in agreement with the findings of Iglowstein et al. (2003), who found mean total night time sleep duration of 1-3 year old children to be 12.5-13.9 hours per day and day time sleep duration to be 1.7-2.4 hours per day.

Mothers were asked to report the typical number of minutes their child spends watching TV/video each day. The majority of mothers in all ethnic groups reported that their children watch TV/video. According to the American Academy of Pediatrics (2001), the recommendation for young children is that TV viewing should be discouraged and for 3 year old children it should be no more than 2 hours a day (there is no similar recommendation in Britain). The results in the current study show that 3 year old Indian, Bangladeshi and Black African children exceeded the recommended maximum viewing time. A possible explanation for this might be that their mothers depend on the TV to provide their children with entertainment, learning and to pass time, especially if their children do not attend any activity groups or nursery. In addition, it is possible that mothers are not aware of these recommendations. Another possible explanation may be misreporting of the estimated time their children spent viewing TV/video.

3.4.4 Nutritional knowledge

In the present study, special attention was paid to testing the nutritional knowledge of mothers. Mothers play a pivotal role in providing healthy foods and primary care to their children. Evidence suggests that mothers who have sufficient health/nutrition knowledge can raise children more healthily (Glewwe, 1999; Khattak et al., 2007). Therefore, it is important to measure mothers' nutritional knowledge before starting to design any nutrition intervention or educational campaign, since this will illustrate areas of weakness that need improvement in the target group. In the current study, different sources of nutritional information were observed. However, the TV was the main source for Pakistani and Bangladeshi mothers. As the majority of the Pakistani and Bangladeshi participants in this study belonged to low income groups, this finding accords with a previous study among low income families conducted by Dobson et al. (1994), who indicated that the main source of information on food and food related issues is TV. A comparison among mothers in regards to nutritional knowledge was made and it was found that the highest score for nutritional knowledge was among White mothers, whereas the lowest score was among Pakistanis. The reason for this may have something to do with the mother's education level and their relied upon source of information. In addition, the researcher observed during the interviews with South Asian mothers that culture, beliefs and personal experiences had some influence on their nutritional knowledge. The relationship between education level and nutritional knowledge is a well established one. Several studies have showed a positive relationship between educational level and nutritional knowledge (Variyam and Blaylock, 1998; Variyam et al., 1999; Parmenter et al., 2000; Rasanen et al., 2003; Hearty et al., 2007). Individuals with a high level of education have a greater chance to be exposed to knowledge and information, and have a better understanding of this information and therefore make better dietary choices (Thomas et al., 1991; Hearty et al., 2007). In regards to the TV as a source of information relied upon by low income families for knowledge, Dobson et al. (1994) have described it as "fragmentary knowledge". This may be applied to the Pakistani community, who rely upon the TV as their main source of information and who achieved a low nutritional knowledge score in the study.

All this information has been taken into consideration in subsequent chapters for analysis and discussion of the results. Furthermore, this chapter has highlighted some important areas and provided fertile ground for future research to better understand the cultural issues and needs of ethnic groups.

3.5 **Key finding**

- The incidence of breastfeeding in the South Asian group was the highest compared to Black African and White mothers, and incidence of breastfeeding was highest among Indian mothers in the South Asian group.
- The incidence of formula feeding was highest among Bangladeshi mothers compared to other ethnic groups.
- Indian children had the lowest daily consumption of meat and meat alternatives.
- Bangladeshi children had the highest consumption of crisps, sweets and confectionary and the lowest consumption of fruit and vegetables.
- All children were found to be in line with the national sleep foundation's guideline for sleep duration.
- The majority of children watched TV/video; however, Bangladeshi and Black African children 3 years old exceeded the maximum viewing time recommended by the American Academy of Pediatrics.
- The highest proportion of mothers who had good nutritional knowledge was White mothers and the lowest proportion of mothers who had insufficient nutritional knowledge were Pakistani mothers.

Chapter 4: Validation of food photographs booklet

4.1 Introduction

One of the difficulties a researcher may face in fieldwork when assessing the dietary intake of an individual/group is the estimation of food portion sizes. Previous studies suggest that the use of food photographs can increase the accuracy of the estimation of food portion sizes (Lucas et al., 1995; Nelson et al., 1996; Venter et al., 2000; Turconi et al., 2005; Foster et al., 2006). However, the food photographs should be customised to the user. Foster et al. (2006) noted that the estimation of food portion sizes were more accurate when the photographs showed age-appropriate portions. In addition, Nelson et al., 2007 in the low income diet and nutrition survey in the UK emphasised that one of the limitations of the study was the use of the photographic food atlas which is based on adult portion sizes to estimate the food portion sizes for children. As has been discussed earlier, it was found in the pilot study that South Asian mothers faced some difficulties when using the food photograph atlas for adults (Nelson et al., 1996) to estimate their children's food portion sizes. Before starting the development of the foods photographs booklet the researcher searched for existing food atlases that could be used for children that included ethnic foods. To our knowledge, ethnic-specific-food photographs for South Asian pre-school children in the UK were non-existent and so this type of food photograph booklet has been developed for the first time in this study. The purpose of this chapter is to test the hypothesis regarding the food photographs being a visual tool that is useful for estimating food portion sizes. In addition, to test whether demographic characteristics, such as age, ethnicity, education level and BMI, can influence the individual's ability to estimate food portions.

4.2 Aims

- To test the feasibility of a newly developed food photographs booklet of foods commonly consumed by South Asian children in the UK and improve the accuracy of estimated portion sizes.
- To identify whether the demographic characteristics of the participant influence their food portion size estimations.

4.3 Results

4.3.1 Phase 1 validation

Demographic and socio-economic characteristics

In phase 1, photographs on a computer screen vs. hardcopies of the photographs on paper were used in the validation. Table 4.1 summarises the demographic characteristics of the study participants. Most of the participants were not of South Asian origin, with a mean age of 27.5 ±7.4 (range 18-51 years), a mean height of 1.67 ±0.1 (range 1.52-1.85 m), a mean weight of 62 ±10.5 (range 46-90 kg), and a mean BMI of 21.8 ±0.4 (range 17.3-26.6 kg/m^2).

Table 4.1: Demographic characteristics of the study participants

Characteristic	Sample size	%of sample
Age	Total (n=30)	
<30	20	66.7
≥30	10	33.3
Gender	Total (n=30)	
Male	11	36.7
Female	19	63.3
Ethnicity	Total (n=30)	
South Asian	4	13.3
Not South Asian	26	86.7
BMI (Caucasians' cut off point)	Total (n=25)	
<18.5 Underweight	1	4
< 25 Acceptable weight	22	88
≥25 Overweight	2	8
Education level	Total (n=30)	
Undergraduate	17	56.7
Postgraduate	13	43.3

Pattern of responses

In all, a total of 300 portion size estimations were completed by the participants. For the computer screen photographs, 75.3% ±14.1 of the estimations were correct, and estimations using hardcopy paper photographs were 77.3% ±18.7 correct. Underestimation for the computer screen photographs was slightly higher than the paper, at 17.3% ±13.9 and 15.3% ±21.3, respectively, whereas overestimation for both was similar; for computer photographs it was 7.3% ±8.8 and for paper photographs it was 7.3% ±5.9. In general, by comparing the participants' responses to the two techniques using an independent-sample t-test there were no significant differences found Figure 4.1.

Figure 4.1: Comparison between the participants' responses using Computer and paper photographs.

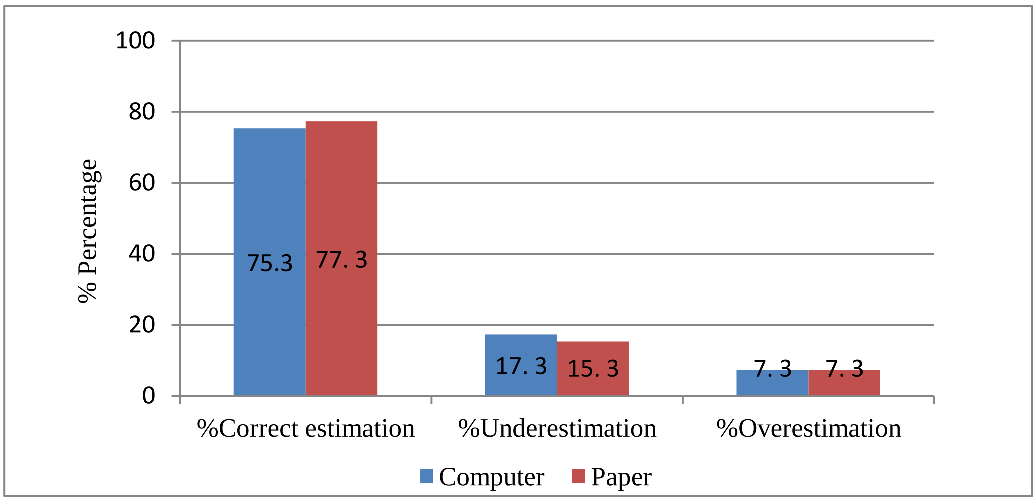


Table 4.2 shows the proportion of participants who chose the photographs that corresponded with the served portion size on the plate in both the computer screen and hardcopy paper validation sessions. For the computer screen photographs the highest proportions of correct estimations were obtained for *aloo matter* (100%), followed by *palak paneer* (93%) and *kheer* (87%). The poorest proportions of correct estimations were obtained for mixed vegetables (53%), followed by *dhal* (47%). Forty percent of the participants overestimated the *dhal* and 47% underestimated the mixed vegetables portion sizes. Underestimation was high for both chicken curry (33%) and *keema matter* (27%). On the other hand, in the case of the hardcopy paper photographs the highest proportions of correct estimations were obtained for both *aloo matter* and *palak paneer* (100%), followed by both *keema matter* and rice (87%). The poorest estimations were obtained for mashed potato (53%). Underestimation was high for both mashed potato and mixed vegetables (33%), followed by *kheer* (27%), and overestimation was high for soup (27%) and chicken curry (20%). Although the participants had the choice to select the portion that was smaller than the smallest portion or larger than the largest portion, no one selected these choices. Generally, in terms of errors in estimation, most common were overestimation of small portions and underestimation of large portions.

Table 4.2: Percentage of participants estimating the portion size correctly, underestimating, and overestimating using computer and paper photographs.

Food	Portion size	Computer (n=15)			Paper (n=15)		
		% C	% U	% O	% C	% U	% O
Aloo matter	B	100	0	0	100	0	0
Chicken curry	D	67	33	0	73	7	20
Dhal	F	47	13	40	73	13	13
Keema matter	H	73	27	0	87	13	0
Kheer	H	87	13	0	73	27	0
Mashed potato	D	80	13	7	53	33	13
Mixed vegetable frozen	H	53	47	0	67	33	0
Palak paneer	B	93	0	7	100	0	0
Rice	F	73	20	7	87	13	0
Soup	D	80	7	13	60	13	27

%C: percentage of correct estimation; %U: percentage of underestimation; %O: overestimation; B: the first and smallest portion; D: the second portion; F: the third portion; H: the fourth and largest portion.

Degree of accuracy

Table 4.3 shows actual and mean estimated portion sizes, 95% confidence intervals, and degree of accuracy for all foods under investigation using computer screen and paper food photographs. For the computer screen food photographs, no significant differences were found between the estimated and the actual portion sizes, except for chicken curry (p=.025), *keema matter* (p=.046), and mixed vegetables (p=.011); all were found to be significantly lower than the actual portion sizes. In the case of the hardcopy paper photographs, for two out of ten foods the estimated portion sizes were found to be significantly lower than the actual portion, namely *kheer* (p=.046) and mixed vegetables (p=.034). Figure 4.2 shows the degree of accuracy for both the computer screen and the hardcopy paper photographs when used to estimate food portion sizes. The smaller the percentage difference the higher the degree of accuracy. In both the computer and the paper photographs, portion sizes tended to be underestimated rather than overestimated. For the computer photographs, the percentage of errors ranged from small to moderate (chicken curry -16% and mixed vegetables -13.3%, which is >10%), whereas the paper photographs tended to fall within a small range of errors (≤10%). When the percentages of misreporting of both techniques were compared for each food item, no significant differences were found between them, except for chicken curry (p=0.019). The computer screen photographs underestimated chicken curry portion size by 16% ±24.39, whereas the hardcopy paper photographs overestimated portion size by 13.3% ±39.94.

Figure 4.2: Percentage differences between actual and estimated portion sizes for both computer and paper photographs.

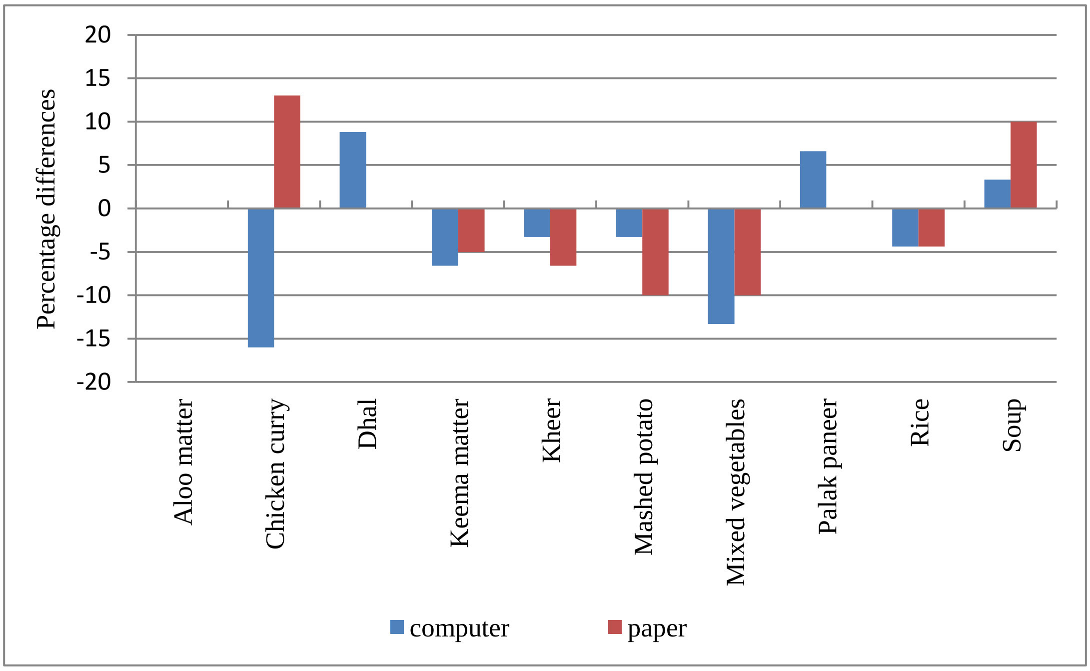


Table 4.3: Comparison between actual and estimated portion sizes using both computer and paper food photographs.

Food presented	Portion	Actual weight (g)	Computer: Estimated weight (g)	Computer: %Diff.	Computer: 95% CI	Computer: *p* value	Paper: Estimated weight (g)	Paper: %Diff.	Paper: 95% CI	Paper: *p* value
Aloo matter	B	30	30	0	---	NS	30	0	---	NS
Chicken curry	D	60	50	-16.6	4.9-58.1	0.025	68	13	54.7-81.3	NS
Dhal	F	90	98	8.8	86.3-109.7	NS	90	0	81.11-89.8	NS
Keema matter	H	120	112	-6.6	104.4-119.6	0.046	114	-5	104.7-123.3	NS
Kheer	H	100	96.7	-3.3	91.79-101.5	NS	93.3	-6.6	86.9-99.7	0.046
Mashed potato	D	60	58	-3.3	50.4-65.6	NS	54	-10	42.8-65.2	NS
Mixed vegetable	H	60	52	-13.3	46.7-57.3	0.011	54	-10	48.7-59.3	0.034
Palak paneer	B	20	21.3	6.6	18.5-24.2	NS	20	0	---	NS
Rice	F	60	57.3	-4.4	51.6-63.1	NS	57.3	-4.4	53.4-61.2	NS
Soup	D	60	62	3.3	54.4-69.6	NS	66	10	53.1-78.8	NS

%Diff.: degree of accuracy; B: the first and smallest portion; D: the second portion; F: the third portion; H: the fourth and largest portion; CI: confidence interval.

4.3.2 Phase 2 validation

Demographic and socio-economic characteristics

In this phase all participants were South Asian mothers (n=37), 22% of whom were Indians and 78% of whom were Pakistanis. The mean age of the participants was 36 ±12 (range 21-64 years), with a mean height of 157.7 ±4.6 (range 150.4-167.5 cm), mean weight of 72.9 ±15.5 (range 56-126 kg), and mean mothers' BMI of 29.3 ±6.0 (range 20.1-48.2 kg/m^2). According to Vasudevan et al. (2011), using standard WHO criteria for BMI is inadequate among South Asians. It was therefore decided to use specific cut-off points of the Asian-Pacific region. Demographic characteristics are summarised in Table 4.4.

Table 4.4: Demographic characteristics of the South Asian mothers.

Characteristic	Sample size	% of sample
Age	Total (n=36)	
<30	13	36
≥30	23	64
Ethnicity	Total (n=37)	
Indian	8	22
Pakistani	29	78
BMI (Caucasians cut-off point)	Total (n=21)	
<25	4	19
≥25	10	48
≥30	7	33
BMI (South Asian cut-off point)	Total (n=21)	
<23	3	14
≥23	1	5
≥25	17	81
Education level	Total (n=19)	
Low	3	16
Medium	14	74
High	2	10

Pattern of responses

In total, 370 portion size estimations were completed by the participants. Table 4.5 shows the proportion of participants who chose the photographs that corresponded with the served portion sizes on the plate. Estimations of portion size outside or between the range of the photographs presented did not occur. The results show that the participants had the ability to estimate food portion sizes accurately; an average of 82.7% ±13.26 correct estimations were made. The smallest portions were the most successfully estimated portions; *palak paneer* (100%), followed by fruit salad

(97%). Incidences of underestimation and overestimation were found as well. Medium portions (D and F) and the large portion (H) were underestimated (by 3-27% and 22-24%, respectively). Medium portions (D and F) were overestimated by 5-22%. Overall, underestimation of portions occurred more than overestimation, at 11.5% ±10.8 and 5.9% ±8.6 respectively. The food item which was found to be the most difficult to estimate in terms of portion size was mixed dhal: 51% correctly estimated, 27% underestimated, and 22% overestimated. Figure 4.3.shows the structure of the mixed dhal.

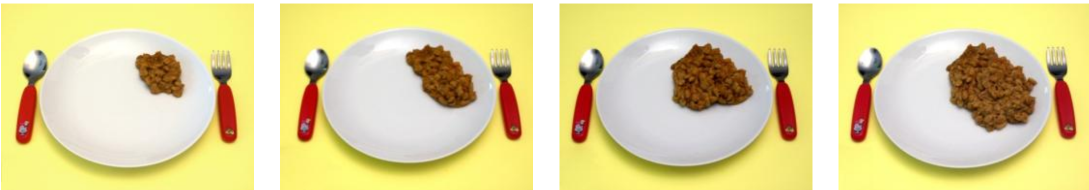
Table 4.5: Percentage of South Asian participants estimating portion size correctly, underestimating portion size, and overestimating portion size.

Food	Portion	% C	% U	% O
Aloo matter	D	92	3	5
Breakfast cereal	H	76	24	0
Chicken bryani	D	92	0	8
Chicken curry	D	73	11	16
Mixed dhal	F	51	27	22
Fruit salad	B	97	0	3
Keema matter	H	78	22	0
Palak curry	B	100	0	0
Rice	F	87	14	0
Soup	F	81	14	5
Total		82.7	11.5	5.9

%C: percentage of correct estimation; %U: percentage of underestimation; %O: overestimation;
B: the first and smallest portion; D: the second portion; F: the third portion; H: the fourth and largest portion.

Figure 4.3: The structure of the mixed dhal

Mixed dhal



B D F H

Degree of accuracy

The smaller the percentage difference the higher the degree of accuracy. Table 4.6 illustrates that no statistically significant differences were found between the estimated and the actual portion sizes, except for breakfast cereal (p=.004), *keema matter* (p=.005), and rice (p=.025); all were found to be significantly lower than the actual portions. The majority of mis-classifications tended to be small and within an acceptable range of ±10%. The average percentage differences ranged from -10.8% underestimation for breakfast cereal to 4.1% overestimation for *chicken bryani*. In terms of errors, the smallest portion tended to be overestimated and the largest portion tended to be underestimated. With regards to medium portions, underestimation and overestimation happened to the same extent.

Table 4.6: Comparison between actual and estimated portion sizes among South Asian mothers.

Food description	Portion	Actual weight (g)	Estimated weight (g)	%Diff.	95% CI	*p* value
Aloo matter	D	60	60.8	1.4	57.9-63.7	NS
Breakfast cereal	H	60	53.5	-10.8	49.7-57.3	.004
Chicken bryani	D	120	124.9	4.1	119.3-130.4	NS
Chicken curry	D	60	61.6	2.7	56.4-66.9	NS
Mixed dhal	F	90	88.4	-1.8	81.3-95.4	NS
Fruit salad	B	30	30.8	2.7	29.2-32.5	NS
Keema matter	H	120	113.5	-5.4	109.3-117.7	.005
Palak curry	B	20	20	0	---	NS
Rice	F	60	57.3	-4.5	54.9-59.6	.025
Soup	F	90	86.8	-3.6	81.6-91.9	NS

%Diff.: Degree of accuracy; B: the first and smallest portion; D: the second portion; F: the third portion; H: the fourth and largest portion; CI: confidence interval.

Participants' characteristics and their responses

In order to identify whether the demographic characteristics of the participant had an effect on their food portion size estimations, the percentage of correct estimations, underestimations and overestimations for each participant were calculated and compared with their demographic characteristics (see Table 4.7). There were no significant age, mothers' BMI, ethnicity, or education level-related differences in terms of their ability to estimate portion sizes on a plate using the food photographs. These results should interpreted with caution due to the small sample size.

Table 4.7: Compassion between participants' demographic characteristics and mean percentages of correct estimations, underestimations and overestimations.

Characteristics	% Correct estimation		% Underestimation		% Overestimation	
	Mean	SD	Mean	SD	Mean	SD
Age (n=36)						
< 30 years (n=13)	85.4	9.7	8.5	5.5	6.2	7.7
≥ 30 years (n=23)	80.9	15.0	13.5	12.7	5.7	9.5
p value	.338		.110		.871	
BMI (n=21)						
< 23 (n=3)	83.3	11.5	10	.00	6.7	11.5
≥ 23 (n=18)	82.8	14.9	10	11.9	7.2	10.2
p value	.952		1.00		.932	
Ethnicity (n=37)						
Indians (n=8)	75	20	18.8	13.6	6.3	10.6
Pakistanis (n=29)	84.8	10.2	9.3	9.2	5.9	8.3
p value	.062		.097		.926	
Education level (n=19)						
Low (n=3)	70	26.5	16.7	11.5	13.3	15.3
Medium (n=14)	85.7	10.2	7.1	8.3	7.1	9.9
High (n=2)	75	21.2	20	28.3	5	7.1
p value	.195		.192		.614	

4.4 Discussion

Obtaining accurate estimates of food intake is one of the main methodological challenges in nutritional studies. The self-reporting of food intake is generally associated with a great number of errors, mainly due to poor estimation of food portion sizes. Various tools, including real food samples, standard portions, household measures, food models, food photographs, computer graphics, and food package labels, have been used to quantify food portion sizes during dietary data collection (Cypel et al., 1997). The use of food photographs to assess food portion sizes among adults and children has been described in various studies (Nelson et al., 1994; Lucas et al., 1995; Venter et al., 2000; Foster et al., 2006; Turconi et al., 2005; Ovaskainen et al., 2008). Therefore, the present study aimed to develop a food photograph booklet customised for South Asian children's portion sizes in the UK, as a tool to enhance the estimation of reported portion sizes during data collection in fieldwork using 24-hour MPRs in combination with household measurements. When using food photographs as a portion size measurement tool, three elements of the process need to be considered (Chapter 1, section 1.1.12.1). In this chapter, perception error in portion size estimation was studied.

In the first phase of the validation, no significant differences were found between the use of photographs on a computer screen and hardcopy photographs on paper. This suggests that the participant's ability to estimate food portion size is not enhanced by the use of photographs on a computer screen. It was therefore decided that hardcopy photographs on paper would be used in the next phase of the validation and in the main study's data collection due to its practicality, portability, ease of use, attractiveness and cost effectiveness.

Overall, it was found that the estimation of food portion sizes using food photographs was an easy task for the participants. This was illustrated by the high percentage of correct estimations achieved in both phases using the hardcopy photographs on paper (77.3% ± 18.7 for phase 1 and 82.7% ± 13.3 for phase 2) when compared to other studies using the same method; Lucas et al. (1995) reported correct estimation of 50%, Venter et al. (2000) reported 68% correct estimation, and 60% was reported by Lillegaard et al. (2005). The high percentage of correct estimation in this study can be explained by the number of photographs presented in the booklet. Four series of photographs were presented to cover a range of small to large portions for each food. These four photographs were found to be appropriate to estimate food portion sizes. This is in agreement with other studies that found that presenting up to seven photographs allows the participant to estimate portion sizes more easily (Navarro et al., 2000; Faggiano et al., 1992; Turconi et al., 2005) without turning to a larger number of portions, as with Nelson et al. (1994, 1996). The use of eight portion sizes was previously tested in the pilot study, and participants encountered a lot of difficulty with their use. Although direct comparisons of studies in this area are difficult, as they were conducted with different ethnic groups, their results support the idea that people can estimate portion sizes easily if they are shown fewer (up to seven) photographs.

The percentage of correct estimations in the second phase of the study was higher than in the first phase due to the fact that study participants in phase 2 were exclusively South Asian mothers, which meant that they were familiar with the type of food presented in the session. This is similar to the findings of Gittelsohn et al. (1994) and Venter et al. (2000), who found that foods that are unfamiliar to and infrequently eaten by the participant are less accurately estimated than commonly eaten foods.

In the present study, participants were more likely to underestimate large portions and overestimate small portions. This phenomenon can be referred to as 'flat-slope syndrome'. Similar trends have been reported in previous studies (Faggiano et al., 1992; Nelson et al., 1994; Lucas et al., 1995; Robinson et al., 1997; Venter et al., 2000). In agreement with Nelson et al. (1994), it was also found that portion sizes of some foods were more difficult to estimate correctly than others. For instance, in this study, *palak curry* tended to be estimated with great success whereas mixed *dhal* was more difficult to estimate. This can be explained by different factors relating to visual perception. Food portion size can be a factor, as small portions were more likely to be correctly estimated than large portions. *Aloo matter* and *palak curry* were estimated correctly 100% of the time due to their portion size (portion B, the smallest portion). This find was different to the finding of Gittelsohn et al. (1994), who found that larger portion sizes were more accurately estimated than smaller portion sizes. In addition, the actual foods which were prepared for presentation in the tests may have differed in appearance to the food photographs. Although the researcher tried to present the actual foods on the plate so that they resembled the food photographs as closely as possible, some factors cannot be controlled during such sessions. It is important to acknowledge that the characteristics and nature of food can affect judgment when estimating food portion sizes from photographs For example, food presented in pieces may be either smaller or larger than in the photographs. In addition, Nelson and Haraldsdóttir (1998) have suggested that portion size estimation from photographs can be affected by the volume of foods which cannot hold their shape (shapeless/ amorphous foods), as well as the area and depth of foods. Previous studies have emphasised that amorphous foods are less likely to be accurately estimated than solid foods (Weber et al., 1997; Venter et al., 2000). In this study, all the foods except for soup were amorphous and this phenomenon appeared clearly in the case of mixed *dhal* in the first phase that used computer screen photographs (49% correct estimations) and mashed potato in the case of hardcopy paper photographs (50% correct estimations). Mixed *dhal* again appeared in the second phase of the validation (51% correct estimations). In the case of *dhal*, one possible explanation is that during the validation sessions it could not hold its shape due to its fat content, which led to the illusion of a greater volume being on the plate. Lastly, it is conceivable that the errors in estimation of portion sizes made by the participants may have occurred due to other factors. It was observed by the researcher that a lack of motivation among some participants had a negative effect on their level of cooperation during the validation sessions which may have influenced their portion size estimations.

Lucas et al. (1995) found that errors in the estimation of portion sizes were frequent, although they were usually small (<10%) to moderate (10-25%). In this study, similar to Venter et al. (2000), an estimated portion was seen as successful when the percentage error fell between ±10% of the actual portion size.

With regard to the demographic characteristics of the participants in relation to portion size estimation, results from previous studies have been contradictory. Nelson et al. (1994) found that the estimation of portion sizes was influenced by gender, age, and BMI. They showed that men tend to under estimate portion size more than women, participants 65 years and over tend to overestimate portion size more than younger participants, and participants with a BMI $\geq$ 30 kg/m^2 underestimate portion size which reflects the fact that heavier people have larger portions and are therefore likely to underestimate the amount of food they eat. Whereas Turconi et al. (2005) suggested that there is no influence of age, gender or BMI on portion size estimation. Similar findings have been made by Robinson et al. (1997) and Venter et al. (2000) in regard to age and gender. In addition, Venter et al. (2000) found that the mean percentage of correct estimations by participants was not related to their education level. Interestingly, the accuracy of estimations did not improve with a higher education level. In this study, there were no statistically significant differences between age, mothers' BMI, ethnicity or education level, on the percentage of correct, underestimated, and overestimated food portion sizes. The effects of age mothers' BMI, ethnicity, and education level on portion size estimations were inconclusive in this study due to the small sample size within the groups. It is possible that trends related to these factors may appear with a larger sample size.

There are three main skills involved in the estimation of food portion sizes: perception, conceptualization and memory (Nelson et al., 1994, 1996). The techniques employed during validation focused on the perception of the participants only; neither their conceptualization nor their memory were addressed. Therefore, further validation concerning both conceptualization and memory is recommended

In conclusion, results obtained by this study show that a photographic food booklet of South Asian children's portion sizes was a valuable tool to be used for estimation of portion sizes during dietary assessment investigations. However, as this is the first time that this tool has been used for South Asian foods, further investigation is needed to improve the validity of the photographs. The tool can be used, together with the experience gained in this study as the starting point for development of a photographic food booklet containing ethnic foods consumed in the UK.

The study achieved its aim to provide a tool which made estimation of food portion size more feasible among South Asian mothers. The tool was therefore used by the researcher subsequently to make the estimation of food portion sizes by South Asian mothers easier.

4.5 **Key findings**

- The results show that the photographic food booklet of South Asian children's portion sizes is suitable for use with South Asian mothers.
- A series of four photographs of each food type was found to be sufficient to cover a range of small to large portions and allow for the appropriate estimation of food portion sizes.
- Different factors affected the percentage of correct estimations during validation sessions, including the size of the portion, the appearance of the food presented on the plate and the properties of the food.
- Participants' motivation and levels of cooperation may have affected the percentage of errors present in the study.
- This study is the starting point and interested bodies in the UK can adopt and improve the study tool for use with minority groups in the UK, considering the experience of this study.

Chapter 5: Food consumption and average food portion sizes

5.1 Introduction

A healthy diet during early life is essential for future health, therefore it is important to assess children's diets. During childhood, development of food preferences is started and this influences dietary patterns in later life (Birch, 1998; Cooke, 2007). To assess dietary intake there is a need for data on accurate portion sizes of each food consumed. Food portions are of paramount importance of any diet. However, they are one of the most complex issues in any nutritional study. Although data on average portion sizes for children are available in the UK (Wrieden et al., 2008), to our knowledge no such data are available for South Asian preschool children living in the UK. Obtaining a list of typical food portions for the most commonly consumed foods by South Asian children would be a useful tool for use in the assessment of children's diets among this community. This study could be the starting point and the basis for the development of data on food portion sizes of South Asian children.

5.2 Aims

- To identify the most commonly consumed foods and assess the average portion sizes among South Asian preschool children (1-3 years old) in terms of food groups and meal time.
- To provide information on the nutrient composition of traditional dishes most commonly consumed by South Asian children in terms of food groups.
- To assess the energy, macro- and micro-nutrient contribution in terms of meal times of preschool South Asian children.

5.3 **Results**

5.3.1 Household level response

Data was obtained from areas in West Yorkshire with a high South Asian population. Four hundred households were approached. People who met the criteria of the study (n=385, 96.3%) were approached and had the study explained to them. The total number of respondents from whom consent to participate was obtained was 164 (42.6%). Of these, 4 (2.4%) dropped out from the study and thus in total, 160 (41.5%) respondents were obtained.

5.3.2 The study participants: demographic and socio-economic characteristics

The general demographic and socio-economic characteristics of the study participants (n=160) are summarized in Table 5.1. For demographic information based on South Asian sub-groups, please refer to Chapter 3. Participants were comprised of Pakistanis, Indians, and Bangladeshis (42%, 39%, and 19%, respectively) and included more boys (55%) than girls (45%). The age range of the participants was 1-3 years, with an average age of 2.4 years ± 0.80 for boys and 2.3 years ±0.72 for girls. The majority of participants were Muslims (72.5%), whereas 27.5% followed other religions, such as Hinduism (21.3%), Sikhism (5%), and Christianity (1.3%). It was found that South Asian households on average had two children. However, Bangladeshis had the highest number of children on average; 32% of Bangladeshi households had 3 or more children. There were high proportions of mothers with a "high and medium" education level (44.5%). On average, Indian mothers were found to have the highest level of education, while Bangladeshi mothers had the lowest. Sixty eight percent of children lived in households with an annual income of ≤ £20,000. With regards to body shape, in general 37% of mothers reported themselves to be overweight or obese, and Pakistani mothers had the highest proportion (39%). The proportion of families who were classified as nuclear families among South Asian sub-groups in the UK were higher than joint families (82.5% and 17.5%, respectively).

Table 5.1: General demographic and socio-economic characteristics of the study participants.

Characteristics	Number of participants	Percentage
Gender		
Boys	88	55
Girls	72	45
Average age, years ±SD	2.3±0.76	
1 years old	56	35
2 years old	66	41.3
3 years old	38	23.8
Child's ethnic origin		
Indian	62	39
Pakistani	67	42
Bangladeshi	31	19
Religion		
Muslim	116	72.5
Other*	44	27.5
Number of children in the family		
1 child	38	24
2 children	56	35
3 children	36	22
More than 3 children	30	19
Father's education level		
Low	14	9
Medium	58	36
High	88	55
Mother's education level		
Low	18	11
Medium	71	44.5
High	71	44.5
Household income		
≤ £20,000	109	68
£21,000-£40,000	35	22
£41,000 and above	16	10
Mother's body shape (self reported)		
Normal	101	63
Overweight or obese	59	37
Mother's nutritional knowledge		
≤ 5	117	73
< 5	43	27
Type of family		
Nuclear family	132	82.5
Joint family	28	17.5
Total sample size	160	100

* Hindu (n=34, 21.3%), Sikh (n=8, 5%), and Christian (n=2, 1.3%)

5.3.3 Commonly consumed foods in terms of food groups

The amount of foods consumed in terms of grams per day in each food group are shown in Figure 5.1. The milk and milk products (dairy group) was the largest contributor to daily diet (499.1 g/p/d). The least amount of food consumed was from the fat group (4.4 g/p/d) as spread. It was interestingly to identify the type of foods contributed in the dairy group; Table 5.2 shows the amount of milk and milk products consumed in terms of grams per day in the dairy group.

Figure 5.1: Food consumption in grams per day in terms of food groups

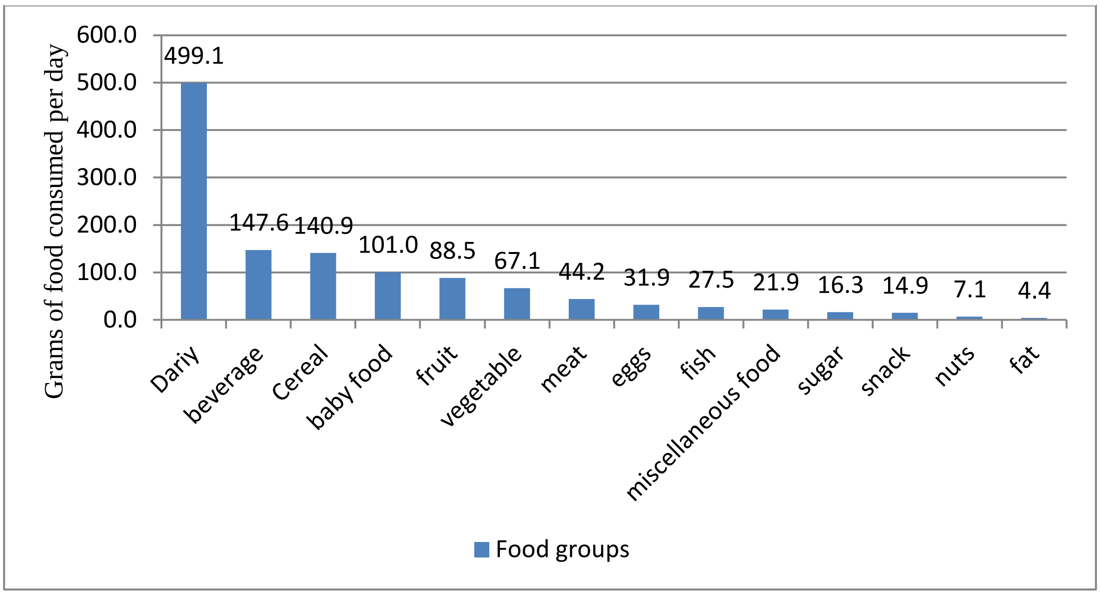


Table 5.2: The amount of milk and milk products consumed in terms of grams per day in the dairy group among South Asian preschool children.

Type of food	Amount consumed g/day
Whole milk	383.2
Formula milk	32.0
All type of yogurt	30
Semi skimmed milk	12.3
Human milk	11.5
Fromage frais	11
Ice cream	4.4
cheese	4
Other food items	10.7
Total	499.1

In total, three hundred and sixty eight food items from all the different food groups were consumed by South Asian children aged between 1 and 3 years. Out of these foods, 60 food items between mainstream and traditional foods were found to be consumed by 10% or more of all the children. These foods were considered the most commonly consumed foods. Table 5.3 presents a list of these foods in terms of food groups, frequency, percentages, average portion sizes, standard deviation, minimum and maximum average portions, and the serving size of each food item.

Among the cereal and cereal products, 14 food items out of 91 were found to be the most commonly consumed foods. Out of the 14 items, 4 were traditional foods: chapatti, *pilau*-plain, vegetable-*pilau*, and white rice. Looking at the portion size differences in terms of gender, no significant differences were found, except for breakfast cereals and chocolate chip cookies (p=0.006 and p=0.033, respectively). Boys had larger portion sizes of breakfast cereals (median= 24g) and chocolate chip cookies (median= 24g) than girls (median= 17.5g and median= 12g, respectively). As for portion size differences in terms of religion, only white rice and chapatti were found to be significantly different between “Muslims” and “others” (p=0.008 and $p \leq 0.001$, respectively). Muslims consumed a higher amount of rice (median=40g) than “others” (median=27g), whereas “others” consumed more chapatti (median=55g) than Muslims (median=50g). In addition, the current study found that the staple food among Bangladeshi children was white rice, whereas chapatti and rice were consumed by Indian and Pakistani children. Significant differences regarding portion sizes could not be computed due to insufficient cases.

Among the milk and milk products, 7 food items out of 34 were found to be of the most commonly consumed foods in this group. Of these 7, none were traditional foods. No significant differences were found in average portion sizes in terms of religion and gender in this group, except for whole milk yogurt (plain) (p=0.027). Girls (median= 118.5g) had significantly larger portion sizes of whole milk yogurt (plain) than boys (median= 82.5g).

Among the eggs and egg dishes, out of 8 food items, 2 were found to be the most frequently consumed foods: fried and boiled eggs. No significant differences were found between average portion sizes in terms of religion or gender.

Among the meat and meat products, both chicken curry and lamb *balti* were the most commonly consumed foods out of 35 food items, and both are considered to be traditional foods. No significant differences were found in average portion sizes in terms of gender. However, there was significant differences between "Muslims" and "others" in average portion sizes of chicken curry (p=0.005). Although the frequency of chicken curry consumption was higher among "Muslims" (n=73) than "others" (n=8), "others" had a larger average portion size (median= 60g) of chicken curry than "Muslims" (median= 34g).

Among the fish and fish dishes group, 3 out of 15 food items were found to be commonly consumed (canned tuna, fish fingers, and fish curry), of which 1 was a traditional dish (fish curry). Regarding portion size differences in terms of gender, only canned tuna was significantly different between girls and boys (p=.016). Girls had larger portion sizes (median=32g) than boys (median=25g). No significant differences were found in terms of religion.

In the fat and oil group, there were only 3 types of fat in this category (butter, *ghee*, and margarine), all of which were commonly consumed; 1 was found to be traditional in terms of type (*ghee*). No significant differences were found between average portion sizes in terms of gender or religion.

Among the vegetables and vegetable dishes, 9 food items out of 68 were found to be the most commonly consumed foods. Out of the 9 items, 4 were traditional foods: *channa* mixed, mixed vegetable curry, *mung dhal,* and *tarka dhal*. No significant differences were found in average portion sizes between different genders. However, there were significant differences in *channa* mixed and *tarka dhal* in terms of religion (p=0.025 and p=0.012, respectively). In both *channa* mixed and *tarka dhal*, "others" had higher average portion sizes (median=60g and median=61g, respectively) than "Muslims" (median=30g).

Seven fruit items out of 31 were found to be the most commonly consumed fruit: banana, apple, grapes, strawberries, pears, tangerines, and raisins. While no significant differences were found in average portion sizes in terms of gender, there were significant differences in average portion sizes of grapes and strawberries in terms of religion (p=0.034 and p=0.009, respectively). "Others" had higher average portion sizes of grapes and strawberries (median=29g and median=55g, respectively) than “Muslims” (median=20g and median=36g, respectively).

In the sugars and confectionary group, out of 25 food items, 5 were found to be the most frequently consumed foods; none were traditional foods. There was only a significant difference in average portion size between boys and girls for honey (*p*=0.036). The boys’ average portion (median=8g) was higher than the girls’ average portion (median=4.5g). No significant differences were found in terms of religion.

In the beverages group, 4 out of 9 were found to be commonly consumed beverages, of which 1 was a traditional drink: Asian tea. No significant differences were found in terms of gender or religion in average portion sizes.

In the savoury snacks group, only potato crisps out of 4 items in this category were found to be a frequently consumed food item. No significant differences were found in terms of gender or religion in average portion sizes.

In the miscellaneous group, 2 out of 20 food items were found to be the most commonly consumed foods: mayonnaise and tomato ketchup. No significant differences were found in terms of gender or religion in average portion sizes.

In the baby foods group, only 1 out of 16 food items was found to be the most commonly consumed food in this category: baby desert fruit canned bottle. There was a significant difference in average portion size between boys and girls (*p*=0.025). Boys had a larger average portion size (median=100g) than girls (median=50g). No significant differences were found in terms of religion.

5.3.4 Energy, macronutrients and micronutrients in average portions of most commonly traditional consumed foods by food group

Table 5.4 provides information on energy and macronutrients of average portion sizes of the most frequently consumed traditional foods by South Asian preschool children. The cereal and cereal products group was the main source of energy, carbohydrate, starch, and dietary fibre. An average portion of chapatti provided 81 kcal, carbohydrate 17.5g, and starch 17.0g. Meat and meat products were found to be the second highest source of energy. An average portion of lamb *balti* provided 80 kcal, followed by chicken curry at 79 kcal. In addition, it was the main source of protein, total fat, PUFA, MUFA, SFA, and cholesterol. An average portion of chicken curry provided 7.0g of protein, 5.1g of total fat, 2.1g of PUFA, and 29.0g of cholesterol.

Tables 5.5 and 5.6 illustrate information on micronutrients (vitamins and minerals) in average portion sizes of traditional foods commonly consumed by South Asian children. The cereal and cereal products group was the main source of chloride, iodine, and vitamin A. Average portion sizes of *pilau* plain rice provided 174.0mg chloride /portion, 2.1µg iodine /portion, and 11.0µg vitamin A /portion. The key source of phosphorus, sodium, potassium, iron, zinc, selenium, niacin, and vitamin D on the basis of average portion size was the meat and meat products group. For instance, an average portion of chicken curry provided 59.4mg of phosphorus and 2.2mg niacin, while an average portion of fish curry provided 58.2mg of phosphorus, 223.6mg of sodium, 167.9mg of potassium, 7.8µg of selenium, 0.7µg of vitamin D. An average portion of lamb *balti* was found to be the highest source of iron and zinc, providing 1.4mg/portion and 1.1mg/ portion, respectively. The vegetable and vegetable dishes group was the main source of calcium, magnesium, folate, and vitamin A. Channa (mixed) was the main source of calcium (28.5mg/portion), whereas mung dhal was the main source of magnesium (17.7mg/portion) and folate (10.4mg/portion). Tarka dhal was the second main source of folate (9.0µg/portion). Mixed vegetables were the main source of vitamin A (66.5 µg/portion).

5.3.5 Comparison with the NDNS food portion sizes

The food portion sizes were extracted from 480 food recalls. Comparison then took place between children in the current study and children in the study of Wrieden et al. (2008). Forty-three food items were chosen for the comparison as they were found to be commonly consumed foods by children in both studies. It can be seen from the data in Table 5.7 that the NDNS children had larger portion sizes of food items from the meat, fruits and beverages groups than the South Asians, whereas the South Asian children had larger portion sizes of food items from the vegetables, eggs, fish, milk and milk products, sugars and confectionary, and miscellaneous groups than the NDNS children.

Table 5.3: Frequency and percentages of the most commonly consumed foods by South Asian preschool children and their average portion sizes.

Food items	Frequency (%)	Average portion size(g) ±SD	Median (g)	Min-Max (g)	Serving size
Cereal and cereal products group					
Breakfast cereal high fibre	82 (51.3)	20±8.3	19	7-60	Small (1 biscuit)
Breakfast cereal, other	71 (44.4)	23±9.9	20	8-58	Small
Brown bread	40 (25)	41±16.9	36	18-90	1 medium slice
Chapatti	88 (55)	40±24.2	30	9-178	3/4 chapatti
Chocolate cake	16 (10)	39±20.5	30	15-98	1/2 slice
Chocolate chip cookies	23 (14.4)	22±11.6	18	12-48	2 small cookies
Macaroni boiled	26 (16.3)	54±20.7	60	23-90	2 tbsp
Pilau-plain	27 (16.9)	41±15.1	40	20-70	1 tbsp
Pizza cheese and tomato take away	18 (11.3)	96±29.9	88	66-175	1 ½ slices of 9-10" diameter
Porridge	19 (11.9)	101±54.8	83	20-280	Small
Semi sweet biscuits	35 (22)	12±6.5	11	4-32	2 biscuit
Vegetable pilau	20 (13)	59±18.6	60	40-120	1 ¼ tbsp
White bread	81 (50.6)	31±12.8	30	10-75	1 medium slice
White rice	89 (56)	43±15.6	40	10-80	1 tbsp
Milk and milk products group					
Cheddar cheese	24 (15)	17±7.8	18	5-40	1 ¾ tbsp
Fromage frais fruit	43 (27)	82±47.9	71	40-252	2 tbsp
Ice-cream	20 (12.5)	57±24	58	30-120	1 average scoop
Processed cheese	19 (11.9)	21±7.5	20	10-45	1 slice
Whole milk	150 (93.8)	153±52.2	153	20-325	¾ average glass
yogurt whole milk fruit	30 (18.8)	100±46.2	98	40-200	2 ¼ tbsp
yogurt whole milk plain	38 (23.8)	101±43.3	100	40-200	2 ¼ tbsp
Eggs group					
Boiled eggs	25 (15.6)	66±23.9	67	33.5-134	1 ¼ eggs
Fried eggs in vegetable oil	31 (19.4)	57±17.5	67	17-80	1 eggs

Continued…

Food items	Frequency (%)	Average portion size(g) ±SD	Median (g)	Min-Max (g)	Serving size
Meat group					
Chicken curry	81 (50.6)	44±18.2	40	15-105	1 ½ tbsp
Lamb balti	24 (15)	46±21.4	30	10-90	1 ½ tbsp
Fish group					
Fish curry	17 (10.6)	52±21.1	50	20-94	1 ¾ tbsp
Fish fingers cod fried /grilled	26 (16.3)	44±18.0	43	26-100	1 ½ fingers
Tuna canned	16 (10)	29±10.8	30	15-60	¼ small canned
Fat group					
Butter	59 (36.9)	5±2.3	5	1.25-13	1 tsp
Ghee	16 (10)	5±4.3	4	3-20	1 tsp
Margarine	46 (28.8)	6±4.6	5	3-30	1 tsp
Vegetables group					
Backed beans	35 (21.9)	45±16.8	40	30-90	1 tbsp
Channa mixed	21 (13.1)	50±25.8	30	20-105	1 ¾ tbsp
Chips oven baked	16 (10)	46±19.4	49	20-90	5 pieces
Chips fried	59 (36.9)	62±25.5	60	16-140	6 pieces
Cucumber	22 (13.8)	22±8.9	20	12-39	4 slices
Mixed vegetable curry	42 (26.3)	49±20.3	45	20-120	1 ½ tbsp
Mixed vegetable frozen boiled	16 (10)	22±8.2	20	15-40	¾ tbsp
Mung dhal	16 (10)	52±28.0	46	20-120	1 ¾ tbsp
Tarka dhal	32 (20)	53±27.6	53	20-120	1 tbsp
Fruits group					
Apple	83 (51.9)	56±25.5	55	13-100	½ medium
Banana	104 (65)	69±26.6	58	20-120	¾ medium
Grapes	46 (28.8)	24±11.9	24	6-50	½ small bunch
Pears	24 (15)	107±51.9	90	20-180	¾ medium
Raisins	16 (10)	17±11.8	14	5-43	½ tbsp
Strawberries	25 (15.6)	45±21.5	36	24-120	4 pieces
Tangerine	35 (21.9)	53±28.3	45	10-135	1 small

Continued					
Food items	Frequency (%)	Average portion size (g) ±SD	Median (g)	Min-Max (g)	Serving size
Sugars and confectionary group					
Chocolate milk	32 (20)	24±10.5	26	7-49	¾ snack size
Fruit jam	23 (14.4)	13±8.6	9	2-30	1 ½ level teaspoon
Honey	19 (11.9)	7±2.5	8	3-12	1 level teaspoon
Kitkat	17 (10.6)	21±5.6	24	12-24	2 fingers
White sugar	72 (45)	4±2.2	3	1.25-18	1 level teaspoon
Beverages group					
Asian tea	33 (20.6)	63±34.7	50	25-200	¼ average cup
Fruit juice	90 (56.3)	107±44.4	100	44-300	½ average glass
Fruit juice drinks	103 (64.4)	117±45.9	100	50-400	½ average glass
Soft drink carbonated	28 (17.5)	111±69.9	100	6-50	½ average glass
Savoury snack group					
Potato crisps	77 (48.1)	22±6.9	25	6-50	Small pack
Miscellaneous group					
Mayonnaise	16 (10)	10±3.2	10	7.5-15	½ level tablespoon
Tomato ketchup	28 (17.5)	13±4.8	10	7-30	1 sachet
Baby food group					
Baby desert fruit canned bottle	16 (10)	95 ±43.4	83	50-200	1 small jar

Table 5.4: Energy and macronutrient composition of average portion size of frequently consumed traditional foods by South Asian preschool children.

	Portion (g)	Energy (kcal)	protein (g)	Fat (g)	PUFA (g)	MUFA (g)	SFA (g)	Cholesterol (mg)	CHO (g)	Total sugars (g)	Starch (g)	NSP (g)	Water (g)
Cereal group													
Chapatis, made without fat*	40	81	2.9	0.0	0.2	0.0	0.0	0.0	17.5	1.0	17.0	NI	18.3
Pilau-plain*	41	58	0.9	2.0	0.2	0.5	1.0	4.0	10.2	0.0	10.0	0.1	28.5
Vegetable pilau	59	76	1.9	0.9	0.3	0.4	0.2	2.4	14.9	0.2	12.0	2.8	40.8
White rice, easy cook, boiled*	43	59	1.1	1.0	0.2	0.1	0.1	0.0	13.3	T	13.0	0.0	29.2
Meat group													
Chicken curry	44	79	7.0	5.1	2.1	1.5	1.1	29.0	1.3	0.6	0.0	0.5	29.8
Lamb balti	46	80	6.0	5.1	2.1	1.5	1.1	20.2	2.6	0.6	0.0	0.8	31.5
Fish curry	52	76	5.9	4.9	1.9	1.8	0.9	7.2	2.1	0.9	0.0	0.8	38.2
Fat group													
Ghee	5	44.3	0.0	4.9	0.2	1.3	2.9	12.3	0.1	NM	NM	NM	0.0
Vegetable group													
Tarka dhal	53	75	2.9	1.8	0.8	0.5	0.4	3.7	11.7	0.4	5.1	1.1	35.8
Channa (mixed)	50	65	2.8	1.6	0.6	0.7	0.2	2.0	9.9	0.6	4.2	2.2	35.0
Mung dhal	52	60	2.6	1.9	1.8	2.1	1.2	3.6	8.2	0.1	3.9	1.2	38.5
Mixed vegetables	49	49	1.2	2.6	0.9	1.1	0.3	0.9	4.9	1.7	1.4	1.1	39.3
Beverages group													
Asian tea*	63	5	0.3	0	Trace	0.1	0.2	1	0.3	0	0	0	61.9

Note: PUFA, poly unsaturated fatty acids; MUFA, monounsaturated fatty acids; SFA, saturated fatty acids; CHO, carbohydrates; NSP, non-starch polysaccharide; NI, no information; NM, not measured

Calculation derived from Moyle and Khokhar, 2008; EuroFIR Project no.FP6-513944, 2010; Khokhar et al., 2012; * The calculation is derived from the UK database of McCance and Widdoson's 6th edition

Table 5.5: Mineral composition of average portion size of frequently consumed traditional foods by South Asian preschool children.

	Portion (g)	Ca (mg)	P (mg)	Mg (mg)	Na (mg)	K (mg)	Cl (mg)	Fe (mg)	Zn (mg)	Cu (mg)	Se (µg)	I (µg)
Cereal group												
White rice, boiled	43	8.0	23.0	5.0	0.0	23.0	2.0	0.1	0.3	0.1	2.2	2.2
Chapattis, made without fat	40	24.0	48.0	15.0	48.0	60.0	92.0	0.8	0.4	0.1	1.6	NI
Pilau, plain	41	9.0	20.0	5.0	113.0	30.0	174	0.2	0.2	0.0	1.6	2.1
Vegetable pilau	59	9.4	21.2	5.9	100.3	51.9	NM	0.3	0.2	0.0	NM	NM
Meat group												
Chicken curry	44	11.4	59.4	11.0	146.1	147.8	NM	0.4	0.4	0.0	3.9	NM
Lamb balti	46	16.6	53.4	11.0	218.5	144.9	NM	1.4	1.1	0.1	2.8	NM
Fish curry	52	23.4	58.2	14.0	223.6	167.9	NM	0.6	0.2	0.0	7.8	NM
Fat group												
Ghee	5	0.1	0.0	0.0	0.1	0.0	NM	0.0	0.0	0.0	NM	NM
Vegetable group												
Tarka dhal	53	14.3	38.2	13.3	170.1	118.2	NM	1.0	0.4	0.1	3.2	NM
Channa (mixed)	50	28.5	38.5	15.0	155.5	101.5	NM	0.8	0.4	0.1	NM	NM
Mung dhal	52	11.4	43.2	17.7	141.4	139.9	NM	0.5	0.3	0.1	NM	NM
Mixed vegetables	49	19.6	28.4	11.8	183.3	184.7	NM	0.4	0.1	0.1	NM	NM
Beverages												
Asian tea	63.0	8.0	8.0	2.0	4.0	25.0	8.0	0.0	0.1	0.0	Trace	1.3

Note: NI, no information; NM, not measured

Table 5.6: Vitamin composition of average portion size of frequently consumed traditional foods by South Asian preschool children.

	Portion (g)	B_1 (mg)	B_2 (mg)	Niaceq (mg)	B_6 (mg)	B_{12} (µg)	Folat (µg)	Vit-C (mg)	Vit-A (µg)	Vit-D (µg)	Vit-E (mg)
Cereal group											
Chapattis, made without fat	40	0.1	0.0	1.0	0.1	0.0	6.0	0.0	0.0	0.0	Trace
White rice, easy cook, boiled	43	0.0	Trace	1.0	0.0	0.0	3.0	0.0	0.0	0.0	Trace
Pilau, plain	41	0.0	0.0	1.0	0.0	Trace	2.0	Trace	11.0	0.0	0.1
Vegetable pilau	59	0.0	0.0	NM	NM	NM	4.7	0.0	30.6	NM	0.5
Meat group											
Chicken curry	44	0.0	0.1	2.2	0.1	0.1	6.2	NM	18.4	NM	0.6
Lamb balti	46	0.0	0.1	1.2	0.1	0.6	6.9	0.5	7.7	NM	0.7
Fish curry	52	Trace	0.0	0.9	Trace	0.7	4.7	0.0	26.0	0.7	1.7
Fat group											
Ghee	5	NM	NM	NM	0.0	NM	NM	NM	63.9	0.1	0.3
Vegetable group											
Tarka dhal	53	0.1	0.1	0.6	NM	NM	9.0	0.0	9.1	NM	1.1
Channa (mixed)	50	0.0	0.0	0.4	Trace	NM	6.5	1.0	14.3	NM	0.9
Mung dhal	52	0.1	0.0	0.0	NM	NM	10.4	0.5	13.1	NM	0.9
Mixed vegetables	49	0.0	0.0	0.0	0.0	NM	2.9	2.9	66.5	0.0	NM
Beverages											
Asian tea	63	0.0	0.0	0.0	Trace	2.0	0.0	4.0	0.0	0.0	0.0

Note: NM, not measured

Table 5.7: Comparison of food portion sizes between South Asian preschool children in the current study and the children in the NDNS (Wrieden et al., 2008)

Food group	SA Median (g)	NDNS Median (g)	Median Difference (g)	% of difference
Cereal and cereal products group				
Pasta boiled	60	63	-3	4.8
Rice boiled	40	50	-10	20
Pizza thick base	88	70	18	25.7
Bread white	30	31	-1	3.2
Bread brown	36	30	6	20
Weetabix	19	19	0	0
Porridge	83	129	-46	35.7
Cookies	18	14	4	28.6
Chocolate cake	30	30	0	0
Semi sweet biscuit	11	8	3	37.5
Milk and milk products group				
Milk	153	136	17	12.5
Processed cheese	20	18	2	11.1
Fromage frais	71	53	18	34
Ice cream	58	49	9	18.3
Yogurt	100	119	-19	16
Eggs group				
Egg boiled	67	50	17	34
Egg fried	67	40	27	67.5
Meat group				
Chicken curry	40	57	-17	30
Fish group				
Fish finger	43	43	0	0
Oily fish canned	30	23	7	30.4
Fat group				
Butter	5	5	0	0
Margarine	5	5	0	0
Vegetables group				
Cucumber	20	16	4	25
Mixed vegetable boiled	20	19	1	5.3
Baked beans	40	52	-12	23.1
Potato chips	60	56	4	7
Fruits group				
Apples	55	63	-8	12.6
Pears	90	85	5	5.9
Tangerine	45	49	-4	8.2
Banana	58	68	-10	14.7
Grapes	24	42	-18	42.9
Raisins	15	15	0	0
Strawberries	36	50	-15	30
Sugars and confectionary group				
Sugar white	3	4	-1	25
Jam	9	8	1	12.5
Honey	8	6	2	33.3
Chocolate	26	20	6	30
Kitkat	24	21	3	14.3
Beverages group				
Fruit juice	100	110	-10	9
Soft drinks	100	145	-45	31
Savoury snack group				
Crisps	25	25	0	0
Miscellaneous group				
Tomato ketchup	10	7	3	42.9
Mayonnaise	10	7	3	42.8

5.3.6 Meal and snack patterns

Generally, all children consumed the three main meals and the afternoon snack daily, whereas 98% and 96% of children ate a morning snack and evening snack, respectively. Only 12.5% of children consumed food on another eating occasion, namely night feeding.

Table 5.8 shows the foods typically consumed on each eating occasion by South Asian preschool children. The current study found that South Asian children consume whole milk in their dietary regime during most of their eating occasions throughout the day. It is interesting to note that breakfast cereal was not only consumed at the breakfast meal, it was frequently consumed on other eating occasions, such as morning snack and evening meal. In addition, it was detected that traditional foods were mainly consumed at the evening meal and some items were consumed at lunch time. Another important finding was that fruit juice drinks appeared in all eating occasions except the night feeding. Moreover, it was found that fruits were mainly consumed during the morning and afternoon snacks.

The nutrient contributions of meals and snacks are provided in Table 5.9. It is apparent from this table that lunch and dinner provided the highest levels of energy intake throughout the day, followed by the afternoon snack and breakfast meal. The breakfast meal provided a higher level of micronutrients than all eating occasions, including vitamin A, thiamin, riboflavin, niacin, vitamin B_6, vitamin B_{12}, vitamin D, folate, Fe, Zn, and calcium. Whereas lunch and dinner provided higher levels of macronutrients than all eating occasions, including fat, protein, and CHO. It is interesting to note that the afternoon snack provided the highest level of vitamin C intake out of all eating occasions throughout the day.

Table 5.8: Most commonly consumed foods by South Asian preschool children throughout the day.

Food name	n (%)	Mean (g)± SD	Median	Min-max (g)	Serving size
Breakfast					
Whole milk	141(88)	143±65	125	20-380	¾ glass
Breakfast cereal, high fibre	78(49)	20±28	19	7-60	Small (1biscuit)
Sugar, white	65(41)	4±1.68	2.5	1.3-8.3	1 level tsp
White bread	51(32)	30±13	30	5-76	1 slice
Breakfast cereal	50(31)	22±8	20	8-45	1.5 tbsp
Margarine	25(16)	6±3	5	3-10	1 tsp
Butter	26(16)	5±2	5	3-10	1 tsp
Porridge, with whole milk	17(11)	101±54	100	50-280	1 small
Honey	16(10)	7±2.4	8	3-10	¾ level tsp
Fruit, juice drink	16(10)	113±43	100	50-200	½ glass
Lunch					
Fruit, juice drink	65(40)	126±48.6	100	50-250	¾ glass
White rice	63(39)	45±15	50	20-80	1 tbsp
Chicken, curry	41(25)	43±16.5	30	15-75	1.5 tbsp
Butter	21(13)	4±2	5	2.5-10	1 tbsp
Yogurt, whole milk, plain	18(11)	97±42.5	91	50-175	2.5 tbsp
Pilau plain	18(11)	38±15	40	20-70	1 tbsp
Macaroni, boiled	17(11)	58±22.4	60	30-90	1/3 small
White bread	17(11)	33±15	30	10-60	1 slice
Fruit, juice	16(10)	105±23	100	50-150	½ glass
Evening meal					
Chapatti	82(52)	41±24.6	34	9-178	¾ slice
White rice, boiled	60(38)	43±16	40	10-80	1 tbsp
Fruit juice drink	53(34)	110±53	100	15-225	½ glass
Chicken curry	43(28)	46±21	40	15-105	1.5 tbsp
Whole milk	36(24)	153±72	150	23-270	¾ glass
Chips, fried	35(22)	58±22.6	60	21-100	½ small
Butter	36(22)	9±16.8	5	1-10	1 ¾ tsp
Mixed vegetables curry	25(15)	46±24	45	14-120	1.5 tbsp
Fruit juice	23(14)	100±70	100	13-300	½ glass
Tomato ketchup	23(14)	13±5.7	10	5-30	1 sachet
Tarka dhal	20(13)	52±31	56	11-120	1 ¾ tbsp
Breakfast cereal	19(12)	32±19	30	11-90	2 tbsp
Yogurt, whole milk, plain	18(11)	86±44	50	10-150	2 tbsp

Continued					
Food name	n (%)	Mean (g)	Median	Min-Max(g)	Serving size
Morning snacks					
Whole milk	81(51)	145±70	150	10-300	¾ glass
Bananas	61(38)	71±31	58	20-120	1 small
Fruit, juice drink	57(36)	132±69	125	30-500	¾ glass
Apples	31(19)	55±26	50	12.5-100	¾ small
Fruit, juice	24(15)	91±43	100	3-150	½ glass
White bread	23(14)	27±11	30	11.5-57	1 slice
Grapes	19(12)	24±11	24	6-48	¼ small bunch
Butter	18(11)	6±3	5	2.5-15	1 tsp
Breakfast cereal	18(11)	18±7.5	15	10-37.5	1.2 tbsp
Tangerines	17(11)	54±32	45	22.5-135	1 small
Brown bread	16(10)	34±13.6	36	18-72	1 slice
Afternoon snacks					
Potato crisps	68(42.5)	22±9	25	6-68	1 small
Bananas	54(33.8)	68±29	58	20-120	¾ small
Apples	51(31.9)	60±27	66	16.5-100	1 small
Fruit juice drink	35(21.9)	123±44.7	130	22-200	¾ glass
Grapes	27(16.9)	26±12	24	6-50	¼ small bunch
Fromage, frais fruit	23(14.3)	78±43.8	80	14-200	1 ½ tbsp
Tangerines	17(10.6)	54±28.5	45	10-130	1 ¼ small
Strawberries	16(10)	45±25	36	10-120	4 raw
Fruit juice	18(11.3)	94±44.5	100	11.3-150	½ glass
Chocolate milk	20(12.5)	23±12	21	7-49	½ bar
Evening snacks					
Whole milk	126(79)	180±64.7	180	20-417	1 glass

Note: The abbreviation of ‘tablespoon’ is tbsp; the abbreviation of ‘teaspoon’ is tsp.

Table 5.9: Energy, macronutrient and micronutrient contribution of meals and snacks.

	Breakfast Mean ± SD	%	M. snack Mean ± SD	%	Lunch Mean ± SD	%	Afternoon Mean ± SD	%	Evening meal Mean ± SD	%	E. snack Mean ± SD	%	Other Mean ± SD	%
Energy kcal	199.2±68.9	18	145.1±72.2	13	214.2±82.4	19	200.9±80.7	18	212.7±82.2	19	128.0±72.6	12	12.5±37.5	1
Fat g	7.7±3.3	17	5.9±4.1	13	8.3±4.4	18	8.8±4.2	19	8.0±3.8	17	6.7±4.1	15	0.7±2.1	1
SFA g	3.9±1.8	18	2.9±2.1	13	2.7±1.74	13	4.2±2.1	19	3.4±5.56	16	3.8±2.2	18	0.4±1.3	2
Protein g	7.4±3.1	19	4.0±2.7	10	8.6±3.8	22	5.3±2.9	13	8.4±3.8	21	5.3±3.1	13	0.5±1.7	1
CHO g	26.6±10.8	19	20.1±10.3	14	27.9±11.3	20	26.7±11.2	19	28.2±11.3	20	12.2±8.9	9	1.0±3.0	1
Sugar g	12.8±6.1	18	13.6±7.9	19	8.1±5.6	11	18.2±8.4	25	7.7±5.7	11	9.8±5.2	14	1.0±3.0	1
NMES g	5.6±4.9	16	6.4±6.7	19	5.3±5.6	15	8.9±7.2	26	6.3±9.8	18	1.9±3.6	6	0.02±0.2	0
NSP g	1.2±1.15	20	0.9±0.66	23	1.4±0.9	23	1.1±0.73	18	1.3±0.9	22	0.26±0.7	4	0.0±0.0	0
Vita A µg	75.8±45.9	20	50.3±45.1	13	56.4±56.5	15	62.4±44.0	16	58.9±96.3	15	66.4±43.9	17	9.6±31.5	3
Thiamin mg	0.24±0.15	31	0.08±0.05	10	0.12±0.08	16	0.10±0.06	13	0.14±0.09	18	0.07±0.10	9	0.01±0.2	1
Ribo mg	0.49±0.2	30	0.18±0.1	11	0.14±0.1	8	0.24±0.1	2	0.15±0.1	9	0.34±0.2	21	0.03±0.1	2
Niacin mg	4.0±2.1	26	1.6±0.9	10	3.2±1.6	21	1.9±1.0	12	2.9±1.5	19	1.6±1.5	10	0.2±0.4	1
Vita B_6 mg	0.23±0.1	23	0.14±0.09	14	0.16±0.1	16	0.16±0.08	16	0.15±0.08	15	0.11±0.1	11	0.01±0.03	1
VitaB_{12} µg	1.2±0.6	26	0.5±0.5	11	0.4±0.4	9	0.7±0.6	15	0.4±0.5	9	1.2±0.8	26	0.1±0.4	2
Vita D µg	0.6±0.7	46	0.1±0.3	8	0.2±0.3	15	0.2±0.5	15	0.2±0.3	15	0.1±0.4	8	0.04±0.2	3
Vita C mg	7.4±8.9	13	12.3±11.4	21	9.7±10.4	17	15.0±13.6	26	8.1±8.9	14	5.4±5.4	9	0.8±2.6	2
Folate µg	40.5±22.5	31	15.8±11.9	12	18.9±9.7	14	17.7±9.2	14	20.0±13.9	15	15.7±15.8	12	1.6±4.7	1
Fe mg	1.9±1.5	29	0.6±0.5	9	1.2±0.6	19	0.7±0.5	11	1.4±1.2	22	0.4±1.0	6	0.29±0.48	5
Zn mg	1.0±0.4	21	0.5±0.3	11	0.9±0.4	19	0.6±0.3	13	0.9±0.4	19	0.7±0.4	15	0.08±0.2	2
Ca mg	209.6±131.4	25	94.3±77.0	11	86.0±65.4	10	137.5±88.7	17	96.4±72.0	12	182.6±134.2	22	19.7±62.1	2
Na mg	196.7±144.2	18	116.0±90.3	11	250.0±139.9	23	157.3±107.2	15	260.0±131.3	24	90.4±93.8	8	7.3±22.8	1
Se µg	3.6±2.9	17	2.0±1.9	10	5.8±3.9	28	2.3±2.5	11	5.0±3.0	24	1.7±1.4	8	0.1±0.5	0
I µg	41.0±21.7	23	21.3±20.8	12	15.6±17.3	9	30.5±23.2	17	15.9±17.4	10	43.8±28.7	25	4.6±15.6	3

5.4 Discussion

5.4.1 Selection of dietary assessment method

According to Burrows et al. (2010), the best method to use for estimating total energy intake in children aged 4 to 11 years old involves at least three 24-hour MPRs including weekdays and weekends, with parents used as reporters. The same study also found that a weighed food record is the best method to use for younger children. Although weighed food records would have provided the most accurate measurements of nutrient intake, it was decided that this method would not be used for the present study because the food weighing method has been reported as being invasive for South Asian populations, as well as demanding and complicated (Khokhar et al., 2001). This was confirmed when most of the mothers refused to use this method during the pilot study, saying the task was too hard and that they did not have enough time to take part since they also had to care for a young child. This method requires a high level of motivation and participants with a high level of literacy and numeracy skills (Livingstone et al., 2004; Magarey et al., 2011). According to Nog et al. (2009), the most frequently used methods to assess dietary intakes of European immigrant groups have been food frequency questionnaires and repeated 24-hour recalls. In addition, the assessment method used in the low income diet and nutrition survey in the UK, was four 24-hour recalls of diet within a 10 day period including at least one weekend day and incorporated different ethnic groups (Nelson et al., 2007). The decision was therefore made to use 24-hour MPRs (on non-consecutive days, one of which was a weekend day) because it was seen as the most appropriate dietary collection method to achieve the aims of this study.

5.4.2 Food consumption and average portion sizes in term of food group and meal time

The primary focus of this chapter was to determine the most commonly consumed foods and the average portion sizes of South Asian preschool children in the UK. To date, there have been no studies regarding these issues. Khokhar et al. (2013) were the first to examine ethnic-specific food portion sizes. A critical issue is whether portion sizes were reported accurately in this study. Employing face-to-face 24-hour MPRs as an assessment methodology enabled direct contact with the participant, which allowed the researcher to establish a detailed assessment of food portion sizes through questions tailored to each participant, in addition to the use of the developed food photographs booklet. Furthermore, the researcher had easy access to the participants' kitchens to see firsthand the servings and children's utensils and check the actual portions from the food labels of some food items eaten by the children, such as cereal bars, fruit yogurts, etc. This increased the accuracy of the data obtained. In this respect, this study is a unique source of data on food portion sizes. However, the data may not be representative of this section of the population. In the absence of anything else, the data collected can provide useful information and can be used to develop children's portion size assessment tools such as computer software packages to reduce the respondent burden on large groups of South Asian children during dietary surveys in the UK.

Our findings indicate that the milk and milk products group was the main food source that mothers relied on for their children, particularly whole milk. This finding is in agreement with Harbottle and Duggan (1992) which showed similar trend among South Asian preschool children previously. This result may be explained by the fact that whole milk is simple, fast and inexpensive food to be provided for children. In addition, this practice probably derives from South Asian's culture, more details will be provided in Chapter 7 regarding South Asian's culture and beliefs. Another noteworthy finding is that South Asian children had mixed diets of Western and traditional foods. Sixty out of 368 food items were found to be the most commonly consumed foods. From these, 13 foods were found to be traditional. Statistical comparisons were made for portion sizes in terms of gender and religion. The results did not show any significant differences except in the case of a few food items. It was therefore decided to report the results on the portion sizes as a combined portion between boys and girls for all foods to avoid reducing the number of food items, due to the small sample size if the portion was reported separately, similar to Wrieden et al. (2008). However, the few food items that had differences when compared to each other may have been influenced by the age of the participants, in addition to the number of participants in each group that consumed a certain type of food. For example, it was observed that there was a significant difference between boys and girls in terms of the portion size of their breakfast cereal. The number of boys (n=14) aged 3 years who consumed breakfast cereal was greater than the number of girls (n=5) of the same age group. As portion sizes increase with age (Wrieden et al., 2008), it can be assumed that this may have affected the results in this study in some cases. In addition, a few differences in food portion sizes were found between ‘Muslims’ and ‘Others’ when comparisons were made of some food items. ‘Others’, which included Hindus, Sikhs and Christians, were found to have significantly larger portion sizes of chicken curry than ‘Muslims’. This finding was unexpected and suggests that the number of children consuming this dish in both groups may have affected the result. Children belonging to the ‘Others’ group numbered 8, compared with ‘Muslims’ who numbered 73 children. It is possible, therefore, that this may have affected the results. As there the sample size of ‘Others’ was small, these results should be interpreted with caution.

Among ‘Muslims’ and ‘Others’ it was found that there were significant differences in average portion sizes of *channa* mixed and *tarka dhal* between both groups; ‘Others’ had larger portions than ‘Muslims’. These results may be explained by the fact that Indians (Gujarati Hindus) are basically vegetarians (Simmons and Williams, 1997) since the proportion of Hindus was more than Sikhs and Christians in the current study (see Chapter 3). In addition, Joshi and Lamb (2000) reported that the typical Gujarati meal comprises of chapatti, rice, dhal and vegetables with pulses. Regarding the fruits group, it is interesting to note that significant differences in average portion sizes were found only for grapes and strawberries in relation to religion; ‘Muslims’ had smaller portions than ‘Others’. A possible explanation for these results might be that income plays a role in the choice of fruits, since grapes and strawberries are considered to be expensive fruits when compared to other types, such as apples or bananas. It was found from the demographic characteristics of the participants that Indians, in the ‘Others’ group in this case, had the highest income compared to other South Asian sub-groups.

Another noteworthy finding was that the staple food among Bangladeshi children is white rice, whereas chapatti and rice are consumed by Indian and Pakistani children. This finding is consistent with those reported in other studies. Kassam-Khamis et al. (2000) reported that consumption of staples varied within South Asian sub-groups; Bangladeshis mainly consumed rice and Pakistanis mainly consumed chapattis. Gilbert and Khokhar (2008) mentioned in their review that Indians consumed chapatti, *paratha* and rice as traditional staples in their diet. In the current study, among South Asian preschool children, Asian tea was found to be one of the most commonly consumed beverages. This finding supports previous studies that found that offering Asian tea to children was common practice in this community (Lilly, 1995; Parsons et al., 1999). It is recommended that tea and coffee should not be given to young children due to the tannic acid content which may affect non-haem iron absorption (Watt et al., 2000; Khokhar and Apenten, 2003).

Based on the most commonly consumed traditional foods by South Asian preschool children, the macronutrients and micronutrients of average portion sizes were determined. It was found that energy, CHO, and starch were derived primarily from the cereal and cereal products group, such as chapatti and rice. This finding supports those of previous studies that showed that the South Asian diet is predominantly cereal-based rather than meat or fish-based (Church et al., 2005). However, protein is derived from fish, lamb and chicken dishes, such as chicken curry, lamb *balti* and fish curry. South Asian people do not eat beef or pork due to religious considerations (Kassim-Khamis, 1995). Although cereals and vegetables do not have a high fat content, they nevertheless represent, alongside meat and fat groups, the principal sources of total fat, including PUFA, MUFA, SFA, and cholesterol. As noted by several authors (Smith et al., 1993; Kassim-Khamis et al., 2000; Gardinue-Diaz, 2012), traditional South Asian dishes are fatty as a result of cooking practices which involve the use of vegetable oil and ghee rather than due to the actual content of fat.

Generally, vegetables and fruit represent the main sources of fibre. Bingham et al. (2003) revealed that cereals were the primary source of fibre in the Netherlands, Germany, Sweden and Denmark. On the other hand, fruit was the main source of fibre in Italy and Spain, whereas in the United Kingdom and France, vegetables were the main source of fibre. Regarding the main sources of fibre in traditional foods most commonly consumed by South Asian preschool children in this study, they were discovered to be vegetable pilau (cereal group) and channa mixed (vegetable group).

The primary source of iron and zinc in the traditional foods commonly consumed by the group investigated was lamb *balti* in the meat group, providing 1.4 mg/portion and 1.1 mg/portion, respectively. Moyle and Khokhar (2008) reported that lamb *balti* was the main source of iron and zinc in the South Asian diet, containing 3mg/100g of iron and 2.3mg/100g of zinc. Some studies among South Asian children have looked at the relationship between meat consumption and iron deficiency. Lawson et al. (1999b) observed that South Asian children consumed meat less frequently at 15 months of age than Caucasian children; 69% of Caucasian children consumed meat on a daily basis, in contrast to only 53% of children from Bangladesh, 30% of children from Pakistan, and 21% of children from India. Moreover 22% of Indian families were found to have a strictly vegetarian diet. However, this study did not observe a correlation between meat consumption and iron deficiency, as opposed to the study conducted by Parsons et al. (1999), which did reveal that children who consumed less meat were more likely to suffer from iron deficiency. Regarding other factors related to dietary habits that can affect iron levels in the body, Pushpangali and Khokhar (1996) brought evidence that phytates decrease the level of minerals in organisms, in particular zinc and iron. One food which has high phytate content and is consumed regularly by over 90% of children from India and Pakistan is chapatti, one of the primary components of the South Asian diet (Lawson et al., 1999b). The present finding seems to be consistent with these studies. It has observed that more than half of the participants consumed chapatti on a daily basis. Further details regarding the factors that may affect iron and other nutrient intakes among this community are provided in the next chapter.

The results of this study have also shown that vitamin D is mainly derived from fish curry and *ghee* as traditional foods. Moyle and Khokhar (2008) and Khokhar et al. (2013) reported that fish curry and *ghee* were important sources of vitamin D, providing 1.4 µg/100g and 1.1 µg/100g, respectively. South Asian children’s levels of vitamin D are lower than those of Caucasian children (Lawson et al., 1999b). It was found that factors other than food intake can affect levels of vitamin D in the body. One such factor can be skin pigmentation, as studies have demonstrated that individuals with dark skin need protracted exposure to the sun in order to adequately synthesise vitamin D (Huh and Gordon, 2008; Carvalho et al., 2001). Awumey et al., (1998) and have argued that vitamin D synthesis among people in South Asia may be determined by genetic differences. In general, children with sufficient exposure to the sun do not require a dietary surplus of vitamin D, in contrast to children with dark skin or insufficient sun exposure, who are likely to have lower levels of vitamin D (Clements, 1989). However, another cause of low levels of vitamin D among South Asian children is a diet rich in phytates and fibres. As previously indicated, chapatti, one of the South Asian staples, may be responsible for vitamin D deficiency as it has high phytate content (Clements, 1989; Awumey et al., 1998).

When the current study was compared with Wrieden et al. (2008), median differences between food portion sizes were found in some food items between children. This result can be explained by the fact that both studies used different methodologies. No method of dietary assessment is perfect and strengths and limitations of different dietary assessment methods have been well explained in literature. Wrieden et al. (2008) used data derived from the NDNS. The NDNS used a weighted method to assess children's diets. One of the strengths of a weighed record is that it provides the most accurate measurement of portion sizes (Willett, 1998; Thompson and Subar, 2001; Thomas and Bishop, 2007); however, under-reporting still exists (Gibson, 2005). In the current study, a 24-hour MPR technique was used, similar to that used by McConahy et al. (2004) who used 2 nonconsecutive 24-hour recalls to determine portion sizes of commonly consumed foods among preschool children.

To provide more in depth understanding of South Asian preschool children's dietary habits, foods consumed and nutrient intakes by eating occasions were reviewed. Skipping meals or snacks was not a problem among this group. All children consumed the three main meals. It is interesting to note that out of all three snack periods, the afternoon snack was more popular than the morning or evening snacks. However, most of the children consumed all three snacks. Only 12.5% of children consumed on the 'other' period occasion, which represented night feeding time, and all of these children belonged to the age group of 1 year olds. Having frequent eating occasions during the day is recommended for children of this age so as to achieve energy and nutrient requirements (Thomas and Bishop, 2007). However, it is important to maintain healthy eating guidelines during these periods.

It was not surprising that whole milk was a popular food item and it appeared in most eating occasions throughout the day. Thomas and Bishop (2007) suggested that children of this age need less milk than in their first year of life, since it may reduce the child's appetite which leads to a decrease in their food intake, especially those foods with a high amount of iron. It is recommended that foods from the milk and milk products group, such as milk, yogurt and cheese, are served three times per day (Chapter 1 section 1.4.1).

Breakfast cereal appeared in more than one eating occasion throughout the day. Since breakfast cereal is fortified with iron this may put the cereal and cereal group as one of the main sources of iron intake among this group, especially if meat is not consumed frequently by these children (further details on this are provided in the next chapter). Although South Asian children in the UK had 'Westernized' food items, they also retained traditional foods in their diet. In the current study, the evening meal mainly consisted of traditional foods, although they sometimes appeared in lunch as well. This finding is in agreement with Mellin-Olsen and Wandel (2005), who found that traditional foods are served during the evening meal and that this occasion is used to strengthen the family's cultural identity.

Regarding the nutrient contribution of meals and snacks, the results of this study indicate that the lunch and evening meal provided the highest levels of energy and macronutrients than other eating occasions throughout the day. However, the breakfast meal provided the highest levels of most micronutrients. These findings further support the idea that breakfast is the most important meal of the day, providing several nutrients which can positively impact children's health (Ruxton and Kirk, 1997; Rampersaud et al., 2005). In addition, it was found that the afternoon snack provided the highest level of vitamin C. A possible explanation for this might be the high consumption of fruits and fruit juice drinks during this period which may be fortified with vitamin C. Another important finding was that fruit juice drinks were consumed in high amounts throughout the day; they appear in every eating occasion except the evening snack. It is recommended to consume fruit juice with, rather than between meals to decrease the risk of dental caries (Thomas and Bishop, 2007). The high consumption of fruit juice drinks among these children makes them more susceptible to dental caries.

This chapter has provided a better understanding of South Asian preschool children's dietary habits and their needs to cover their daily dietary requirements.

5.5 **Key findings:**

- The milk and milk products group was the main food source that mothers relied on for their children, particularly whole milk.
- South Asian preschool children had a mixed diet of western and traditional foods, traditional foods were mainly consumed at the evening meal and some items were consumed at lunch time.
- Differences between South Asian and NDNS children in terms of food portion sizes were found in relation to some food items. These differences can be explained by the use of different methodologies in both studies.
- The results of this study show that the breakfast meal provided the highest level of micronutrient intakes, whereas lunch and the evening meal provided the highest level of energy and macronutrient intake.

Chapter 6: Assessment of dietary intake

6.1 Introduction

The risks associated with nutrient inadequacies during childhood are potentially high, therefore great attention needs to be paid to the quality of children's diets and the possible relationships between their diets and health outcomes. In the case of South Asian children this is even more important as researchers hypothesise that South Asian children are susceptible to nutritional problems including vitamin and mineral deficiencies in their diet. In addition, it is likely that factors such as gender, religion and other socio-demographic factors may affect children's nutrient intake. Although a child's preschool years are critical for growth and development, few studies investigating children up to 4 years of age are available, especially South Asian children living in the UK.

6.2 Aims

- To assess the average nutrient intake of South Asian preschool children (1-3 years old) living in West Yorkshire, UK, compared with national recommendations and the National Diet and Nutrition Survey, the new rolling programme (2008/2009 - 2009/2010).
- To describe the association between the socio-demographic factors on average nutrient intake of these young children.

6.3 Results

6.3.1 The study participants' demographic and socio-economic characteristics

In the previous chapter, the demographic and socio-economic characteristics of the participants were described. Please refer to Table (5.1) for more details.

6.3.2 Anthropometric characteristics

Descriptive data is presented in Table 6.1. by gender. For all measurements, boys were slightly taller and heavier than girls in all age groups. Boys' lengths and weights were significantly higher than girls' at the age of 1 year old (p= 0.017 and p=0.001, respectively. At the age of 2 years old no significant differences were found between boys and girls in terms of their weight, whereas the height of boys was significantly higher than that of girls (p=0.005). At the age of 3 years old, no significant differences were found between boys and girls in terms of height or weight. BMI was calculated as weight (kg)/height^2 (m^2) for all children; no significant differences were found between boys and girls in terms of BMI for all age groups.

Table 6.1: Anthropometric measurements of children taking part in the study.

Characteristic	Boys n=88		Girls n=72		
	Mean ±SD	Range	Mean ±SD	Range	p value*
1 years old	**n=31**		**n=25**		
Length (m)	0.84± 0.06	0.74-0.97	0.80 ± 0.05	0.72-0.91	0.017
Weight (kg)	11.8 ± 1.43	9.00-15.20	10.4 ± 1.68	7.60-13.00	0.001
BMI(kg/m^2)	16.8 ± 1.71	13.58-20.67	16.07± 1.72	13.84-19.29	0.122
2 years old	**n=31**		**n=35**		
Height (m)	0.93 ± 0.06	0.79-1.10	0.89 ± 0.06	0.80-0.99	0.005
Weight (kg)	14.1 ± 2.01	11.34-21.90	12.8 ± 1.72	9.00-15.50	0.059
BMI(kg/m^2)	16.4±2.04	11.57-22.08	15.8±1.53	13.01-18.96	0.128
3 years old	**n=26**		**n=12**		
Height (m)	0.99 ± 0.05	0.92-1.10	0.98 ± 0.05	0.93-1.10	0.431
Weight (kg)	15.4 ± 1.92	12.00-18.30	14.9 ± 1.65	12.30-18.00	0.632
BMI(kg/m^2)	16.0 ± 1.84	12.00-18.84	15.1 ± 1.05	12.55-16.30	0.153
Total 2-3 years old	**n=57**		**n=47**		
Height (m)	0.95 ± 0.06	0.79-1.10	0.92 ± 0.07	0.80-1.10	0.001
Weight (kg)	14.7 ± 2.06	11.34-21.90	13.3 ± 1.92	9.00-18.00	0.023
BMI(kg/m^2)	16.2 ± 1.95	11.57-22.08	15.6 ± 1.44	12.55-18.96	0.070

* Note: t-test was used, difference between boys and girls is significant at p <0.05

Regarding the current data, 2-3 year old children (excluding 1 year old children) were grouped by their BMI classification as an indicator of weight status (i.e. being overweight or obese) using different BMIs for age and percentile cut-offs (the UK 85th percentile and the Indian 75th percentile). A total of 104 children were studied (see Figure 6.1). The results showed that when using the UK cut-offs, the prevalence of overweight boys was 12%, and when the Indian cut-offs were applied this increased by 25%, reaching 37%. In the case of girls, the prevalence of being overweight was 6% using UK cut-offs. This increased by 28% using Indian cut-offs, reaching 34%. Furthermore, the prevalence of obesity among boys using UK cut-offs was 12%. This increased by 2% with Indian cut-offs. The prevalence of obesity among girls with UK cut-offs was 4%, and this increased by 9% when Indian cut-offs were applied.

The percentage of overweight and obese children was compared with the most recent NDNS data (2008/9-2009/10 NDNS Rolling Programme) using both the UK and Indian cut-offs. In general, the prevalence of being overweight and obese in

NDNS children (boys and girls) was higher than with the children studied in the present study. In both studies, the prevalence of being obese was higher in boys than in girls.

When the prevalence of being overweight and obese was calculated among South Asian sub-groups using the UK cut-offs 85th percentile, the results suggested that Bangladeshi boys (18%) and Indian girls (9.5%) had the highest prevalence of being overweight, whereas the prevalence of obesity was highest among Pakistani boys (21.4%) and Bangladeshi girls (12.5%). The picture changed with the Indian cut offs 75th percentile, whereby the prevalence of being overweight was found to be highest among Indian boys (50%) and Bangladeshi girls (50%), while the prevalence of obesity was highest among Pakistani boys (25%) and Indian girls (14.3%) (see Table 6.2). Due to the small sample size, these results should be interpreted with caution.

Figure 6.1: The prevalence of being overweight, obese, and overweight and obese among South Asian children using different cut-offs, compared with the NDNS children.

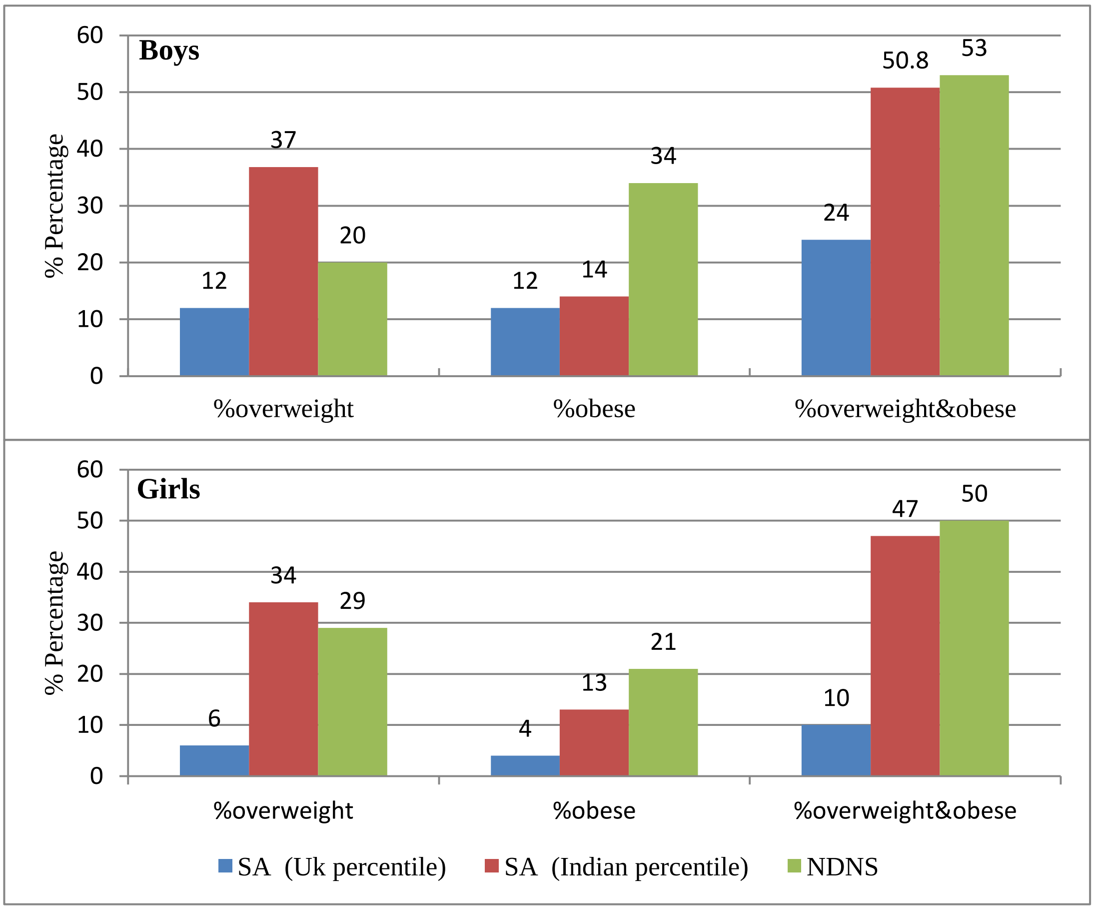


Table 6.2: The prevalence of being overweight, obese, and overweight and obese among boys and girls by South Asian sub-group.

UK cut-offs						
	Boys (n=57)			Female (n=47)		
Age 2-3 years	Indian (n=18) n (%)	Pakistani (n=28) n (%)	Bangladeshi (n=11) n (%)	Indian (n=21) n (%)	Pakistani (n=18) n (%)	Bangladeshi (n=8) n (%)
Overweight	2 (11)	3 (10.7)	2 (18)	2 (9.5)	1 (5.5)	0
Obese	0	6 (21.4)	1 (9)	1 (4.8)	0	1 (12.5)
Overweight and obese	2 (11)	9 (32)	3 (27.3)	3 (14.3)	1 (5.5)	1 (12.5)
Indian cut-offs						
Overweight	9 (50)	9 (32)	3 (27.3)	1 (4.8)	8 (44.4)	4 (50)
Obese	0	7 (25)	1 (9)	3 (14.3)	1 (5.5)	1 (12.5)
Overweight and obese	9 (50)	16 (57)	4 (36.4)	4 (19)	9 (50)	5 (62.5)

6.3.3 Over- and under-reporting of energy intake

Table (6.3) shows the prevalence of over[19]- and under-reporting[20] and the correct reporting of energy intake by gender, South Asian sub-group, and mother's education level using energy intake cut-offs based on BMR (Torun et al., 1996). In general, this study had slightly more under-reporters (20%) than over-reporters (18.8%). Moreover, under-reporting among boys was more common than under-reporting among girls (25% and 13.9%, respectively). The percentage of correct reporting of energy intake was highest in the Indian group and lowest in the Bangladeshi group. In addition, the mothers with a high education level were better to report their children's energy intake than those with a low educational level.

Table 6.3: The percentage of children classified as 'under-reporter', 'correct reporter', and 'over-reporter' of energy intakes, by gender, South Asian sub-group, and mother's education level.

	Under-reporter (%)	Correct-reporter (%)	Over-reporter (%)
By gender			
Boys (n=88)	22 (25)	55 (62.5)	11 (12.5)
Girls (n=72)	10 (13.9)	43 (59.7)	19 (26.4)
By South Asian sub-groups			
Indian	6 (9.7)	42 (67.7)	14 (22.6)
Pakistani	16 (24)	38 (57)	13 (19)
Bangladeshi	10 (32)	18 (58)	3 (18)
By mother's education level			
Low	5 (27.8)	9 (50)	4 (22.2)
Medium	19 (26.8)	41 (57.7)	11 (15.5)
High	8 (11)	48 (68)	15 (21)
Total	32 (20)	98 (61.2)	30(18.8)

Source: Torun et al., 1996

[19] Over-reporter: means the mother reports her child's food intakes higher than actually consumed.
[20] Under-reporter: means the mother reports her child's food intakes lower than actually consumed.

6.3.4 Comparison with different recommendations

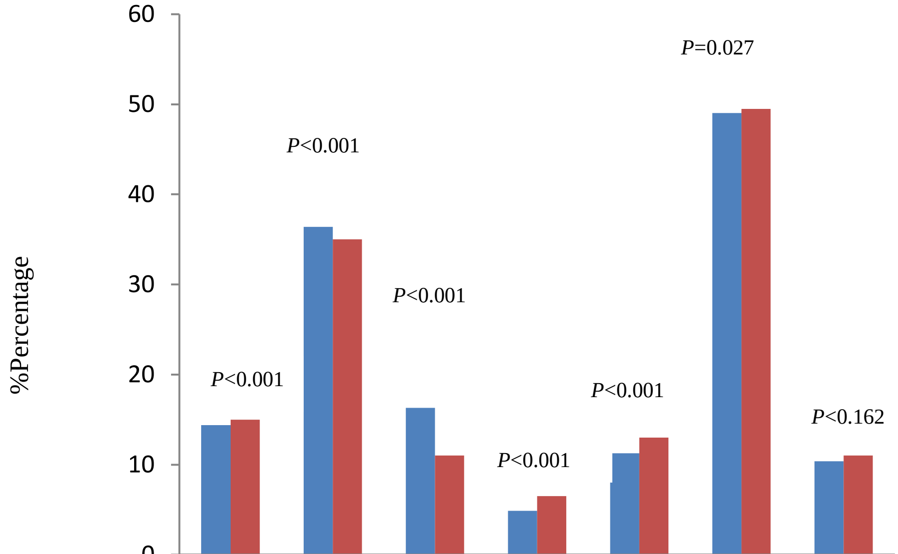
A comparison with UK Dietary Reference Values

A total of 480 dietary 24 hour MPRs were obtained. The mean energy and daily nutrient intakes of South Asian children were assessed and compared with UK Dietary Reference Values (DRVs) (Department of Health, 1991). Energy intakes were compared with the estimated average requirements (EARs), whereas vitamin and mineral intakes were compared with the reference nutrient intake (RNI). In addition, average daily intake of vitamins and minerals as a percentage of RNI and the percentage of children with intakes below the lower RNI (LRNI) were calculated (see Table 6.4). The percentage contributions of protein, total fat, saturated fatty acids (SFA), mono-unsaturated fatty acids (MUFA), poly-unsaturated fatty acids (PUFA), and carbohydrate (CHO) towards total daily energy intake were compared with the UK DRVs (see Figure 6.2). In addition, the distribution of macronutrient and micronutrient intakes in relation to food groups were analysed (see Figures 6.3 and 6.4).

Energy intakes

Mean energy intakes were significantly lower than the EARs in both boys and girls (1126.4 kcal/d ±197.75 (p<0.001) and 1106.2 kcal/d ± 225.86 (p=0.030), respectively). Mean energy intakes in boys and girls were 91% and 95% of the EAR, respectively. The main food sources of energy intake were milk and milk products, which provided around 32% of the energy intake, followed by cereal and cereal products at 29%. The mean intakes of total fat and SFA as a percentage of food energy intake (36.4% and 16.3%, respectively) were significantly higher than the DRVs, whereas PUFA and MUFA (4.8% and 11.2%, respectively) were significantly lower than the DRVs. Milk and milk products were the main source of fat and SFA, providing about 44% and 58% of the average intake, respectively. The main sources of PUFA in the children's diet were cereal and cereal products and vegetable and vegetable dishes, each providing around 20% of the total average intake. This was followed by meat and meat products, which provided approximately 17.5% of the total average intake. Milk and milk products provided 39% of MUFA intake. The total CHO intake as a percentage of food energy intake was significantly lower than the DRVs. Cereal and cereal products were the main contributors to CHO in the children's diet, providing about 41% of the total average. Milk and milk products provided one-fifth of total CHO. No significant difference was found between the percentage of food energy driven from NMES (10.4%) and the recommendation of 11%. The main sources of NMES were beverages, which provided one-third of the energy intake. Cereal and cereal products, sugar, preserves and confectionary contributed 19% of the average intake. Average protein intakes were significantly higher than the RNI (39.77g/day±9.68 (p<0.001)), whereas the percentage of food energy driven from protein was significantly lower than the DRVs (14.39±2.16 (p<0.001)). Milk and milk products provided about 42% of the average intake, followed by cereal and cereal products (23%) and meat and meat products (13%).

Figure 6.2: Average percentage of protein, total fat, SFA, PUFA, MUFA, CHO, and NMES to daily total energy intake.



	Protein	Total fat	SFA	PUFA	MUFA	CHO	NMES
South Asian children (%)	14.39	36.4	16.3	4.86	11.28	49.01	10.36
UK recommendation (%)	15	35	11	6.5	13	50	11

Note: Difference between South Asian children's daily intake and the UK recommendation is significant at p <0.05, one sample t-test was used

Micronutrient intakes

Intakes of most vitamins and minerals were well above the RNI, except for vitamin D, and minerals Zn, and Fe. Mean intakes of vitamin D were well below the RNI, at 18.7% of the RNI. Milk and milk products provided 30% of vitamin D intake, while eggs and eggs dishes provided 17%, followed by cereal, cereal products and baby food, which provided around 14%. The mean intakes of vitamin A, thiamin, niacin, riboflavin, vitamin B_6, vitamin B_{12}, and vitamin C were above the RNI. The main sources for thiamin and niacin were cereal and cereal products, which provided 45.7% and 36%, respectively, while milk and milk products contributed about 25% and 28%, respectively, of the average intakes. As for riboflavin and vitamin B_6, milk and milk products were the main source providing 66% and 28% of the average intakes, respectively, followed by cereal and cereal products, which provided 18% and 26% of intakes, respectively. Milk and milk products was the main contributor for vitamin B_{12}, providing 82% of the average intake. As for vitamin C, the beverages group was the main contributor providing 33.4%, followed by the fruit group, which provided 23%, and milk and milk products, which provided 19%.

When looking at minerals, the mean intakes of Fe and Zn were below the RNI, at 89.5% and 95.5% of the RNI, respectively. Intakes of Fe and Zn below the LRNI were found in 10.6% and 6.25% of children, respectively. The main food sources for Fe intake were cereal and cereal products, and vegetables and vegetable dishes, which provided 52% and 12% of the average intake, respectively. As for zinc intake, milk and milk products were the main food source, providing around 43% of the average intake. Cereal and cereal products contributed 26%. The main sources of Ca, Mg, and P were milk and milk products, which provided about 69%, 34% and 55% of the average intake, respectively. The second main contributor was cereal and cereal products, which provided about one-fifth of the average intakes of Ca and P and also one-third of the average intake of Mg.

Regarding Na and Folate, cereal and cereal products provided around 33% and 36% of intake, respectively, and milk and milk products provided 22% and 32%, respectively. Although the mean intakes of Se and I were well above the RNI, 2.5% and 1.25% of children, respectively, were found to have intakes below the LRNI. The main sources of Se were cereal and cereal products, which provided 34%, and milk and milk products, which provided 27% of average intake. As for I, milk and milk products was the main contributor providing 83% of the average intake. As for Cu, cereal and cereal products provided 47%, and vegetable and vegetable dishes provided 17.5% of the average intake. Cereal and cereal products provided 34%, while milk and milk products provided about 32% of the average intakes of Cl. Regarding K, milk and milk products provided 42%, vegetable and vegetable dishes 13%, and cereal and cereal products and the fruit group each provided about 12% of average intake.

Table 6.4: Energy and micronutrient intakes of South Asian preschool children compared with UK recommendations, with intakes as a percentage of RNI and the percentage of children with LRNI.

Nutrient	Mean(±SD)	UK DRVs	% RNI **	LRNI	% LRNI	*p* value
Energy and protein intakes						
Energy boys (kcal) n=88	1126 (±197.8)	1230	91.6(EAR)	NA	NA	<0.001
Energy girls (kcal) n=72	1106 (±225.9)	1165	95(EAR)	NA	NA	0.030
Protein (g)	39.8 (±9.7)	14.5	274.2	NA	NA	<0.001
Vitamins						
Vitamin A	423.9 (±185.0)	400 µg/d	106	200	5.6	0.104
Thiamin B_1*	0.7 (0.6-0.9)	0.5 mg/d	154	0.3#	0	<0.001
Riboflavin*	1.5 (1.1-1.9)	0.6 mg/d	270	0.23	0	<0.001
Niacin *	14.9 (12.6-17.6)	8 mg/d	194	4.4#	0	<0.001
Vitamin B_6*	0.9 (0.8-1.1)	0.7 mg/d	142	11$	0	<0.001
Vitamin B_{12}	4.6 (±2.2)	0.5 µg/d	931.4	0.3	0	<0.001
Vitamin C *	52.8 (38.2-75.0)	30 mg/d	196.6	8	0	<0.001
Vitamin D‡	0.7 (0.2-1.3)	7 µg/d	18.7	NA	NA	<0.001
Folate *	126.2 (105.0-151.0)	70 µg/d	187.6	35	0	<0.001
Minerals						
Ca *	781.3 (607 -1014.0)	350 mg/d	238.7	200	0	<0.001
Mg *	151.6 (130.5-178.8)	85 mg/d	184.7	50	0	<0.001
Na	1075.9 (±317.61)	500 mg/d	216.1	200	0	<0.001
K	1773.4 (± 425.1)	800 mg/d	221.7	450	0	<0.001
Cl	1499.1 (±488.1)	800 mg/d	188.3	NA	NA	<0.001
P	848.6 (±225.6)	270 mg/d	314.3	NA	NA	<0.001
Fe *	5.7 (4.6-6.9)	6.9 mg/d	89.5	3.7	10.6	<0.001
Zn	4.8 (1.2)	5 mg/d	95.5	3	6.3	0.017
Cu *	0.5 (0.4-0.6)	0.4 mg/d	125.8	NA	NA	<0.001
Se *	19.2(15.0-25.0)	15 µg/d	138	7	0	<0.001
I *	158.2 (119.3-219.0)	70 µg/d	250	40	0	<0.001

Statistical tests were carried out to compare between South Asian children's intakes and the UK recommendations, significance level was set at p <0.05.
*Log transformation: geometric mean and IQR were reported; ‡Non-parametric test: Wilcoxon Siged Rank test Median and IQR were reported, all based on raw data
** % RNI= (mean intake/ RNI)x100; # LRNI (mg/1000kcal); $ LRNI(µg/g protein); NA, no LRNI for these nutrients.

Figure 6.3: Distribution of energy and macronutrient intake in relation to food groups.

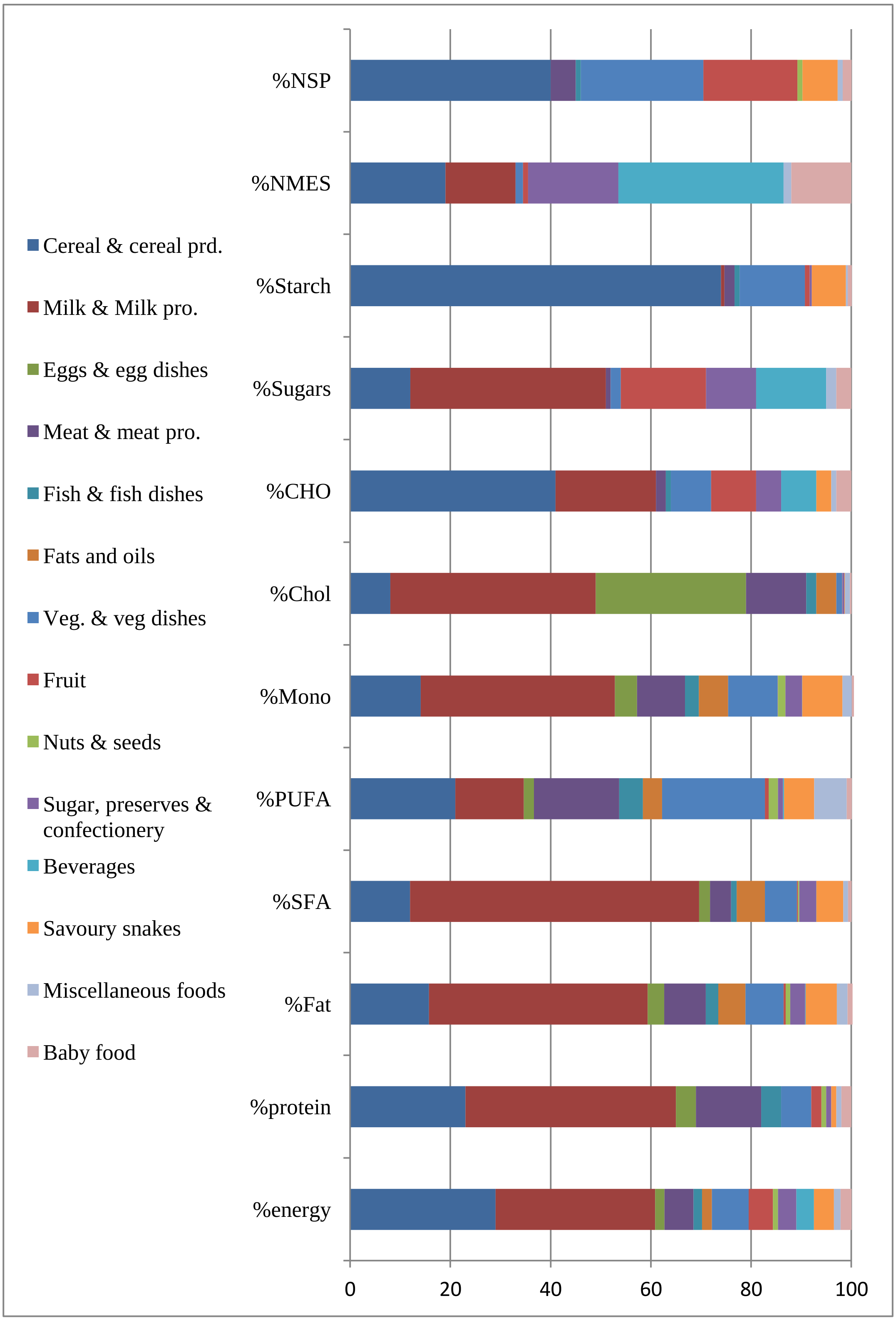
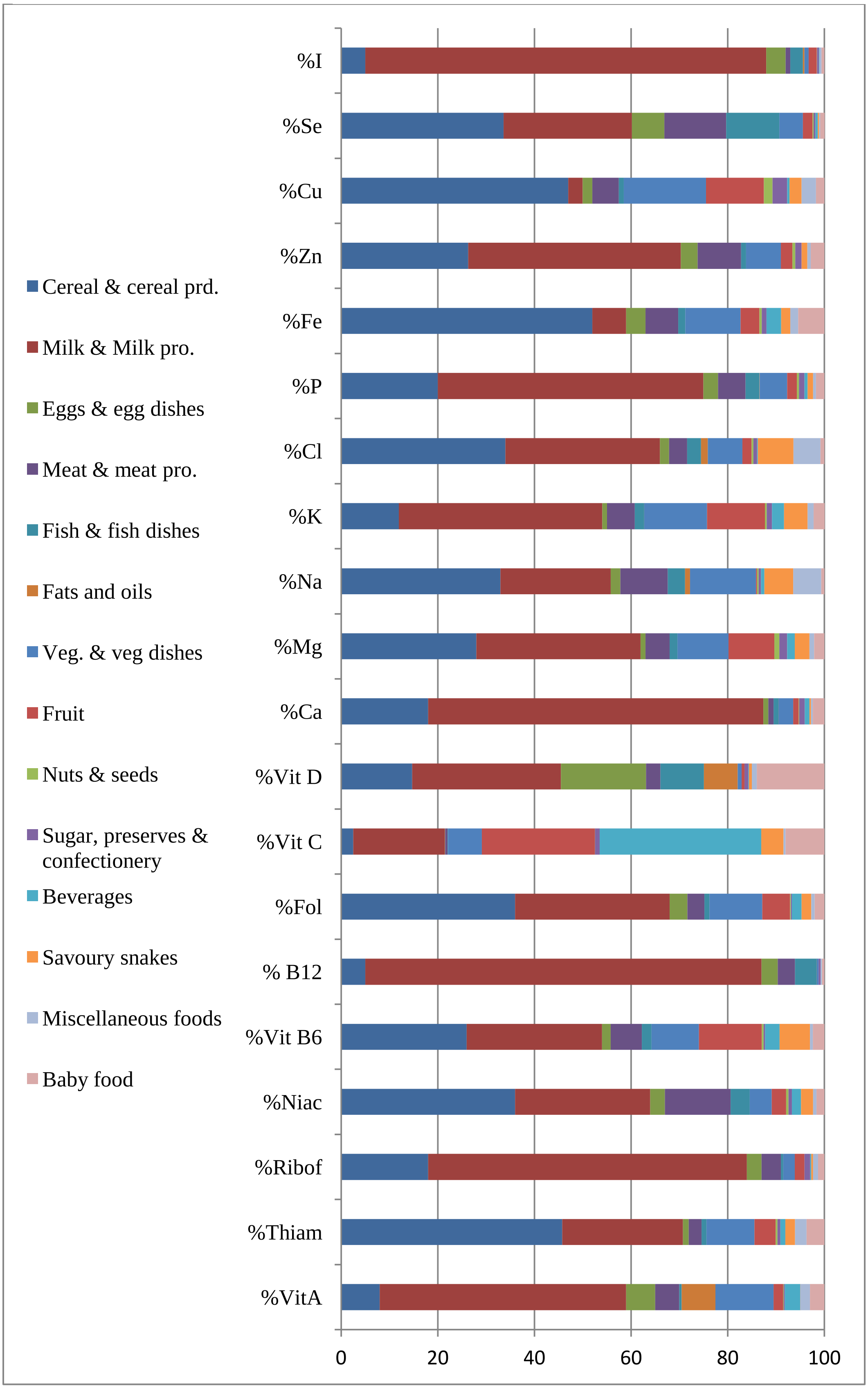


Figure 6.4: Distribution of micronutrient intake in relation to food groups.



Indian and WHO recommendations

Table 6.5 compares the nutrient intakes of the South Asian preschool children in the current study with Indian and WHO recommendations. When a comparison was made with the Indian recommendations (ICMR, 2009), energy and protein intakes for children were significantly higher than the recommendation (1117.3 kcal/d, p=0.001, and 39.77 g/d, p<0.001, respectively). For most of the micronutrients, the mean intakes were significantly higher than the recommendations, except for Fe and Zn where intakes were significantly lower than the recommendations (5.75 mg/d, p<0.001, and 4.78 mg/d, p=0.017, respectively). However, when nutrient intakes were compared with the WHO recommendations (FAO/WHO/UNU, 1985; FAO/WHO, 1998), it was found that the mean energy intake of children was significantly lower than the recommendations, and the mean protein intake was significantly higher than the WHO recommendations, which was similar to what was found when a comparison was made with the UK recommendations. Moreover, it was found that the mean intakes of vitamin D and Se were significantly lower than the recommendations (p<0.001) for all. In addition, the mean intakes of Fe and Zn were slightly lower than the recommendations, though there were no significant differences found between them (p=0.140 and p=0.789, respectively). Regarding other micronutrients, such as thiamin, riboflavin, niacin, vitamin B_6, vitamin B_{12}, vitamin C, Mg, and I, all were found to be significantly above the recommendations (p<0.001).

Table 6.5: South Asian preschool children nutrient intakes compared with Indian and WHO recommendations.

	Mean	Reference	p value	% of recommendation
Indian recommendations				
Energy	1117 (± 210.4)	1060 kcal/d	0.001	105.4
Protein	39.8 (±9.7)	16.7 g/d	<0.001	238
Vitamin A	423.9 (±185.0)	400 µg/d	0.104	106
Thiamin B_1*	0.7 (0.9-0.6)	0.5 mg/d	<0.001	146
Riboflavin*	1.5 (1.2-1.9)	0.6 mg/d	<0.001	253.3
Niacin *	14.9 (12.6-17.6)	8 mg/d	<0.001	187
Vitamin B_{12}	4.7 (±2.2)	0.2-1.0 µg/d	<0.001	NA
Vitamin C *	52.7 (38.2-75.0)	40 mg/d	<0.001	131.7
Folate *	126.2 (105.0-151.0)	80 µg/d	<0.001	157.6
Ca *	781.3 (606.5-1014.0)	600 mg/d	<0.001	130.2
Mg *	151.6 (130.5-178.8)	50 mg/d	<0.001	303.3
Fe *	5.7 (4.6-6.9)	9 mg/d	<0.001	63.7
Zn	4.8 (1.2)	5 mg/d	0.017	95.6
WHO recommendations				
Energy				
1y (n=56)	1071 (± 206.9)	1150 kcal/d	0.006	93
2y (n=66)	1121 (± 212.9)	1350 kcal/d	<0.001	83
3y (n=38)	1179 (± 199.6)	1550 kcal/d	<0.001	76
Protein				
1y (n=56)	38.2 (± 10.1)	13.5 mg/d	<0.001	282.7
2y (n=66)	40.0 (± 9.7)	15.5 mg/d	<0.001	258.3
3y (n=38)	41.7 (± 8.8)	17.5 mg/d	<0.001	238
Vitamin A	423.9 (±185.0)	400 µg/d	0.104	106
Thiamin B_1*	0.7 (0.9-0.6)	0.5 mg/d	<0.001	146
Riboflavin*	1.5 (1.1-1.9)	0.5 mg/d	<0.001	304
Niacin *	14.9 (12.6-17.6)	6 mg/d	<0.001	249.5
Vitamin B_6*	0.9 (0.8-1.1)	0.5 mg/d	<0.001	190
Vitamin B_{12}	4.6 (±2.2)	0.9 µg/d	<0.001	516.6
Vitamin C *	52.7 (38.2-75.0)	30 mg/d	<0.001	175.6
Vitamin D‡	0.7 (0.3-1.3)	5 µg/d	<0.001	13.8
Ca *	781.3 (606.5-1014.0)	500 mg/d	<0.001	156.3
Mg *	151.6 (130.5-178.8)	60 mg/d	<0.001	252.7
Fe *	5.7 (4.6-6.9)	%10 bioavali=6	0.140	95.6
		%12 bioavali=5	0.000	114.8
		Mean =5.5	0.125	104.3
Zn	4.8 (±1.2)	4.8 mg/d	0.789	99.5
Se *	19.2 (15.0-25.0)	22 µg/d	<0.001	87.2
I *	158.2 (119.3-219.0)	75 µg/d	<0.001	210.9

Statistical tests were carried out to compare between South Asian children's intakes and the Indian and WHO recommendations, significance level was set at $p < 0.05$

*Log transformation: geometric mean and IQR were reported; ‡Non-parametric test: Wilcoxon Siged Rank test Median and IQR were reported, all based on raw data; NA: not applicable.

6.3.5 Comparison between South Asian children in the present study and children from the National Diet and Nutrition Survey (NDNS) (the new rolling programme for 2008/2009)

Table 6.6 gives a comparison of energy and macronutrient intakes between the children in the present study and those in the NDNS. The mean daily intake of energy in the present study was lower than those in the NDNS by 10 kcal/day. Milk and milk products were the main source of energy in the present study, contributing about 32% of energy, followed by cereal and cereal products, which provided about 29% of energy intake. However, in the NDNS, cereal and cereal products were the main contributor to energy intake, providing 30% of intake. The second main source of energy were milk and milk products, providing 25% of energy intake. Protein intakes were higher in the NDNS study by 2.8 g/day than the present study. In both the present study and the NDNS the main source of protein intake were milk and milk products, which provided 42% and 35% of intake, respectively, and cereal and cereal products, which provided on average about one-fifth of intake in both studies.

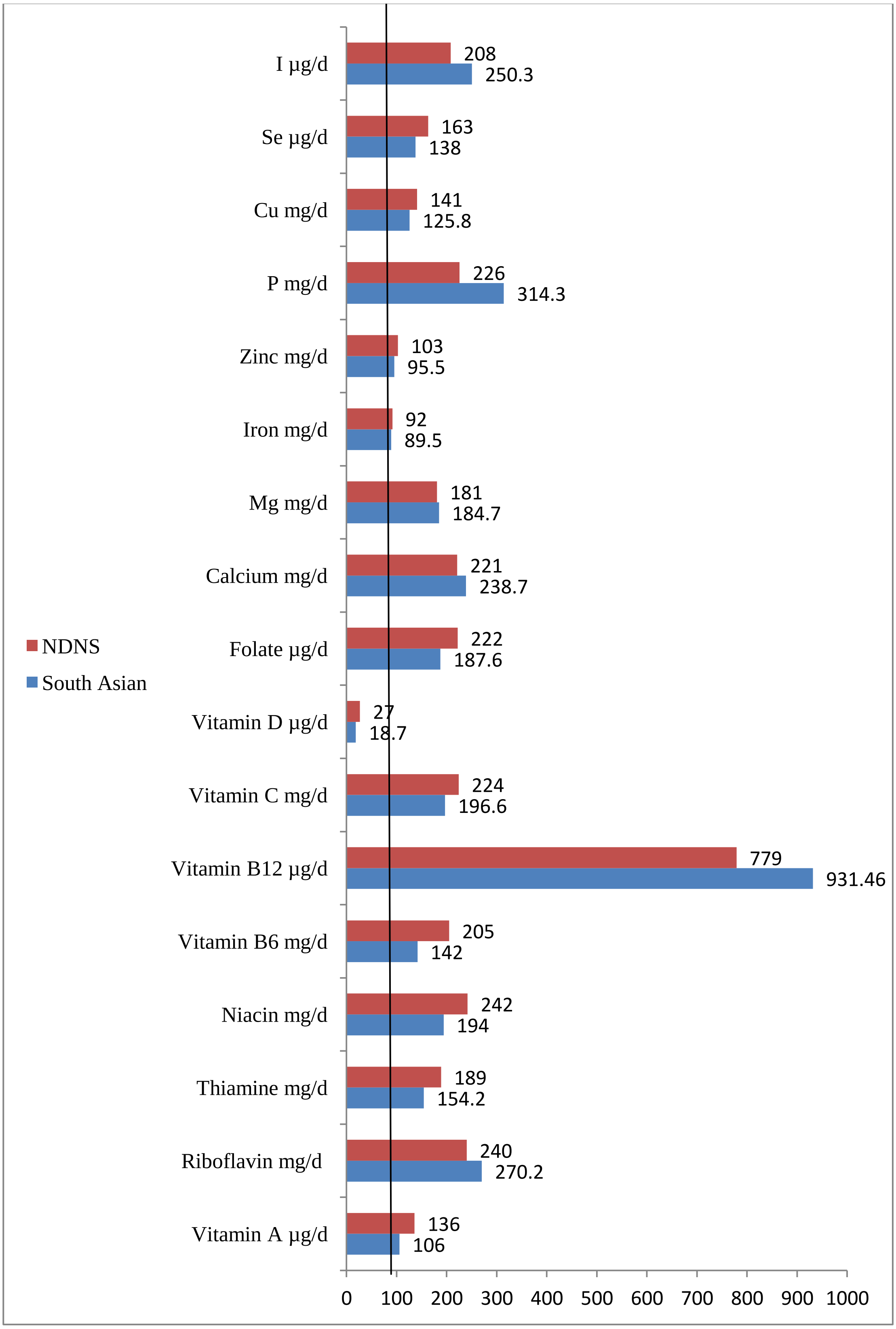
Carbohydrate mean intakes were also higher in the NDNS by 7.8g/day than the present study. Cereal and cereal products was the major contributor of carbohydrate in both studies, providing 41% of intake, followed by milk and milk products, which provided 20% of carbohydrate intake in the present study and 16% in the NDNS study. The mean intakes of NMES were similar in both studies and the main sources of NMES were non-alcoholic beverages, mainly fruit juices and fruit drinks, cereal and cereal products, sugar, preserves and confectionery. For NSP, the mean intake of South Asian children was lower than those in the NDNS study by 2g/day. The main sources of non-starch polysaccharides (NSP) were similar in both studies; cereal and cereal products were the main source of NSP, providing about 40% of intake. Vegetables and vegetable dishes including potatoes were the second greatest contributor of NSP, providing around 25% of intake. When the mean intakes of total fat, SFA, and PUFA were compared it was found that in the present study the mean intakes were higher than the NDNS, while mean intakes of MUFA were similar in both studies. Milk and milk products were the major source of total fat and SFA in both studies, providing around 44% of total fat intake and 58% of SFA in South Asian children, and 34% of total fat and 46% of SFA in the NDNS.

Table 6.6. Comparison of energy and macronutrient intakes between South Asian preschool children in the current study and the NDNS, the new rolling programme for 2008/2009.

Nutrient	Present study (mean)	NDNS (mean)	Mean difference	% of difference
Energy (kcal)	1117	1127	-10	-0.9
Protein (g)	39.8	42.6	-2.8	-7.0
Carbohydrate (g)	143.2	151	-7.8	-5.4
NMES (g)	34.6	34.7	-0.1	-0.3
NSP (g)	6.1	8.1	-2	-32.8
Total fat (g)	46.3	43.2	3.3	7.1
SFA (g)	21.6	18.7	2.9	13.4
MUFA (g)	14.3	14.4	-0.1	-0.7
PUFA (g)	6.6	5.9	0.7	10.6

Figure 6.5 shows average micronutrient intakes as percentages of RNI in South Asian children, along with micronutrient intakes as percentages of RNI for 1.5-3 year old children in the NDNS. Children in both the present study and the NDNS had mean intakes of most vitamins and minerals above the RNI. However, Fe and vitamin D mean intakes were below the RNI in both groups. South Asians' mean intakes of Zn were below the RNI, while children in the NDNS had mean intakes of Zn above the RNI. South Asian children's mean intakes of Ca, Mg, P, I, B_{12}, and riboflavin were higher than the NDNS children's intakes, whereas the NDNS children had higher mean intakes of vitamin A, thiamin, niacin, vitamin B_6, vitamin C, folate, Cu, and Se than the South Asian children.

Figure 6.5: South Asian vs. NDNS children: average daily intake of micronutrients as percentage of RNI



6.3.6 Effect of socio-demographic factors on the dietary intake of South Asians

Key nutrients for preschool children were selected to identify the association between different socio-demographic factors and their intakes. The socio-demographic factors considered were gender, ethnicity, religion, family type, family size, parental education level, mother's weight status, and mother's nutritional knowledge. In this sample, gender, father's education level, and family type had no significant associated with the mean nutrient intakes of South Asian children. The socio-demographic factors that significantly affected mean nutrient intakes are shown in Table 6.7 (please refer to Appendix (O) for tables showing analyses of all the socio-demographic factors).

Table 6.7: Socio-demographic factors that significantly associated with the mean nutrient intakes of South Asian preschool children.

Nutrients	*p* value
Ethnicity South Asian sub-groups*	
Energy	0.004
Fat	0.002
Fat (% energy)	<0.001
Protein	0.007
Carbohydrate	0.001
Carbohydrate (% energy)	<0.001
Sugar	0.003
Vitamin A	0.014
Thiamin	0.004
Niacin	0.001
Salt	0.005
Se	0.005
Religion	
Fat (% energy)	<0.001
Carbohydrate	<0.001
Carbohydrate (% energy)	<0.001
NSP	<0.001
Mother's weight status	
NMES	0.007
Mother's education level *	
Carbohydrate	<0.001
Carbohydrate (% energy)	0.003
NSP	0.006
Mother's nutritional knowledge	
NMES	0.002

Statistical analysis were carried out to identify the association between South Asian children's nutrient intakes and the demographic factors, * a one-way between groups ANOVA or Kruskal-Wallis test were used otherwise an in dependent-samples t-test or Mann-Whitney U test were used. The significance level was set at $p < 0.01$to restrict the possibility of error due to the multiple comparisons

South Asian sub-group (ethnicity) was a factor that associated several mean nutrient intakes. Regarding energy and protein intakes, differences were found between Pakistani and Bangladeshi children: Pakistanis had significantly higher intakes of energy (1154.6 kcal/day) and protein (41.9 g/d) than Bangladeshis (1006.5 kcal/day and 35.4 g/d) (p=0.003 and p=0.005, respectively). In addition, differences were found within the three groups: Pakistanis had significantly higher intakes of fat (g/d) than Indians (p=0.010) and Bangladeshis (p=0.006) (49.8 g/d, 44.3 g/d and 42.6 g/d, respectively). The mean intake of fat as a percentage of energy intake was significantly higher in both Pakistanis (37.9%) and Bangladeshis (36.8%) than Indians (34.5%) (p<0.001 and p=0.007, respectively). Furthermore, Indians were more likely than Bangladeshis to have a higher intake of CHO g/d (151.8 g/d, 127.1 g/d, respectively; p<0.001). The CHO as a percentage of energy intake was significantly higher among Indians (51.4%) than Pakistanis (47.0%) (p<0.001). Moreover, in both Indian and Pakistani children the mean intake of sugar (73.9 g/d, 74.3 g/d, respectively) was higher than in Bangladeshi children (62 g/d) (p=0.006 and p=0.004, respectively).

Differences in the mean intakes of thiamin, niacin, salt, and Se were found between the three groups. Among them, no significant differences were found between Indian and Pakistani children, except for mean intakes of niacin and Se. Pakistanis had higher intakes of niacin (16.28 mg/d) and Se (21.69 µg/d) than Indians (15.50 mg/d, p=0.049 and 17.53 µg/d, p=0.001, respectively). When Pakistani children were compared with Bangladeshi children, no significant differences were found between them, except for niacin. Pakistan children had significantly higher mean intakes of niacin (16.28 mg/d) than Bangladeshi children (0.13.33 mg/d, p=0.001). However, when Indian and Bangladeshi children were compared, mean intakes of thiamin and salt were significantly higher (p=0.002, p=0.025, p=0.003, and p=0.003, respectively) among Indians (0.78 mg/d and 2.9 g/d) than Bangladeshis (0.63 mg/d, p=0.003 and 2.3 g/d, p= 0.003, respectively).

Religion was significantly associated with this mean intake of fat as a percentage of energy intake, CHO g/d, CHO as a percentage of energy intake, and NSP. The mean intake of fat as a percentage of energy intake was significantly higher among Muslims (37.6%) than the children of other religions (33.3%) (p<0.001). Whereas, the mean intake of CHO (156.6 g/d), CHO as a percentage of energy intake (52.8%), and NSP (6.77 g/d) were significantly higher among children of other religions than Muslim children (138.1 g/d, 47.6% and 5.16 g/d, p<0.001 for all, respectively). In addition, mother's education level had a significant association with the mean intake of CHO g/d, CHO as a percentage of energy intake, and NSP g/d. The children of mother's with a university level education and above had intakes of CHO (152.43 g/d), CHO as a percentage of energy intake (50.45%), and NSP (6.18 g/d) significantly higher than the mean intakes of children whose mother's education level was lower than university level (135.76 g/d and p<0.001, 47.9% and p=0.003, and 5.10 g/d and p=0.006). The mean intake of NMES was associated with two factors: mother's weight status and mother's nutritional knowledge. The children of overweight or obese mothers had mean intakes of NMES (39.67 g/d) significantly higher than the children of normal weight mothers (31.63 g/d) (p=0.007). If the mother's nutritional knowledge was ≤ 5, the child's mean intake of NMES (32.47 g/d) was significantly higher than the mean intake of children whose mothers' nutritional knowledge a scored >5 (23.83g/d) (p=0.002).

6.4 **Discussion**

6.4.1 Weight status

Overweight and obese children are an epidemic problem. In 2010 there were 43 million overweight and obese preschool children (under 5 years) in both developing and developed countries (de Onis et al., 2010). These problems are associated with various health implications in adulthood (Reilly et al., 2003) (further details on this are mentioned in Chapter 1, sections 1.1.8.3.3 and 1.1.9). Usually boys under the age of 8 years are heavier than girls, and after this age, girls become heavier due to the fat gain linked to puberty (Weichselbaum and Buttriss, 2011). In agreement with this fact, in the current study it was found that boys were slightly taller and heavier than girls. In addition, BMI was used as a tool to measure the prevalence of being overweight and obese in this study. In the UK, BMI thresholds are the most frequently used tool to measure the prevalence of being overweight and obese, based on 85th and 95th percentiles of the UK 1990 growth reference for population thresholds (SACN and RCPCH, 2012). In the current study, different BMI cut-off points for age and sex were used: 85th and 95th percentiles of the UK 1990 growth reference (Cole et al., 1995), and 75th and 97th percentiles of Indian cut-offs (Khadilkar and Khadilkar, 2011). Differences between both BMI cut-offs were found. The first cut-offs were chosen to have a valid comparison with the NDNS, since they used the 85th and 95th percentiles, and the second cut-offs were used due to the work of Khadilkar et al. (2012), which suggested that age and sex specific cut-off points for BMI for screening the prevalence of being overweight and obese among Indian children were lower than the cut-offs for European populations; the Indian cut-offs are available for both clinical use and research purposes.

It was found that the prevalence of being overweight in the NDNS children was higher by 8% for boys and 23% for girls in comparison with the South Asian children in this study. In addition, the prevalence of obesity among NDNS children was higher by 22% for boys and 17% for girls than the South Asian children. However, when Indian cut-offs 75th and 97th percentiles were applied, it was found that the prevalence of being overweight among the NDNS children was lower than the South Asian children in the current study by 16.8% for boys and 5% for girls, while the prevalence of obesity was higher in the NDNS than the South Asian children by 20% for boys and 8% for girls. Although comparisons are limited because no other studies have provided results that support our results, this study has provided evidence that supports the results obtained by Khadilkar and Khadilkar (2011), who recommended the use of the 75th percentile value for screening Indian boys and girls who are overweight. This Indian cut-off is based on the cut-off standards for BMI at 23 and 28 adult equivalents, which is the WHO recommended value for adult Asian Indians, since these cut-offs show risk factors for the development of metabolic syndrome. In addition, Khadilkar and Khadilkar (2011) found that on the BMI charts, the 75th percentile for the data of the study was close to the UK's 85th percentile on BMI charts.

According to El-Sayed et al. (2011), aggregating may not be appropriate among South Asians in studies about obesity since they found significant differences in the prevalence of obesity between Indian, Pakistanis and Bangladeshis. Therefore, the prevalence of being overweight and obese were measured separately based on South Asian sub-groups. In the current study, it was found that when using the UK cut-offs, the prevalence of being overweight was high among Bangladeshi boys (18%) and Indian girls (9.5%). The prevalence of obesity was found to be high among Pakistani boys (21.4%) and Bangladeshi girls (12.5%). When the Indian cut-offs were used, the prevalence of being overweight was found to be high among Indian boys (50%) and Bangladeshi girls (50%). The prevalence of obesity was found to be high among Pakistani boys (25%) and Indian girls (14.3%). These findings were different to those found in a previous study carried out by Saxena et al. (2004), which found the highest prevalence of being overweight among Indian boys (29.6%) and Pakistani girls (25.7%). In addition, the prevalence of obesity was found to be high among Indian boys (9%) and Pakistani girls (8%). Only a small number of participants were covered in the present study and this clearly affecting confidence in the estimation of the study. Further research needs to be conducted in this area.

6.4.2 Over- and under-reporting of energy intake

In this study, estimation of possible under-reporting was established by applying standard equations based on BMR. The percentage of children classified as under-reporters was 20% and it was greater among boys than girls (25% and 13.9%, respectively). The incidence of under-reporting in those children may most likely be the result of misreporting of children's foods and drinks or inaccuracies with the estimation of food portion sizes. Furthermore, using standard equations based on BMR to estimate under-reporters has its limitations. It has been proposed that the equations tend to overestimate BMR in adults (Shetty et al., 1996), and children and adolescents (Torun et al., 1996). As a result, it overestimates total energy expenditure which may lead to overestimation of the prevalence of under-reporting. It may have been more prevalent among boys due to the higher cut-off points value relevant to the equation implemented for use with boys. In addition, body composition was not taken into account in the calculations, thus leading to inaccurate estimations of BMR in some children, since the main determinant of BMR is body composition which is the ratio of lean tissue mass to fat mass. As fat mass has a lower metabolic rate than lean tissue (McNeill, 1993), children with a high proportion of fat tissue may be misclassified as under-reporters by this method (Glynn et al., 2005). It has also been proposed that ethnic differences may affect the prediction of BMR when using the standard equations. However, there is on-going debate on this conclusion. Schofield et al. (1985) noted that Asiatic subjects (Indian and Chinese) had lower BMR than Europeans, and Henry and Rees (1991) showed that BMR was lower among tropical populations. Some studies emphasise that predicting BMR using the present FAO/WHO/UNU equations can lead to overestimation of BMR in many communities, including the Asian community (Case et al., 1997). Some studies, however, have showed there is no difference in

BMR between Indians and Europeans (Soares et al., 1993; Hayter, 1992). The debate about the use of BMR equations was summarised by Soares et al. (1993) as follows: "whatever the reason it is becoming increasingly evident that the equations of Schofield derived from measurements made over 60 years ago are not at present valid for the precise prediction of BMR of population groups worldwide." Due to all of the above reasons, participants identified as under- or over-reporters were included in the main analysis.

6.4.3 Nutrient intake

The results of the present study based on reported mean intakes shows that South Asian preschool children in the UK have adequate intakes of most vitamins and minerals, except in terms of their dietary intake of energy, vitamin D, iron, and zinc, which are essential for normal children's health and development, when compared with UK recommendations. When a comparison was made with Indian recommendations it was found that children consume significantly higher amounts of energy than the recommended intake, while their iron, and zinc levels are still below recommendations (the recommendation of vitamin D was not available). However, when compared with WHO recommendations, the dietary intakes of only energy, and vitamin D were lower than the recommended intakes, whereas iron and zinc intakes were adequate.

It is possible that energy intakes were found to be lower than the EARs when compared with UK and WHO recommendations due to under-reporting of food consumption. This phenomena is well known as a problem in the NDNS (the previous survey by Gregory et al. (1995) and the NDNS, the new rolling programme for 2008/2009) and in any dietary survey worldwide (Prentice et al., 1986; Livingstone et al., 1990; Livingstone et al., 1992b; Black et al., 1993). According to SACN (2011), another possible explanation is that food energy which has been used to evaluated energy intakes in the UK is set at too high a value. SACN recommend a revision to the EAR values for food energy for infants, children, adolescents and adults.

The survey of Gregory et al. (1995) of children in the UK aged 1½ to 4½ years old found vitamin A, vitamin C, vitamin D, iron, and zinc below the RNI. Additionally, studies by Lawson et al. (1998) and Lawson and Thomas (1999a) that used data from a survey on infant feeding in Asian families in the UK found that South Asian children are at risk of iron and vitamin D deficiency. In agreement with these studies, the current study found low intakes of vitamin D, iron, and zinc. These low intakes probably occurred due to the infrequent use of supplementation, which is recommended to be used in this age group. Another explanation of the low intakes of these nutrients may be the mothers' dietary habits and weaning practices. For example, delay in introducing solid food to their children and prolonged bottle feeding on cow's milk were found to be common practices (see Chapter 7 for further explanation). This confirmed the findings of Harbottle and Duggan (1992), who found that milk remained the main food source that was relied upon until the age of two years. In addition, Lawson et al. (1998) suggested that introducing cow's milk at an early age explains the prevalence of iron deficiency among South Asian children. Furthermore, as previously reported in this study, tea and chapatti are some of the most commonly consumed foods by South Asian children (see Chapter 5). Similar observations were made by Lilly (1995) and Parsons et al. (1999), who found that offering Asian tea to children is a common practice in this community. It is recommended to not offer tea to young children due to tannic acid content which has an inhibitory affect on non-haem iron absorption (Watt et al., 2000; Khokhar and Apenten, 2003). Moreover, Lawson et al. (1999b) found there was high intake of chapatti among Pakistani and Indian children and it has been reported that due to high content of phytate in chapatti, the food has a significant association with poor vitamin D intake. In addition, high intake of phytates in the daily diet decreases the availability of certain minerals, such as iron, zinc, and calcium (Pushpanjali and Khhokhar, 1996; Lopez et al., 2002). Furthermore, prolonged cooking is a common practice when preparing South Asian foods (Begum, 1979; Abraham, 1982) and this may result in the loss of certain vitamins, such as vitamin C, which can inhibit iron absorption in the body (Alvi et al., 2003).

It was found that there is a paradox in the iron requirements stated in different recommendations. The Indian recommendations set a high requirement of iron intake at 9 mg/day, the UK recommendations state 6.9 mg/day, and the WHO recommendation is 6 mg/day, applying the factor of 10% bioavailability. This can be explained by the factors that affect iron balance in the body. There are three factors that can affect iron balance: absorption (intake and bioavailability), losses, and the amount stored in the body. Indian recommendations for iron are the highest in the world and are based on iron content and bioavailability from the Indian diet, iron losses, and iron stores.

The NDNS is a cross-sectional survey designed to provide baseline information on the diet and nutritional status of the UK population. In the current study, when results were compared with the NDNS rolling programme (2008/2009) some differences were identified. These differences can be explained by the different dietary research methods used in both studies; three 24-hour MPRs were used in the current study, while a four day estimated diary was used by the NDNS. This methodological difference had to be taken into account when a comparison took place. It showed that both groups had mean energy intakes below the recommendations. However, the NDNS children had energy intake slightly higher than the children in the current study. The main food groups considered to be the main contributors to energy intake among both groups were different. With children in the NDNS, cereal and cereal products were the main sources of energy, followed by milk and milk products, whereas with the South Asian children in the current study, milk and milk products were the main sources of energy, followed by cereal and cereal products. This may explain the differences found between the two groups in regards to the SFA, which was found to be high among South Asian children, and the NSP, which was high among the NDNS children.

It was also identified that most vitamins and minerals were above the RNI in both groups, apart from certain nutrients that were found to be below the recommendations. Although both groups had iron intakes below the RNI, the NDNS children had higher intakes of iron than the South Asian children. Furthermore, intake of zinc was above the RNI for NDNS children and not for the South Asian children. This probably occurred due to different dietary habits and practices among both groups, as discussed previously. In both groups, intakes of vitamin $B_{12,}$ riboflavin, calcium, and phosphorus were well in excess of the RNI. However, the South Asian children's intakes of these vitamins and minerals were higher than the NDNS children's intakes. This may reflect the high consumption of milk among South Asian children.

6.4.4 Factors affecting nutrient intakes

Adult studies have shown that dietary intakes may be affected by various factors, such as gender, ethnicity, age, and socioeconomic status (Hulshof et al., 2003; Giskes et al., 2004; Beydoun and Wang, 2008). Among children, it is also expected that there are certain factors that may affect usual dietary intake, therefore attention was focused on gender, ethnicity, parental education level, family type, family size, maternal weight status, and mother's nutritional knowledge, and these were evaluated as potential factors that may affect children's nutrient intakes.

Gender, father's education level, family type, and family size were not significantly associated to any of the mean nutrient intakes. Regarding gender differences in nutrient intakes among preschool children, results from previous studies have been contradictory. Huynh et al. (2008) found that boys have greater intakes of total energy, protein, and fat than girls. They hypothesised that culturally, the preference of a male child over a female was the main reason, since this phenomenon still remains in some communities and boys are often better nourished than girls. However, Lakshmi et al. (2005) indicated that nutrient intakes among female children were higher than among males and gender discrimination in food distribution was referred to as a regional problem. In this study, no gender differences in nutrient intakes were observed. Similar trends among preschool children have been reported previously by Salles-Costa et al. (2010). In addition, some studies have reported that family size has an impact on South Asian preschool children's nutritional status in their home countries (Dwivedi et al., 1993; Iram and Butt, 2006). However, the finding of this study is in agreement with Luthra and Parvan (2010), that there is no association between family size and nutrient intake among South Asian preschool children.

When parental education levels were tested, it was found that father's education level had no statistically significant associated with the children's intakes, whereas the mother's education level was significantly associated to CHO, CHO as a percentage of energy intake, and NSP. A study by Chaudhury (1984) among preschool children in Bangladesh reported that the father's education has very little effect on the children's dietary intakes compared to mother's education level, which has a significant effect on children's intakes. The probable reason for this is that in South Asian custom, it is women who are responsible for food preparation in the household (Bush et al., 1997; Bush et al,, 1998; Simmons and Williams, 1997).

Norhayati et al. (1995) undertook a study of children aged 1 to 7 years old and noted that mother's education level was strongly associated with children's nutrient intakes. They found that educated mothers were more knowledgeable and concerned about the health and nutrition of their children. The current study found that the mother's nutritional knowledge was inversely related to preschool children's NMES intake, while the mother's weight status was directly associated with the intake of children's NMES. This may reflect mothers' awareness of the types of foods and snacks that they choose for their children.

The most interesting finding was that a number of mean nutrient intakes were affected by the South Asian sub-group (ethnicity) variable. This could be due to traditional family and cultural food patterns. South Asian sub-group dietary practices are mainly based on regional and religious differences (see section 1.3.1). Kassm-Khamis et al. (2000) note that there is variation in the fat and energy content of similar recipes amongst the diverse South Asian groups. This may explain the differences found within the three groups, as well as religious differences, in terms of the mean nutrient intakes of children in the current study. A previous study by Chaudhury (1984) found that the type of family preschool children live in can affect their nutrient intake. This study has been unable to demonstrate this association. However, caution should be taken when considering this result due to sample size distribution among the family type groups (nuclear family n=132, joint family n=28). Although income is an important variable that may affect children's nutrient intakes, in this study it was not included in the analysis since the researcher, during the recruitment, observed that information regarding household income was inaccurate. Some studies have found a relationship between household income and children's nutrient intakes (Norhayati et al., 1995; Ruxton et al., 1996). However, Johnson et al. (1994) reported that household income had no statistically significant association on children's intakes. Thus, it is important to mention that more studies need to be carried out to generalise the findings regarding South Asian children.

6.5 Key findings

- The prevalence of being overweight and obese among South Asian pre-school children varied when different BMI cut-offs (Indian and UK) were used.
- The prevalence of being overweight and obese among the NDNS children was 8% and 22% higher for boys and 23% and 17% higher for girls, respectively, than the South Asian children in the current study.
- The incidence of under-reporting in this study was 20% and it was greater among boys than girls.
- South Asian pre-school children in the current study had adequate intakes of most vitamins and minerals except energy intake, vitamin D, iron and zinc when compared with UK recommendations.
- Milk and milk products was the main food group that contributed towards energy, macronutrients and micronutrients among South Asian children.
- Some similarities and differences were found between the children from the NDNS, the new rolling programme (2008/2009), and children in the current study.
- Different factors can associated to South Asian pre-school children's dietary intake particularly ethnicity.

Chapter 7: Weaning habits and factors influencing food choice among South Asian mothers

7.1 Introduction

Weaning practices can be affected by parents' knowledge, cultural and religious beliefs, attitudes and resources (James and Underwood, 1997). Relatively little research been done to investigate what may influence South Asian mothers regarding the food choices and weaning practices for their children. In this study, an in-depth interview questionnaire was employed to seek more information and increase our knowledge in this area.

7.2 Aim

To identify and investigate factors influencing South Asian mothers' food choices and weaning practices concerning their children.

7.3 Results

7.3.1 The study participants: demographic and socio-economic characteristics

A total of thirty interviews were conducted with South Asian mothers aged between 22-39 years. The interviews finished at saturation (when no further themes or information were thought to be obtained). The sample comprised Indian, Pakistani and Bangladeshi mothers. The Bangladeshis had the highest average length of stay in the UK compared to Pakistanis and Indians. All Pakistanis and Bangladeshis were Muslims, whereas Indians were Hindu, except for one Indian mother who was Muslim. Bangladeshi households had the highest number of children, followed by Pakistanis, when compared to Indians. The majority of participants lived in a nuclear family. Indian mothers had the highest level of education, whereas most Pakistani and Bangladeshi mothers had a medium level of education (please refer to Chapter 2 for details on the classification education level). The majority of Pakistani and Bangladeshi participants were in families with an income of ≤ £20,000 (Table 7.1).

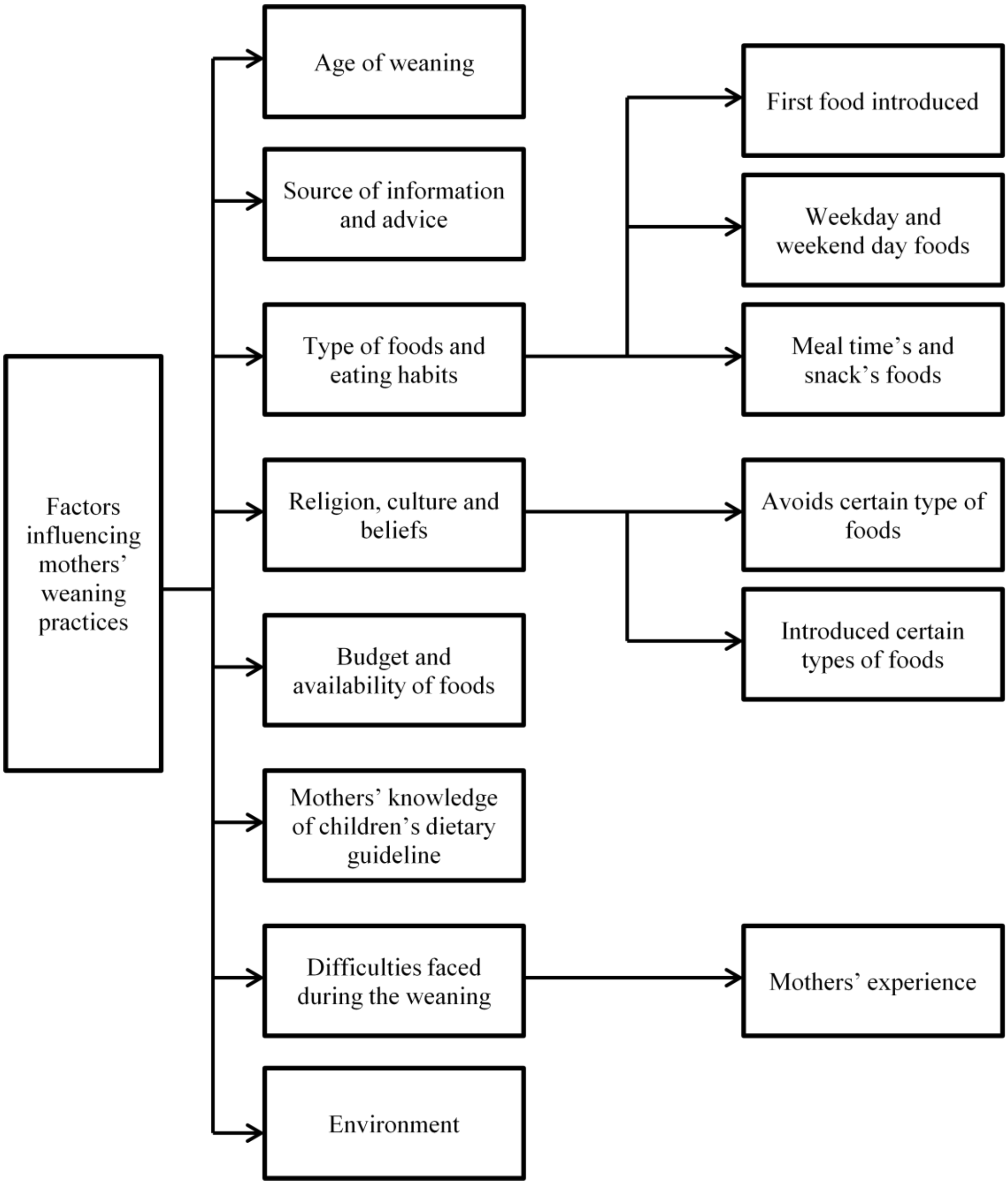
Table 7.1: Demographic information based on ethnic group

Characteristics	Indian n=10	Pakistani n=10	Bangladeshi n=10	Total n=30
Average age of mothers, yrs ±SD	35.6 ±2.0	27.8 ±3.8	33.2 ±2.7	32 ±4.2
Length of stay in the UK ±SD	9.7 ±10.2	19.4 ±8.8	29.0 ±9.4	19.3 ±12.1
Religion				
Muslim	1	10	10	21
Other	9	0	0	9
Number of children				
1 child	6	2	1	9
2 children	2	2	2	6
3 children	2	6	3	11
More than 3 children	0	0	4	4
Type of family				
Nuclear family	8	7	10	25
Joint family	2	3	0	5
Mother's education level				
Low	0	2	0	2
Medium	2	7	7	16
High	8	1	3	12
Household income				
≤ £20,000	4	9	8	21
£21,000-£40,000	6	0	2	8
≥ £41,000 above	0	1	0	1

7.3.2 Main findings

The evidence from the interviews suggested common themes regarding factors influencing South Asian mothers' weaning practices in the UK. These themes are presented in Figure 7.1.

Figure 7.1: Thematic map, showing eight main themes affecting South Asian mothers' weaning practices



7.3.2.1 Age of weaning

The analysis explored some similarities and differences among mothers in the South Asian sub-groups. This study found that generally, South Asian mothers, especially Bangladeshis, started weaning their children at the age of 6 months. However, few mothers (6 out of 30) mentioned that they started weaning their children around 3-4 months, particularly Pakistani mothers (3 out of 10), whereas late weaning was found to be more common among Indian children (5 out of 10), occurring at around 7-9 months. On this point, two mothers commented thus: “because the child strong enough to eat food at 9 months” (Indian mother, no.26); “8 months because it is family tradition” (Indian mother, no.17). Only one Pakistani mother reported very late weaning, at around 1 year old; she (the mother) stated “...mother’s milk is best for the child till 1 year” (Pakistani mother, no.6). Mothers in the study (18 out of 30) confirmed that introducing solid food at an early age (less than 6 months) was now becoming outdated among their community.

7.3.2.2 Source of information and advice

The majority of respondents, particularly Bangladeshi mothers (7 out of 10), reported that health visitors were the main source of information that they relied upon when starting to introduce solid foods to their children at around the age of 6 months. However, it was noted by the researcher that sometimes the pieces of advice given by health visitors conflicts with the beliefs and traditions of this community (an example will be given in the part on religion, culture and belief). In addition, other sources were mentioned such as “family tradition” (Indian mother, no.17) and also the mother’s experience. One of the mothers reported her “children getting teeth” (Indian mother, no.14), and another stated that her child did not settle after feeding: “…he used to be still hungry even after breastfeeding” (Bangladeshi mother, 12). Generally, the main reasons given for introducing solid foods were similar across South Asian sub-groups.

7.3.2.3 Type of foods introduced and eating habits

The majority of respondents mentioned introducing baby rice and boiled and mashed foods such as fruit and vegetables for their children as their first weaning foods. Nevertheless, differences were observed among South Asian sub-groups regarding the type of foods introduced to their babies.

- Indians: they were predominantly vegetarian and food such as chicken was mentioned by only 1 respondent, being introduced at a later age. Fish was not popular amongst Indians. Although 6 out of 10 respondents mentioned that they gave fish to their children, it was not very often (on an average 1-2 times a month). However, it was found that South Asian traditional foods were introduced to their children such as *dhal*, *Halva* (semolina pudding), rice pudding, *nachni*, grains and pulses. All these were mixed with *ghee* (clarified butter). Ready to eat baby foods were not common among Indian children. One mother commented "…we believed baby homemade food is more healthier" (Indian mother, no.17). Another mother described why she did not use ready to eat baby food; she (the mother) explained 'I believe what you prepare at home is the best. You know what ingredients you are using. I don't like sugar and salt in the food. …., there are preservatives in it" (Indian mother, no.19). "Just for emergency", another Indian mother (Indian mother, no.15) commented.
- Pakistanis: baby rice mixed with vegetable puree was popular among these children. Unlike Indian children, eggs, chicken, fish and red meat were introduced gradually to Pakistani children. However, one respondent mentioned not giving red meat as it is too heavy (Pakistani mother, no.8). Most of the Pakistani mothers (7 out of 10) reported that they served fish once a week to their children. Ready to eat baby foods were common among Pakistani children and one of the reasons given was "because it's easier" (Pakistani mother, no.24).
- Bangladeshis: the most popular foods introduced to Bangladeshi children were baby rice, boiled rice, rice pudding and custard. Fish was more often served among Bangladeshi children than Pakistanis and Indians. Bangladeshis served fish to their children on average more than 2 times a week. They served their regional fishes like *Rohu*, *Rui,* and *Gwal* (all considered oily fish). Similar to Pakistanis, ready to eat baby foods were common among Bangladeshi children. One of the mothers commented that "Bangladeshi mothers think readymade food is cool and modern" (Bangladeshi mother, no.1), and she explained that some mothers live with extended family and so they do not have time to make special food for their children.

When the respondents were asked about whether or not they served family meals to their children, all respondents stated that they did and confirmed that their children eat family meals just as the rest of the members of the family. Only 1 out of the 30 respondents (an Indian) reported that she excluded “salt and spice” from the meal which was served to the child. A higher proportion of Pakistani mothers (5 out of 10) reported that weekday meals were different to weekend day meals when compared to Indians (4 out of 10) and Bangladeshi mothers (3 out of 10). Mothers were asked to report the differences in the type of food served during weekdays and weekend days. Among all South Asian sub-groups, takeaway foods were popular during the weekend days. Indians reported that they made something special during the weekend (savoury traditional Indian food), such as *edli* (rice cakes), *dosa* (rice pancake) and *parathas* (Indian bread stuffed with potatoes or vegetables). Pakistanis and Bangladeshis cooked Asian foods which required ‘elaborate cooking’, such as biryanis and certain types of curries so that they could be enjoyed in the presence of the whole family.

The number of meals and snacks served to children was similar across all respondents, at 3 meals and 3-4 snacks. For breakfast, the majority of children from all South Asian groups had breakfast cereal and milk; Indians and Pakistanis reported that they added honey to the cereal. Eggs were eaten by Pakistani and Bangladeshi children. All South Asians had traditional Asian foods for lunch and dinner; however, few differences were found in terms of the type of foods served to children within the three groups. The staple food for Indians and Pakistanis was chapatti and a type of curry. Indians ate more vegetables and pulse curries, whereas among Pakistanis chicken, red meat and eggs were eaten. Rice was the staple food among Bangladeshis and fish curry was popular too, as mentioned above.

Regarding the type of foods offered as snacks, all groups reported that they gave their children fruit such as apples, bananas, pears and strawberries, and sometimes mangos, dates and kiwis. Biscuits, sweets, chocolates and crisps were also mentioned to a lesser extent.

7.3.2.4 Religion, culture and beliefs

This theme appeared quite strongly in the responses. All Indian mothers who were Hindus expressed their beliefs, religion and culture and how they influence their food choices for their children. Beef is prohibited as Hindus worship the cow. Pork was also excluded from their diet. Seven out of ten respondents avoided other types of meat, being vegetarian, and 3 out of 10 avoided eggs as well due to their religion. In addition, all Pakistani and Bangladeshi mothers confirmed that their religion had a strong influence on their food choices; they only eat halal meat and avoid pork, gelatine based foods and food containing alcohol. Moreover, they believe that they should follow their prophet's *sunnah* [21]. The researcher noted an intersecting example regarding this issue; one Pakistani mother (no.22) stated that she gave her children honey or a date when they were born as it is a *sunnah*.

To increase our general understanding of South Asian dietary practices amongst children, it was interesting to ask about food beliefs in the community (food fallacies). Each group were found to have different beliefs, as shown in Table 7.2.

Table 7.2. Food beliefs among South Asians

Indians	Pakistanis	Bangladeshis
Give the child milk and turmeric to prevent cold and coughs	Avoid water after eating melon	Avoid giving children bananas and eggs when they have a sore throat
Honey and ghee give strength to children	Avoid hot foods in summer like dry fruits and nuts	Avoid sour things when the child has a sore throat
Honey and ginger considered antibiotics for cold and cough	Avoid drinking yogurts (*lassi*) in winter as it gives body pain	Avoid eating pineapple and drinking milk as this may cause nausea
Do not eat fish and milk as it is thought this causes indigestion, leading to vomiting	Do not eat fish and milk as they cause increased pigmentation	Do not eat fish and milk, it cause pigmentation
Avoid mixing milk and orange as it may cause nausea	Avoid eating eggs in summer they cause diahorrea	Avoid eating fish and meat at the same time
		Avoid boiled eggs as they lead to constipation
		If you eat sour food then avoid water

Interestingly, some participants also gave examples of food fallacies regarding pregnancy and the post-pregnancy period. South Asian mothers believed that eating 'hot food' such as papaya, pineapple, mango, sesame, pickles and chilli should be avoided, as they lead to miscarriage. Indian mothers encourage the drinking of milk with saffron as they believe it is good for the baby's health. Another comment was

[21] Sunnah: one of the sources of Islamic law.

that "water with dill seeds help to get rid of paunch/belly after delivery and eat *laddos* made with dry fruits (also called 'katlu') and *ghee* makes women stronger after delivery" (Indian mother, no.19).

Pakistanis recommend women should drink milk with butter or *ghee* because it helps during labour. In addition, one of the mothers commented that "in our community, for 40 days after delivery the women should eat stuff with flour, almond and raisins it is called (*pinjiri*), because it is good for the child and women, their body gets recovered quickly" (Pakistani mother, no.8). Another mother explained that "eating (*chasko*) after the child is born good for cleaning women's internal organ; it is made from almonds, pistachios, ghee and semolina" (Pakistani mother, no.28). Also, they commented that lactating women should eat slowly to avoid indigestion for the child, and should not eat too much meat so that the child does not get a stomach ache.

Bangladeshi mothers believe that pregnant women should take sour things in the morning to avoid sickness (Bangladeshi mother, no.12). Another stated that they should avoid nuts during pregnancy as the "Baby may have nut allergy" (Bangladeshi mother, no.13). In addition, one said that after delivery of the baby, the mother should not eat meat for 6 weeks because of the belief that the uterus does not go back down and it damages the uterus (Bangladeshi mother, no.30)

7.3.2.5 Budget and availability of foods

Budget was not a major issue for Indians; only 3 out of 10 mentioned budget as a factor that influenced their food choices. This theme appeared more amongst Pakistani (5 out of 10) and strongly amongst Bangladeshi mothers (8 out of 10) using phrases such as 'defiantly' and ' it is a main issue'. A minority of participants (Bangladeshis 3 out of 10) indicated availability of food as a factor that influenced their weaning practices. They gave examples of limited availability of halal baby foods, hygienic halal meat and certain types of fish as limiting their food choices for their children. One mother pointed out that the availability of a hygienic butcher selling halal meat limited her food choice, stating "local butchers are different and it is not hygiene; in the city centre the butchers they are hygienic but are not halal" (Bangladeshi mother, no.9).

7.3.2.6 Mothers' knowledge of child dietary guidelines

Seven statements were introduced in question 4 to find out mothers' knowledge and views regarding child dietary guidelines. For the first four statements the overall responses were very positive. Mothers were knowledgeable about the guidelines and agreed with the statements. However, when the mothers were asked about the rest of the statements, numbers 5, 6, and 7, interesting findings were observed, as explained hereunder.

Statement 5: '*Children should be given cow's milk before the age of 1 year.'*

This statement was contrary to the guidelines. Surprisingly, Indian mothers were less knowledgeable regarding this issue. Only 4 out of 10 mothers disagreed with this statement. Respondents who agreed with giving children cow's milk before the age of 1 year cited reasons such as "breast milk not sufficient for the child" (Indian mother, no.18). One mother stated "we give cow milk from 6-8 months" (Indian mother, no.17). In addition, one mother considered cow's milk as healthy and light compared to buffalo milk, which is commonly used in India and has high fat content. The majority of Pakistani (80%) and Bangladeshi (90%) mothers were more knowledgeable and aware of the guideline that they should not introduce cow's milk before the age of 1 year. Different statements were given by them. Some referred to the fact that cow's milk does not have all the nutrients needed for the child's growth and explained that formula is better. One mother stated "…formula milk has more nutrients" (Pakistani mother, no.24). Another woman stated "the nutrients are more in breast milk" (Bangladeshi mother, 15). Yet another said "because health visitor said start after 1 year" (Pakistani mother, no.7), and one Bangladeshi mother commented that "cow milk cause allergies in early age" (Bangladeshi mother, no.4).

Statement 6: '*You should avoid giving honey to your child before 1 year'.*

In response to this question, most of the mothers disagreed with this statement. Only 2 out of 10 Indian mothers, 4 out of 10 Pakistani mothers, and 4 out of 10 Bangladeshi mothers agreed that honey is not advisable for children before 1 year. All mothers who gave honey to their children felt strongly that honey was 'good' for the child, healthy and that it has medicinal properties. For example, one stated that it "…prevent cold and coughs…" (Indian mother, no.26). One respondent mentioned that "honey relieves the pain when the child teething" (Pakistani mother, no.22).

They mentioned that they do not give it in mass amounts, just a little bit for its medicinal properties. In addition, they reported that honey is better than sugar and that it does not have any side effects on the child (Indian mother, no.16). Moreover, respondents also mentioned reasons like religion, family tradition and their mother-in-law's advice. Others who agreed with the statement gave the reason that it was their health visitor's advice.

Statement 7: '*Oily fish is not suitable for children aged 1 year.'*

The answers were controversial in this part and the responses to this question were poor. Some mothers did not answer the question because they were vegetarian (Indian). Others did not know the answer because they did not know the difference between oily fish and white fish. However, 9 out of 10 Bangladeshi mothers disagreed with the statement. The researcher noted that the majority of Bangladeshi mothers considered fish to be a staple food for their community. They reported that it is healthy for their children's bones. An interesting statement given by one mother was that "... rice, dhal and fish is staple. *River* fish is oily and culturally children are born or used to oily fish from start" (Bangladeshi mother, no.1).

In addition to question 4, questions 11, 14 and 17 were related to the mothers' nutritional knowledge.

Question 14: Awareness of '5 a day of fruits and vegetables.'

The majority of South Asian mothers were aware of the need to eat '5 a day' and they tried to achieve this goal. However, some respondents could not achieve it and felt it difficult particularly Bangladeshi (8 out of 10) and Pakistani (5 out of 10) mothers, given that children have small appetites and can be fussy. One Bangladeshi mother (no.1) mentioned "one of my English colleague, her child 2½ years old and he eats more than 5 a day, but I personally feel it is not possible. They are small; they have small stomach, so if we give 5 portions of fruits and vegetables they will not have enough space for other types of foods…." On the other hand, a Pakistani mother (no.29) stated "…it is easy to achieve fruit but not vegetables because she does not like vegetables." On the other hand, interestingly one of the respondents explain how she achieved the '5 a day' rule for her child, stating that they "have fresh orange juice, then on the way to nursery a piece of fruit. At the nursery they have fruit as well. In the evening they have vegetable and lentils, so it is achievable"

(Indian mothers, no.25). It was noted by the researcher that Indian mothers (7 out of 10) found it more easy to achieve the '5 a day' rule as they offered fruit to their children and curries that were made with vegetables or lentils.

When mothers were asked for their opinion on what were healthy foods and what a balanced diet is, the words 'different' and 'variety' appeared strongly. The majority of South Asian mothers explained well their perceptions regarding a balanced diet and gave some examples of what foods they considered to be healthy and unhealthy. One Indian mother stated that a "Balance diet is where you have varied amount of food, different foods at different time" (Indian mother, no. 25). A Pakistani mother stated that a "Balance diet is getting a bit of everything, less of sweet and more of fruits and vegetables" (Pakistani mother, no.22). One Bangladeshi mother mentioned it was "Getting variety of foods like vegetables, and meat, and some sugar and fat, and have portion control as well" (Bangladeshi mother, 13).

All Asian mothers considered fruit, vegetables and South Asian cuisine such as chapatti and *dhal* as healthy foods, and considered takeaway food, food with too much sugar/salt and fizzy drinks as unhealthy foods for their children.

7.3.2.7 Difficulties of weaning

Some mothers spoke about the difficulties that they faced when starting to give solid foods to their children. Four out of ten Indian mothers, four out ten Pakistani mothers, and six out of ten Bangladeshi mothers had faced similar problems with their children. They reported difficulties such as the child not chewing properly and not liking the texture of the food. One mother spoke about her experience when she exposed new foods to her child. She (Pakistani mother, no.8) explained thus: "I started with baby foods, which were sweet, then he not eat anything else. When I gave him some home food, I used to give him chapatti with banana, mix the sweet and the sour together".

In addition, the researcher asked the mothers how they were able to tell if their children were eating well. Most of the mothers commented that they were happy, playing happily, growing and that the child was eating what was being served. Another comment from a Pakistani mother (no.10) about her experience was as follows: "I have 3 different experiences and I know what is best for my child". Furthermore, the mothers gave some examples which illustrated why their children sometimes refused to eat well, including the child being poorly/unwell, the child wanting to play, the child not liking the food served, and the food being spicy.

7.3.2.8 Environment

At the end of the interviews all mothers were welcomed to add anything about their community's dietary habits or any factors they felt may affect their dietary practices or food choices that the researcher had not covered with the interviewee. The majority of mothers were happy to participate in this part and some of them gave their own comments. Some mothers stated that the environment affects their food choices. One Bangladeshi mother (no.4) stated "…it lot about where you have brought up your children, like my mother, brought all of us in this country. So we followed the British tradition. If children brought up in Bangladesh their traditions are quite different". Another mother commented that "in our country women not allowed to go out by themselves. They are to be accompanied by their brother or father. So sometimes this may affect the food choices" (Bangladeshi mother, no.4). One Bangladeshi mother (no.11) emphasised that the Bangladeshi diet is healthy and their lifestyle in Bangladesh is much healthier than their lifestyle in the UK. She commented thus: "the soupy type of curries, not much oil, the vegetables are fresh, the fish is fresh, rice is grown and all is natural and not tampered. Also, you work in the fields. Here we eat more meat and not much exercise, children do not go out much often because of the climate".

7.4 Discussion

7.4.1 Selection of in-depth interview method

The qualitative technique of focus group interviewing is quite a successful method and widely used in health and nutrition research to understand and explain the complexity surrounding factors that may influence food choices and dietary and lifestyle behaviours (Rabiee, 2004). However, in this study, individual in-depth interviews were used as a research technique, since the researcher encountered certain difficulties in gaining access to the participants on a specific day and at a particular time. The participants preferred the researcher to come to their houses, citing the reasons that they were unable to leave their children home alone without any supervision and a lack of time due to other household responsibilities. Although meeting mothers individually is time consuming, the researcher's experience with

South Asian mothers, gained during the first part of the research, was used to predict that this method would give more privacy to the participants during the discussion and prevent the risk of others influencing the participants' views. In addition, it would allow the researcher to obtain information on individual and personal experiences without causing any embarrassment to the participants. Moreover, it allowed the researcher to observe some facts that cannot be known by using other type of methods. For instance, the researcher observed the authority of the mother in-law on mother's views regarding food choices and dietary habits. In addition, it was also observed that some South Asians underreported their yearly income in the questionnaire. This means that the answers given in the questionnaire may not truly reflects the socioeconomic status of the participants.

7.4.2 Main findings

Despite being a small-scale study, this exploratory study of mothers' views on their weaning practices and what may affect their food choices for their children provides interesting information that enriches the existing literature in this field. Some findings were contrary to those of the reviewed studies and others confirmed what had been investigated earlier. Although some similarities were found between South Asian sub-groups regarding their weaning practices and food choices, differences were observed as well. In the current study it was found that the age when solid foods were introduced to the child was different between groups. In a survey of 'Infant feeding in Asian families' by Thomas and Avery (1997) it was noted that 90% of all South Asian groups had started weaning their children by 4 months of age. However, in the current study it was found that some Indian and Pakistani mothers and the majority of Bangladeshi mothers chose the right time to wean their children to be around 6 month, and this was in line with their health visitor's advice. This finding is in agreement with Harris et al. (1983) whose findings showed that although the age of weaning among the Bangladeshi community was between 2 months and 2 years, generally Bangladeshi mothers started weaning their children at 6 months of age. Similar to other studies, which are summarised in Table 1.4 of Chapter 1, late weaning occurs in some cases, particularly among Indian mothers, and also weaning that is earlier than recommended, especially among Pakistani mothers. Therefore, Indian and Pakistani mothers need to be informed about the correct age of weaning since both early and late weaning cause health implications that may affect the child in his/her current and later life, as mentioned in the literature review of Chapter 1.

Different sources of advice were found to be used by South Asian mothers regarding pregnancy and weaning practices. These included health visitors, family, traditions, and the mother’s experience. This finding was in agreement with Sarwar (2002) and Ahmad et al. (2012) to a certain degree; however, they found that South Asian mothers did not rely on scientific sources for dietary advice during pregnancy and while rising children. In this study it was found that South Asian mothers appreciated advice from health visitors, although weaning practices and food choices appeared to be influenced by their religion, culture and beliefs. It was found that some advice given by health visitors contradicted the advice given by family or religion, culture and beliefs and this may cause confusion for the mothers. For example, although some participants were aware that feeding honey to babies before the age of 1 year is not recommended by health visitors, this practice is part of their culture or religion. This conflicts with the recommendation of the Food Standard Agency to not feed children below 1 year of age honey because it may contain botulism bacteria which babies’ guts are not sufficiently developed enough to fight at such an early stage of life and it may cause serious illness (FSA, 2010c).

The majority of South Asians in the current study were particularly religious and religious orientation had a strong influence on their food choices and dietary practices. For example, Indians, as Hindus, were found to avoid eggs, beef and other types of meat; and Muslims avoided non-halal meat and pork, gelatine based foods and food containing alcohol. These findings were also made in other studies (Sheikh and Thomas, 1994; Kassam-Khamis, 1996; Hakeem, 1997; The South Asian Public Health Association, 2002). Another example raised during the interviews which illustrates how culture and beliefs can influence the dietary practices of pregnant mothers and mothers of new babies in the South Asian community is that some South Asian mothers still believe in the concept of ‘hot’ and ‘cold’ foods. From the results it was found that South Asian pregnant women were not allowed to eat ‘hot’ foods such as papaya, mango, pineapple and chillies because it was thought it may lead to miscarriage. This finding corroborates the results of Caplan (1997), who noted that South Asian pregnant women avoid ‘hot’ foods since they consider pregnancy to be a ‘hot’ condition. In addition, there are similarities between the results of the current study and those expressed by Ingram et al. (2003) and Laroia and Sharma (2006). It was found that Pakistani women believe that foods made with flour, almond, dried fruit, *ghee* and semolina such as *punjiri* are recommended because it helps the body recover quickly after delivery. Surprisingly, many beliefs and myths were found to be deeply rooted among South Asian mothers and need to be replaced by scientific advice and messages. Thus health advice, when given to this community, should take into account religion, customs, culture and beliefs. This finding supports previous research carried out by Skinner et al. (2008) involving the South Asian community which found that weaning advice among South Asians should take into consideration traditional customs so as ensure good nutritional practices are disseminated among them.

Consistent with previous research involving Pakistani mothers (Sarwar, 2002), several South Asian mothers in the current study reported that the first foods introduced to their children were baby rice and mashed fruit or vegetables. This was recently supported by Ahmad et al. (2012). This finding follows the recommendations by COMA on weaning diet (Lilly, 1995) which noted that the most suitable first weaning foods are non-wheat cereal such as rice and pureed fruit, vegetables and potatoes. Although it was found that South Asian mothers introduced some solid foods to their children at the right time, they still mainly relied on milk as the main food source for their children (Chapter 4 and 5). This finding was confirmed previously by Harbottle and Duggan (1992). Furthermore, from the interviews it was noted that some mothers introduced cow's milk to their children at an early age of between 3-8 months. This result corroborates the findings of previous work carried out by Sarwar (2002), who reported a similar finding. Ziegler (2006) explained the adverse effects of cow's milk; children under 1 year who are fed cow's milk do not get enough iron due to the low iron content in cow's milk. Calcium and casein inhibit the absorption of non-heme iron from foods. In addition, they receive more protein and minerals such as Na and K than they need. Moreover, the type of protein in cow's milk is difficult to digest and be absorbed in children's systems and this may cause intestinal blood loss. Ziegler estimated that blood loss in the gastrointestinal system occurred in around 40% of infants when they were fed on cow's milk. A study by Lawson et al. (1998) found that there was a high prevalence of iron deficiency among South Asian babies due to the introduction of cow's milk to babies at an early age. This practice contradicts the recommendation of COMA not to introduce cow's milk before the age of 1 year (Lilly, 1995).

The results regarding the type of food consumed by each South Asian sub-group were similar to what was found earlier in the literature review of Chapter 1. *Ready to eat* baby food was common among Pakistani and Bangladeshi mothers, but Indian mothers preferred homemade foods as they were concerned about the ingredients used in the *ready to eat* baby foods. Again, religion appeared to influence this behaviour. Although Pakistani and Bangladeshi mothers were found to use *ready to eat* baby foods, they were keen to choose halal baby foods. Some mothers reported that the variety of halal baby food was minimal and this reduced their food choices. This finding is in agreement with Sarwar's (2002) findings, which showed similar concerns among South Asian mothers. Other factors mentioned by some South Asian mothers which influence their food choices included budget and availability of certain traditional foods. Douglas (1993) reported that South Asian foods have become more widely available in the UK but are still expensive due to importation costs. In the current study, budget was not a major issue among Indians. However, it seemed to be more of an issue among some Bangladeshi and Pakistani mothers. This may be because they have lower affluence levels than Indians. Generally speaking, in this study food choices of South Asians were not strongly influenced by availability or cost. These results are consistent with those of Landman and Wyke (1995) in a survey of South Asians in Central Scotland.

The results also showed that mothers' nutritional knowledge may affect their weaning practices. In fact there is an overlap between participants' dietary knowledge and their beliefs, culture and religion. For instance, it was found that Indian mothers, although highly educated, were not aware of the difference between white fish and oily fish due to them being vegetarians as Hindus are not consuming a lot of fish. On the other hand, Bangladeshi mothers were found to be less well educated than Indians but they were aware of the differences between the two types of fish. This can be explained by the fact that fish is a very important part of the traditional Bangladeshi diet (Kassam-Khamis, 1996). It was apparent from the interviews that Bangladeshi mothers believed that oily fish is healthy due to their culture. Furthermore, when South Asian mothers were asked about their awareness of the '5 a day fruit and vegetables' rule, the majority of South Asian mothers were aware of it. However, not all respondents were able to achieve this goal. Interestingly, it was noted that for Indian mothers it was easy to achieve the ‘5 a day rule’ with their children, as opposed to Pakistani and Bangladeshi mothers. This might be related to their religion as Hindus are vegetarians. As a result, it is likely that Indian parents eat more fruit and vegetables than Pakistanis and Bangladeshis. Cooke et al. (2003) found that there was a positive correlation between parents’ and children’s consumption of fruit and vegetables. This, in turn, means that Indian children are more likely to eat fruit and vegetables as they are widely consumed by their parents. Another possible explanation for this is that the Indian mothers were highly educated. In previous studies by Laitinen et al. (1995) and Gibson et al. (1998) it was observed that there was a positive relationship between maternal education level and fruit consumption. Moreover, Cooke et al. (2003) found a similar relationship with vegetable consumption.

In this study, although the education level of Indian mothers was higher than that of Pakistani and Bangladeshi mothers, it was found that Bangladeshi mothers, followed by Pakistani mothers, were more knowledgeable regarding the UK dietary guidelines than Indians. A possible explanation for this might be that the length of stay in the UK was longer among Bangladeshis compared to Pakistanis and Indians. This study also found that South Asian mothers encountered certain difficulties during weaning, particularly the child rejecting food due to its texture. Generally, weaning is a multistage process in which many difficulties can be encountered. Thomas and Bishop (2007) explain that the rejection of new food by the child is normal during this period and advise that new food should be offered more than once. Similar to Leung and Stanner (2011), it was found in the current study that the dietary habits of these groups can be affected by various factors, such as socio-economic status (including income and education level), religion, and food beliefs.

7.5 Key findings

- South Asian mothers, especially Bangladeshi mothers, introduced solid foods at the right age of around 6 months.
- Late weaning occurred in some cases among Indian mothers and it was earlier than recommended in some cases among Pakistani mothers.

- South Asian mothers are aware and understand health visitors' advice regarding weaning practices, a number of them still follow family advice which is influenced by their religion, customs, culture and beliefs.
- South Asians were not influenced by cost and availability of foods; it was of great concern to Bangladeshi but less amongst Pakistani and not Indian mothers.
- Bangladeshi mothers were more knowledgeable regarding the UK guidelines than Indian and Pakistani mothers despite having lower educational level.
- South Asian mothers were aware of '5 a day' rule for fruits and vegetables. Bangladeshi and Pakistani mothers found this hard to achieve, however, Indian mothers did not.

Chapter 8: General discussion and future research

8.1 Introduction

There is a growing consensus that childhood is the time when dietary habits are formed which are very likely to continue into adulthood and the emphasis in this study was on preschool South Asian children. The principle aim of the current study was to *assess the dietary habits and nutrient intake of preschool South Asian children (1-3 years) living in the UK.* The study achieved its principle aim gradually, as documented in the different chapters. This study, for the first time, produced novel and valuable dietary information on preschool South Asian children living in the UK, and expanded research skills for discovering the nutritional status of ethnic minority groups. Various challenges were faced during the research, as will be discussed shortly.

Specifically, this thesis has achieved the following:

- Highlighted important practical implications which can help other researchers to recruit participants and avoid dropout in future studies among minority groups (such as South Asians).
- Explored differences in preschool children's dietary habits, sleeping habits and mothers' nutritional knowledge among different ethnic groups including South Asians, Black Africans and White children living in the UK through a structured questionnaire developed by the researcher (Chapter 3).
- Developed food photographic booklet of foods commonly consumed by preschool South Asian children in the UK which was used as a complementary tool to enhance the estimation of food portion sizes during the dietary data collection (Chapter 4).
- Investigated the most commonly consumed foods by preschool South Asian children and unique data on typical portion sizes of these foods which can be used to developed a useful assessment tool (Chapter 5).
- Assessed the average nutrient intake of preschool South Asian children from food sources using 24-hour MPRs. This provided a clear picture of children's dietary status which can be used for the development of strategies to prevent nutritional related diseases at an early stage (Chapter 6).

In addition, this study, in agreement with other studies, has identified the factors that affect South Asians mothers' weaning practices (Chapter 7).

8.2 Recruitment

Since the study was conducted among an immigrant group (South Asians), this required adaptations not only to the assessment tools, but also the sampling frame and recruitment technique as well. South Asians are a heterogeneous group and this diversity makes it difficult to recruit participants. Therefore, to recruit people 'door to door' and 'snowball' sampling techniques were used as they are recommended to be the best techniques to recruit people from ethnic minority groups. Experience gained from this study suggests important practical implications which can help other researchers to recruit participants from within this community. It was found that word-of-mouth and involvement of an active member of the community are essential to encourage study participation among South Asians. In addition, fears regarding immigration status mean that participants need a guarantee from the researcher that there is no link between the study and the local authority or Home Office. Moreover, it was found that due to cultural reasons, mothers-in-law and husbands had a great influence on the agreement of mothers to participate in the study; mothers needed to have permission from their husbands or sometimes their mothers-in-law to participate in the study.

Although the use of random sample selection is important to minimise any selection bias that may occur during statistical analysis, this did not apply to the current study due to the nature of the target group, its diversity, the timescale, the research resources, and the fact that there was only a single researcher trying to recruit participants. Therefore, a convenience sample was used. However, to ensure that the sample in the study represented the target group, socio-demographic characteristics were used as indicators to identify how representative the sample was. South Asians that participated in this study were similar to those found nationally (Census, 2001). An issue that was not addressed in this study was whether having a mixed ethnic background, specifically half Caucasian and half South Asian, influenced the child's diet. The current study only focussed on children whose both parents were South Asians and only included a minuscule number (n=2) of children of 'mixed' ethnic background. Another source of weakness in this study was the exclusion of non-English speaking participants from the sample; there were participants who were willing to participate but they could not be included due to language barriers. Due to the limited funds available for the current study it was not possible to provide a translator.

8.3 Dietary assessment tools

It was necessary to accurately assess dietary intake. Different methods are now in use to assess children's diets. Weighed food recording is assumed to be the 'gold standard' method of dietary assessment. It has been used in the UK in the NDNS, by Gregory et al. (1995), and by Gregory et al. (2000). However, it could not be applied to the South Asian community. The most appropriate method depends on various factors. For this study there was a need for a method which did not require participant literacy or a large amount of time, so as to respect South Asians mothers' responsibilities. Moreover, the fact that South Asians are a diverse group, having a wide variety of foods and dietary habits due to regional and religious differences, was taken into account. The choice of using 24-hour MPRs as a type of in-depth dietary interview strengthened the results of this research. An implication of this is the possibility that 24-hour MPRs can be considered a 'gold standard' method for use among ethnic minority groups. All interviews took place in the participants' own homes. Although the process was difficult, the methodology presented a number of advantages. It was convenient for the participants to be interviewed at home, which increased participation rates. In addition, it caused the researcher to be in direct contact with mothers, which allowed the gathering of unlimited levels of specific information regarding children's dietary habits, food preparation methods and food recipes, as well as detailed information on quantification of food portion sizes. The latter was considered to be a source of error in all dietary surveys. The researcher in this study used household measurements to quantify food portion sizes. The interviews conducted at participants' houses allowed easy access to participants' kitchens to see first-hand the servings and children's utensils, and check the actual portions on food labels of certain food items eaten by children. In addition, to enhance food portion size estimation the newly developed food photographs were used as well (further details on the newly developed food photographs will be discussed shortly).

Although 24-hour MPRs were a successful tool when employed with South Asian mothers in this study, the researcher still encountered certain difficulties. One of these difficulties was that mothers sometimes forgot what their child had eaten the day before, or the amount of food consumed. This is well-known as a major limitation of the 24-hour recall method, since participants rely on their memory to recall foods eaten and food portion sizes. Therefore, the researcher had to ask questions in a manner designed to facilitate the participant's ability to recall what her child had eaten. Another obstacle that was encountered was a lack of participant motivation during the interviews, which led to incomplete and inaccurate information being given by some mothers, particularly in the second and third interviews. For instance, some mothers stated "my child eats similar food every day, so it is similar to what I told you before". To tackle this issue the researcher tried to spend time explaining the purpose of the research. In addition, the researcher tried creating a friendly atmosphere before starting the interview, respecting the mother's right to change the day of the interview due to her responsibilities or her being tired. Furthermore, it was important to express appreciation for their effort and time spent participating in the study and so a modest gift was provided in the form of a gift voucher for a toy shop or a local supermarket. Moreover, dietary advice based on guidelines was provided if requested and information on the nutrient intake of the child was given after analysis if needed.

8.3.1 Development of food photographs

Visual aids such as food photographs are commonly used in dietary surveys to enhance the estimation of food portion sizes. However, the portion size assessment aid should be suitable for the target group under investigation. In this study, a review of the literature showed that ethnic-specific-food photographs for South Asian pre-school children in the UK were nonexistent. Therefore, the present study aimed to develop a food photograph booklet that was appropriate for the target group to be used as a complementary tool to enhance the estimation of reported portion sizes during data collection in the field (Chapter 4). Although the ability to estimate portion sizes using food photographs was examined and it was shown that it was an easy task for South Asian mothers, some difficulties that were encountered limited the validity of the tool. It was difficult to find and motivate participants to come to the university to validate the food photographs. Participants were unwilling to come to the university for several reasons, such as a lack of time, travel costs and unfamiliarity with the university. In addition, taking into account the timescale of the research and the availability of resources, the validation focused only on perception. Perception involves a subject's ability to relate an amount of food which is present in reality to an amount depicted in a photograph to validate the food photographs developed (Nelson et al., 1994, 1996). The study achieved a high percentage of correct estimations, at 82.7% of South Asian mothers, although a small trend of underestimation and overestimation of some types of food was observed. In the current study the use of the food photographs booklet was limited. It was used as a complementary tool with the household measurements to ease and enhance the estimation of food portion sizes among South Asian mothers. Moreover, it was used by the researcher to become familiar with traditional South Asian food during the fieldwork. The findings of this study suggest that food photographs were useful and could be used as a valuable tool for estimation of portion sizes during the assessment of dietary intake. However, further investigation is needed to improve the validity of the photographs. Experience gained from this part of the study, in addition to the average portion sizes of the most commonly consumed obtained from the 24-hour MPRs, can be the starting point for development of a photographic food booklet containing ethnic foods consumed by preschool children in the UK. It is necessary to cover both conceptualization and memory during the validity of the tool, as these are considered to be skills involved in the estimation of food portion sizes, as mentioned in the literature review in Chapter 1, section 1.1.12.1.

8.3.2 Food composition database

Reliable data on food composition is fundamental for the assessment of dietary intakes. The current food composition database in the UK does not include all the South Asian foods consumed by South Asians, which limited the data analysis. It is important to recognise the limitations to obtaining accurate dietary evaluation. In this regards, in the current study in order to transfer the dietary information of South Asian children into quantifiable nutrients the researcher used WinDiet software, which includes the UK database McCance and Widdoson's 6th edition and all currently available supplements. In addition, the researcher expanded the food composition database with the latest available data on South Asian foods generated by the Food Standard Agency and European Food Information Resource Network, making the current study unique in terms of its results. However, some key nutrients were still not measured for certain types of food which appeared to be consumed by South Asian children during the data collection and so need to be analysed; they include *chicken bryani*, *idli, soji* and *poha*. To fill the gap in the present study regarding certain types of traditional foods, food packing, Indian (Gopalan et al., 2007) and USDA database, recipe calculation were used.

8.3.3 Food habits and dietary intakes

The findings of the current study indicate that the South Asian community living in the UK has adopted some Western eating habits due to urbanization and migration which has put them in direct contact with Western culture during their daily lives. However, they do differ in their dietary practises compared to a non-ethnic local population. They are still attached to their customs, family traditions, beliefs and dietary laws of their religion, all of which have a clear impact on their children's eating habits and lifestyle. The results suggested that South Asian children had a mixed diet of traditional and Western foods. Traditional foods were mainly consumed at the evening meal when all the family members meet together, and sometimes they were offered at lunch time. It was notable that South Asians have retained their staple traditional foods such as chapatti and rice, as well as introduced new foods from the host culture such as processed foods, examples being ready-to-eat baby food, fish fingers and processed cheese. The results point to the fact that for most South Asian mothers, milk is a core and dominant food in their children's diet, followed by traditional vegetable dishes such as dhal and vegetable curries, rather than foods from animal sources, particularly red meat and fish. Animal source foods such as red meat and fish are an excellent source of micronutrients, including Fe, Zn, and vitamin D. This is one of the major differences between South Asian children and children from a non-ethnic local population. Furthermore, the effect of religion was obvious among South Asian children. Meat, such as chicken curry, was more frequency consumed by Muslims than Hindus or Sikhs, since Hindu and some Sikh families are vegetarian. It was found that each group of South Asians avoided some types of food depending on the dietary laws of their religion. Although mothers who have given birth to their children in this country have the opportunity to take advantage of the advice offered by health visitors regarding their children's health and weaning practices, it was noted that a number of South Asian mothers still followed family advice, even though they were aware of and understood their health visitor's advice. For example, it was found that all South Asian mothers introduced honey and cow's milk to their children's diet at an early age yet they were aware of the advice of health visitors to avoid giving honey or cow's milk to children under 1 year old. These examples illustrate the extent of the impact of culture and religion on their children's dietary habits.

Turning to South Asian children in their home country, Sarwar (2002) made a direct comparison between the infant feeding and weaning practices of mothers from the same cultural background living in two different countries (Mian Channu in Pakistan and Nottingham in the UK). It was found that there were differences between mothers in the two countries in feeding practices related to breast and bottle-feeding. Bottle-feeding was practised more in England. However, mothers apparently followed the same weaning practices in both groups. Foods regularly provided to children were rice, eggs, fruit and vegetables, as well as traditional family food. However, children in England were offered more meat and convenience foods. In addition, cow's milk had been provided to children before the age of 1 year in both countries. Sarwar (2002) recommended that mothers in both countries be given more advice regarding weaning practices.

Dietary intakes

The results from this study showed that South Asian children are vulnerable to becoming deficient in certain micronutrients it was shown that South Asian children's mean intake of vitamin D, iron, and zinc were below the reference nutrient intakes (RNI) in the UK. A number of possible explanations were discussed previously in Chapters 5, 6 and 7, particularly incorrect dietary practices among South Asian mothers which were noted by this study and briefly highlighted above. Those dietary habits have been well-documented previously to have a negative effect on certain nutrient intakes, such as iron and zinc and vitamin D (Mills, 1990; Kim et al., 1996; Lawson et al., 1998; Male et al., 2001). Another possible explanation for the inadequate intake of these nutrients is the introduction of solid foods later than the recommended age in some cases among South Asian children, particularly among Indians. In addition, in all cases it was found that most mothers provided vegetable and legume based food more than meat based food to their children, believing that meat is a 'heavy food' for their children. Although it is good practice to offer and eat vegetables, it is possible that the cooking practices of South Asians may affect the nutrient content of these foods. Prolonged cooking (Begum, 1979; Abraham, 1982) and reheating the remains of curries to consume the following day (Kalka, 1988) are common practices among South Asians and this may affect the nutrient composition of the food and decrease the health benefit to the children's diet. Furthermore, it was found that the bioavailability of iron and zinc can be affected by certain dietary practices. For instance, one of the most commonly consumed beverages among South Asian preschool children was found to be Asian tea and one of the most commonly consumed foods was chapatti. As mentioned in the literature review, both of these food items have an inhibitory effect on non-haem iron absorption due to the tannic acid (tea) and phytates content (chapatti). The main food source of iron in South Asian children's diets found in this study was cereal and cereal products, which is non-haem iron..

The current study raised some interesting questions that need to be answered, leading to the provision of fertile ground for future studies. Ethnic variation in body composition makes comparison complicated when trying to detect the prevalence of being overweight and obesity among South Asian and White children. The study found that South Asian preschool children have a lower rate of being overweight and obese than White children when UK BMI cut-offs (Cole et al., 1995) were applied. However, using lower BMI cut-offs suggested by Khadilkar and Khadilkar (2011) the results were different (Chapter 6). This suggests that the use of UK cut-offs may have underestimated the prevalence of being overweight and obesity among South Asian children. Thus, the results raised an important question: which cut-offs are most suitable for use in detecting obesity-related risk factors among South Asian children in the UK? Again it was interesting to observe that comparison of South Asian children's nutrient intake with various recommended nutrient parameters, including those from the UK (Department of Health, 1991), India (Indian Council for Medical Research, 2009), and the WHO (FAO/WHO, 1998), revealed some differences (Chapter 6). Therefore, one may ask whether is it better to apply the food intake recommendations for the host country to a migrant people, since they have adopted a new dietary pattern due to their migration which has led to nutritional transition in their daily life, or whether it is better to apply the food intake recommendations of migrant's home country, due to the physiological needs related to their anthropometric and genetic characteristics. There is also a need to make efforts to include a sufficient number of ethnic minority groups in the NDNS in order to examine their diet.

The current study only provides an outline and not the true level of the dietary habits, sleeping habits and mothers' nutritional knowledge among South Asian, White and black African children, therefore generalisation of the results is not possible. Overall, there were some differences between the children regarding their dietary habits and lifestyle, all of which were covered in Chapter 3. In addition, it was found that the level of South Asian mothers' nutritional knowledge was poor according to scale by Turconi et al., 2008. It was notable that most of the questions that most South Asian mothers answered incorrectly were related to their dietary practices, where the impact of their beliefs, culture, family and personal experiences on their nutritional knowledge was clear. However, the questions that arises is poor nutritional score was the result of mothers not using health resources and information that are available to them due to their culture, beliefs or language barriers, or is it the result of health experts who deliver the health messages to South Asian mothers giving them general health advice that does not consider their unique needs and beliefs? Further investigation is needed to cover these issues.

Although the researcher took many precautions to obtain accurate information from the participants, whether it was personal information or regarding foods consumed and their portion sizes, during the data collection and analysis, some methodological limitations may have occurred. The researcher, during the recruitment, observed that the information regarding annual household income was collected inaccurately; it was observed that South Asians underreported their yearly income in the questionnaire. This means that the answers given in the questionnaire may not truly reflect the socioeconomic status of the participants. Therefore, it was excluded from the analysis. However, income is an important factor that may be associated with children's nutrient intake and it therefore needs to be covered using different types of questions similar to those used by Nelson et al., 2007 in the low income diet and nutrition survey such as questions about receipt of benefits (if applicable to low income group), car ownership and employment status which may gives an overview of South Asian's yearly income. With regards to food portion sizes, although comparison between children in the current study and those included in the study of

Wrieden et al. (2008) took place, one important issue limited the comparability, namely the differences in the assessment methodology used in both studies. However, this could not be avoided because no similar studies have been carried out on South Asian children, as far as the researcher is aware. Another limitation that was observed in this study was that of under-reporting of children's food intake by their mothers. In fact, under-reporting of food intake is a documented phenomenon in many dietary studies and it was only 20% in the current study. Another limitation that should be acknowledged in this study is that the contribution of breast milk in some cases may be underestimated or overestimated due to the method used to impute breast milk intake, based on the duration of each breastfeeding period. This assumption has been used previously by other studies (Paul et al., 1988; Mills and Tyler, 1992). Another area that has been neglected in this study is to identify the effect of seasonality on children's food consumption.

Despite the limitations of the current study, findings consistent with those of other studies of the South Asian community were made.

8.4 **Significance of thesis**

This is the first time that the food intake of South Asian children (1-3 years) living in the UK has been assessed, and the results indicate that certain feeding practices lead to insufficiencies in iron, Zn and vitamin D intake. If these practices are not addressed or corrected, a significant proportion of these children will suffer from chronic diseases that will reduce their life-expectations and quality of life.

The current study clearly demonstrates that South Asian mothers' dietary practices are heavily influenced by religion and culture, and go against government recommendations. This indicates that current dietary advice given by health professionals is unsuitable for this group. A better approach would be to deliver tailored information via respected members of the community, using examples suitable for their culture and beliefs.

8.5 **Recommendations for future work**

- Although this study has presented valuable descriptive data and some interesting results on dietary habits, nutrient intake, food portion sizes and food practices among preschool South Asian children in the UK, generalisation of the results is limited and there is a need to confirm the results through a larger study. It would be useful to conduct further research with a larger sample size of diverse groups of South Asian children from different areas of the country so as to obtain prospective data and generalise the findings where possible. However, caution must be taken when generalisations are made among South Asians due to their regional and religious diversity.

- To strengthen the current South Asian food photographs booklet, it is recommended to re-develop the photographic food portion sizes based on the established portions obtained from this study as a starting point, since no published data exists on portion sizes of commonly consumed foods by preschool South Asian children in the UK. There is also a need to validate them with a representative sample size of South Asians, benefitting from the awareness of the limitations that occurred during the development and validation phase in this study. For instance, there is a need to choose more than one portion of food to be validated, considering not only perception but also conceptualization and memory. Furthermore, in order to improve the estimation of food portion sizes among South Asian preschool children, it would also be useful to focus on the leftovers as well.
- Longitudinal and prospective cohort studies are needed to better understand the level of acculturation among South Asian children in the UK and to assess their dietary patterns and health consequences.
- It is recommended to use biochemical markers of nutritional intake and status such as DLW, blood or urine serum tests since they can be measured with high accuracy and objectivity without reliance on information being given by the participants. This will help estimate the prevalence of inadequate intake of specific nutrients, such as iron or vitamin D, to develop appropriate dietary recommendations for South Asian children that suit their needs.
- It is important to examine food behaviours and environments which can influence children's food consumption in order to help to identify a suitable approach not only to deliver dietary messages to South Asian mothers, but also to help mothers to translate those messages into actions in their daily lives so that they modify their children's diets to meet their children's needs, whilst at the same time being acceptable to their culture, religion and beliefs. To achieve this aim it may be useful to involve active and respective members of their

community to help in delivering health advice to people and encourage them to adopt the advice in their daily life, using workshops in community centres or places of worship during their regular attendance there. Mothers should be encouraged to feed their children a variety of foods from all food groups, particularly foods that are rich in heme iron and zinc. In addition, it is important to clarify the importance of modifying some of their cooking practices when preparing food. For example, they should try to avoid prolonged cooking of their food, particularly vegetables, so as to maintain the nutritional value within the food, such as vitamins and minerals. Finally, the importance of the use of vitamin D supplementation for their children should be illustrated and they should be encouraged to use it.

- It would be interesting to consider technological strategies for future research, such as computer based technology and mobile phones, to assess dietary intake among the South Asian community.

The researcher gained many new skills and experiences during the period of the PhD and has future plans to carry out similar research in Kuwait in order to assess preschool children's dietary habits and food intakes and find out their needs. However, to make the tools applicable for use in Kuwait and to suit local traditions and customs, certain changes in methodology would be required. For example, the development of a technology-based method such as use of a smart phone to assess children's diets and food portion sizes instead of using the conventional dietary method. In Kuwait, this type of method will motivate people to participate in any study and will both aid the researcher in terms of making it easier to conduct and analyse the data, and aid the participant in terms of making it easier for them to record the food consumed by the children. It would also make it easy for them to take a picture of the food being served on the plate and any leftovers.

Manuscripts submitted and waiting for decisions:

- Ashkanani, F. , **Husain, W.** , Garduño-Diaz, S. D. and Khokhar A tool for ethnic-specific dietary assessment: food portion photographs.

Manuscripts waiting for submission:

- **Husain, W.** , Ashkanani, F. and Khokhar, S. What food and how much of it is consumed by South Asian children living in the UK?
- **Husain, W.** , Ashkanani, F. , Garduño-Diaz, S. D. and Khokhar, S. Teaching children about nutrition: development of the vegetable and fruit education activity (VFEA).

Manuscripts accepted:

- Khokhar, S., Ashkanani, F., Garduño-Diaz, S. D. and **Husain, W**. (2013). Application of ethnic food composition data for understanding the diet and nutrition of South Asian in the UK. *Food Chemistry*. **140**, 436-442.

- Garduño-Diaz, S. D, **Husain, W**, Ashkanani, F. and Khokhar, S. (2013). Meeting challenges related to the dietary assessment of an ethnic minority population. *Journal of Human Nutrition and Dietetics*. dio:10. 1111/jhn.12153.

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Appendix A: Ethical Approval part I

Research Support
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UNIVERSITY OF LEEDS

MEEC Faculty Research Ethics Committee
University of Leeds

27 August 2010

Wafaa Husain
School of Food Science & Nutrition
University of Leeds
Leeds, LS2 9JT

Dear Wafaa

Title of study: **Dietary Patterns and Nutrient Intake of British Asian Children in UK**
Ethics reference number: **MEEC 09-030**
Amendment number: **2**
Amendment date: **29/07/10**
Amendment description: **Further information provided**

The above amendment was reviewed by the MEEC Faculty Research Ethics Committee at its meeting of 26th August 2010. The following documentation was considered:

Document	*Version*	*Date*
MEEC 09-030 researcher's 2nd response.doc	1	29/07/10

On the basis of the information provided, the Committee is happy to approve this project but would like to offer the following comments and advice.

1. The Committee feels a counter signature by a witness would be appropriate given the nature of the project and for this reason asks you to obtain counter signatures for the participants' consent.

2. It would be preferable for the two copies of the form to be signed in the presence of the researcher (as opposed to returned to the researcher by post) so that the researcher can satisfy themselves that they have appropriate consent, and that the participants fully understand the research.

Yours sincerely

J Blaikie

Jennifer Blaikie
Research Ethics Administrator, Research Support
On Behalf of
Professor Richard Hall
Chair, MEEC FREC.

CC: Student supervisor

Appendix B: Structured questionnaire part I

UNIVERSITY OF LEEDS

School of Food Science and Nutrition

Dietary Patterns and Nutrient Intake of British Asian Children in UK

We are looking for parents or legal guardians of children age 1-3 years to answer questions about their child/children's food consumption. Please take a moment to answers the following questions. There are no right or wrong answer.

This questionnaire is for research purposes. The answers will be kept private and confidential.

Date of today (Day/Month/Year) ☐ / / Subject No. (For Office Use ☐

Gender Male ☐ Female ☐ Child's date of Birth (Day/Month/Year) ☐ / /

Place of Birth ☐ Religion ☐

Ethnic Origin

White		**Mixed White and South Asian**	
Indian		Black-Caribbean	
Pakistani		African	
Bangladeshi		Other please specify	

1. Number of members in the family

Children	Adult	Elderly

2. Level of education of the father, please tick

☐ Primary school ☐ Secondary school
☐ High school ☐ Training courses
☐ Undergraduate university ☐ Postgraduate university
☐ Never attend school ☐ Other Please specify ---------------

3. Level of education of the mother, please tick

☐ Primary school ☐ Secondary school
☐ High school ☐ Training courses
☐ Undergraduate university ☐ Postgraduate university
☐ Never attend school ☐ Other Please specify ---------------

4. How much is your approximate annual income?

☐ Less than £10,000 ☐ £11,000-20,000
☐ £21,000-30,000 ☐ £31,000-40,000
☐ £41,000 and above

5. Anthropometric Measures for the child

Height (cm)	Weight (kg)

6. Has your child been diagnosed with any health problems?

Yes ☐ NO ☐ If yes please specify------------------------------

7. Does the mother or father have any of the following? (Please circle)

High Blood Pressure	Father	Mother	None	Don't know
High Cholesterol	Father	Mother	None	Don't know
Kidney Disease	Father	Mother	None	Don't know
Diabetes	Father	Mother	None	Don't know
Heart Disease	Father	Mother	None	Don't know
Overweight / Obesity	Father	Mother	None	Don't know
Other (Please specify)				

8. Is /was your child

☐ Breast fed ☐ Formula fed ☐ Both

If he/she was breast fed, for how long? -------------- month or ☐ still breast feeding

If he/she was formula fed, for how long?------------- month or ☐ still formula feeding

If still on formula feeding:

a. What is the brand name of the formula?--
b. How many times does your child drink formula each day?
c. What amount of formula in (millilitre or ounce) does your child drink per feeding?
d. How do you prepare the formula

Amount of water --------------- Amount of formula-----------------

e. Do you ever add anything besides water to the formula ☐ Yes ☐ No

If yes please specify---

On an average day

9. How many **portions** of the following foods does your child eat?

Foods	No. of portions							
	0	1	2	3	4	5	6	7+
Fruit								
Vegetable								
Starchy food (rice/pasta/chapatti/breakfast cereal)								

10. How many times does your child drink any of the following?

Drinks	Number/per day							
	0	1	2	3	4	5	6	7+
Milk (glass/bottle)								
Juice from fresh fruit (glass)								
Fruit drinks/ squash (glass)								
Fizzy soft drink (glass/can)								
Diet fizzy soft drink (glass/can)								

11. If your child drinks cow's milk which type does he/she drink most often;

☐ Whole milk ☐ Semi-skimmed milk ☐ Skimmed milk, ☐ Others

12. How often does your child eat crisps or confectionery such as sweets and chocolate?

☐ Every day ☐ 2-3 times a week ☐ occasionally ☐ never

On an average week

13. How many times does your child eat any of the following foods?

Food	Time per week							
	0	1	2	3	4	5	6	7
Chicken								
Red meat								
*White fish								
** Oily fish								
Cheese								
Yogurt								
Flavoured yogurt								
Egg (fried, boiled,...)								
Legumes (dhal/peas/beans)								

*White fish: Cod/Haddock/Monk fish

** Oily fish Salmon/Trout/Mackerel/Tuna(fresh)/Katla/Sardines

14. What type of fat do you use most often for cooking?
☐ Butter ☐ Vegetable oil ☐ Margarine ☐ Ghee
☐ Other, please specify.............................

15. Does your child take any nutritional supplements (e.g.multi vitamins,minerals, Omega 3, fish oil...)?
☐ Yes ☐ No
If Yes, which brand name---

16. How would you describe your child's appetite?

☐ Good ☐ Average ☐ Poor ☐ Picky

17. Does your child avoid any foods for cultural, religious, or health reasons?

☐ Yes ☐ No if yes, please specify --

----

18. If a child refuses to eat some kind of food

☐ It is best not to serve it again ☐ It is best to serve it again

19. What would you like to change about your child's eating habits?

Level of activity:

Time spent sleeping.

20.What time does your child normally go to bed ---------------

21.What time does he/she wake up ----------------

22. Does your child have a nap during the day? ☐ Yes ☐ No

If yes, for how long? ----------------------

23. On a daily basis does your child :

☐ Play actively outdoors for 2 or more hours

☐ Play actively indoors and outdoors for 2 hours

☐ Play actively indoors for 1 to 2 hours

☐ Play mostly indoors.

24. For how long does your child watch TV/video per day [min]

Nutritional Knowledge

Please, tick the answer that best describes you

25. Where do you get dietary information/advice from?

☐ T.V ☐ Friends ☐ Doctor

☐ Nutritionist/Dietician ☐ Magazines ☐ Internet

☐ Family ☐ Other, please specify

26. Which of the following provides the most calories?

☐ Protein ☐ Carbohydrate ☐ Fat ☐ Don't know

27. Which of the following is responsible for the growth and formation tissue of the child's body?

☐ Protein ☐ Carbohydrate ☐ Fat ☐ Don't know

28. which of the following is the richest source of iron?

☐ Milk ☐ Egg ☐ Red meat ☐ Spinach ☐ Dhal ☐ Chapatti ☐ Don't know

29 .Which is higher in calcium: whole milk or skimmed milk?

☐ Whole milk ☐ Skimmed milk ☐ Equal ☐ Don't know

30. At what age is it suitable to provide your child with cow milk?

☐ 9 month ☐ 12 month ☐ 18 month ☐ Don't know

31. At what age it is safe to provide your child with honey?

☐ 9 month ☐ 12 month ☐ 18 month ☐ Don't know

32. How many portions of fruits and vegetables should your child eat every day?

☐ 1-2 ☐ 3-4 ☐ 5 or more ☐ Don't know

33. Do you believe that?

	Yes	No	Maybe	I don't know
Ghee and butter gives strength for your child				
Margarine contain less fat than butter				
If the label says 'low fat' the food will be healthy				

THANK YOU FOR YOUR TIME

Appendix C: Letter for the school

UNIVERSITY OF LEEDS

Name of Centre: **School of Food Science & Nutrition, University of Leeds**

Project Title: **Dietary Pattern and Nutrient intake of British Asian Children in UK**

Dear Sir/ Madam ,

There is evidence that healthier food choices and lifestyle from early childhood could prevent chronic and nutrition-related diseases in adulthood. Therefore, it is important that children eat both the right amount and type of food. However, measuring children's food intake aged between 1 - 3 years is very difficult. Thus less information is available about this and we need your help.

We would like to investigate the ethnic specific factors to determine the impact of diet on health and well being among children (1 yrs to 3 yrs). To achieve this, it is essential to adequately measure their food intake to provide information on the quality of their diet in line with current UK recommendations.

The study is being carried out by a PhD student (Wafaa Husain) at the School of Food Science & Nutrition, University of Leeds, towards the award of a PhD.

We are looking for children who are British, British Asian, African and their parents or guardians, living in Yorkshire and The Humber to participate in this study.

We would be very grateful if you could distribute information sheets and consent forms for the parents / guardians.

If you agree to help, would like more information or have any questions please contact us

Mrs. Wafaa Husain

PhD Researcher School of Food Science & Nutrition University of Leeds, LS2 9JT.

Email: fswagm@leeds.ac.uk

OR

Dr. Santosh Khokhar
Academic Supervisor

Senior Lecturer in Food Biochemistry

Tel:01133432975

E-mail: s.khokhar@food.leeds.ac.uk

Yours sincerely,

Dr Santosh Khokhar

Appendix D: Information sheet for the questionnaire part I

Participant Information Sheet

Name of centre: School of Food Science and nutrition, University of Leeds

Project Title: Dietary Patterns and Nutrient Intakes of British Asian Children in UK

Dear Parent or Guardian,
I am writing to ask your permission for your child to take part in a research project at University of Leeds. Please take a few minutes to read the following information.
The decision about participation is yours without having to give a reason and without penalty. To help you make this choice, a short explanation of the project is given. You have two weeks to decide whether to take part or not.

What is the purpose of this study?

"You are what you eat". Recent studies show that everything you eat and drink reflects your health. It is important that children eat both the right amounts and types of food - Diet improves the growth and development of children's immunity, and may prevent serious disease in childhood and adulthood. The purpose of the study is to investigate the dietary Patterns and nutrient Intakes children aged 1 - 3 years in the UK and will also elaborate the impact of ethnicity and socio-economic factors on their eating patterns and nutrient intakes. In addition it will assess the nutritional adequacy of children's diet as compared with recommendations of the host country (i.e. Reference Nutrient Intake (RNIs) and Dietary Reference Values (DRV). The information obtained will help to identify issues of concern related to diet-related health and determine strategies for addressing these.

Who is doing the study?

The study is being carried out by a PhD student (Wafaa Husain) at the School of Food Science & Nutrition, University of Leeds, towards the award of PhD.

Who is being asked to participate?

I am looking for preschool children aged 1 -3years and their parents or guardians, living in the UK to take part in the study. The language of communication will be English

What will be involved if I take part in this study?

I will talk you through the project and will answers any question you might have about the study. I then will ask you some questions about your child's food habits. Weighing scale and height measure will be provided for you to take your child's weight and height. The session will take about15-30 minutes.

What are the advantages and disadvantages of taking part?

There is no direct benefit to you or your child for taking part. However, the information obtained from this study will help us to better understand the nutritional adequacy of the diets and identify any nutrition related problem of South Asian children.

As an appreciation, your child will receive a gift voucher for completing the questionnaire.

Can I withdraw from the study at any time?

Participation is voluntary. You can withdraw at any stage without having to give a reason and this will not affect your statutory rights.

Will the information I give be kept confidential?

Any information you provide will be treated with utmost confidentiality and handled in accordance with the Data Protection Act 1998. Participants names will be number coded and therefore you will not able to be identified. Only the researcher and the supervisor (Dr. S. Khokhar) will have access to information relating codes to names and this will be securely locked in cabinet at the School of Food Science and Nutrition, University of Leeds.

What will happen to the results of the study?

The results obtained from this study will provide information on the dietary patterns and will help assess the nutrient intakes and identify any nutrition related problem of British Asian children. In addition, this data together with information from future studies will help provide dietary advice which could lead to the prevention of diet-related diseases in later years.

The study is also being conducted as a requirement for an award of a PhD.

Who has reviewed this study?

The study has been reviewed by the university of Leeds Research Ethics Committee and ethical approval granted.

If you agree to take part, would like more information or have any questions please contact:

Wafaa Husain, PhD Researcher
School of Food Science & Nutrition
University of Leeds, LS2 9JT.
Email: fswagm@leeds.ac.uk

OR

If you require further information, you may also may contact my supervisor Dr. Santosh Khokhar on **Tel :** 01133432975 **e-mail:** s.khokhar@food.leeds.ac.uk.

If you have no questions and you and your child agree to take part, please complete, sign and date both the enclosed the enclosed <u>Participant Consent Forms</u>, keep one for your records and send the second copy to me Wafaa Husain using the stamped addressed envelope provided.

Thank you for making the time to read this information.

Appendix E: Consent form

UNIVERSITY OF LEEDS

School of Food Science and Nutrition

<u>Participant Consent Form</u>

Project Title: Dietary Patterns and Nutrient Intake of British Asian Children in UK
The parent/legal guardian should complete the whole of this sheet himself/herself

	Please confirm the statements below
I have read and understood the participant information sheet	Yes / No
I have had the opportunity to ask questions and discuss this study	Yes / No
I understand that my participation is voluntary and I am free to withdraw from the study:- 1 At any time 2 Without having to give a reason for withdrawing	Yes / No
I understand that any information I provide, including personal details, will be confidential, stored securely and only accessed by those carrying out the study.	Yes / No
(When relevant) I understand that any information I give may be included in published documents but my identity will be protected by the use of pseudonyms	Yes / No
I agree to take part in this study Yes/No	
Participant Signature …………………………… Date..............................	
Name of Participant	
Home Address of participant.. Tel.. Email	
Researcher Signature ………………………………… Date...............................	Witness Signature .... Date...............................
Name of Researcher	Name of Witness

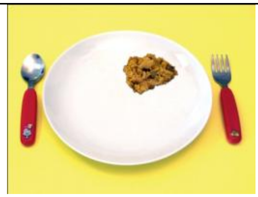
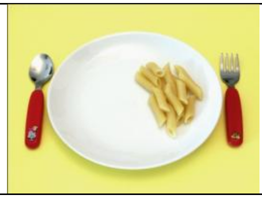
Thank you for agreeing to take part in this study

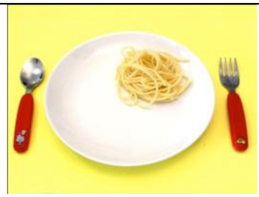
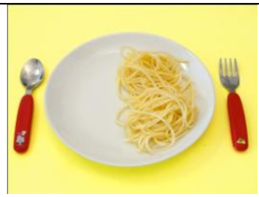
Appendix F: A Photographic booklet of Food Portion Sizes

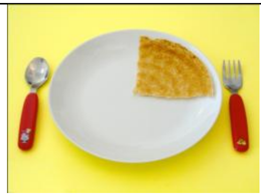
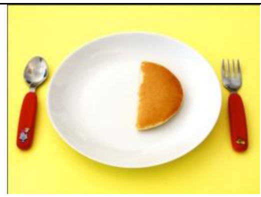
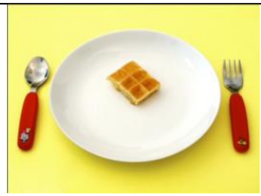
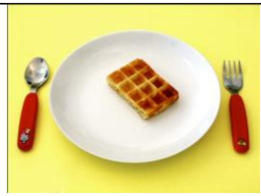
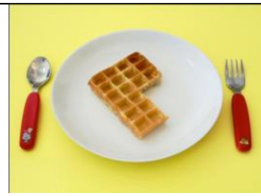
A Photographic Booklet of Food Portion Sizes

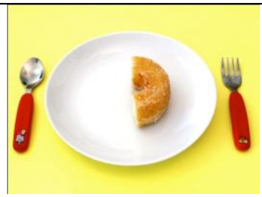
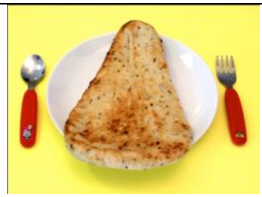
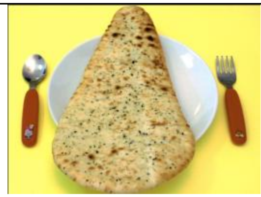
By: Wafaa Husain

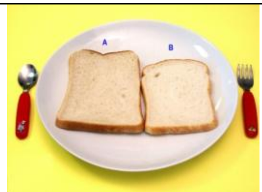
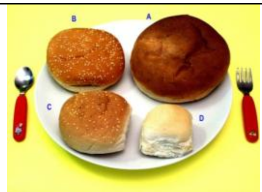
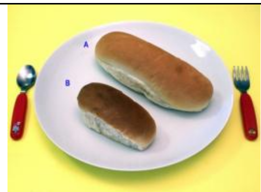
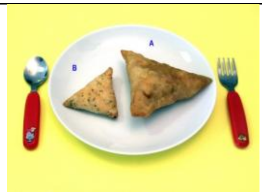
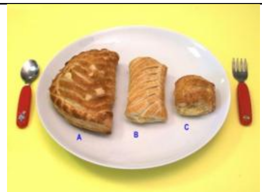
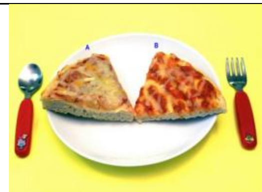
Supervisor: Dr. Santosh Khokhar

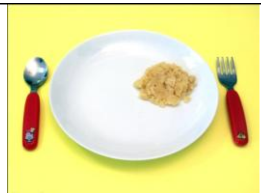
1. Vegetable rice				
	1B	1D	1F	1H
2. Chicken bryani on bone				
	2B	2D	2F	2H
3. Rice				
	3B	3D	3F	3H
4. Pasts				
	4B	4D	4F	4H

5. Spaghetti				
	5B	5D	5F	5H
6. Noodles				
	6B	6D	6F	6H
7. Breakfast cereal				
	7B	7D	7F	7H
8. Muesli				
	8B	8D	8F	8H

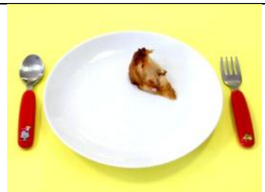
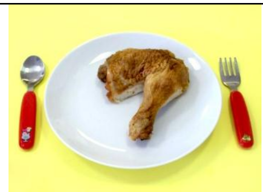
9. Porridge				
	9B	9D	9F	9H
10. Pancake				
	10B	10D	10F	10H
11. Irish pancake				
	11B	11D	11F	11H
12. Waffle				
	12B	12D	12F	12H

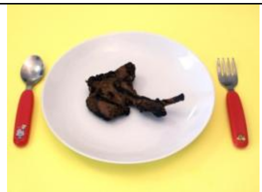
13. Doughnut				
	13B	13D	13F	13H
14. Chapatti				
	14B	14D	14F	14H
15. Naan				
	15B	15D	15F	
Pitta bread				
	16. Pitta bread (circle)	17. Pitta bread (oval)		

				
	18. Sliced bread	19. Bun	20. Roll	21. Pappadum
				
	22. Samosa	23. Pastry cheese and onion	24. Muffin	25. Pizza
26. Pizza (thick)				
	26B	26D	26F	26H
27. Pizza (thin)				
	27B	27D	27F	27H

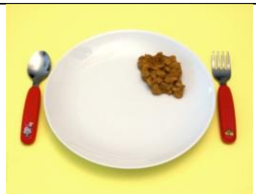
28. Nutella				
	28B	28D	28F	28H
29. Cake				
	29B	29D	29F	29H
30. Sweet rice				
	30B	30D	30F	30H
31. Halwa				
	31B	31D	31F	31H

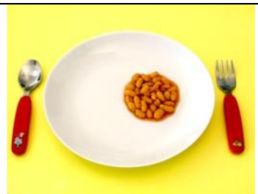
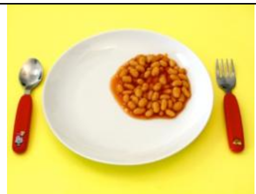
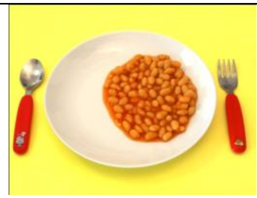
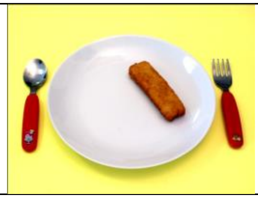
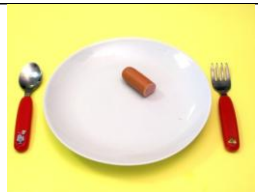
32. Gajar halwa				
	32B	32D	32F	32H
33. Rassmalai				
	33B	33D	33F	33H
34. Kheer				
	34B	34D	34F	34H
35. Chicken pakora				
	35B	35D	35F	35H

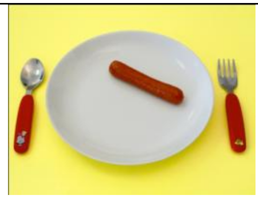
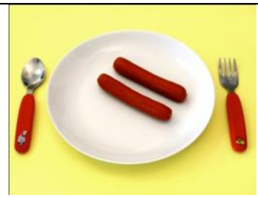
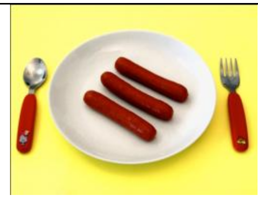
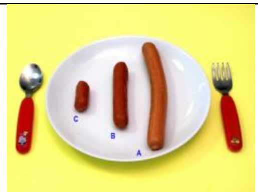
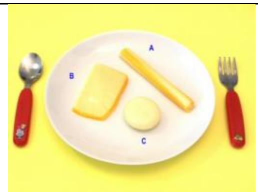
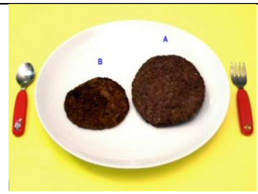
36. Chicken wings				
	36B	36D	36F	36H
37. Chicken breast				
	37B	37D	37F	37H
38. Chicken leg				
	38B	38D	38F	
39. Shrimp curry				
	39B	39D	39F	39H

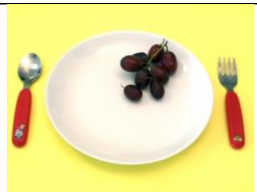
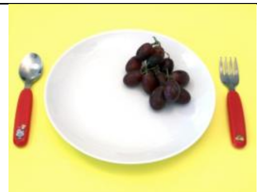
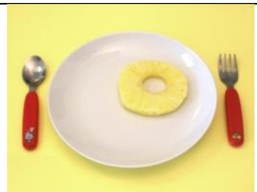
40. Lamb chops				
	40B	40D	40F	
41. Seekh kebabs				
	41B	41D	41F	41H
42. Fried fish				
	42B	42D	42F	42H
43. Tuna				
	43B	43D	43F	43H

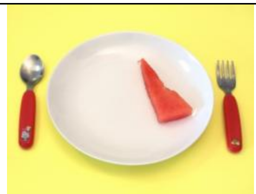
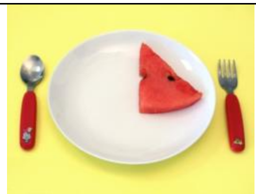
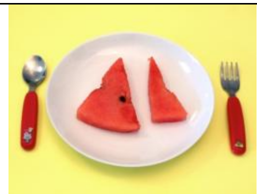
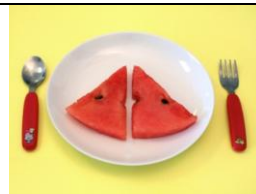
44. Keema matter				
	44B	44D	44F	44H
45. Chicken curry				
	45B	45D	45F	45H
46. Aloo matter				
	46B	46D	46F	46H
47. Palak paneer				
	47B	47D	47F	47H

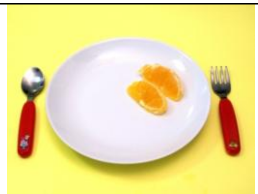
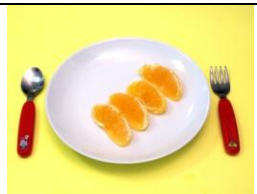
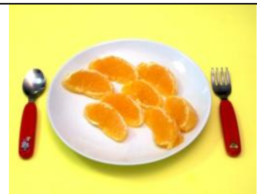
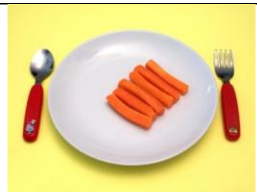
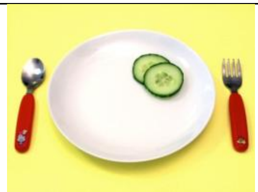
48. Paneer				
	48B	48D	48F	48H
49. Dhal				
	49B	49D	49F	49F
50. Onion bahji				
	50B	50D	50F	50H
51. Vegetable pakora				
	51B	51D	51F	51H

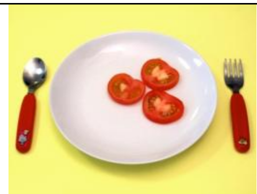
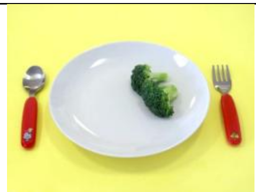
52. Baked beans				
	52B	52D	52F	52H
53. Fish fingers				
	53B	53D	53F	53H
54. Chicken nuggets				
	54B	54D	54F	54H
55. Sausage (large)				
	55B	55D	55F	55H

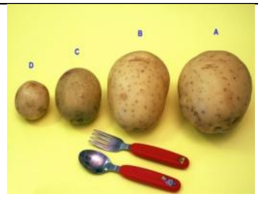
56. Sausage (medium)				
	56B	56D	56F	56H
57. Mini sausage (cocktail)				
	57B	57D	57F	57H
				
	58. Sausages	59. Cheese	60. Burgers	
				
	61. Apple different size			

62. Apple				
	62B	62D	62F	62H
63. Grapes				
	63B	63D	63F	63H
64. Pineapple				
	64B	64D	64F	64H
65. Melon				
	65B	65D	65F	65H

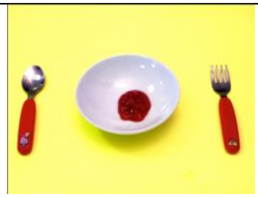
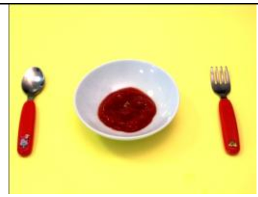
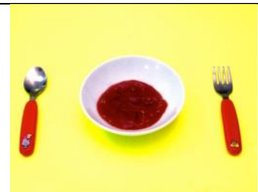
66. Water melon				
	66B	66D	66F	66H
67. Strawberry				
	67B	67D	67F	67H
				
	68. Bananas different size			
69. Banana				
	69B	69D	69F	69H

70. Orange				
	70B	70D	70F	70H
71. Fruit salad				
	71B	71D	71F	71H
72. Carrot sticks				
	72B	72D	72F	72H
73. Cucumbers				
	73B	73D	73F	73H

74. Tomato				
	74B	74D	74F	74H
75. Lettuce				
	75B	75D	75F	75H
76. Broccolis				
	76B	76D	76F	76H
77. Mixed vegetables				
	77B	77D	77F	77H

78. Potato (chips)				
	78B	78D	78F	78H
79. Potato (mashed)				
	79B	79D	79F	79H
80. Potato (wedges)				
	80B	80D	80F	80H
				
	81. Potato (baked)			

82. Raisins				
	82B	82D	82F	82H
83. Cashews				
	83B	83D	83F	83H
84. Peanuts				
	84B	84D	84F	84H
85. Bombay mix				
	85B	85D	85F	85H

86. Soup				
	86B	86D	86F	86H
87. Mint sauce				
	87B	87D	87F	87H
88. Mango ashar (pickels)				
	88B	88D	88F	88H
89. Ketchup				
	89B	89D	89F	89H

90. Different cutlery				
				
				

				
B	D	F	H	J
			] 	
B	D	F	H	J

		Portion Size			
Food Number.	Food Name	B	D	F	H
1	Vegetable rice	20 g	40 g	60 g	80 g
2	Chicken bryani on bone	60 g	120 g	180 g	220g
3	Rice	20 g	40 g	60 g	80 g
4	Pasta	30 g	60 g	90 g	120g
5	Spaghetti	30 g	60 g	90 g	120g
6	Noodles	50 g	100 g	150 g	200g
7	Breakfast cereal	15 g	30 g	45 g	60 g
8	Muesli	15 g	30 g	45 g	60 g
9	Porridge	40 g	80 g	120 g	160g
10	Pancake	17 g	33 g	50 g	69 g
11	Irish pancake	11 g	18 g	29 g	38 g
12	Waffle	5 g	13 g	15 g	24 g
13	Doughnut	15 g	30 g	41 g	56 g
14	Chapatti	14 g	30 g	44 g	58 g
15	Naan	57 g	130 g	139 g	
16	Pitta bread (circle)				
17	Pitta bread (oval)				
18	Sliced bread				
19	Buns				
20	Roll				
21	Pappadum				
22	Samosa				
23	Pastry				
24	Muffins				
25	Pizza (thick/thin)				
26	Pizza (thick)	35 g	68g	90 g	133g
27	Pizza (thin)	28 g	56 g	84 g	113g
28	Nutella	5 g	10 g	15	20g
29	Cake	15g	30	45g	60g
30	Sweet rice	20 g	40 g	60 g	80 g
31	Halwa	20 g	40 g	60 g	80 g
32	Gajar halwa	20 g	40 g	60 g	80 g
33	Rassmalai	50 g	100 g	150 g	200g
34	Kheer	25 g	50 g	75 g	100g
35	Chicken pakora	19 g	40 g	57 g	76 g
36	Chicken wings	20 g	51 g	72 g	99 g
37	Chicken breast	30 g	60 g	90 g	120 g
38	Chicken leg	65 g	81 g	146 g	
39	Shrimp curry	15	30	45	60
40	Lamb chops	39 g	86 g	129 g	
41	Seekh kebabs	13 g	24 g	33 g	50 g
42	Fried fish	40 g	87 g	137 g	178g
43	Tuna (oily fish, canned)	15 g	30 g	45 g	60 g
44	Keema matter	30 g	60 g	90 g	120g

Food Number.	Food Name	B	D	F	H
45	Chicken curry	30 g	60 g	90 g	120 g
46	Aloo matter	30 g	60 g	90 g	120g
47	Palak paneer	20 g	40 g	60 g	80 g
48	Paneer	20 g	40 g	60 g	80 g
49	Dhal	30 g	60 g	90 g	120g
50	Onion bahji	35 g	67 g	96 g	113g
51	Vegetable pakora	24 g	41 g	57 g	74 g
52	Baked beans	30 g	60 g	90 g	120g
53	Fish fingers	25 g	47 g	72 g	93 g
54	Chicken nuggets	17 g	33 g	50 g	67 g
55	Sausage (large)	11 g	22 g	33 g	44 g
56	Sausage (medium)	11g	24 g	48 g	72 g
57	Mini sausage(cocktail)	15 g	29 g	44 g	59 g
58	Sausage(different size)				
59	Cheese				
60	Burger				
61	Apple different sizes				
62	Apple	18 g	35 g	51 g	66 g
63	Grapes	20 g	42 g	61 g	82 g
64	Pineapple	21 g	43 g	64 g	85 g
65	Melon	35 g	70 g	103 g	141g
66	Watermelon	27 g	54 g	81 g	106g
67	Strawberry	20 g	40 g	62 g	81 g
68	Bananas different sizes				
69	Banana	20 g	36g	52g	66g
70	Orange	30 g	61 g	98 g	120g
71	Fruit salad	30 g	60 g	90 g	120g
72	Carrot sticks	13 g	26 g	39 g	52 g
73	Cucumber	14 g	28 g	41 g	55 g
74	Tomato	10 g	19 g	29 g	37 g
75	Lettuce	10 g	20 g	30 g	40 g
76	Broccolis	15 g	28 g	36 g	46 g
77	Mix vegetable	15 g	30 g	45 g	60 g
78	Potato (chips)	30 g	58 g	86 g	116g
79	Potato (mashed)	30 g	60 g	90 g	120g
80	Potato (wedges)	17 g	32 g	49 g	66 g
81	Potato (baked)	44 g	129 g	332 g	512g
82	Raisins	10 g	20 g	30 g	40 g
83	Cashews	10 g	20 g	30 g	40 g
84	Peanuts	10 g	20 g	30 g	40 g
85	Bombay mix	10 g	20 g	30 g	40 g
86	soup	30 g	60 g	90 g	120 g
87	Mint sauce	10 g	20 g	30 g	40 g
88	Mango ashar (pickels)	10 g	20 g	30 g	40 g
89	Ketchup	10 g	20 g	30 g	40 g

Food Number	Food Name	Letters on the photograph	Description	Weight (g)
13	Doughnut	A	Regular size	53 g
13	Doughnut	B	Mini size	12 g
16	Pitta bread		Circle	36 g
17	Pitta bread		Oval	45 g
18	Sliced bread	A	Large sliced	43 g
18	Sliced bread	B	Medium sliced	27 g
19	Bun	A	XL size	97g
19	Bun	B	L size	74 g
19	Bun	C	Medium size	65 g
19	Bun	D	Small size	34 g
20	Roll	A	Large size	76 g
20	Roll	B	Small size	40 g
21	Pappadum			8 g
22	Samosa	A	Large size	79 g
22	Samosa	B	Small size	20 g
23	Pastry cheese and onion	A	Large size	172g
23	Pastry cheese and onion	B	Medium size	69g
23	Pastry cheese and onion	C	Small size	39g
24	Muffin	A	Large size	89 g
24	Muffin	B	Small size	30 g
24	Muffin	C	Mini	13 g
25	Pizza	A	Thick pizza	55 g
25	Pizza	B	Thin pizza	48 g
58	Sausage	A	Large size	44g
58	Sausage	B	Medium	23g
58	Sausage	C	Mini	8g
58	Cheese	A	Stick	20 g
58	Cheese	B	Slice	20 g
59	Cheese	C	Circle	20 g
60	Burger	A	Large size	94 g
60	Burger	B	Small size	35 g
61	Apple	A	Regular size	204 g
61	Apple	B	Small size	97 g
68	Banana	A	Large size	179 g
68	Banana	B	Small size	101 g
81	Potato (baked)	A	XL size	512 g
81	Potato (baked)	B	L size	332 g
81	Potato (baked)	C	Medium size	129 g
81	Potato (baked)	D	Small size	44 g

Appendix G: Photographs validation sheet

Subject number ....

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School of Food Science and Nutrition

Validation of food portion pictures

In order to better understand eating habits of the population it is important to estimate as accurately as possible the amount of food that people eat.

You will now be shown a set of photographs corresponding to different foods you will then be presented with a sample of the food and asked to select the photograph that you think comes closest to the amount of food presented.

If you have any questions please ask one of the researchers.

Thank you for taking the time to participate in this study.

1. Date: _____________
2. Age: _____________
3. Ethnicity: _____________
4. Height: ____________________
5. Weight: ____________________
6. Do you have children? Yes / No If yes, how old are they? ____________
7. Do you have children between 4-11 years old? Yes / No
8. Do you have any problem with your eyesight? Yes / No

Food Name	less than	B	D	F	H	more than
Aloo mutter						
Cereal						
Chicken beryani						
Chicken curry						
Dhal						
Fruit salad						
Keema matter						
Palak paneer						
Rice						
Soup						

Appendix H: Information sheet for South Asian s in part 1

Participant Information Sheet

Name of centre: School of Food Science and nutrition, University of Leeds

Project Title: Dietary Patterns and Nutrient Intakes of British Asian Children in UK

Dear Parent or Guardian,
I am writing to ask your permission for your child to take part in a research project at University of Leeds. Please take a few minutes to read the following information.
The decision about participation is yours without having to give a reason and without penalty. To help you make this choice, a short explanation of the project is given. You have two weeks to decide whether to take part or not.

What is the purpose of this study?

"You are what you eat". Recent studies show that everything you eat and drink reflects your health. It is important that children eat both the right amounts and types of food - Diet improves the growth and development of children's immunity, and may prevent serious disease in childhood and adulthood. The purpose of the study is to investigate the dietary Patterns and nutrient Intakes of South Asian children aged 1 - 3 years in the UK and will also elaborate the impact of ethnicity and socio-economic factors on their eating patterns and nutrient intakes. In addition it will assess the nutritional adequacy of children's diet as compared with recommendations of the host country (i.e. Reference Nutrient Intake (RNIs) and Dietary Reference Values (DRV). The information obtained will help to identify issues of concern related to diet-related health and determine strategies for addressing these.

Who is doing the study?

The study is being carried out by a PhD student (Wafaa Husain) at the School of Food Science & Nutrition, University of Leeds, towards the award of PhD.

Who is being asked to participate?

I am looking for preschool children from South Asian communities, aged 1 -3 years and their parents or guardians, living in the UK to take part in the study. The language of communication will be English

What will be involved if I take part in this study?

The study is in two parts:

1st **Part:** You will be invited to a briefing session for 30-40 minutes in one of the ethnic community centres, baby and toddler groups and religious places such as temples and mosques whichever is convenient for you. I will talk you through the project and will answers any question you might have about the study. I then will ask you some questions about your child's food habits. Weighing scale and height measure will be provided for you to take your child's weight and height.

2nd **Part:** At an appointed time (on three separate occasions one of which takes place during a weekend), I will ask you about all foods and drinks consumed by your child on the previous day. Each session will take approximately 30-40 minutes.

What are the advantages and disadvantages of taking part?

There is no direct benefit to you or your child for taking part. However, the information obtained from this study will help us to better understand the nutritional adequacy of the diets and identify any nutrition related problem of South Asian children.

As an appreciation, your child will receive a £15 gift voucher for completing the two parts of the study.

Can I withdraw from the study at any time?

Participation is voluntary. You can withdraw at any stage without having to give a reason and this will not affect your statutory rights.

Will the information I give be kept confidential?

Any information you provide will be treated with utmost confidentiality and handled in accordance with the Data Protection Act 1998. Participants names will be number coded and therefore you will not able to be identified. Only the researcher and the supervisor (Dr. S. Khokhar) will have access to information relating codes to names and this will be securely locked in cabinet at the School of Food Science and Nutrition, University of Leeds.

What will happen to the results of the study?

The results obtained from this study will provide information on the dietary patterns and will help assess the nutrient intakes and identify any nutrition related problem of British Asian children. In addition, this data together with information from future studies will help provide dietary advice which could lead to the prevention of diet-related diseases in later years.

The study is also being conducted as a requirement for an award of a PhD.

Who has reviewed this study?

The study has been reviewed by the university of Leeds Research Ethics Committee and ethical approval granted.

If you agree to take part, would like more information or have any questions please contact:

Wafaa Husain, PhD Researcher

School of Food Science & Nutrition

University of Leeds, LS2 9JT.

Tel: 01133432953 **Mobile:** 07901345809

Email: fswagm@leeds.ac.uk

OR

If you require further information, you may also may contact my supervisor Dr. Santosh Khokhar on **Tel :** 01133432975 **e-mail:** s.khokhar@food.leeds.ac.uk.

If you have no questions and you and your child agree to take part, please complete, sign and date both the enclosed the enclosed Participant Consent Forms, keep one for your records and send the second copy to me Wafaa Husain using the stamped addressed envelope provided.

Thank you for making the time to read this information.

Appendix I: 24 hour multiple pass recall form

24 Hour Diet Recall Form

Date of recall:--------------------

Subject No. (For Office Use Only) --------------

Time	Food Item and Method of Preparation	Amount Eaten	Drinks	Where
Breakfast				
Snack				
Lunch				
Snack				
Dinner				
Supper				

Appendix J: Pictures for the fieldwork

Note: Photos were taken under participants' permission

Appendix K: Nutrient dataset for selected food items that not available in the UK or EurFIR food composition data

	Frequency	Portion (g)	Energy (kcal)	protein (g)	Fat (g)	PUFA (g)	MUFA (g)	SFA (g)	Chol (mg)	CHO (g)	Total sugars (g)	Starch (g)	DF (g)	Water (g)
USDA Food Composition Data														
Baby food, dinner, pasta with vegetable	3	100	60.0	1.7	2.1	0.1	0.6	1.2	5.0	8.4	1.2	0.0	1.5	87.3
Baby food, teething biscuits	1	100	398.0	9.0	5.0	0.9	1.4	1.5	0.0	78.0	28.5	0.0	1.9	4.6
Baby food, juice, apple	2	100	47.0	0.0	0.1	0.0	0.0	0.0	0.0	11.7	10.7	0.0	0.1	88.0
Baby food, juice, pear	1	100	47.0	0.0	0.0	0.0	0.0	0.0	0.0	11.9	7.3	0.0	0.1	87.9
Baby food, juice, orange	1	100	45.0	0.6	0.3	0.1	0.1	0.0	0.0	10.2	8.3	0.0	0.1	88.5
Indian dataset Food Composition Data														
Poha	7	100	346.0	6.6	1.2	0.0	0.0	0.0	0.0	77.3	0.0	0.0	0.0	12.2

	Frequency	Portion (g)	Ca (mg)	P (mg)	Mg (mg)	Na (mg)	K (mg)	Cl (mg)	Fe (mg)	Zn (mg)	Cu (mg)	Se (µg)	I (µg)
USDA Food Composition Data													
Baby food, dinner, pasta with vegetable	3	100	14.0	50.0	24.0	11.0	133.0	0.0	0.5	0.4	0.11	6.0	0.0
Baby food, teething biscuits	1	100	100.0	164.0	35.0	258.0	323.0	0.0	3.5	0.9	0.14	24.0	0.0
Baby food, juice, apple	2	100	4.0	5.0	3.0	3.0	91.0	0.0	0.6	0.0	0.04	0.0	0.0
Baby food, juice, pear	1	100	12.0	12.0	8.0	0.0	130.0	0.0	0.0	0.1	0.06	0.0	0.0
Baby food, juice, orange	1	100	12.0	11.0	9.0	1.0	184.0	0.0	0.2	0.1	0.05	0.0	0.0
Indian Food Composition Data													
Poha	7	100	20.0	238.0	101.0	11.0	154.0	17.0	20.0	0.0	0.37	0.0	0.0

	Frequency	Portion (g)	B1 (mg)	B2 (mg)	Niaceq (mg)	B6 (mg)	B12 (µg)	Folat (µg)	Vit-C (mg)	Vit-A (µg)	Carot (µg)	Retin (µg)	Vit-E (mg)	Vit-D (µg)
USDA Food Composition Data														
Baby food, dinner, pasta with vegetable	3	100	0.06	0.05	0.0	0.11	0.0	9.0	2.9	41.0	282.0	16.0	0.23	0.0
Baby food, teething biscuits	1	100	0.23	0.54	0.0	0.11	0.07	49	9.1	28.0	13.0	27.0	0.23	0.0
Baby food, juice, apple	2	100	0.01	0.02	0.0	0.03	0.0	0.0	57.9	1.0	8.0	0.0	0.6	0.0
Baby food, juice, pear	1	100	0.01	0.03	0.0	0.01	0.0	4.0	33.8	0.0	0.0	0.0	0.09	0.0
Baby food, juice, orange	1	100	0.05	0.03	0.0	0.05	0.0	26.0	62.5	3.0	9.0	0.0	0.04	0.0
Indian Food Composition Data														
Poha	7	100	0.21	0.05	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix L: Ethical Approval Part II

Performance, Governance and Operations
Research & Innovation Service
Charles Thackrah Building
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Leeds LS2 9LJ
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Email: j.m.blaikie@leeds.ac.uk

UNIVERSITY OF LEEDS

Wafaa Husain
School of Food Science and Nutrition
University of Leeds
Leeds, LS2 9JT

MEEC Faculty Research Ethics Committee
University of Leeds

9 March 2012

Dear Wafaa

Research title **Dietary Patterns and Nutrient Intake of British Asian Children in the UK**
Ethics reference **MEEC 11-030**

I am pleased to inform you that the application listed above has been reviewed by the MaPS and Engineering joint Faculty Research Ethics Committee (MEEC FREC) I can confirm a favourable ethical opinion as of the date of this letter. The following documentation was considered:

Document	*Version*	*Date*
MEEC 11-030 Ethical_Review_Form_V6 new.doc	1	16/02/12
MEEC 11-030 Participant Information (In-depth interview).doc	1	16/02/12
MEEC 11-030 Consent form for the interview.doc	1	16/02/12
MEEC 11-030 general_risk_assessment_form.doc	1	16/02/12
MEEC 11-030 Appendix for the interview discussion.docx	1	16/02/12

Committee members made the following comments:

- Committee members wondered whether it would introduce bias into the sample if you only recruit participants who are fluent English speakers for this study.
- There is a danger that the research will be seen to be critical of mothers' nutritional choices for their children and the researcher needs to ensure this doesn't happen. Perhaps change the information sheet under "purposes of the study" from "identify issues of concern" to "identify any issues of concern" so that is does not suggest there is an expectation that there is a potential problem here.
- Committee members commented on the language throughout the participant information form and wondered whether is appropriate for young south Asian mothers. If the interviews are to be conducted in English then it is important to check that the information sheet is truly understandable in a lay (and possibly non-English as a first language speaker) person's language. The minor mistakes/ typos on the information sheet also need to be corrected.

Please notify the committee if you intend to make any amendments to the original research as submitted at date of this approval, including changes to recruitment methodology. All changes must receive ethical approval prior to implementation. The amendment form is available at www.leeds.ac.uk.

Please note: You are expected to keep a record of all your approved documentation, as well as documents such as sample consent forms, and other documents relating to the study. This should be kept in your study file, which should be readily available for audit purposes. There is a checklist listing examples of documents to be kept which is available at http://researchsupport.leeds.ac.uk/index.php/academic_staff/good_practice/other_information_nhs_sites in the '*Other useful documentation*' section.

Yours sincerely

JBlaikie

Jennifer Blaikie
Senior Research Ethics Administrator, Research & Innovation Service
On behalf of Professor Gary Williamson, Chair, MEEC FREC

CC: Student's supervisor(s)

Appendix M: In-depth interview questionnaire

Appendix A: In-depth interview discussion

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School of Food Science and Nutrition

Dietary Patterns and Nutrient Intake of British Asian Children in UK

Day/Month/Year

Date of today [/ /]   Subject No. (For Office Use Only) [ ]

Years resident in the UK [ ]   Place of birth [ ]

Religion [ ]

Ethnic Origin

Indian	
Pakistani	
Bangladeshi	

1. Number of members in the family

Children	Adult	Elderly

2. Your education Level

- ☐ Primary school
- ☐ Secondary school
- ☐ High school
- ☐ Training courses
- ☐ Undergraduate university
- ☐ Postgraduate university
- ☐ Never attend school
- ☐ Other Please specify ---------------

3. How much is your approximate annual income?

- ☐ Less than £10,000
- ☐ £11,000-20,000
- ☐ £21,000-30,000
- ☐ £31,000-40,000
- ☐ £41,000 and above

Interview guidelines

The researcher (interviewer) will:

- **Thank the subject for participating**

  "I want to thank you for taking the time to meet with me today"

- **Inform the participant about who is doing this study and the aim of the study**

  "My name is Wafaa Husain a PhD student at School of Food Science and Nutrition, University of Leeds. One of the aims of this project is to determine the relationship between the mother's nutritional knowledge and their dietary practices among their children I would like to talk to you about your dietary knowledge and your experiences on food choices and practices among your children"

- **Inform the rules of the discussion**

  - The discussion will last about 1-2 hours.
  - Although I will be taking some notes during the session, the discussion needs to be recorded in mp3 or wma format because I don't want to miss any of your comments. These recordings will be treated with confidentiality. Once the information is changed into written format the recordings will be erased and we ask for your permission.
  - Because we're recording the interview using mp3 player please be sure to speak up so that we don't miss your comments.
  - During the discussion you will remain anonymous, however identification number will be given to you to be used during the discussion.
  - General questions will be asked and discussed and you should feel free to speak your opinion, there are no right or wrong answers. We are interested to know your view.
  - Please remember, you don't have to talk about anything you don't want to and you may end the interview at any time.
  - Are there any questions you would like to ask me? (If no, we will start)

1. How old was your child when you started weaning onto solid food?	Why?

2. Which foods were introduced? And in what order?	Why?

3. Did you offer ready-to-eat baby food?	If no, why?	If yes, at what age and which foods?

I will now read out statement to you. Please tell me if you agree, disagree or don't know.

Statement	Agree	Disagree	Don't know	If disagree why?
1. Children at this age(1-3 years) require more energy and nutrients in their foods than adults				
2. Children at this age should be allowed to eat according to their appetite rather than choosing a specific serving size				
3. At an age of one year, most of his/her foods should be "solid"				
4. Children in this age need less milk than before				
5. Children can be given cow milk before 1 year				
6. You should avoid giving your child honey before 1 year				
7. Oily fish is not suitable for children aged 1 years old				

4. Does your child eat the same food as the rest of the family now? If no, why?
5. Do you give different types of foods during the weekend days? If yes, what are the differences?
6. On a typical day, how many meals and snacks does your child eat per day? (for example 3 meals and 3 snacks)

7. Please give the name of foods your child would normally eat:		
Breakfast	Lunch	Dinner

8. What kind of snacks does he/she like?
9. Some factors may influence what we eat such as ethnicity, religion, or family traditions. Do these factors influence what your child eats? If so, how?(give example) e.g. a child may not eat pork because of religion

10. Are there any other factors which may influence your choice of food you buy or prepare for your child?
11. How do you know that your child is eating well?
12. What type of food you avoid to give your child? Why?

13. Does your child eat fish? If yes, how many times a week does your child eat fish? What type of fish? If no, Why?
14. "Five-a- day of fruits and vegetable" Is it possible to achieve this goal with children aged 1-3 years? If yes, how? If no, Why?
15. Please tell me why your child sometime refuses to eat well?

16. What are the difficulties you faced during the weaning?
17. In your opinion what are healthy foods and a balanced diet?
18. In your opinion what are unhealthy foods?

19. What weaning practices might be outdated among your community? Why?
20. Are there any food fallacies and taboos? If yes, give example? Why? e.g. In some countries, milk and fish is a dangerous combination it cause food poisoning
21. Is there anything more you would like to add?

Thank you for your time

Appendix N: Information sheet for South Asian mothers part II

Participant Information Sheet

Name of centre: School of Food Science and nutrition, University of Leeds

Project Title: Dietary Patterns and Nutrient Intakes of British Asian Children in UK

Dear Parent or Guardian,
I would like to invite you to take part in a research project being conducted by the University of Leeds. Please take a few minutes to read the following information before making up your mind about whether or not you would like to help us with our research. The decision about participation is yours without having to give a reason and without penalty. To help you make this choice, a short explanation of the project is given. You have two weeks to decide whether to take part or not.

What is the purpose of this study?

"You are what you eat". Recent studies have shown that everything you eat and drink reflects onto your health. It is important that children eat both the right amounts and types of food. Diet improves the growth and development of children's immunity, and may prevent serious disease in childhood and adulthood. One of the aims of this project is to investigate in-depth the mother's nutritional knowledge in relation to their dietary practices among their children.

Ethnicity and socio-economic factors may influence a mother's food choices and practices for their children. The information obtained will help to identify issues of concern related to diet-related health and determine strategies for addressing these.

What is doing the study?

The study is being carried out by a PhD student (Wafaa Husain) at the School of Food Science & Nutrition, University of Leeds, towards the award of PhD

Who is being asked to participate?

I am looking for South Asian mothers, have children aged between 1 -3 years, living in the Yorkshire and Humber to take part in the study. The language of communication will be English.

What will be involved if I take part in this study?

We would like you to participate in a face-to-face interview which will last around 1 hour. The interview will consist of a series of questions reflecting your food knowledge and food preparation and eating practices. During this discussion, we will not be using your name. We however, will give you a number and we will use that number to identify you. Also we would like to ask for consent from you to use mp3 or wma recorder so that we don't miss anything you said. These recordings will be treated with confidentiality. Once the information is changed into written format the recordings will be erased.

What are the advantages and disadvantages of taking part?

There is no direct benefit to you or your child for taking part. However, the information obtained from this study will help us to better understand the nutritional adequacy of the diets and identify any nutrition related problem of South Asian children.

As an appreciation, you will receive a £10 gift voucher for completing the interview.

Can I withdraw from the study at any time?

Participation is voluntary. You can withdraw at any stage without having to give a reason and this will not affect your statutory rights.

Will the information I give be kept confidential?

Any information you provide will be treated with utmost confidentiality and handled in accordance with the Data Protection Act 1998. Participants names will be number coded and therefore you will not able to be identified. Only the researcher and the supervisor (Dr. S. Khokhar) will have access to information relating codes to names and this will be securely locked in cabinet at the School of Food Science and Nutrition, University of Leeds.

What will happen to the results of the study?

The results obtained from this study will provide information on the dietary patterns and will help assess the nutrient intakes and identify any nutrition related problem South Asian children. In addition, this data together with information from future studies will help provide dietary advice which could lead to the prevention of diet-related diseases in later years.

The study is also being conducted as a requirement for an award of a PhD.

Who has reviewed this study?

The study has been reviewed by the university of Leeds Research Ethics Committee and ethical approval granted.

If you agree to take part, would like more information or have any questions please contact us

Mrs. Wafaa Husain
PhD Researcher School of Food Science & Nutrition University of Leeds, LS2 9JT.
Email: fswagm@leeds.ac.uk

OR

Dr. Santosh Khokhar
Academic Supervisor
Senior Lecturer in Food Biochemistry
Tel:01133432975
E-mail: s.khokhar@food.leeds.ac.uk

If you have no questions and you agree to take part please:

- **Complete the enclosed consent form and send it to the researcher using the stamped addressed envelope provided.**

Thank you for making the time to read this information.

Appendix O: Association between socio-demographic factors and nutrients intake tables

Analysis by gender

	Boys (n=88)			Girls(n=72)			
	Mean	SD	IQR	Mean	SD	IQR	*P* value
Energy (kcal)	1126	197.7		1106	225.8		0.548
Fat (g)	46	10.8		46.4	11.34		0.852
Fat (% energy)	35.9	4.89		36.9	4.54		0.176
Protein (g)	40.5	9.57		38.819	9.77		0.265
Protein (%energy)	14.5	2.17		14.2	2.13		0.341
Carbohydrate (g)	145	28.44		140	31.63		0.354
Carbohydrate(% energy)	49.3	5.56		48.7	5.60		0.520
Sugar (g)	72.68	18.1		70.68	17.8		0.483
Sugar(% energy)	24.63	4.61		24.69	5.57		0.938
Starch (g) *	67.27	21.99		63.27	22.51		0.259
Starch (% energy)	22.78	6.05		21.63	5.56		0.217
NMES (g)*	32.34		23.5-48.9	27.11		19.15-42.12	0.054
NMES (%energy)	11.13		8.50-15.92	9.50		6.62-15.07	0.054
NSP (g) *	5.84		4.60-8.12	5.23		3.82-6.80	0.112
Vitamins							
Vitamin A(µg)	419.5	166.5		429.3	206.5		0.741
Thiamin (mg)*	0.74		0.57-0.92	0.725		0.60-0.87	0.692
Riboflavin (mg) *	1.51		1.15-2.04	1.516		1.23-1.92	1.000
Niacin (mg)*	15.5		12.9-18.4	14.33		11.92-16.57	0.058
Vitamin B_6 (mg)*	0.96		0.80-1.21	0.93		0.80-1.10	0.562
Vitamin B_{12} (µg)	4.74	2.29		4.55	2.08		0.586
Vitamin D (µg) ‡	0.75		0.45-1.36	0.55		0.19-1.30	0.247
Vitamin C (mg) *	56.0		41.05-80.2	48.8		35.47-72.60	0.077
Folate (µg)*	127.8		105-155.5	124.12		103.7-145.7	0.523
Minerals							
Fe (mg)*	5.93		4.7-7.22	5.54		4.45-6.70	0.245
Zn (mg)*	4.73		4.1-5.6	4.51		3.90-5.20	0.237
Ca (mg)*	784.7		600.7-1024	776.9		611.0-997.5	0.865
Na (mg)	1072.2	305.8		1080.3	334.1		0.873
Salt (g)	2.72	0.77		2.74	0.84		0.870
Se (µg)*	20.13		16.3-26.0	18.08		15.0-22.8	0.096
I (µg)	175.5	82.53		174.7	68.87		0.951

*Log transformation: geometric mean and IQR were reported, ‡Mann-Whitney test Median and IQR were reported based on raw data

Analysis by ethnicity

	Indian (n=62)			Pakistani (n=67)			Bangladeshi (n=31)			
	Mean	SD	IQR	Mean	SD	IQR	Mean	SD	IQR	*p* value
Energy (kcal)	1132.3	205.6		1154.6	196.3		1006.5	218.4		0.004
Fat (g)	44.3	10.1		49.8	10.4		42.6	12.3		0.002
Fat (% energy)	34.51	4.29		37.99	4.52		36.77	4.90		0.000
Protein (g)	39.6	8.6		41.9	10.1		35.4	9.5		0.007
Protein (%energy)	14.20	2.05		14.65	2.17		14.20	2.33		0.430
Carbohydrate (g)	151.8	30.9		142.6	27.9		127.1	25.4		0.001
Carbohydrate(% energy)	51.40	5.18		47.02	5.14		48.53	0.962		0.000
Sugar (g)	73.9	18.7		74.3	15.9		62.0	17.6		0.003
Sugar(% energy)	25.21	5.57		24.57	3.89		23.75	6.12		0.419
NMES (g)*	29.03		20.45-41.65	33.08		24.90-49.30	25.40		19.80-39.30	0.095
NMES (%energy) *	9.93		6.50-14.62	11.05		8.30-15.60	9.80		8.10-12.50	0.432
NSP (g) *	6.05		4.75-8.15	5.69		4.60-7.20	4.44		3.50-6.50	0.005

*Log transformation: geometric mean and IQR were reported, ‡Kruskal-Wallis test Median and IQR were reported based on raw data

Continue analysis by ethnicity

	Indian (n=62)			Pakistani (n=67)			Bangladeshi (n=31)			
	Mean	SD	IQR	Mean	SD	IQR	Mean	SD	IQR	*p* value
Vitamins										
Vitamin A(µg) *	422.1		333.5-532.0	392.2		320.0-497.0	322.3		224.0-424.0	0.014
Thiamin (mg)*	0.78		0.65-0.97	0.74		0.61-0.86	0.63		0.54-0.76	0.004
Riboflavin (mg) *	1.51		1.21-1.97	1.6		1.3-2.1	1.4		0.9-1.9	0.160
Niacin (mg) *	14.50		12.37-17.63	16.28		13.70-18.80	13.33		11.50-16.40	0.001
Vitamin B_6 (mg) *	0.91		0.76-1.21	1.01		0.84-1.20	0.90		0.76-1.09	0.111
Vitamin B_{12} (µg)*	3.88		2.77-5.91	4.46		3.52-6.37	3.82		2.37-6.55	0.240
Vitamin D (µg)‡	0.60		0.25-0.98	0.86		0.45-1.82	0.80		0.05-1.21	0.054
Vitamin C (mg) *	50.5		36.6-78.7	54.1		39.8-74.0	54.2		38.0-83.1	0.680
Minerals										
Folate (µg)*	129.7		105.8-160.3	126.7		107.0-150.0	118.2		95.0-145.0	0.321
Fe (mg)*	6.0		4.7-7.8	5.7		4.7-6.6	5.3		4.0-6.6	0.252
Zn (mg)	4.9	1.2		4.9	1.2		4.3	1.0		0.025
Ca (mg)*	794.8		622.3-1044.0	813.2		652.0-1022.0	692.0		524.0-941	0.119
Na (mg)	1145.9	304.6		1083.1	311.6		920.1	311.5		0.005
Salt (g)	2.9	0.8		2.8	0.8		2.3	0.8		0.005
Se (µg) *	17.53		15.0-21.0	21.69		17.0-28.0	17.63		13.0-26.0	0.005
I (µg) *	159.60		117.8-224.0	168.21		146.0-221.0	136.32		85.0-216.0	0.121

*Log transformation: geometric mean and IQR were reported, ‡Kruskal-Wallis test Median and IQR were reported based on raw data

Analysis by family size

	1 Child		2 Children		3 children		More than 3 children		
	Mean	SD or IQR	Mean	SD or IQR	Mean	SD or IQR	Mean	SD or IQR	*P* value
Energy (kcal)	1127.68	213.54	1144.07	176.89	1065.63	264.30	1116.03	189.97	0.369
Fat (g)	45.12	9.87	46.46	9.85	45.75	13.81	48.04	11.28	0.738
Fat (% energy)	35.46	4.36	35.74	4.69	37.34	4.64	37.72	5.16	0.095
Protein (g)	39.33	8.97	41.11	8.82	38.15	10.40	39.75	11.19	0.544
Protein (%energy)	14.14	2.17	14.51	1.83	14.51	2.13	14.34	2.75	0.850
Carbohydrate (g)*	145.04	127.5-173.6	145.99	135.4-167.5	129.09	109.1-162.5	136.31	123.1-150.9	0.032
Carbohydrate(% energy)	50.35	5.41	49.64	5.35	47.80	4.82	47.60	6.64	0.088
Sugar (g)	69.79	19.50	76.09	16.92	69.65	19.27	68.83	15.15	0.170
Sugar(% energy)	23.63	4.89	25.57	4.97	25.12	5.33	23.73	4.91	0.195
NMES (g)‡	24.35	19.38-35.22	36.65	26.48-51.00	30.50	23.10-44.75	28.90	18.85-44.63	0.058
NMES (%energy)*	9.21	6.30-9.00	11.56	8.23-16.55	11.36	8.30-16.68	8.79	6.23-15.03	0.045
NSP (g)*	6.50	4.93-8.90	5.60	5.00-6.90	4.98	3.73-6.55	5.11	3.43-7.33	0.041
Vitamin A(µg)	461.8	159.7	413.9	161.6	404.5	239.7	418.1	183.7	0.540
Thiamin (mg)*	0.73	0.55-0.91	0.74	0.62-0.91	0.68	0.56-0.82	0.79	0.61-0.99	0.216
Riboflavin (mg)	1.55	0.49	1.65	0.61	1.48	0.43	1.82	0.77	0.092
Niacin (mg) ‡	14.75	11.98-14.75	15.55	13.53-18.20	14.65	12.15-18.83	15.40	12.53-18.68	0.497
Vitamin B_6 (mg) ‡	0.87	0.76-0.98	1.00	0.83-1.21	0.91	0.71-1.12	0.99	0.89-1.31	0.023
Vitamin B_{12} (µg)	4.42	1.97	4.86	2.18	4.34	1.94	4.96	2.76	0.521
Vitamin D (µg)‡	0.75	0.43-1.24	0.70	0.27-1.29	0.70	0.33-1.83	0.66	0.14-2.23	0.985
Vitamin C (mg) *	43.84	30.95-62.30	60.93	47.50-81.68	51.37	30.63-84.38	52.21	34.70-72.98	0.014
Folate (µg)*	128.15	102.8-160.3	126.06	109.0-154.0	117.05	93.75-143.8	135.45	116.8-151.8	0.204
Fe (mg)*	6.17	4.60-8.05	5.88	4.85-6.58	5.13	4.40-5.98	5.77	4.28-7.53	0.153
Zn (mg)	4.80	1.15	4.91	1.15	4.43	1.01	4.89	1.41	0.250
Ca (mg)*	759.02	567.8-999.5	800.08	647.0-	712.58	537.3-892.0	865.35	657.3-	0.173

				1077.5				1149.5	
Na (mg)	1156.66	306.62	1094.84	311.12	993.41	324.11	1037.06	321.73	0.136
Salt (g)	2.94	0.78	2.78	0.79	2.52	0.82	2.63	0.82	0.136
Mg(mg) ‡	164.0	134.8-182.5	158.0	141.3-182.0	137.5	111.5-171.8	148.5	132.3-182.3	0.066
Se (mg)	21.00	14.75-26.00	19.00	16.00-24.00	20.00	16.00-26.00	19.00	15.00-23.00	0.757
I	157.50	112.8-209.3	159.50	123.8-237.3	159.50	114.3-211.3	193.00	116.0-257.0	0.729

*Log transformation: geometric mean and IQR were reported, ‡Kruskal-Wallis test Median and IQR were reported based on raw data

Analysis by family type

	Nuclear family (n=132)			Joint family (n=28)			
	Mean	SD	IQR	Mean	SD	IQR	*P* value
Energy (kcal)	1128.0	200.3		1066	250.8		0.161
Fat (g)	46.6	10.8		45.0	12.6		0.495
Fat (% energy)	36.3	4.8		36.7	4.6		0.715
Protein (g)	39.9	9.4		39.1	11.1		0.692
Protein (%energy)	14.3	2.2		14.7	1.9		0.358
Carbohydrate (g)	145.2	29.3		133.4	31.3		0.054
Carbohydrate(% energy)	49.2	5.6		47.9	5.4		0.268
Sugar (g)	72.4	17.4		68.9	20.4		0.362
Sugar(% energy)	24.7	5.2		24.6	4.2		0.920
NMES (g)‡	31.3		21.3-43.9	31.6		25.4-45.1	0.595
NMES (%energy) ‡	10.1		7.5-15.1	11.9		9.4-15.9	0.317
NSP (g) *	5.7		4.5-7.8	4.9		3.5-6.6	0.077
Vitamins							
Vitamin A(µg) ‡	406.0		317.0-513.2	369.0		242.5-424.0	0.061
Thiamin (mg) ‡	0.74		0.6-0.9	0.73		0.6-0.9	0.590
Riboflavin (mg) *	1.5		1.2-1.9	1.5		1.1-2.0	0.957
Niacin (mg)*	15.1		12.9-17.6	14.5		11.7-18.1	0.461
Vitamin B_6 (mg)‡	0.93		0.8-1.1	0.95		0.8-1.2	0.957
Vitamin B_{12} (µg)‡	4.6		3.1-6.1	4.6		2.5-6.5	0.903
Vitamin D (µg) ‡	0.7		0.3-1.5	0.6		0.1-1.2	0.112
Vitamin C (mg) *	53.9		39.9-77.7	47.0		34.8-65.8	0.180
Minerals							
Folate (µg)*	128.5		107.0-154.0	115.6		96.0-140.5	0.070
Fe (mg) ‡	5.8		4.7-7.2	5.2		3.9-6.3	0.049
Zn (mg)	4.85	1.2		4.4	1.1		0.071
Ca (mg)*	784.5		606.5-1019.3	765.6		598.0-1011.5	0.752
Na (mg)	1082.9	322.7		1042.9	295.6		0.547
Salt (g)	2.75	0.8		2.64	0.75		0.545
Se (µg) ‡	20.0		15.3-25.0	18. 0		15.0-25.5	0.453
I (µg) ‡	167.0		118.3-219.0	153.5		126.5-216.5	0.814

*Log transformation: geometric mean and IQR were reported, ‡Mann-Whitney test Median and IQR were reported based on raw data

Analysis by religion

	Muslim (n=116)			Other (n=44)			
	Mean	SD	IQR	Mean	SD	IQR	*P* value
Energy (kcal)	1108.8	221.6		1139	205.36		0.412
Fat (g)	47.54	11.29		42.94	9.78		0.018
Fat (% energy)	37.58	4.48		33.29	4.01		0.000
Protein (g)	39.82	10.25		39.60	8.04		0.900
Protein (%energy)	14.47	2.22		14.17	1.99		0.425
Carbohydrate (g)	138.05	27.96		156.6	31.0		0.000
Carbohydrate(% energy)	47.56	5.15		52.83	4.82		0.000
Sugar (g)	71.16	17.15		73.45	19.93		0.472
Sugar(% energy)	24.61	4.89		24.80	5.49		0.833
NMES (g)*	29.68		22.40-44.88	30.40		21.70-45.50	0.816
NMES (%energy) *	10.36		8.13-15.08	10.37		6.58-15.70	0.990
NSP (g) ‡	5.16		3.83-6.70	6.77		5.70-8.88	0.000
Vitamins							
Vitamin A(µg)	411.1		193.3	457.6		158.4	0.157
Thiamin (mg) *	0.72		0.58-0.87	0.78		0.61-0.99	0.152
Riboflavin (mg) *	1.53		1.17-1.96	1.49		1.17-1.95	0.721
Niacin (mg) *	15.33		12.83-18.38	14.08		12.35-16.83	0.069
Vitamin B_6 (mg)‡	0.98		0.83-1.20		0.87	0.73-1.09	0.044
Vitamin B_{12} (µg)‡	4.81	2.37		4.25	1.58		0.145
Vitamin D (µg) ‡	0.75		0.30-1.72		0.58	0.15-0.97	0.115
Vitamin C (mg) *	52.59		36.22-73.95		52.89	45.58-81.80	0.949
Folate (µg)*	122.97		103.25-149.00	134.91		110.50-164.00	0.062
Minerals							
Fe (mg) *	5.53		4.60-6.58	6.36		4.80-8.00	0.031
Zn (mg)	4.69	1.21		5.00	1.07		0.126
Ca (mg)*	773.77		591.25-1000.50	801.16		632.25-1058.0	0.597
Na (mg)	1047.23	329.2		1151.36	274.2		0.064
Salt (g)	2.66	0.83		2.93	0.69		0.063
Se (µg)	20.0		16.0-26.0	18.0		15.0-22.8	0.120
I (µg)	167.0		119.25-219.0	152.50		119.25-205.0	0.583

*Log transformation: geometric mean and IQR were reported, ‡Mann-Whitney test Median and IQR were reported based on raw data

Analysis by father's education level

	Father education under lower than university level			Father education under university level and above			
	Mean	SD	IQR	Mean	SD	IQR	*P* value
Energy (kcal)	1111.18	218.23		1122.26	204.94		0.741
Fat (g)	47.24	11.96		45.49	10.27		0.320
Fat (% energy)	37.15	4.81		35.79	4.63		0.071
Protein (g)*	39.74	10.59		39.79	8.92		0.976
Protein (%energy)	14.39	2.28		14.38	2.07		0.981
Carbohydrate (g)	139.72	28.36		145.96	30.99		0.190
Carbohydrate(% energy)	48.11	5.71		49.75	5.38		0.065
Sugar (g)	70.13	16.88		73.14	18.72		0.292
Sugar(% energy)	24.25	5.03		24.99	5.07		0.357
NMES (g)*	29.31		20.98-50.15	30.35		20.13-51.45	0.704
NMES (%energy) *	10.22		6.70-15.98	10.48		6.65-17.73	0.772
NSP (g) *	5.31		3.73-7.88	5.77		4.00-8.25	0.240
Vitamin A(µg)	400.3	208.1		443.3	162.4		0.144
Thiamin (mg)*	0.74		0.56-0.97	0.73		0.58-0.99	0.722
Riboflavin (mg)	1.64	0.62		1.60	0.57		0.666
Niacin (mg) *	15.43		12.10-20.48	14.61		12.45-18.70	0.197
Vitamin B_6 (mg) *	1.01		0.75-1.35	0.89		0.67-1.23	0.015
Vitamin B_{12} (µg)	4.69	2.38		4.63	2.05		0.844
Vitamin D (µg)‡	0.77		0.28-1.83	0.69		0.29-1.26	0.534
Vitamin C (mg) *	53.88		31.78-83.78	51.72		33.60-80.38	0.600
Folate (µg)*	125.22		100.0-162.75	126.90		104.25-163.75	0.767
Fe (mg)‡	5.53		4.03-7.58	5.93		4.23-7.90	0.229
Zn (mg)	4.73	1.20		4.81	1.16		0.658
Ca (mg)*	783.94		518.50-1105.50	778		572.50-1012.75	0.914
Na (mg)	1037.61	310.88		1107.17	321.37		0.169
Salt (g)	2.63	0.79		2.81	0.82		0.170
Mg(mg)*	152.76	40.98		160.53	41.73		0.239
Se (mg)*	19.17		12.25-28.0	19.19		14.0-27.75	0.983
I*	156.97		100.50-240.75	159.29		105.25-226.0	0.845

Analysis by mother's education level

	Mother education under lower than university level			Mother education under university level and above			
	Mean	SD	IQR	Mean	SD	IQR	*P* value
Energy (kcal)	1086.87	219.18		1155.39	193.73		0.040
Fat (g)	46.42	12.15		46.10	9.06		0.859
Fat (% energy)	37.26	4.83		35.33	4.45		0.010
Protein (g)*	39.06	10.15		40.64	9.04		0.307
Protein (%energy)	14.49	2.17		14.27	2.15		0.519
Carbohydrate (g)	135.76	27.92		152.43	29.93		0.000
Carbohydrate(% energy)	47.87	5.71		50.45	5.09		0.003
Sugar (g)	69.15	17.65		75.08	17.83		0.037
Sugar(% energy)	24.43	5.18		24.95	4.91		0.525
NMES (g)*	28.11		20.0-50.10	32.26		21.00-51.80	0.134
NMES (%energy) *	10.04		6.65-15.85	10.79		6.80-17.90	0.402
NSP (g) *	5.10		3.85-7.80	6.18		3.80-8.60	0.006
Vitamin A(µg)	406.1	205.4		446.3	154.4		0.172
Thiamin (mg)*	0.73		0.62-0.96	0.73		0.52-1.00	0.980
Riboflavin (mg)	1.68	0.62		1.54	0.55		0.130
Niacin (mg) *	15.11		12.45-20.65	14.80		11.80-17.70	0.621
Vitamin B_6 (mg) *	0.97		0.74-1.39	0.91		0.67-1.21	0.160
Vitamin B_{12} (µg)	4.89	2.35		4.35	1.96		0.119
Vitamin D (µg)‡	0.680		0.26-1.49	0.710	0.33-1.27		0.717
Vitamin C (mg) *	52.10		32.25-81.65	53.41		30.80-82.60	0.752
Folate (µg)*	123.72		100.50-158.50	129.26		99.0-169.0	0.329
Fe (mg)‡	5.51		4.05-7.40	6.06		4.50-8.10	0.105
Zn (mg)	4.65	1.22		4.94	1.11		0.125
Ca (mg)*	787.73		552.50-1066.50	773.12		557.0-1031.0	0.751
Na (mg)	1021.16	325.01		1144.45	296.24		0.014
Salt (g)	2.59	0.825		2.90	0.752		0.014
Mg(mg)*	150.08	39.72		165.76	42.18		0.017
Se (mg)*	18.30		12.0-26.0	20.36		14.0-28.0	0.099
I*	161.59		111.0-246.0	154.14		98.0-214.0	0.532

Analysis by mother's weight status

	Normal weight (n=101)			Overweight or obese (n=59)			
	Mean	SD	IQR	Mean	SD	IQR	*P* value
Energy (kcal)	1101.37	220.17		1151.24	184.62		0.146
Fat (g)	45.56	11.71		47.71	9.77		0.237
Fat (% energy)	36.24	4.83		36.61	4.64		0.636
Protein (g)	39.72	10.03		39.83	9.13		0.945
Protein (%energy)	14.63	2.13		13.97	2.16		0.062
Carbohydrate (g)	139.84	30.13		148.82	28.91		0.067
Carbohydrate(% energy)	48.76	5.44		49.44	5.83		0.460
Sugar (g)	70.51	18.14		73.97	17.48		0.240
Sugar(% energy)	24.58	4.72		24.81	5.59		0.783
NMES (g)	31.63	16.55		39..67	19.89		0.007
NMES (%energy) *	9.58		6.55-14.25	11.85	8.30-15.60		0.016
NSP (g) *	5.52		4.25-7.50	5.61		4.60-7.00	0.763
Vitamins							
Vitamin A(μg)	432.9	200.5		408.6	155.4		0.425
Thiamin (mg) *	0.72		0.57-0.92	0.76		0.65-0.89	0.235
Riboflavin (mg) *	1.52		1.17-2.03	1.50		1.15-1.88	0.842
Niacin (mg)*	14.82		12.35-17.35	15.24		13.40-17.70	0.523
Vitamin B_6 (mg)*	0.94		0.80-1.13	0.95		0.81-1.21	0.819
Vitamin B_{12} (μg)	4.82	2.32		4.38	1.96		0.230
Vitamin D (μg) ‡	0.68		0.28-1.50	0.71		0.31-1.23	0.914
Vitamin C (mg) *	52.23		38.90-77.45	53.44		35.80-75.0	0.775
Folate (μg)*	126.15		103.50-152.50	126.15		105.0-151.0	1.000
Minerals							
Fe (mg) *	5.64		4.30-7.45	5.93		4.80-6.60	0.392
Zn (mg)	4.76	1.19		4.79	1.16		0.882
Ca (mg)*	768.87		587.50-1020.0	802.81		645.0-1011.0	0.478
Na (mg)	1075.64	332.36		1076.25	293.38		0.991
Salt (g)	2.73	0.84		2.73	0.74		0.990
Se (μg) ‡	21.11	8.13		20.03	7.93		0.417
I (μg) ‡	176.52	79.88		172.89	70.79		0.773

*Log transformation: geometric mean and IQR were reported, ‡Mann-Whitney test Median and IQR were reported based on raw data

Analysis by mother's nutritional knowledge

	≤ 5 knowledge (n=117)			> 5 (n=43) knowledge			
	Mean	SD	IQR	Mean	SD	IQR	*P* value
Energy (kcal)	1136.72	196.68		1064.37	238.46		0.054
Fat (g)	47.19	10.38		43.77	12.53		0.082
Fat (% energy)	36.55	4.72		35.99	4.87		0.511
Protein (g)	40.18	9.80		38.63	9.33		0.371
Protein (%energy)	14.25	2.02		14.76	2.49		0.184
Carbohydrate (g)	145.53	28.38		136.69	33.22		0.098
Carbohydrate(% energy)	48.99	5.61		49.06	5.55		0.951
Sugar (g)	73.46	18.46		67.23	15.69		0.051
Sugar(% energy)	24.76	4.98		24.39	5.28		0.676
NMES (g)*	32.47		23.10-46.55	23.83		17.40-37.70	0.002
NMES (%energy) *	11.05		8.00-16.00	8.71		6.10-12.90	0.013
NSP (g) *	5.39		4.25-7.25	6.03		5.00-7.70	0.152
Vitamins							
Vitamin A(µg)	424.9	179.9		421.2	200.58		0.911
Thiamin (mg) *	0.73		0.61-0.89	0.73		0.57-0.92	0.965
Riboflavin (mg) *	1.55		1.23-2.01	1.42		1.10-1.88	0.192
Niacin (mg)*	14.95		12.75-17.40	15.05		12.40-18.40	0.892
Vitamin B_6 (mg)*	0.95		0.83-1.14	0.94		0.69-1.22	0.816
Vitamin B_{12} (µg)	4.89	2.20		4.01	2.08		0.025
Vitamin D (µg) ‡	0.67		0.31-1.33	0.80		0.25-1.37	
Vitamin C (mg) *	53.33		40.30-74.50	50.93		34.70-81.0	0.598
Folate (µg)*	127.99		105.0-155.0	121.25		102.0-145.0	0.281
Minerals							
Fe (mg) *			4.70-7.00			4.40-6.60	0.464
Zn (mg)	4.81	1.17		4.68	1.19		0.544
Ca (mg)*			612.0-1051.50			557.0-933.0	0.329
Na (mg)	1080.80	294.88		1062.44	376.11		0.747
Salt (g)	2.75	0.749		2.69	0.95		0.746
Se (µg)	20.98	8.52		19.98	6.64		0.485
I (µg)	181.51	78.62		157.98	68.11		0.084

*Log transformation: geometric mean and IQR were reported, ‡Mann-Whitney test Median and IQR were reported based on raw data