Examining the effects of stress on eating behaviour in children and young adults

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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.

The following chapter is based on work of a jointly authored publication:

> Chapter 2: Exploring the effects of stress on eating behaviours in children aged 8 to 12 years old: A systematic review and meta-analysis.

The reference to this jointly authored publication is the following:

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Within this publication, the following tasks were conducted by the following individuals:

1. Rachael Moss, Deborah Hill, Daryl O'Connor and Mark Conner identified a gap in the literature, which led to the development of this review and meta-analysis.
2. Rachael Moss and Deborah Hill conducted the literature search (including article selection/elimination) and extracted the data from suitable articles.

Daryl O'Connor and Mark Conner provided support within each of these stages.

3. Bianca Sykes-Muskett helped Rachael Moss and Deborah Hill with the analytical steps involved, as did Daryl O'Connor and Mark Conner.
4. Rachael Moss, Deborah Hill, Daryl O'Connor and Mark Conner wrote the manuscript.
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Dedication

I would like to dedicate this thesis to my parents. I will be forever grateful for all that you have given me. I hope this thesis makes you proud.

Accompanying conference presentations

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Abstract

In adults, stress has been found to initiate both increases and decreases in eating behaviours, and has been found to affect the types of foods consumed. However, there is a paucity of research on stress and eating amongst children and few studies have investigated the role of other factors such as positive and negative emotions. This thesis explored the impact that stress and emotions had on the eating behaviours of children aged 8-12 years in comparison to that of undergraduate students aged 18-49 years. To explore this, four studies were conducted, of which two utilised a repeated measures daily diary design where stress was also measured using salivary cortisol.

Stress was measured by assessing daily hassles and emotions were measured by assessing positive and negative emotions together with daily uplifts. To explore eating behaviour, self-reported between-meal snacking was the main outcome variable.

Overall, stress was found to be associated with the snacking behaviours of both children and undergraduate students (Studies 1 and 2). Children provided more snack responses for positive emotions, whereas undergraduate students responded more for negative emotions (Study 1). Total hassles were found to be positively related to total snack consumption. The impact of total hassles on total snack consumption was moderated by cortisol reactivity within children (Study 3). Amongst undergraduate students, the relationship between total hassles and unhealthy (high in sugar and fat) snack consumption was moderated by cortisol awakening response (Study 4).

Future research should consider concerns of under/over-reporting snack behaviours and the difficulty of ensuring newly formed stress measures are valid. There are however additional individual factors (e.g., gender and ethnicity) that could influence the stress-eating relationship. It would be useful if researchers explored developing individual coping strategies to reduce the effects of stress and emotion on eating behaviours.

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List of Abbreviations

AUC	Area under the curve
AUCg	Area under the curve with respect to ground
BMI	Body mass index
CAR	Cortisol awakening response
CMA	Comprehensive Meta-Analysis Software
DEBQ	Dutch Eating Behavior Questionnaire
DH	Deborah Hill
DOH	Department of Health
DNA	Deoxyribonucleic acid
DV	Dependent variable
HLM	Hierarchical Linear and Non-Linear Modelling Software
HPA	Hypothalamic-pituitary-adrenal axis
IV	Independent variable
M	Mean
MCAR	Missing completely at random (Little's (1988) test)
MHF	Mental Health Foundation
NHS	National Health Service
PHE	Public Health England
SAM	Sympathetic adrenal medullary system
SD	Standard deviation
SE	Standard error
SES	Socio-economic status
TSST	The Trier Social Stress Task (Kirschbaum, Pirke & Hellhammer, 1993)
TSST-C	The Trier Social Stress Task for Children (Kirschbaum et al., 1997)
UG	Undergraduate students
WHO	World Health Organization
WP-12	Wake-peak sample minus 12 hour sample

Chapter 1. Introduction: Exploring the stress-eating relationship in children aged 8-12 years

1.1 Childhood Obesity

The World Health Organization (WHO, 2003) claim that obesity is a clearly 'visible' but largely 'neglected' health problem that needs large scale action. The scale of the problem has now become widespread because obesity explains a high level of 'all-cause mortality' in four continents across the world (The Global BMI Mortality Collaboration, 2016). Obesity levels have risen dramatically in the past 10 to 20 years where, in 2016, more than 650 million adults were obese (WHO, 2018). A similarly concerning picture can be seen for children, where worldwide, in 2016, more than 340 million children and adolescents (aged 5-19 years) were either overweight or obese (WHO, 2018).

Public Health England (PHE, 2017a) considers the problem of childhood obesity to be a 'serious global public health challenge' for the 21st century. In England, 2016 statistics show that amongst 4-5 year old children, 9.6% were obese and a further 13% were classified as overweight (Baker, 2018). In 2016, amongst those aged 10-11 years old, 20% were obese and 14.3% were overweight (Baker, 2018). Such rates are alarming across both age groups, however, interestingly, rates of obesity amongst children are doubling across just 5-6 years of development (further emphasising the influence of cohort and age). This exponential rate of growth is important to acknowledge for two reasons. Firstly, being obese in childhood increases the risk of developing health conditions that were previously thought to originate in adulthood. For example, the prevalence of non-alcoholic fatty liver disease, atherosclerosis (hardened arteries), high blood pressure, and type 2 diabetes is increasing amongst children who are obese (Daniels, 2006). Secondly, there is the concern that obese children maintain their detrimental eating behaviours as they move into adulthood. Children who are classified as obese, are more likely to become obese in adulthood, when compared to their normal weight counterparts (Daniels, 2006). More alarmingly, it has been found that older obese children are more likely to maintain their obese status as they move into adulthood, in comparison to younger obese children (Daniels, 2006). This presents a concerning picture given that recent statistics found that rates of obesity amongst children had doubled from 4 to 10 years of age.

1.2 ‘Causes’ of Childhood Obesity

It is evident that childhood obesity is growing exponentially and as such, it is becoming ever more important to understand why this prevalence is increasing. Existing research provides suggestions in regards to what may be affecting this increase.

Anderson and Butcher (2006) acknowledge that the family home environment has changed dramatically over the last 30 years. Changes in the availability of convenience foods, increased parental working hours and a reduction in the number of households that have a stay-at-home parent are all possible factors that could explain the decrease in the amount to which home cooked food is prepared. It has been found that cooking meals at home increases the likelihood that an individual will be consuming a ‘healthier diet’ than those who do not cook at home (Wolfson & Bleich, 2015), even without knowing what specific food is being prepared.

Evidence suggests that up to 70-80% of obesity has a genetic basis (Friedman, 2009). Such evidence, Ells, Demaio, and Farpour-Lambert (2018) argues, could allow individuals who have weight concerns to place blame on their genes, and as such, allow themselves to become passive when they make decisions about their dietary behaviours. However, although genes have been seen to play a role in obesity, it is important to appreciate that ‘monogenic’ (singular genetic) causes that lead to the development of obesity are infrequent, and more commonly, genetic predisposition has a ‘polygenic’ origin (from multiple genes, Ells et al., 2018).

Stress-related or stress-induced eating has been identified as a mechanism behind the change in eating behaviours. Stress has been found to directly affect eating behaviour (e.g., O'Connor, Jones, Conner, McMillan & Ferguson, 2008). For example, Conner, Fitter, and Fletcher (1999) found that students’ (aged 18-22) reports of daily hassles were positively correlated to the number of snacks consumed. Cartwright et al. (2003) showed that when adolescents had high stress levels, they ate more fatty foods and less fruit and vegetables.

Such research shows examples of eating behaviours that have changed in the presence of increasing stress levels, although it is interesting to note the ‘mechanisms’ that have been associated with such eating behaviour changes. For example, Araiza and Lobel (2018) acknowledge that it is ‘mood, cognition, coping and hormones’ that have been the most frequently explored.

There is a plethora of existing literature that documents the eating behaviour changes that can occur in response to stress. As such, this provides evidence to suggest that stress could be a potential contributing factor for childhood obesity. This provides justification for further exploration.

1.3 The Role of Snacking in the Development of Obesity

It has been evidenced that stress can lead to changes in eating behaviours, however, certain evidence highlights that snacking behaviours can also alter in response to stress. Zellner et al. (2006) identified that stress was linked to an overconsumption of food, particularly in favour of high calorie snack foods (that students (mean age: 22 years) reported they would usually avoid). The earlier work of Oliver and Wardle (1999) identified similar findings, however, additionally found that students (19-54 years) reported eating fewer ‘meal-type’ foods (e.g., meat and vegetables) when they were experiencing stress.

These examples illustrate that when adults are experiencing stress, an overconsumption of snacks can occur alongside a reduction in the consumption of meal foods. Food overconsumption has been associated with leading a sedentary lifestyle, an interaction that Jacobs (2006) states increases an individual’s risk of developing obesity.

1.4 What is Stress?

Today, stress is frequently discussed in both media and academic sources. Lazarus and Folkman (1984) explore the connotations associated with the word *stress*. Historically, Lazarus and Folkman appreciate that it had previously been used to denote 'hardship or adversity'. Hinkle (1977, as cited in Lazarus & Folkman, 1984) acknowledge that *stress* was used within the scientific domain, to denote the internal force within an object. Lazarus and Folkman (1984) report that it was only in the 19th century that words such as *stress* and *strain* became used to relate to physical ill health and struggle. However, in this sense, Lazarus and Folkman define stress as the 'relationship that an individual has with their environment', when the individual believes the environment is asking something that is too demanding for them to cope with (i.e., in terms of using their own abilities and resources). It is this inability to cope that can have a detrimental effect on individual health outcomes (Lazarus & Folkman, 1984).

The change of focus within the stress definition may be one of the reasons why the word *stress* is so frequently utilised today. The Mental Health Foundation (MHF, 2018b) appreciate that experiencing stress may not always be detrimental for individuals, and that sometimes it may help some perform or cope better (known as eustress, Selye, 1987). Any individual could experience and suffer from the effects of stress, however, the MHF (2018b) acknowledge that most individuals suffer with stress due to their perceived inability to cope with their environmental demands.

Stress is not visible per se, and unless someone expresses such an emotion, it may not be possible to visibly detect the presence of stress. This makes measuring the prevalence of stress difficult. As such, some have assessed stress by measuring the outcomes of experiencing stress. For example, amongst adults, 13.3 million working days are lost each year due to stress-related mental health concerns (i.e., depression, anxiety or stress, MHF, 2018b). This figure may be largely underestimated because not all sufferers will need to or will allow themselves to take days off work due to stress, and there is the potential that some people will suffer with the effects of stress in silence.

Amongst children, the prevalence of stress can be equally difficult to measure, however, the MHF (2018a) reports that up to 1 in 10 children are currently affected by mental health problems. Although this statistic gives us a clearer insight into the prevalence of mental ill health, it is important to appreciate that this statistic may underestimate the impact in regards to those suffering from the effects of mental ill health in silence.

1.5 Stress-Related Eating

In addition to physiological changes (i.e., changes in heart rate (Delaney & Brodie, 2000)), stress is also related to subsequent changes in eating behaviours (Laitinen, Ek, & Sovio, 2002). Morley, Levine, and Rowland (1983) report that historically, humans have frequently shown a tendency to consume food, bite or chew whenever stress is experienced, with examples including teeth grinding, nail biting and gum chewing.

Robbins and Fray (1980) confirm the presence of food-related stress responses, by exploring the factors that relate to eating behaviours in humans. This research identifies that stress-related eating can occur for different reasons other than just craving palatable foods or reducing hunger from food-deprivation. Robbins and Fray (1980) state that stress-related eating does not have the ability to remove the ‘aversive’ nature of the distressing stimuli, just the ability to allow the individual to focus and become more ‘responsive’ to food. As such, stress-related eating has been linked to both hyperphagic (increased) and hypophagic (decreased) responses in regards to food consumption (O'Connor et al., 2008).

However, it is vital to appreciate that eating behaviours can be specifically altered in response to stress. For example, individuals may choose to consume more snacks, eat less fruit and vegetables or main meals when stress is present (O'Connor et al., 2008). The types of foods consumed when stress is present can alter dramatically, with Oliver and Wardle (1999) showing that sweets, chocolate, cakes and biscuits were 60-70% more likely to be consumed at this time. Interestingly, specific food alterations can be gender specific too, with women more likely to experience hyperphagia for sweets and chocolate, and hypophagia for meat, fruit and vegetables (Oliver & Wardle, 1999).

Stress-related eating is not clear cut, and as such it is difficult to ascertain exactly what initiates such eating responses. For example, Araiza and Lobel (2018) acknowledge that an individuals' emotional state and coping resources are factors that act as 'potential mechanisms' within the stress-eating relationship.

Macht (2008) explores the reasoning behind the influence of emotional eating, where the presence of negative emotions initiate the consumption of palatable foods, allowing the individual to get subsequent short-term relief from such negative emotions. The pleasurable distraction of over-eating is a tool that Macht (2008) believes may be increasingly being used to deal with 'everyday emotions'.

1.6 Stress-Related Eating Amongst Adults

It is useful to understand the stress-eating literature in adults for two reasons: 1: understanding the patterns of behaviour associated within stress-eating behaviour in this population can help guide the direction of new literature in children and 2: the current research used undergraduate students (i.e., young adults) as a comparison group so understanding adult behaviour patterns would be useful for comparing the behaviour present amongst students.

Within the adult literature, the overarching theme is that stress is associated with a change in eating behaviour (e.g., Greeno & Wing, 1994), either leading to hyperphagic, hypophagic eating or identifying no change in eating behaviours. A variety of eating behaviours have been found to be affected by stress. For example, snacking behaviours (Oliver & Wardle, 1999), fruit and vegetable consumption and main meal consumption (O'Connor, 2018). Such examples show that an array of eating behaviours can be influenced by stress, where it seems that adults engage in more unhealthy and less healthy eating behaviours (O'Connor et al., 2008). This finding suggests that overall, stress seems to have a detrimental influence on the eating behaviours of adults. However, an up to date meta-analysis (following the work of Greeno & Wing, 1994) in this area does not currently exist, so it is vital to acknowledge that some research studies may give a misrepresented view of the stress-eating relationship if they have a small sample size or unequal balance of males and females in the study for example. Nevertheless, a summary of some notable studies (selected because of their choice of stress/eating measure or study findings) within the adult stress-eating literature are presented in Table 1.1 below.

Table 1.1. A summary table showing the main characteristics of key studies in the adult stress-eating literature.

Author(s) and Year	Sample size	Gender	Stress measurement	Eating behaviour measurement	Overall finding
Conner et al. 1999	60	33 females 27 males	Daily diary	Between-meal snack consumption	The number of hassles experienced was found to be significantly correlated with the number of snacks consumed.
Epel, Lapidus, McEwen and Brownell 2001	59	All female	Induced and objective (salivary cortisol)	Objectively measured food intake	Those with high cortisol levels were found to consume more calories after being exposed to an induced stress task.
Newman, O'Connor and Conner 2007	50	All female	Induced and daily diary	Between-meal snack consumption	A significant relationship between daily hassles and snack intake was identified (those with more daily hassles were found to consume more snacks).
O'Connor et al. 2008	422	229 females 193 males	Daily diary	Between-meal snack consumption	Daily hassles were found to be associated with an increased consumption of between-meal snacks and a decrease in the consumption of main meals and fruit and vegetables.
Wallis and Hetherington 2009	26	All female	Induced	Objectively measured food intake	The relationship between amount of food consumed and emotional eating status was significant. Those with high emotional eating were more likely to report overeating behaviours.

1.7 Using Theory to Understand the Stress-Eating Relationship

To explore the stress-eating relationship, it is useful to refer to theory to help explore how this interaction is underpinned. Existing literature presents both hyperphagic and hypophagic eating behaviours as stress responses, both of which relate to dietary choice (albeit conscious or subconscious, Oliver, Wardle & Gibson, 2000). Maintaining a focus on dietary choice, it is possible to use both the reward and escape theories to explore the relationship between stress and eating behaviours. The reward theory was proposed by Adam and Epel (2007), where cognitive restraint (cognitively restricting food consumption, Lowe & Kral, 2006) was said to be a pre-cursor for altering eating behaviours. Within this theory, when stress was present, cognitive restraint initiated specific reward pathways within the brain. These pathways sought stimulation through the consumption of highly palatable food to reduce the impact of the stress ('threat') experience. The consumption of palatable food items consumed in response to cognitive restraint acted as a 'reward' for the individual (Adam & Epel, 2007).

The escape theory by Heatherton and Baumeister (1991) stated that overeating results from an individual's attempt to 'escape' thoughts of the self (i.e., being self-aware – having 'knowledge' of the self, Brown & Ryan, 2003). Heatherton and Baumeister (1991) acknowledge that some individuals find it to be a burden if they are self-aware, so may at times try to 'escape' this level of awareness. This theory reported that such escapism would allow an individual to focus on their current environment and step away from thoughts of self-awareness.

Both these theories focus on the pleasure that individuals can obtain from engaging in eating behaviours. This element of pleasure may be associated more with hyperphagia than hypophagia. However, the core principle that aligns both theories is the underlying sense of improving an individual’s feelings (e.g., rewarding behaviour or escaping from the present moment). These theories provide one avenue of exploration for understanding the stress-eating relationship.

1.8 Moderators of the Stress-Eating Relationship

Existing research has identified that individual differences affect the way in which individuals engage with and consume food. In this regard, there are different variables that have been found to act as moderators of the relationship between stress and eating.

For many health behaviours, age has been found to affect the way in which an individual behaves. For example, PHE (2017b) found that the amount of physical activity children engage in decreases by 40% as they move from age 5 to 11. Fast food consumption is another behaviour that has been found to differ by age, with a sample of children found to consume more fast food (42%), compared to a sample of adults (37%, Paeratakul, Ferdinand, Champagne, Ryan & Bray, 2003).

Within the stress-eating relationship, eating behaviour differences across different age groups have been identified. Hill, Moss, Sykes-Muskett, Conner, and O'Connor (2018) found that the stress experiences of young children (aged 8-12) were not significantly associated with their healthy eating behaviour (when using the ‘assuming independence’ model of analysis). This shows that stress was not associated with an increase or a decrease in the amount of healthy eating behaviours within the children’s diet. However, in adults the opposite has been identified. O’Connor et al. (2008) found that when adults experienced stress, they subsequently consumed fewer vegetables.

Two particular types of eating style have been linked to stress-related eating. The first is emotional eating style, the tendency to respond to emotion (either positive or negative) by increasing or decreasing your food consumption (van Strien, Frijters, Bergers & Defares, 1986). Although physiologically, our body usually does not want to consume food when we are in a threatening or dangerous situation (because we have a suppressed level of hunger (Charmandari, Tsigos & Chrousos, 2005)), we now know that individuals can mistake feelings of stress as feelings of hunger (Conner et al., 1999). In line with this, research illustrates that the presence of emotional eating has been associated with unhealthy dietary patterns (Michels et al., 2012).

Alongside emotional eating, external eating is another eating style that has been found to influence the presence of stress-related eating. External eating styles are behaviours that individuals display when engaging with and responding to their external environment (Conner et al., 1999). Newman, O’Connor and Conner (2008) illustrated that individuals with high external eating styles had a ‘greater bias’ for snack words, suggesting that such individuals would be more receptive to snacks within their surrounding environment. Both eating styles have supporting literature that suggests stronger levels of each trait encourages an increase in food consumption, emphasising the importance of including such factors as exploratory moderator variables.

Stress can additionally be measured physiologically by measuring blood pressure, heart rate (Cohen, Kessler & Gordon, 1995) or cortisol (Buchanan, al'Absi & Lovallo, 1999). Cortisol is a hormone that is released when stress is experienced, and subsequently it stores glucose to prepare the body for responding to this stress. Cortisol also reduces and prevents inflammation in the body as well as assisting the body in the way fat is stored. The adrenal glands produce cortisol and they are located above the kidneys, deep in the abdomen (Hine & Martin, 2016).

It has been found that cortisol is a useful mechanism for measuring the amount of stress an individual is experiencing. This is of particular use when exploring the stress-eating relationship, as existing literature illustrates. For example, Newman et al. (2007) explored the impact of cortisol reactivity. Cortisol reactivity is a term used to describe the cortisol response that captures the level to which an individual has responded or been reactive to a stressor or external variable. Newman et al. (2007) found that cortisol reactivity acted as a moderator of the association between the frequency of daily hassles and snacking intake. A similar pattern was identified by Epel et al. (2001) who found that it was specifically individuals with high cortisol reactivity who responded to stress by consuming more, although it is interesting to note that such a pattern was not sustained when such individuals did not experience stress. Both examples suggest that stress needs to be present along with the presence of high cortisol reactivity for eating behaviour to be negatively affected.

1.9 Addressing the Need to Further Explore the Effects of Stress on Eating Behaviour amongst Children

Childhood obesity is continuing to grow. This is concerning because not only will it affect the health of children today, it will have an influential effect on the health and behaviours of such children as they move from childhood to adulthood (Mikkilä, Räsänen, Raitakari, Pietinen & Viikari, 2005). The detrimental 'downstream costs' (Araiza & Lobel, 2018) of stress-related eating could be influencing and further increasing the prevalence of overweight and obesity. Such research illustrates that stress has been found to affect the eating behaviours of children. This provides justification for more research to examine this stress-eating relationship further. O'Connor (2018) acknowledges that exploring how the 'nature' of stress affects eating behaviours would be an interesting avenue to expand upon.

1.10 Comparing Children's Eating Behaviours with those of Undergraduate Students

Hill et al. (2018) recognise that in addition to the paucity of literature within the stress-eating domain amongst children, the stress-eating relationship amongst adolescents and young adults (categorised by Hill et al. (2018) as those aged 12-18 years) is equally lacking. Individuals in this age group are likely to be experiencing physiological pubertal changes, one of which leads to an increase in hunger (Bitar, Vernet, Coudert & Vermorel, 2000). Although adolescents maybe experiencing a change in their eating behaviours, Hill et al. (2018) emphasise the importance of exploring the stress-eating relationship in this group. One reason worth acknowledging is the likelihood that ‘poorer’ (i.e., more detrimental) eating behaviours will be more likely to stay with the child as they become an adult (Mikkilä et al., 2005).

While conducting the following research, it quickly became apparent that recruiting child participants was proving difficult. I was able to locate many different avenues for recruiting (i.e., primary schools, Brownie groups and by word of mouth), however, the response rate from these sources remained low throughout the process, despite sending out follow-up invitations. To address this, the research team identified the need to recruit different aged participants to help ensure appropriate statistical power (within each study) was reached.

A recent meta-analysis in the field highlighted that currently there is a lack of research exploring the stress-eating behaviours of those aged 8-18 (Hill et al., 2018). The research team therefore decided to utilise young adults, i.e., undergraduate students as a comparison group within this stress-eating exploration. Undergraduate students are likely to be experiencing stress and consequentially, Serlachius, Hamer and Wardle (2007) acknowledge that this group may subsequently engage in stress-related eating. This research predominantly took place in a University setting, thus making this group more convenient to recruit. Using this group as a comparison enabled appropriate numbers of participants to be obtained.

1.11 Thesis Aims and Overview

1.11.1 Thesis Aims

This thesis aimed to quantify the relationship between the stress and eating behaviours of children aged between 8-12 years old and undergraduate students. More specifically, this thesis aimed to directly compare the eating behaviours of children (aged 8-12 years) with those of undergraduate students (aged 18 and above).

1.11.2 Thesis Overview

The remaining thesis aims were as follows:

1. To synthesise the existing evidence relating to the stress-eating relationship in children aged 8-12 years and to identify the moderators of this relationship. This aim was addressed in the systematic review and meta-analysis reported in Chapter 2.

2. To identify and explore whether there was a relationship between positive and negative emotions and snacking responses in 9-10 year old children and undergraduate students. This aim was addressed in Study 1 (Chapter 3).

3. To understand how the occurrence of daily hassles and uplifts affected the daily snacking behaviours of both children (aged 8-11 years) and undergraduate students. This aim was addressed in Study 2 (Chapter 3).

4. To explore the impact of subjective and objective stress on the between-meal snacking behaviours of children aged 8-11 years. This aim was addressed in Study 3 (Chapter 4).

5. To explore the impact of subjective stress and diurnal salivary cortisol on the consumption of between-meal snacks amongst undergraduate students. This aim was addressed in Study 4 (Chapter 4).

Chapter 2. Exploring the effects of stress on eating behaviours in children aged 8 to 12 years old: A systematic review and meta-analysis

2.1 Introduction

Stress has been found to affect individuals' health behaviours, with research identifying the impact that stress has on changing eating behaviours (Oliver & Wardle, 1999). For example, individuals' vegetable consumption is often reduced (O'Connor et al., 2008) and the risk of becoming obese from engaging in stress-related eating increases (Torres & Nowson, 2007). Within the adult literature, stress is associated with both hyperphagic and hypophagic eating behaviours (Oliver & Wardle, 1999). Oliver and Wardle (1999) acknowledge that stress initiates an increase in subsequent snacking behaviours, with participants showing preference for 'high energy-dense' snacks. These snacking patterns were present across participants, irrespective of gender or dieting status (Oliver & Wardle, 1999).

Greeno and Wing (1994) summarised existing findings to help present the reasons why there may be such changes in eating behaviours. This research explored such changes using two models; the 'general effect' and 'individual-differences' models. The general effect model stems from research using animals, whereby stress was found to lead to physiological change, ultimately leading to an increase in the amount of subsequent food consumed. Greeno and Wing (1994) argued, that while this model is simplistic, it has encouraged research to explore the physiological mechanisms that may trigger these changes (e.g., the stimulating effects of cortisol, Adam & Epel, 2007).

The ‘individual differences’ model (Greeno & Wing, 1994) encompasses the ‘general effect’ model, but this model acknowledges that individual variability will play a role in the way that individuals respond, and become vulnerable to stressors. As such, these individual differences (e.g., individual emotional eating style) initiate a combination of physiological and psychological changes that consequentially lead to either an increase or a decrease in the amount of food consumed in response to stress.

The ‘individual-differences’ model has only been tested in humans, where Greeno and Wing (1994) stated that three factors make an individual more likely to engage in ‘stress-induced eating’: if they are overweight, if they are a ‘restrained’ eater and if they are female. The review by Greeno and Wing (1994) explored research focusing on animals and adults, leaving a gap uncovered in terms of exploring the stress-eating behaviours of children.

More recently, individual research studies have identified that mixed findings exist for examining the stress-eating behaviour relationships amongst children. Such findings measure eating behaviours differently and as a consequence it makes it hard to concisely summarise the direction of effect between different studies. For example, De Vriendt et al. (2012) found that perceived stress was negatively associated with the quality of adolescents’ diets. However, both Roemmich, Wright and Epstein (2002) and Balantekin and Roemmich (2012) identified that high levels of dietary restraint resulted in an increased consumption of (objectively measured) snacks after experiencing induced stress.

Current literature has identified that certain eating behaviour styles are related to the impact of stress on eating behaviours (refer to Section 1.8 for research examples). Different measures of stress have been found to influence eating behaviours in opposing ways. Objective methods for measuring stress responses are often viewed as being one of the 'best biomarkers' for measuring this physiological change (De Vriendt, Moreno & De Henauw, 2009), because chronic levels of stress are indicative of changes in appetite regulation, which can ultimately lead to an overconsumption of food (Wilson & Sato, 2014). On the other hand, subjective methods of measuring stress, although easier to administer and more frequently used (Newman et al., 2007), can often lack detail about the stressor they are capturing. For example, they may often lack detail about the nature of the stressor – in terms of what happened, when and the stressor's intensity (Wilson & Sato, 2014). This type of subjective approach could be seen as less informative, and as such, may not be as predictive of subsequent eating behaviours. Both methods provide different ways of capturing stress experiences and could be used together to create a more comprehensive illustration of individuals' stress experiences.

Sex differences in eating responses to stress have been observed within existing literature. For example, Zellner et al. (2006) found that more women reported overeating in response to stress than men. This pattern is often identified and was a prediction made by Cartwright et al. (2003) when they examined adolescents' behaviour. Cartwright et al. (2003) found that there were significant differences amongst the eating behaviour patterns of girls and boys, with girls eating more fruit and vegetables and less fatty foods than boys when eating in response to stress.

Studies that utilise different methodologies can generate very different findings. Macht, Haupt, and Ellgring (2005) found that examination stress increases the likelihood that participants will consume food. Oliver and Wardle (1999) identified similar findings, where participants were seen to increase their consumption of snack foods, however, there was a decrease in the consumption of ‘meal-style’ foods (e.g., fruit, vegetables, meat and fish). Such research illustrates the disparity with which certain food groups are consumed as a consequence of experiencing stress, thus emphasising the need to explore this relationship further.

The following systematic review and meta-analysis focuses on children aged between 8-12 years of age. The behaviours of children are seen to be more malleable than those of older individuals, but once formed, such behaviours may continue into adulthood (Videon & Manning, 2003). This highlights why it is important for the current research to explore how stress currently affects the eating behaviours of children. Another reason why the current review focused on children aged 8-12 years old is because there is currently a lack of research exploring the effect that stress has on eating behaviours in pre-pubertal children. Although the average onset age for puberty is 11 years for girls and 12 years for boys (NHS, 2018), some children will begin puberty at a younger or older age. This means that some participants within the following studies may have been experiencing physical pubertal changes (e.g., food consumption naturally increases at this stage, Simon, Wardle, Jarvis, Steggles & Cartwright, 2003). However, because the average onset age of puberty is at the upper end of the age range of 8-12 years here (i.e., the focus of this systematic review and meta-analysis), it is acknowledged as being pre-pubertal. Children as young as 8 years old were included in the target population here, because research has found that children of this age have been able to independently report their eating behaviours (Livingstone, Robson & Wallace, 2004). For the purposes of this review, it was necessary to measure the eating behaviours of children (and not their parents/caregivers), and such support for this age group helped determine the specific age range used.

2.2 Method

2.2.1 Databases Utilised

The following main electronic databases were searched: Web of Science (using the Core Collection, BIOSIS Citation Index and the Data Citation Index databases (1990 - present)), Ovid (using the Global Health (1973 – present)), Ovid Medline (1946 – present), Ovid Medline in-Process and Non-indexed citations, Allied and Complimentary Medicine (1985 - present), Food Science and Technology Abstracts (1969 – present) databases and PsycInfo (1806 – present).

2.2.2 Selection Process

Initial literature searches were completed in December 2015, and were repeated again in May 2018. Once the initial searches had been conducted, email alerts were sent to the primary researcher (Rachael Moss) to help identify any suitable articles that had been published after this initial search. The final number of articles was assessed on 31st May 2018.

2.2.3 Search Terms

A list of search terms were selected for use in both searches (see Appendix A for the complete search strategy as well as an example search status from the Global Health database as an example). The search terms focused on three areas: stress, eating behaviours and children, and an appropriate set of words and synonyms were formulated to explore these themes. The following words were searched using the Boolean operator ‘or’ in between each word to specify that the databases should search for papers that contain at least one of these words. The following words within each theme were utilised:

Stress measurement: stress* OR hyperphagi* OR daily hassle* OR daily stress* OR hypophagi* OR cortisol* OR saliva* adj cortisol OR stress reactive* OR worry* OR distress* OR coping OR perceive* stress* OR life event* OR life stress* OR trier social stress test OR initiated stress* OR distressing event*.

Eating behaviour measurement: snack* OR eat* OR stress adj eat* OR eating behavio* OR unhealthy adj diet OR unhealthy adj food* OR unhealthy adj eat* OR healthy adj diet OR healthy adj food* OR healthy adj eat* OR food habit* OR eat* behavio* OR main meal* OR overeat* OR undereat* OR food consum* OR vegetable* OR fruit* OR fast adj food* OR junk adj food* OR calorie* OR food intake OR kilocalorie* OR hypophagi* OR hyperphagi* OR diet* OR eat* pathology OR diet* restrain* OR attitude* OR sugar* OR emotion* eat* OR BMI OR body mass index OR adiposity OR fat OR snack* OR meal OR between-meal snack* OR stress-induced eat* OR eating habit* OR food consum* OR food intake OR between adj meal*.

Children: healthy adolescent* OR healthy young adult* OR teenager* OR adolescen* OR young adult OR youth OR preadult OR child* OR juvenile OR school children* OR minor OR teen OR school* OR student*.

(* = denotes words that have been searched using a truncation, ‘adj’ = adjacent).

2.2.4 Inclusion Criteria

2.2.4.1 Population

Children between the ages of 8-12 years old were the focus of the search. An article was included if it contained any participants within this specified age range. If an article stated that it had used adolescents, it was included so that it could be assessed for further suitability (i.e., in terms of whether the participants were in the specified range of 8-12 years old).

2.2.4.2 Stress Measure

An article was included if the study measured stress in any form. Stress may have been operationalised in many forms, all of which were included at this stage. These operationalisations could have included previous stress related experiences/symptoms, current stress related experiences/symptoms or they could have measured an element of physiological/psychological stress.

2.2.4.3 Eating Behaviour Measure

If an article measured any element of dietary consumption it was included (e.g., snack or meal consumption or the frequency to which foods are consumed (i.e., within the diet as a whole)).

2.3 Data Synthesis

A total of 33,409 articles were identified within this search (see Figure 2.1.). The primary researcher and her colleague (Deborah Hill, DH) conducted this search and screened the articles to assess their eligibility. Inter-rater reliability was checked by both individuals to ascertain the suitability of 10% of the total number of articles identified, at both title (N = 2,800) and abstract levels (N = 40). This second coding process showed that inter-rater reliability across all stages was good at title level ($\kappa = 0.64$), abstract level ($\kappa = 0.71$) and across the whole second coding process ($\kappa = 0.74$). If discrepancies in any level were present, these were discussed to ensure a suitable decision regarding eligibility was reached.

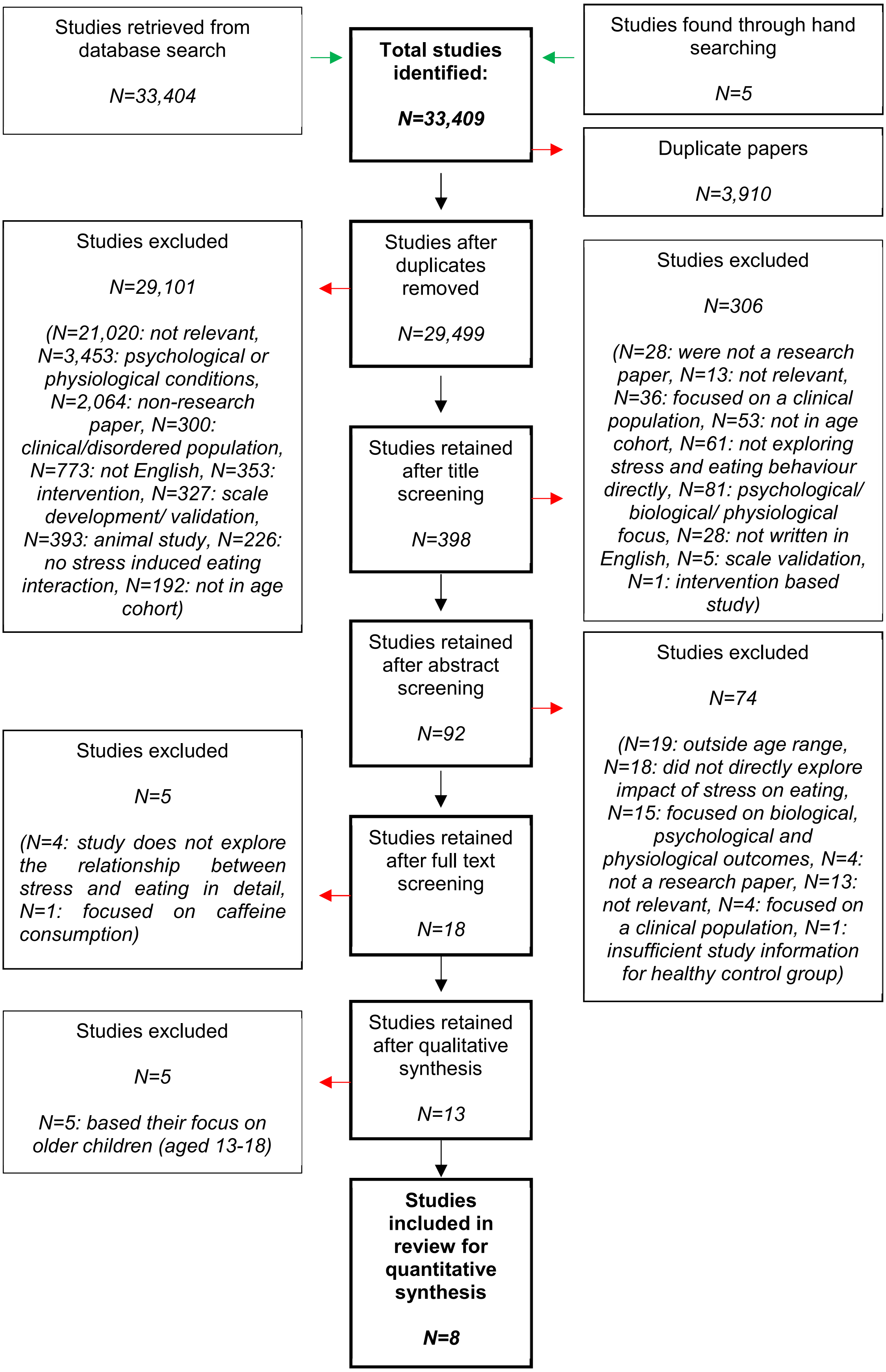

Figure 2.1. A PRISMA flowchart diagram that illustrates the screening process.

2.4 Quality Assessment

The quality of the final articles was assessed by the primary researcher and DH using a quality assessment scale that was created for this meta-analysis. This scale comprised of 7 criteria: study design, number of stress measure time points, objective stress measurement, subjective stress measurement, eating behaviour frequency, objective eating measurement and validation of eating behaviour measures.

Points were awarded on a scale system (ranging from 0-4) depending on which study characteristics were present. The minimum and maximum points within each criteria were awarded for: study design, an article was given 0 points for being cross-sectional (and having unreported data/unclear group definition), 1 point for being cross-sectional (with minimum age and gender categories matched), and 2 points for using a longitudinal or daily diary methodology. For the number of stress measure time points utilised, 0 points were given if stress was measured at one time point only, but 1 point was given if stress was measured more than once. For objective stress measurement, 0 points were given if the article did not use any objective stress measures, and 1 point was given if an objective stress measure was used. For a subjective stress measurement, 0 points were given if subjective stress was not measured (or inadequate information regarding these measurements were given), 1 point if an invalidated single-item scale was used, 2 points if multiple items were used and information on reliability was given, 3 points if a single item from a validated scale was used, and lastly, 4 points were given if the article measured several subjective measures using a validated scale.

For eating behaviour frequency measures, 0 points were given if eating was measured at only one time point, but 1 point was given if eating behaviours were measured more than once. For objective eating measurements (i.e., weighing foods pre and post-consumption), 0 points were given if no objective measures were used, but 1 point was given if an objective eating measure was present. Lastly, for validation of eating behaviour measures, 0 points were given if a single-item scale was used (from an invalid scale), 1 point for multiple items with data on the reliability of the measure, and 2 points were awarded if multiple items were taken from a validated scale.

Each of the final articles within the review were assessed on these 7 criteria, and depending on the features of the study, were given a score of 0, 1, 2, 3 or 4 for each criteria. The scores from each criteria were summed to give each study a 'quality score', where the maximum score was 12. Three levels of quality were determined from these total scores: scoring 0-4 was deemed as low, 5-8 deemed moderate, and 9-12 as being high in quality (criteria generated for use within the work of Hill et al. (2018)). Both reviewers independently assessed each study using the specified criteria, and inter-rater reliability was calculated on these assessments. Kappa values ranged from $\kappa = 0.81$ to $\kappa = 1.00$ across the seven quality criteria, illustrating that a good level of agreement was present.

2.5 Method of Analysis

Data from the final eight studies was assessed using the meta-analysis specific software Comprehensive Meta-Analysis (CMA, Borenstein, 2009). The *Hedge's g* effect size was used because some studies consisted of small samples (Durlak, 2009). This meta-analysis was conducted using the random effects model because previous literature was not able to suggest that similar effects would be identified across all studies (so would not share a ‘common true effect’, Borenstein, 2009, p. 61). Within the analysis, type of eating behaviour, stress measurement, sex (analysed as % female) and study quality were included as moderating variables. Stress measurements were categorised as being objective, perceived or induced. Although the majority of studies were found to utilise one stress measurement, one study (Michels, Sioen, Ruige & De Henauw, 2017) used a combination of perceived and objective stress measures. Stress measures were categorised as being objective if they used a physiological measure to capture stress (e.g., cortisol), perceived if individuals’ were asked to report their level of stress and lastly, induced stress was used if a specific task was administered to trigger a stress response within an individual (e.g., the Trier social stress task, TSST, Kirschbaum, Pirke & Hellhammer, 1993). To assess the impact stress had on eating, eating behaviours were categorised as being either healthy (e.g., ‘fruit and vegetable consumption’) or unhealthy (e.g., ‘fatty foods’).

It is important to note that, the original focus of this meta-analysis was to explore the eating behaviours of those who were aged between 8 and 18 years of age. This encompassed both children and adolescents, and allowed a comparison between the eating behaviours of younger (aged 8-12) and older children (aged 13-18), a comparison which can be seen in the work by Hill et al. (2018). However, for exploration within this thesis the focus is on younger children, so the meta-analysis reported here explores children aged 8-12 years old.

2.5.1 Analysis Overview

This analysis focused on exploring the impact that stress had on the eating behaviours of those aged 8-12 years old, and to examine the moderating effects of type of eating behaviour, stress measurement, sex and study quality. To understand the level of potential publication bias that may be present, a funnel plot analysis was conducted (see Figure 2.2.). A sensitivity analysis was used to understand the influence that each study had on the overall association between stress and eating behaviours.

2.6 Results

2.6.1 Search Process Summary

A total of 33,409 studies were identified in this search. This total reduced to 29,499 studies when duplicate studies were removed. The screening process removed 29,491 studies (see Figure 2.1.), leaving eight studies in the meta-analysis. As Figure 2.1. shows, the most common reason for exclusion was that studies were deemed irrelevant (N = 29,101), however, a large number of studies (N = 3,453) were additionally removed because they focused on a psychological or physiological condition. There was a total of 398 studies retained in the search after title screening, of which 18 were screened at full-text level. Of these 18 articles, 13 were deemed appropriate for use in a meta-analysis exploring both children and adolescents (Hill et al., 2018), but for exploration here, the focus of children aged 8-12 years old was chosen, resulting in a final total of eight studies.

2.6.2 Study Characteristics

Table 2.1. summarises the main study characteristics of the eight studies identified by this systematic review. The study sample sizes varied greatly, from 30 (Balantekin & Roemmich, 2012) to 4,320 (Cartwright et al., 2003) participants. The total number of participants in the meta-analysis was 7,065 (from all eight studies). Within the eight studies, six contained samples with a similar female to male participant ratio (e.g., Balantekin & Roemmich, 2012). All studies except one (Michels, Sioen, Ruige & De Henauw, 2017 used a longitudinal design) used a cross-sectional design. A total of four studies focused on exploring perceived stress (by utilising questionnaires), with three measuring induced stress (stress was induced by using an interpersonal stress condition where children were asked to give a speech) and one study measured objective (salivary cortisol) stress. In terms of eating behaviour measure, there was a plethora of utilised measures, two studies examined a healthy and unhealthy diet (by using food frequency questionnaires), two measured emotional eating and food frequency (by using questionnaires), where one additional article measured food frequency exclusively. Two studies measured food intake objectively and one article measured the amount of time spent eating. In regards to the focus of eating behaviour targeted, unhealthy eating behaviours (e.g., consumption of high calorie, low nutrient dense snacks e.g., sweets) were measured in all eight studies, with healthy eating (e.g., fruit and vegetable consumption) also measured in five of these.

2.6.3 Presentation of Results

Within the work by Hill et al. (2018) it was decided to be most appropriate to choose the ‘use all of the selected outcomes, assuming independence’ option when running the analyses in CMA, both for the overall, and for the individual moderator analyses. The following section that focuses on younger children below will therefore follow suit and will also report the findings using this model.

2.7 Main Findings

This meta-analysis identified that stress was significantly associated with the overall eating behaviours (combining both healthy and unhealthy eating behaviours) of children aged 8-12 years old (*Hedge’s g* = 0.21, 95% CI = 0.12, 0.29, Z = 4.81, $p < .001$), i.e., increased stress was associated with increased eating behaviour. Heterogeneity was not present within the eight younger studies, $Q_{(7)} = 2.72$, $p = 0.099$, $I^2 = 0.000$. It is worth acknowledging that von Hippel (2015) states that I^2 values need to be treated cautiously when meta-analyses have few studies, although it is possible to see this lack of heterogeneity in the forest plot below (Figure 2.2.). Although heterogeneity was not present, it was trending towards significance, and because of the small number of studies within this analysis, it was deemed important to explore the influence of potential moderating variables.

Table 2.1. Methodological, participant and study design characteristics of the eight included studies.

Study Authors (year of publication)	Study sample size	Sex of participants	Age of participants (M and range)	Study design	Stress category	Eating behaviour measurement	Eating behaviour category	Study findings	Total quality assessment score*
Balantekin and Roemmich (2012)	30	15 females 15 males	M: not specified Range: 8-12	Cross-sectional	Induced	Time spent eating[1]	Unhealthy	High dietary restraint led to increased energy intake (when responding to stress)	6.5 (M)
Cartwright et al. (2003)	4,320	1,742 females 2,578 males	M: 11.83 Range: not specified	Cross-sectional	Perceived	Healthy and unhealthy diet[2]	Healthy Unhealthy	High stress associated with more snacking and higher fatty food intake	3.5 (L)
Jenkins, Rew and Sternglanz (2005)	1,026	560 females 465 males	M: 10.43 Range: 8-13	Cross-sectional	Perceived	Healthy and unhealthy diet	Healthy Unhealthy	Perceived stress was correlated with unhealthy eating behaviours	3.5 (L)

Footnotes taken from the work of Hill et al. (2018):

[1] Consumption of an unhealthy snack food determined by a food preference task.

[2] The categories ‘fatty foods’ and ‘snacking behaviours’ were classified as unhealthy eating behaviours while ‘eating fruit and vegetables’ and ‘breakfast’ were classified as healthy eating behaviours.

Study Authors (year of publication)	Study sample size	Sex of participants	Age of participants (years) M and range	Study design	Stress category	Eating behaviour measurement	Eating behaviour category	Study findings	Total quality assessment score*
Michels et al. (2012)	437	219 females 218 males	M: not specified Range: 5-12	Cross-sectional	Perceived	Emotional eating[3] and food frequency[4]	Healthy Unhealthy	Stress was associated with unhealthy eating behaviours	5.5 (M)
Michels et al. (2017)	174	96 females 78 males	M: not specified Range: 5-12	Longitudinal	Perceived and objective	Emotional eating and food frequency	Healthy Unhealthy	Leptin was found to be a moderator in the stress-emotional eating relationship	10 (H)
Roemmich et al. (2002)	40	17 females 23 males	M: not specified Range: 8-11	Cross-sectional	Induced	Objectively measured food[5]	Unhealthy	Those with high dietary restraint are more likely to engage in stress-related eating	8 (M)

[3] Emotional eating behavior measured using a subscale of the Dutch Eating Behavior Questionnaire (van Strien, Frijters, Bergers, & Defares, 1986).
[4] Food frequency, specifically for the consumption of 17 unhealthy snack foods such as bread and cookies.
[5] Preferred snack foods weighed pre and post stress task.

Study Authors (year of publication)	Study sample size	Sex of participants	Age of participants (years) M and range	Study design	Stress category	Eating behaviour measurement	Eating behaviour category	Study findings	Total quality assessment score*
Roemmich, Lambiase, Lobarinas and Balantekin (2011)	40	20 females 20 males	M: not specified Range: 8-12	Cross-sectional	Induced	Objectively measured food	Unhealthy	Children with 'greater' adiposity were found to engage in more stress-related eating	6.5 (M)
Tate, Spruijt-Metz, Pickering, and Pentz (2015)	998	518 females 480 males	M: 9.26 Range: not specified	Cross-sectional	Perceived	Food frequency[6]	Healthy Unhealthy	Perceived helplessness was related to emotion-driven eating	4.5 (M)

Note. * Total quality assessment scores are categorised according to quality level: summed totals were low (L) if they scored 0-4, moderate (M) 5-8 and high (H) 9-12.

[6] Food frequency, specifically for the consumption of 17 unhealthy snack foods such as bread and cookies.

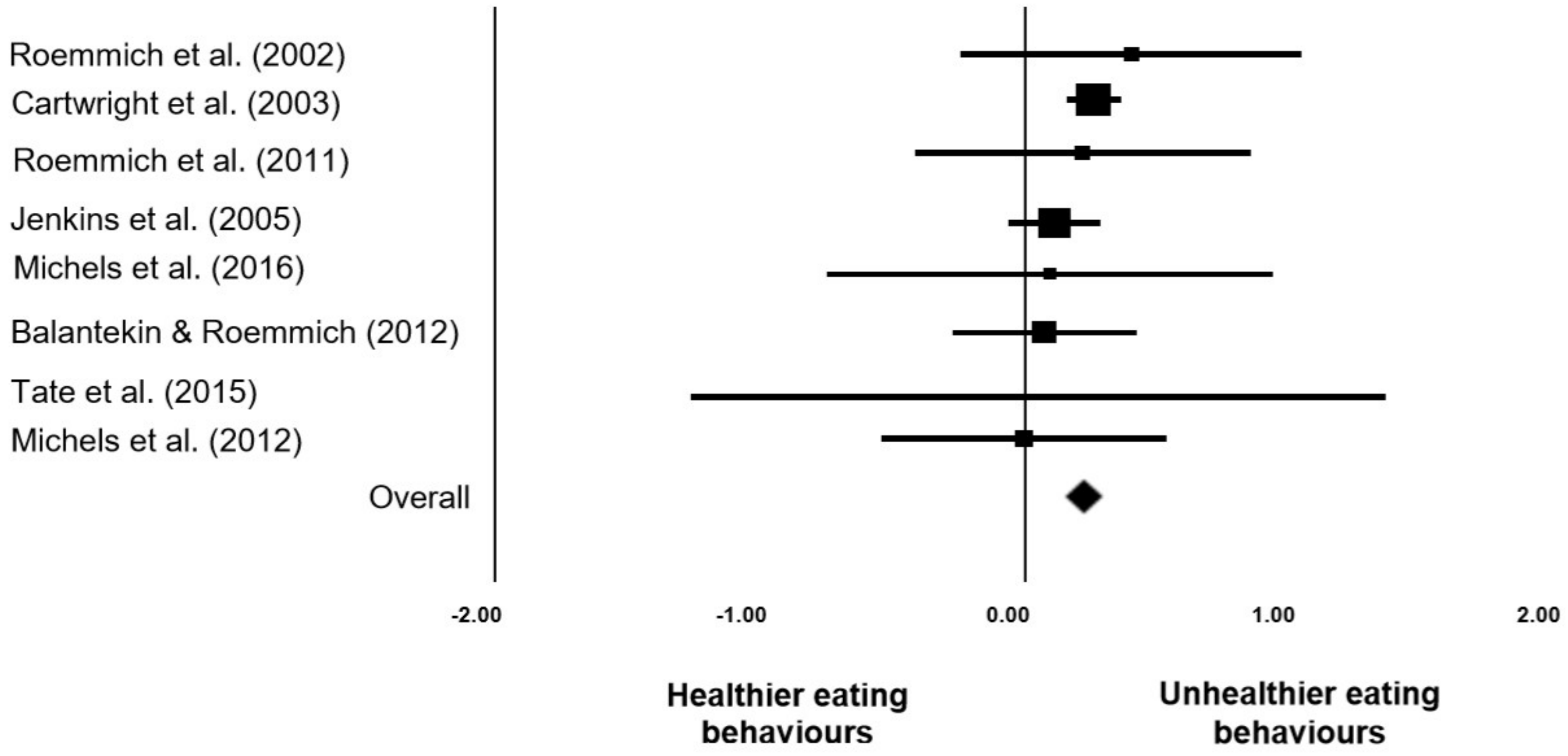

Figure 2.2. Forest plot (extracted from the work of Hill et al., 2018) exploring the overall effect sizes and 95% confidence intervals for the eight studies focusing on younger children.

2.7.1 Publication Bias

To ascertain if this meta-analysis had omitted any suitable studies, publication bias was explored. Using the Egger's regression coefficient (Borenstein, 2009), it was identified that there was no publication bias present within the studies (intercept = 0.74, *df* = 12, *p* = 0.51). This statistic mirrors the finding illustrated by the funnel plot below. Figure 2.3. shows there are no black circles which illustrates that there are no additional studies that remain unidentified or omitted from within this search.

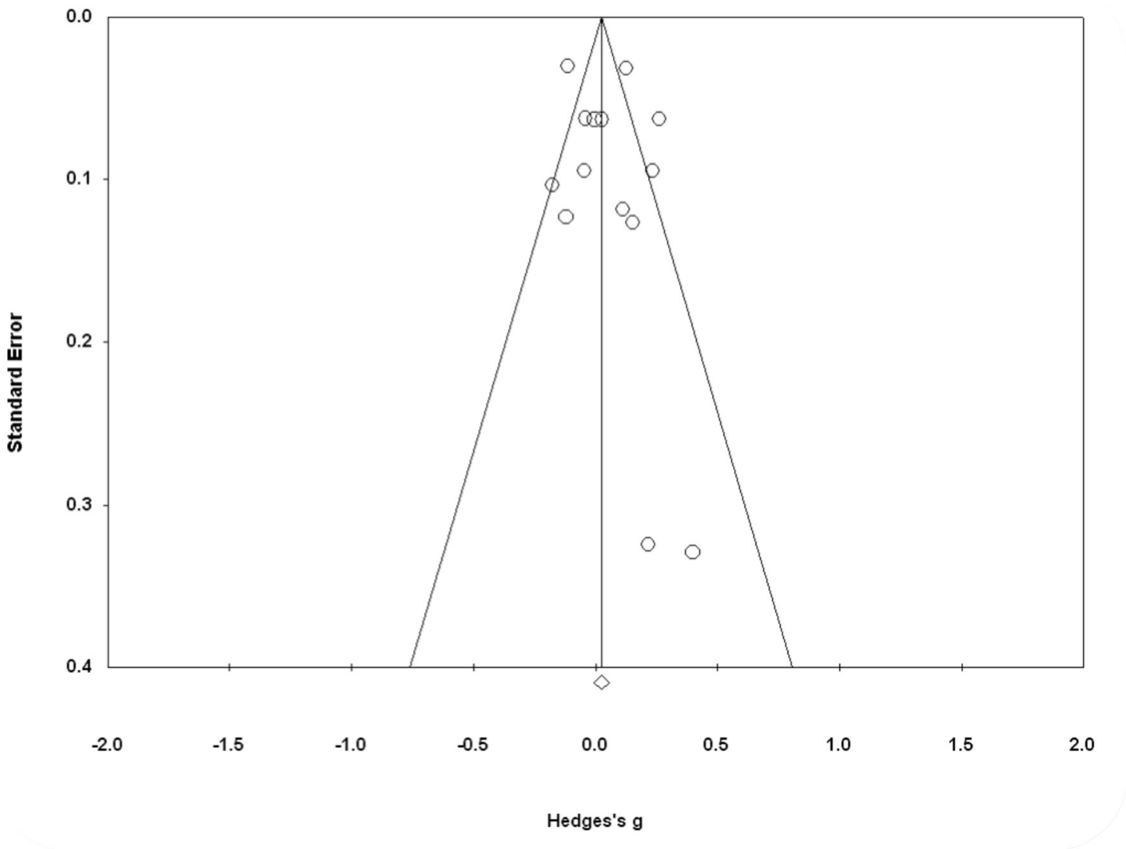

Figure 2.3. A funnel plot illustrating the standard error values (using Hedge's g) of the observed and imputed studies. The white circles represent observed studies and the absence of black circles (that represent imputed studies) shows that no studies have been omitted from the search.

2.7.2 Sensitivity Analysis

In order to understand how vital each study was to the overall effect size, a sensitivity analysis was conducted. The sensitivity analysis calculated how important each study was to the main findings, by removing each of the eight studies in turn to see how it affected the overall significance level. It was found that none of the studies individually had a detrimental impact on the overall significance of the stress-eating relationship in children aged 8-12 (i.e., when each study was removed individually, none of the individual studies made the overall stress-eating relationship non-significant).

2.8 Potential Moderating Variables

Four potential moderating variables were explored because the presence of heterogeneity was trending towards significance. These variables were: the type of eating behaviour category, the type of stress component measured, sex and level of study quality. A summary of the main findings associated with these moderating variables can be seen in Table 2.2.

2.8.1 Type of Eating Behaviour Category

Analysis explored the type of eating behaviour category (i.e., whether healthy or unhealthy foods were measured) as a moderator, and found that it was a significant moderator in the stress-eating behaviour relationship in children, $Q_{(1)} = 5.83$, $p = 0.016$. Further analysis identified that stress was not significantly associated with healthy eating behaviours (*Hedge's g* = 0.13, 95% CI = -0.04, 0.22, Z = 1.42, $p = 0.156$), however, stress was significantly associated with increased unhealthy eating behaviours (*Hedge's g* = 0.28, 95% CI = 0.20, 0.37, Z = 6.54, $p < .001$). This finding suggests that stress was associated with increased consumption of unhealthy food, although the size of this effect was small.

2.8.2 Type of Stress Component Measured

Analysis examined the component of stress that was measured (perceived or induced) and explored it as a potential moderating variable. This analysis found that it was not a significant moderator within the stress-eating behaviour relationship, $Q_{(2)} = 0.16$, $p = 0.925$.

2.8.3 Sex of Participants

Analysis explored the possibility that sex could be acting as a moderating variable amongst the stress-eating behaviour relationship in children. To explore the impact of the male to female ratio of participants across the eight studies, studies were categorised depending on the percentage of female participants within each study, with those containing <50% female in one group (five studies), and those containing >50% in the other (three studies). Analysis (using the unrestricted maximum likelihood model) exploring the heterogeneity between groups found that sex was not a significant moderator of the stress-eating relationship, $Q_{(1)} = 0.95$, $p = 0.329$.

2.8.4 Study Quality

The quality of included studies were explored using a categorical system developed specifically for this meta-analysis (see Method section 2.4), and studies that obtained a total score of between 0-4 points were deemed lower quality, those scoring 5-8 were of moderate quality, and those scoring 9-11 points were of higher quality. Across the eight studies, three studies had lower quality, four were deemed moderate and one study was found to be of higher quality. Analysis revealed that study quality was not a significant moderator of the stress-eating behaviour relationship within this age group, $Q_{(2)} = 0.29$, $p = 0.865$.

Table 2.2. A summary table illustrating the level of heterogeneity across the four potential moderating variables.

Potential moderating variable	Variable component[7]	Number of study outcomes[8]	Effect size (95% CI) Random effects model[9]	I^2 (%)[10]	Q (and p) value(s) (Within studies)[11]	Q (and p) value(s) for the difference between groups (Between studies)[12]
Eating behaviour	Healthy	6	0.13 (0.04, 0.21)	18.49	9.25 (0.75)	6.45 (0.01)
	Unhealthy	9	0.28 (0.20, 0.37)	0.00	3.11 (0.93)	
Stress measurement	Perceived	4	0.11 (0.06, 0.15)	2.20	3.88 (0.57)	0.16 (0.93)
	Induced	3	0.16 (-0.12, 0.44)	0.000	0.807 (0.668)	
	Objective	1	0.10 (-0.08, 0.27)	0.00	0.00 (1.00)	

7 Component of the potential moderating variable being observed.
8 Total number of times the variable component is measured across the eight studies.
9 Effect size value expressed as a *Hedge's g*. The lower and upper 95% CI values are inserted here in brackets.
10 I^2 is expressed here as a percentage to represent the level of heterogeneity within the variable component (Higgins & Thompson, 2002).
11 Q and p values that represent the level of heterogeneity within studies (i.e., within studies on an individual level).
12 Q and p values that represent the level of heterogeneity between studies (i.e., *comparing studies to one another).

Potential moderating variable	**Variable component[7]**	**Number of study outcomes[8]**	**Effect size (95% CI) Random effects model[9]**	**I^2 (%)[10]**	**Q (and p) value(s) (Within studies)[11]**	**Q (and p) value(s) for the difference between groups (Between studies)[12]**
Sex	<50%	5	0.12 (0.07, 0.17)	0.00	2.14 (0.71)	0.95 (0.33)
	>50%	3	0.08 (-0.00, 0.15)	0.00	0.94 (0.63)	
Study quality	Low	3	0.12 (0.06, 0.17)	25.22	2.68 (0.26)	0.29 (0.87)
	Moderate	4	0.09 (0.01, 0.17)	0.00	1.07 (0.79)	
	High	1	0.10 (-0.08, 0.27)	0.00	0.00 (1.00)	

2.9 Exploring the Independence of Potential Moderating Variables

To explore the relationship between the factors identified as potential moderating variables, a Pearson's correlation analysis was conducted. This analysis identified that there was a significant correlation between study quality (categorised as being either low or moderate/strong to differentiate studies of lower and higher quality) and stress measurement (categorised as being either perceived, induced or subjective, $r = 0.53$, $p = 0.042$), suggesting that the studies deemed to be of higher quality were those that used one or more objective stress measures or contained items from a validated stress scale.

2.9.1 Using the 'Mean of Selected Outcomes' Model for Analysis

Although it was decided that it was most appropriate to use the 'assumes independence' model for analysis (as in the work by Hill et al., 2018). It is worth acknowledging that using the 'mean of selected outcomes' model assumes that the different study outcomes are dependent on one another, even if the outcomes are from different studies. Meta-analyses are faced with difficult decisions in regards of how to best deal with multiple outcomes from one study; a problem that was present within this meta-analysis because of the multi-faceted approach used to measure eating behaviours.

Scammacca, Roberts, and Stuebing (2014) appreciates that when such studies are examined, the 'mean of selected outcomes' model can be deemed more suitable. The results in this section are presented using the 'assumes independence' model, although the data were also analysed using the 'mean of selected outcomes' model. These findings presented similar findings to those presented in this section, with the exception of one finding. The 'mean of selected outcomes' model found that stress was significantly related to the healthy eating behaviours of children ($p < .05$). Although this effect was not identified by the 'assuming independence' model. Scammacca et al. (2014) appreciates that both of these analytical options have 'benefits and limitations', and it is up to the researchers to decide which would be most appropriate.

2.10 Discussion

This meta-analysis aimed to explore the stress-eating relationship in children, and identified that stress was significantly associated with the eating behaviours of children aged 8-12. Although, the analysis revealed that there was no heterogeneity across the eight studies identified in the effect size observed, the significance level was trending towards significance.

The funnel plot (Figure 2.3.) displays an almost symmetrical picture, with four studies falling mainly within each side of the plot. This plot suggests that stress therefore affects an equal proportion of healthy and unhealthy eating behaviours, something that is the antithesis to the findings identified within the adult literature (that have a tendency of reporting an increase in the frequency of unhealthy eating behaviours (Zellner et al., 2006)).

Sensitivity analysis identified that none of the eight studies negatively influenced the effect size of the stress-eating relationship overall, if one were to have been individually removed from the analysis. The potential moderating variables: type of stress measurement, sex and study quality were explored but none were found to be significant within the stress-eating relationship in young children. This lack of significance could have been due to the small number of studies (e.g., there were only two studies that had <50% females). Such small numbers may have provided a lack of power within the analysis, resulting in such non-significant findings.

However, exploration of the type of eating behaviour illustrated that this was a significant moderator within these eight studies. More specifically, stress was found to significantly influence the unhealthy eating behaviours of younger children, although no such effect was identified for healthy eating. This finding demonstrates that there was a positive association between younger children's stress levels and their unhealthy eating behaviours, showing that more stress leads to an increase in the frequency of unhealthy eating behaviours.

Unfortunately, condensing this meta-analysis from the 'larger' number of 13 studies utilised within the work of Hill et al. (2018) seems to have removed the significant level of heterogeneity identified within the larger total of studies. As a consequence, it becomes difficult to fully understand the moderators of the stress-eating relationship within young children aged between 8-12 years old, particularly because three out of four of the potential moderating variables explored were found not to be significant. However, it is worth emphasising the importance of the significant moderator, type of eating behaviour, particularly because stress was found to affect children's unhealthy eating behaviours.

The fact that this finding was identified within such a small number of studies, provides further evidence to support the need for more research to explore this area so that more robust and highly powered meta-analyses can create a more detailed summary of the way stress affects the eating behaviours of those under 12 years old.

The analysis of studies within this meta-analysis has been able to confirm that stress influences the eating behaviours of children as young as 8 years old, and as such, the ever-expanding network of literature exploring the stress-eating relationship in children has exposed ‘an important pathway’ for understanding the connection between this relationship and the prevalence of developing avoidable health conditions in the future (O’Connor, 2018). The importance of exploring the stress-eating relationship in children is apparent, however, it remains crucial here to explore some of the mechanisms (as Greeno & Wing (1994) suggest) that may be evident.

The significant stress-eating relationship identified within this meta-analysis supports existing literature, which shows the body can predispose an individual to choose palatable foods by creating physiological pathways that make such foods seem more appealing when stress is experienced (Adam & Epel, 2007). This has been shown in laboratory studies where participants have chosen to consume sweet, high fat foods after experiencing an induced experimental stressor (Oliver & Wardle, 1999). The relationship between stress and palatable foods can be further strengthened by cortisol, a hormone that is found to increase the importance of ingesting palatable nutrient-void ‘comfort’ foods that consequentially lead the body to increase storing fat in its abdominal region (Dallman et al., 2003).

The presence of stress-related comfort eating is supported by research in both animals and humans (Maniam & Morris, 2012; Greeno & Wing, 1994). More specifically, variation in the degree to which 'reward-based stress eating' occurs is influenced by the type and duration of stressor experienced (Adam & Epel, 2007). Emotional stressors were found to initiate a stronger drive to consume food in comparison to physical stressors (Adam & Epel, 2007). It is likely therefore that 'reward-based stress eating' was present in the studies within this meta-analysis, because it is a pattern of behaviour that Adam and Epel (2007) believe is present in humans.

In conclusion, this meta-analysis suggests that stress is associated with unhealthy food consumption in children as young as 8-12 years old. Further research is required to explore the way in which stress affects the eating behaviours of children, to allow a greater appreciation of the mechanisms involved.

2.10.1 Direction of Future Research

The current meta-analysis identified a large number of relevant articles at the beginning of the search (*N* = 33,409), however, only 0.02% of this initial total was suitable for exploration within the meta-analysis (*N* = 8). This reinforces the paucity of literature within this domain and suggests there is need for future research in this area.

Certain characteristics were frequently identified in the final eight studies (e.g., the frequent use of cross-sectional designs). These characteristics helped determine where gaps were present within current literature. This subsequently allowed the current research to explore the areas that were less focused on. The current systematic review and meta-analysis has identified that there is a lack of longitudinal study designs within the stress-eating domain in children. In addition, when measuring stress, the current literature showed that stress induction tasks were used less frequently than measures exploring perceived stress (for example).

Across the final 8 studies within this meta-analysis, there seemed to be a reliance on using perceived (i.e., subjective) measures of stress, with only one study using an objective (salivary cortisol) stress measure. It is difficult to determine why such methodological choices were avoided, however, it is possible that the use of either longitudinal designs or objective stress measures may pose additional ethical considerations. For example, longitudinal studies require participants to be highly engaged, and such an extended time commitment may be seen negatively for both children and their parents/caregivers. Stress induction tasks also pose the ethical concern of whether or not such a task is appropriate for a child (given their age). If such a task was chosen, the practicalities of administering such a task would need to be planned carefully so that children were not put under any undue stress or discomfort. Objective stress measures use cortisol, blood pressure or urine (see Section 4.1.3) to capture individual stress responses, meaning that such a measure would be quite invasive. These measures may therefore be viewed negatively in terms of the ethical considerations of gathering such information from children (i.e., are children clear about what the measure really involves?). There is also an element of difficulty in regards to the practicalities of obtaining an objective (stress) measure from a child. For example, are the physical tools used to gather cortisol, blood pressure and urine (e.g., cotton swabs, blood pressure machines and sample pots) appropriate (in terms of being easy) for children to use comfortably?

On a broader level, in existing stress-eating literature amongst children, there seems to be a lack of focus on potential moderator variables. This current meta-analysis identified that there is a stress-eating relationship present amongst children. However, further exploration of other influencing factors (i.e., moderators or mediators) seems to be lacking.

2.10.2 The Focus of Current Research

The gaps identified in existing literature helped to shape the research studies that are presented within the next two chapters. Chapter 3 focused on using a cross-sectional study design within Studies 1 and 2 to establish the presence of a stress-eating relationship in both children and undergraduate students. Both studies explored the impact of positive and negative emotions on participants' snacking behaviours. In Study 1, emotional and external eating styles were examined as potential moderator variables. In Study 2, emotional eating style was similarly examined as a potential moderator.

Chapter 4 concentrated on using longitudinal study designs to identify the impact that stress had on the eating behaviours of participants over a longer period of time. Both studies used daily diary measures to capture participants' stress experiences and their subsequent snacking behaviours. Objective salivary cortisol measures were also used within both studies. Study 3 examined the stress-eating relationship amongst children, whereas Study 4 explored this relationship in undergraduate students. In a similar manner to Study 1, Studies 3 and 4 also explored emotional and external eating styles as potential stress-eating moderator variables.

Chapter 3. Exploring the relationship between stress and snacking behaviours in children and undergraduate students

3.1 Understanding Stress Measures

As the previous chapter identified, higher levels of stress (subjective stress and cortisol levels) are associated with higher levels of unhealthy eating behaviours (behaviours that can manifest themselves in the consumption of high sweet and high fat foods – foods that are often snack foods, O'Connor et al., 2008). The findings from the meta-analysis reported in Chapter 2 showed that stress had a detrimental impact on the eating behaviours of children, and such findings are similar to those within the adult literature. Individual studies within the review have highlighted some of the specific eating behaviours that increased when stress levels increased. For example, an increase in snack consumption (Michels et al., 2012) and unhealthy eating behaviours (Jenkins et al., 2005) were identified.

It is vital to appreciate that stress has been measured in many different ways (e.g., perceived stress (Cartwright et al., 2003) and daily hassles (Michels et al., 2012)), suggesting that there are multiple facets within this component. Within the review by Hill et al. (2018) it was identified that stress was conceptualised in two main ways within the 13 studies examined, with these forms focusing on perceived (Austin, Smith & Patterson, 2009) and induced stress (Balantekin & Roemmich, 2012).

In addition to these variations, the meta-analysis presented in Chapter 2 also revealed that a variety of stress measures were used (e.g., the Feel Bad Scale (Lewis, Siegel & Lewis, 1984) and the Coddington Life Events Scale for children (Coddington, 1999)), and although these measures are child specific, it is not clear if all these measures exploring stress are age-appropriate.

This literature suggests that there is currently a degree of uncertainty in regards to what measures are most suitable for measuring stress amongst children. In this regard, the research team believed it would be appropriate to utilise a combination of two previously used stress measures (within existing adult literature) to understand the stress-eating relationship in children and undergraduate students.

The two studies presented within this chapter explore participants' perceived stress by measuring responses to positive and negative emotions and daily hassles and uplifts. Adult stress-eating literature supports the use of both positive and negative emotions and daily hassles/uplifts as a means of measuring stress.

In terms of examining emotion, Wallis and Hetherington (2008) found that individuals high in emotional eating were found to overconsume food in both low and high stress conditions. However, there may be more to the emotion-eating relationship than an individual's emotional eating status. For example, Macht (2008) identified that the variability across emotions can influence how subsequent eating behaviours are affected. More specifically, certain characteristics of emotions, namely valence (i.e., pleasure/displeasure), arousal and intensity have been found to influence the emotion-induced eating behaviours that are displayed (Macht, 2008).

When examining the use of daily hassles and uplifts, it has been found that these methods provide a more 'direct' way of measuring the impact stress has on an individual (Kanner, Coyne, Schaefer & Lazarus, 1981, see Section 3.3). Michels et al. (2012) utilised daily hassles and uplifts as a means of measuring stress in children aged 5-12. This method, Michels et al. (2012) acknowledge is often used because it allows the measurement of daily 'problems'. This measurement therefore enables stress to be operationalised in terms of capturing the level of stress 'symptoms' experienced (Michels et al., 2012).

3.2 Understanding Eating Behaviour Measures

Within the meta-analysis reported in Chapter 2, eating behaviours were similarly explored using a range of measures (e.g., measuring diet quality (Austin et al., 2009) and time spent eating (Balantekin & Roemmich, 2012)). This array of behaviours makes it more difficult to evaluate exactly how stress affects eating, and again, such measures may not be age-appropriate for children. The research presented within this chapter focuses on measuring the eating behaviours of children (alongside the behaviours of undergraduate students) so it was vital that the eating behaviours of this group were considered.

This variety within the conceptualisations of both stress and eating behaviours could have contributed to the mixed findings within the meta-analysis by Hill et al. (2018). This emphasises that the nature of the relationship between stress and eating amongst children remains less 'clear' (Hill et al., 2018) than it does in adults.

The work by Hill et al. (2018) highlighted the paucity of exploration here and their review identified that, after irrelevant and duplicate articles were removed, there were only 398 articles from wider existing literature that examined the stress-eating relationship in children and adolescents aged 8-18 years old.

Twenty-five years ago, Greeno and Wing (1994) acknowledged that the stress-eating literature was ‘disparate’. Today, the stress-eating literature is more varied. O’Connor (2018) supports this by highlighting that recent literature explores the way/s in which eating behaviour *changes* in response to stress. Earlier literature focused on the way in which stress led to changes in the quantity of food consumed (O’Connor, 2018). Although there is an absence of a recent meta-analysis, the plethora of research discussed in recent literature (e.g., Araiza & Lobel, 2018; O’Connor, 2018) suggests that this is a frequently explored domain. In light of this, the small number of studies (398) identified at the beginning of the meta-analysis by Hill et al. (2018) suggests that there is a current paucity of exploration in this area amongst children.

The eating behaviour patterns of children therefore needs to be considered to ensure that suitable methods of capturing children’s eating behaviours are age-appropriate for use within future research. For example, due to the age of children, parents/caregivers will have a large amount of control over what food/s are made available and given to their children. Therefore, children could be said to have less control over what food/s they consume (see Section 3.6.18.2). However, to try and reduce the influence of parents/caregivers, the research team decided to focus on measuring children’s snacking behaviours. Snacking behaviour has been identified as being sensitive to stress (O’Connor & Conner, 2011), and additional literature supports this by showing subsequent changes in snacking behaviours have been reported in response to the presence of stress (e.g., Conner et al., 1999; O'Connor et al., 2008). Such research therefore supports the exploration of snacking behaviour when exploring the stress-eating relationship.

3.3 Using Existing Literature to Guide Further Exploration of the Stress-Eating relationship in Children and Undergraduate Students

Therefore, it is currently necessary to use the adult literature to guide the exploration of stress and eating in children. Within the adult literature, it has been found that adults can overconsume (hyperphagia) or under consume (hypophagia) foods when they experience stress (Oliver & Wardle, 1999; Wardle, Steptoe, Oliver & Lipsey, 2000). Evidence suggests hyperphagia is often the more prevalent response when experiencing stress (Oliver & Wardle, 1999), although, individual variation illustrates that hypophagic responses also occur in response to stress (Oliver & Wardle, 1999). There is, however, a lack of findings within existing child literature, providing justification for the need to further explore the stress-eating relationship in children.

As outlined earlier, previous research has examined stress using many different conceptualisations, with Macht (2008) noting the lack of focus on emotions and the way emotions influence eating behaviours. It is important to acknowledge the interconnected nature of stress and emotion. Lazarus (2006) appreciated that stress and emotion can be 'aroused and coped with' and can affect an individual's health and well-being in similar ways. For example, emotions such as anger and frustration could be seen as ‘stress emotions’ because they often derive from stressful situations. Equally, positive emotions can be seen as stemming from positive, goal-affirming situations. In this respect, Lazarus (2006) confirmed the importance of assessing the effects of stress and emotion together.

When understanding the importance of the association between stress and emotions, current research shows that existing physiological and psychological models can help to explain emotion-related changes in food consumption. These changes included increased eating, decreased eating and binge eating in humans (Macht, 2008).

It has been found that negative emotions often precede the consumption of unhealthy, high calorie, low nutrient foods (i.e., fast food (Macht, 2008)), while positive emotions have been found to encourage adults to consume healthy food (i.e., fruit (Macht, 2008)). Early work by Lyman (1982) supports this by finding that healthier foods were chosen more frequently (in 14 of 22 emotions) by university students when experiencing an array of emotions. The emotions explored included both positive (e.g., happiness) and negative (e.g., anger) emotions, suggesting that both types of emotion can elicit positive (i.e., healthy) and detrimental (i.e., unhealthy) eating responses. However, other research has found that the presence of positive emotion was found to relate to an increase in food consumption (Reichenberger et al., 2016), and more specifically, positive emotion was found to increase the consumption of unhealthy food snacks (Evers, Adriaanse, de Ridder & de Witt Huberts, 2013).

Focusing on an alternative perspective, Kanner et al. (1981) acknowledged that research seems to have focused heavily on exploring stress through the presence of large scale ‘dramatic events’. However, such ‘life events’ correlated ‘weakly’ with health behaviours (Kanner et al., 1981), ultimately suggesting that there must be more ‘within’ the stress experience for individuals, if major life events do not explain all of the stress-related change seen in health behavioural outcomes.

One alternative to ‘life events’ is the measurement of daily hassles and uplifts, opposing concepts that focus on the nature of positive/negative daily experiences that an individual may encounter. This concept changes the focus on stress from looking at it on a large scale, to looking at it in terms of diurnal patterns that focus on the day-to-day disruptions individuals encounter. An example by O'Connor et al. (2008) found that the presence of daily hassles were associated with an increased level of unhealthy eating behaviours.

3.4 Individual Differences in Stress and Eating Behaviours

Within the stress and eating behaviour literature, there is a focus on individual differences to explain the variation amongst individual stress responses. Emotional, restrained and external eating styles are three variables that have frequently been explored as moderating variables within the stress-eating relationship. For example, Macht (2008) identified that adults’ emotional eating style can initiate eating responses that try to ‘regulate’ prevalent emotions, and these often lead to the consumption of sweet, high fat foods. Oliver and Wardle (1999) identified that individuals with higher levels of restrained eating have a tendency to overconsume food in response to stress, with unrestrained eaters under-consuming food in response to stress. Newman et al. (2007) found that stressed individuals with high levels of external eating had greater bias for snack-related words, ultimately suggesting that such external cues would negatively impact on their consumption of snack foods.

Stress has been found to affect a multitude of eating behaviours (snacks (Conner et al., 1999); amount of food consumed in main meals (O'Connor et al., 2008); and vegetable consumption (O'Connor et al., 2008)). In particular, individuals are often very aware of any changes they make in regard to their snack consumption (O'Connor & O'Connor, 2004), and the consumption of snacks is often increased (Oliver & Wardle, 1999), so it serves as a useful variable for operationalising eating behaviours within the examination of the stress-eating relationship here.

3.5 Chapter Overview

To extend existing literature, this chapter presents two questionnaire-based studies that explore the relationship of stress and eating in children compared to undergraduate students. Study 1 explored emotion and snacking behaviours using hypothetical scenario questions (e.g., ‘when you feel happy, do you want to eat a snack?’). Study 2 used daily hassles/uplifts in a retrospective style diary design to explore participants’ snacking responses over the past 24 hours. A brief discussion of each study is presented, followed by an integrative general discussion to suggest directions for further study.

3.6 Study 1: Exploring the relationship between positive and negative emotion and snack choice in children and undergraduate students

3.6.1 Study Aim

The aim of this study was to explore the relationship between positive and negative emotions and snack responses to see if different emotions initiate different snack responses amongst participants. The study compared the snack responses of children (aged 9-10) and first year undergraduate students (aged 18 and above).

3.6.2 Hypotheses

It was hypothesised that unhealthy snack responses would be more frequently given for responses to negative emotions compared to responses for positive emotions, with this pattern seen across both child and undergraduate student participants.

3.6.3 Method

3.6.3.1 Power Calculation

Due to the paucity of literature in the stress-eating domain amongst children, the research team did not deem it suitable to conduct a power calculation for this study. Due to the fact that this was the first study conducted as part of this research, the research team decided to try and recruit 50 children and 50 undergraduate students.

3.6.3.2 Participants – Child Sample

The child sample was recruited from primary schools in the Leeds, West Yorkshire area. The schools contacted were identified from a list of primary schools within the county. This list was obtained from the Leeds City Council website.

A total of 113 primary schools were invited to take part, and of these, six agreed to take part. Within these six schools, 258 study information packs were distributed. A study invitation was also sent to a local Girl Guide staff member who passed on four invitations to local Brownie groups. One group agreed to take part and a further seven study information packs were distributed within this Brownie group.

In total, 58 children took part in this study, although the data from only 53 of these children was analysed, because five of the initial 58 responses provided incomplete consent forms/questionnaire data responses (these five children were deemed suitable for inclusion because the school staff member informed the primary researcher they had provided signed consent, however, in time, these forms did not surface, so their data was subsequently removed).

Within the sample of 53 participants; 36 were girls and 17 boys. The participants were either 9 or 10 years old, with the sample mean age at 9.19 years old. A total of 49 parents/caregivers provided information about which ethnic group their child identified with (28 White, five mixed/multiple ethnic groups, 11 Asian or

Asian/British, three Black/African/Caribbean/Black British and two identifying with the ‘other’ ethnic group).

3.6.3.3 Participants – Undergraduate Student Sample

Undergraduate students were recruited from the School of Psychology at the University of Leeds. Within the undergraduate student population in the department, first year students were the focus for recruitment.

A total of 73 undergraduate students expressed interest in taking part, however, one participant did not provide signed consent, so this resulted in a final total of 72 undergraduate students of which 65 were female, six male and one participant did not provide any gender information. The age of participants ranged from 18 to 24 years. The mean age of the undergraduate student sample was 19.63 years. Within this sample, participants identified with these ethnic groups: 63 White, three mixed/multiple ethnic groups, five Asian/Asian British and one Black/African/Caribbean/Black British.

3.6.4 Ethical Approval

Ethical approval was provided by the School of Psychology’s Research Ethics Committee (at the University of Leeds) for both samples (date: 03.03.2017, reference number: 17-0093).

3.6.5 Study Design

The study used a cross-sectional questionnaire design to explore the relationship between positive and negative emotions, emotional and external eating styles and the snack responses of children and undergraduate students.

3.6.6 Study Measures

The study materials were all paper based. Initial contact was made by providing children and undergraduate students with a ‘study information pack’ (see Appendix B).

3.6.7 Study Information Pack

This pack consisted of the following documents: a participant study information letter, a participant consent form and a demographics questionnaire (for child participants, this was completed by the child’s parent/caregiver). For children, the pack contained the addition of a parent/caregiver study information letter and a parent/caregiver study consent form. The demographics questionnaire for both children and undergraduate students can be seen in Appendix B.

3.6.8 Questionnaire One – Study Emotion Measure

All participants were asked to complete two questionnaires. Both questionnaires asked participants to provide information about their snacking and eating behaviours, and both were tested using a ‘pilot’ phase (prior to study commencement) to ensure the wording was suitable for the child sample.

The first questionnaire (see Appendix B), the study emotion measure, was created specifically for this study, and consisted of 20 questions. Each question contained an emotion and asked if the individual would like a snack if they were experiencing a particular emotion. For example, ‘if you were feeling happy, would you eat a snack?’. The question asked the participant to answer ‘yes’ or ‘no’, if they answered ‘yes’ they were asked to specify what snack they would have chosen.

The questions used language that had an intentional focus (e.g., would and choose). The research team decided to use intentional language (as opposed to volitional language, e.g., when and will) because it was believed that the style of the question gave participants a choice over whether or not they believed they would consume a snack. If for example, a participant did not believe they would consume a snack in a given scenario, they would be able to tick ‘no’ when asked about whether or not they would choose a snack.

Each of the 20 questions was based on a positive, negative or neutral emotion, of which there were seven positive, seven negative and six neutral questions. The emotions within the positive (e.g., happy) and negative (e.g., upset) questions were taken from the work by Ebesutani et al. (2012), and the neutral word questions were created by the research team to have a focus that was neither positive nor negative (e.g., at home after school).

For children, this questionnaire was accompanied with a ‘food picture sheet’ to help children think of snack responses (if needed). The pictures (see Appendix B) were spread across two sheets of A4 paper, and were filled with a variety of food and drink snack coloured photographs (taken by the primary researcher).

The ‘food picture sheet’ contained 24 photographs; two were drinks and 22 items displayed food snacks.

This questionnaire was scored in terms of whether or not a snack response was provided. For example, if a participant had ticked ‘yes’ (they would choose a snack) and had written a snack item response, this was coded as ‘1’. If a participant had ticked ‘no’ (they would not choose a snack), and had not written a snack response, this was coded as ‘0’. However, if a ‘no’ response was given, but a snack item was listed, this was deemed to be a ‘yes’ response, and was coded as ‘1’ (this occurred in 3.3% of snack responses: 35 of 1,060 questions).

3.6.9 Categorising the Nutritional Content of Chosen Snack Foods

All of the snack food and drink responses recorded in questionnaire one were categorised as being either healthy or unhealthy (Brown, Ogden, Vogele & Gibson, 2008). Items were coded as healthy if they were unprocessed (e.g., apple, carrots or salad), and unhealthy if they contained any level of intense processing (e.g., crisps, sweets or fizzy drinks).

Research often categorises food in terms of whether it contains a high amount of sugar and/or fat (O'Connor et al., 2008), however, this was not deemed appropriate here because standard nutritional information (on food packaging) is not particularly suitable for consumers that are of childhood age. This is because many nutritional labels sought for use in this context use a standard adult (i.e., whose consumption would be approximately 2000 calories per day) as a reference point. This is important to appreciate when utilising such a method here, and such components of each snack food/drink chosen were assessed using the food composition table from the work of McCance and Widdowson (2014), a method used previously to explore the nutrient components of food (Bradbury et al., 2014).

3.6.10 Questionnaire Two - An Adapted Dutch Eating Behavior Questionnaire

The second questionnaire was an adapted version of the Dutch Eating Behavior Questionnaire (DEBQ, van Strien et al., 1986). This questionnaire (see Appendix B) measures individual levels of external, emotional and restrained eating styles. van Strien et al. (1986) defined these three behaviours, and stated that external eating involves eating as a 'response to' the environment around you (independent of whether or not you are hungry), emotional eating involves eating in response to experiencing certain emotions and restrained eating is present when an individual focuses on maintaining a certain body weight, so an individual may consequently restrict the foods they consume (Stunkard & Messick, 1985).

More recently, van Strien and Oosterveld (2008) adapted the original DEBQ questionnaire and created a version suitable for children aged between 7 and 12. The research team however, decided that it would be more appropriate to adapt the original (adult) measure (i.e., by altering some of the question wording) so it would be more appropriate for both age groups.

Within the current study, the original DEBQ measure was adapted by removing the restrained eating questions. Due to the age of the child participants, it was not deemed appropriate to present questions that could be seen to encourage any form of restraint or alteration of food consumption. The remaining external and emotional eating questions remained in the questionnaire, although some of the wording was adapted to be more child appropriate (e.g., ‘desire’ was changed to ‘want to’). There was a total of 23 questions within the adapted questionnaire, and each question required participants to circle one of five word answers that best represented their response. For example, one question read ‘do you find you want to eat when you are irritated?’. The five category response scale options were as follows: 1: never, 2: rarely, 3: sometimes, 4: often and 5: very often. The items from both external ($n = 10$) and emotional ($n = 13$) eating styles were summed to create a total for each (the minimum and maximum scores for each eating style can be seen in Section 3.6.14).

Cronbach’s alpha values were calculated for the study variables: external eating ($\alpha = 0.79$) and emotional eating ($\alpha = 0.87$) styles (across both age groups of participants combined), with children found to have a slightly smaller Cronbach’s alpha ($\alpha = 0.76$, across both external and emotional eating styles) compared to the undergraduate students ($\alpha = 0.84$). Both the overall and the age specific Cronbach’s alpha values show that strong internal consistency is present.

3.6.11 Treatment of Missing Data

Any blank responses provided in either questionnaire were treated as missing data, and were left blank.

3.6.12 Statistical Analysis

After data collection, data was inputted into the IBM SPSS Statistics Version 22 software program for data analysis. A series of ANOVAs were conducted to test the main effects of type of emotion, age, emotional eating and external eating styles (low versus high). The responses to the neutral emotive words were not analysed because these items acted as a means of disguising participants' focus on the positive and negative emotions.

A four-way ANOVA was chosen to explore the dichotomous variables of age group (children or undergraduate student), emotion (positive or negative) and both emotional and external eating styles (low and high categories were formed using median split values; children: external eating = 34, emotional eating = 29, undergraduate students: external eating = 35, emotional eating = 34).

Specifically, three four-way repeated measures ANOVAs were conducted to explore three different outcome variables:

1. The relationship between age, type of emotion (positive or negative emotion), emotional eating and external eating styles and total number of snacking responses.
2. The relationship between age, type of emotion, emotional eating and external eating styles and the number of healthy snacking responses.
3. The relationship between age, type of emotion, emotional eating and external eating styles and the number of unhealthy snacking responses.

Post-hoc t-tests were conducted when significant interaction effects were identified using the ANOVAs to identify where the significant difference/s were present.

3.6.13 Results

3.6.14 Descriptive Statistics

Table 3.1. shows that more than half of the sample was female (n = 101). The mean age of the child sample was 9.19 years, and the mean age of the undergraduate student sample was 19.63 years. The remaining descriptive statistics can be seen in Table 3.1.

Table 3.1. Descriptive statistics for main study variables (M denotes mean, SD denotes standard deviation).

	Children (N = 53)	**UG Students (N = 72)**
M age (years, SD) *Range*	9.19 *8-10*	19.63 *18-24*
Female (age, years, SD) *Range*	9.15 (n = 36) *8-10*	19.63 (n = 65) *18-24*
Male (age, years, SD) *Range*	9.25 (n = 17) *8-10*	19.00 (n = 6) *19*
	M (SD) ***Range***	
Emotional eating behaviour*	2.41 (0.70) *1.31 - 4.31*	2.64 (0.68) *1.15 - 4.77*
External eating behaviour**	3.36 (0.69) *1.4 - 4.5*	3.45 (0.61) *2 - 4.7*
Snacking response to positive emotion	5.76 (1.43)	1.32 (1.32)
Snacking response to negative emotion	4.30 (1.84)	3.35 (1.46)
Total healthy snack responses to positive emotion	2.53 (1.64)	0.43 (0.75)
Total healthy snack responses to negative emotion	1.92 (1.44)	0.13 (0.53)
Total unhealthy snack responses in positive emotion	3.23 (1.58)	0.89 (1.10)
Total unhealthy snack responses in negative emotion	2.38 (1.55)	3.22 (1.52)

Note. * The M, SD and range of emotional eating scores presented have been divided by 13 (because there were 13 emotional eating items in the study DEBQ) to illustrate the mean emotional eating score per question. ** Similarly, the M, SD and range of external eating scores have been divided by 10 (number of external eating items within the study DEBQ) to show the mean external eating score per question.

Table 3.1. shows that on average, children and undergraduate students responded most with either ‘rarely’ or ‘sometimes’ for an emotional eating question. However, for an external eating question, both children and undergraduate students responded mainly with ‘sometimes’ or ‘often’. These results show that on average, all participants were found to have stronger (i.e., more prevalent) responses for external eating behaviours. An independent t-test illustrated that there were no significant differences between the emotional ($t(123) = -1.86$, $p = 0.065$) and external eating ($t(123) = -0.80$, $p = 0.424$) behaviours of children and undergraduate students.

Table 3.1. illustrated that the largest mean snacking response was given by the children in response to the positive emotion (5.76 snacks out of 7 positive emotions). The children responded most to the positive emotion using both unhealthy (3.23 snacks out of 7 positive emotions) and healthy (2.53 snacks out of 7 positive emotions) snack responses. Amongst the undergraduate students, most responses were identified in relation to negative emotions (3.35 snacks out of 7 negative emotions), with this sample providing more unhealthy responses (3.22 snacks out of 7 negative emotions) for this type of emotion.

3.6.15 Effects of Age, Type of Emotion, Emotional and External Eating Styles on Overall Snacking Responses

In the first four-way ANOVA, an examination of the impact of age, type of emotion, emotional and external eating styles on overall numbers of snacks was assessed. As indicated in Table 3.2., significant main effects were observed for age and emotional eating but not for type of emotion or external eating behaviour. Examination of the means indicated that the main effect for age was attributable to higher levels of snack response for emotions (both positive and negative) in children compared to the undergraduate students group. The main effect of emotional eating was attributable to higher levels of snack responses in the high compared to the low emotional eating group.

Table 3.2. Summary of the four-way ANOVA exploring type of emotion, age group, emotional and external eating styles and overall snacking response.

	df	**Mean Square**	**F**	**p**
Main effects:				
Type of emotion	1, 110	1.59	0.91	0.34
Age group	1, 110	149.70	84.92	<0.001
Emotional eating behaviour	1, 110	9.25	5.25	0.02
External eating group	1, 110	4.07	2.31	0.13
Interaction: Two-way effects:				
Age group * type of emotion	1, 110	149.70	84.92	<.0001
Type of emotion * emotional eating behaviour	1, 110	9.25	5.25	0.02
Type of emotion * external eating behaviour	1, 110	4.07	2.31	0.13
Age group* emotional eating behaviour	1, 110	0.68	0.30	0.58
Age group* external eating behaviour	1, 110	2.83	1.27	0.26
Emotional eating behaviour * external eating behaviour	1, 110	2.98	1.34	0.25
Interaction: Three-way effects:				
Type of emotion * age group * emotional eating behaviour	1, 110	9.40	5.33	0.02
Type of emotion * age group * external eating behaviour	1, 110	2.00	2.58	0.14
Age group * emotional eating behaviour * external eating behaviour	1, 110	0.83	0.37	0.54

These main effects were qualified by significant two-way and three-way interactions. The first significant two-way interaction was between age group and type of emotion. This is illustrated in Figure 3.1. Children indicated that they would eat more snacks for negative emotions when compared to the undergraduate students. Children also provided more snack responses than the undergraduate students when reacting to positive emotions. Post-hoc t-tests confirmed these findings by indicating that a significant difference between the two age groups, within both positive and negative emotions was present (*ps* <.001).

Post-hoc t-tests also indicated that children provided significantly ($t(104) = 4.53$, $p < .0001$) more snack responses to positive compared to negative emotions, while undergraduate students gave significantly ($t(142) = 8.62$, $p < .0001$) less snack responses to positive compared to negative emotions.

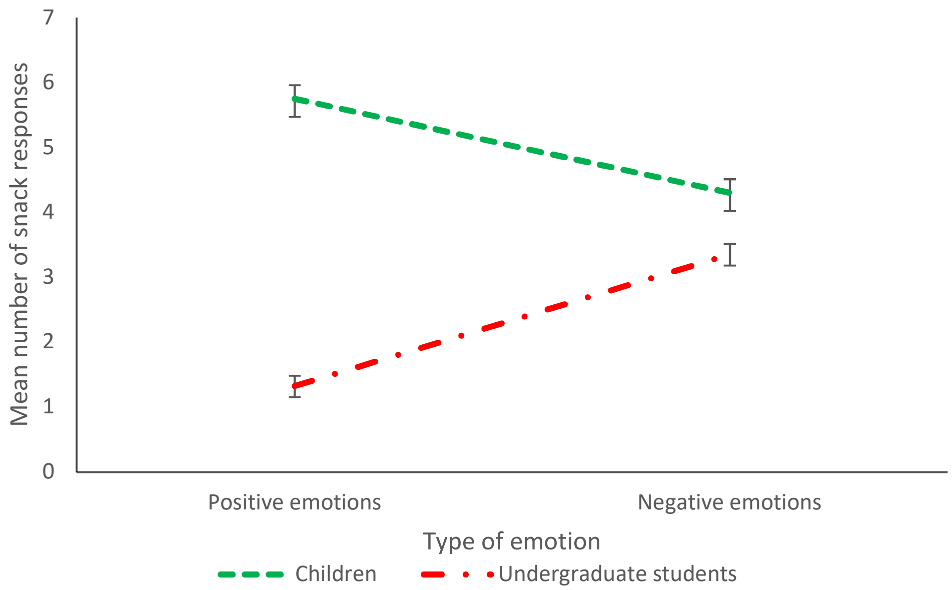

Figure 3.1. Profile plot illustrating the mean snack responses within the two-way interaction of type of emotion and age (the error bars display standard error values).

The second significant two-way interaction explored type of emotion and level of emotional eating. Figure 3.2. shows that the low emotional eating group reported a similar number of snacking responses for positive versus negative emotions (*t*(122) = 0.43, *p* = 0.67). In contrast, in the high emotional eating group, less snack responses were provided for positive versus negative emotions (*t*(124) = 3.47, *p* = 0.0007).

In relation to snack responses for positive emotions, there was no significant difference between the low and high emotional eating groups (*t*(123) = 1.08, *p* = 0.29). In contrast, there was a significant difference between low and high emotional eating groups in response to negative emotions (*t*(123) = 3.41, *p* = .0009).

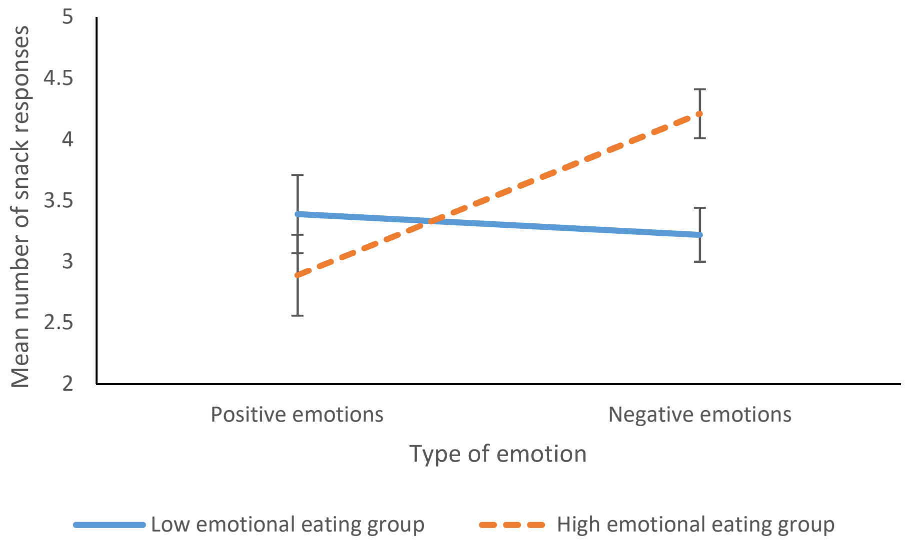

Figure 3.2. Profile plot illustrating the mean snack responses within the two-way interaction between the low and high emotional eating groups and type of emotion (the error bars display standard error values).

Additionally, there was a significant three-way interaction between type of emotion, age group and emotional eating group. This interaction is illustrated in Figure 3.3. Post-hoc t-tests indicated seven significant differences across the responses amongst both positive and negative emotions. In response to positive emotions, positive significant differences ($t(60) = 12.14$, $p < .0001$) were identified for low emotional eating children and low emotional eating undergraduate students. A negative significant difference ($t(47) = 16.68$, $p < .0001$) between low emotional eating undergraduate students and high emotional eating children was identified. High emotional eating children were positively significantly different ($t(61) = 13.33$, $p < .0001$) to high emotional eating undergraduate students.

In response to negative emotions, a positive significant difference ($t(60) = 12.14$, $p < .0001$) was identified between low emotional eating children and low emotional eating undergraduate students. High emotional eating children were positively significantly different ($t(61) = 13.33$, $p < .0001$) to high emotional eating undergraduate students. In response to positive emotions, low emotional eating children were positively significantly different ($t(74) = 11.54$, $p < .0001$) to high emotional eating undergraduate students. Lastly, low emotional eating undergraduate students were negatively significantly different ($t(47) = 16.68$, $p < .0001$) to high emotional eating children.

To summarise, Figure 3.3. shows that while children reported snacking more in response to positive compared to negative emotions, undergraduate students decreased their snacking responses. In children, the differences appeared to be similar in those low or high in emotional eating, while in undergraduate students the difference in snacking between negative and positive emotions was greater in those high in emotional eating. The effects of a four-way interaction were not assessed because such interactions would have moved further away from the study hypothesis (thus making exploration of the relationship between negative emotions and unhealthy snacking responses more difficult to examine).

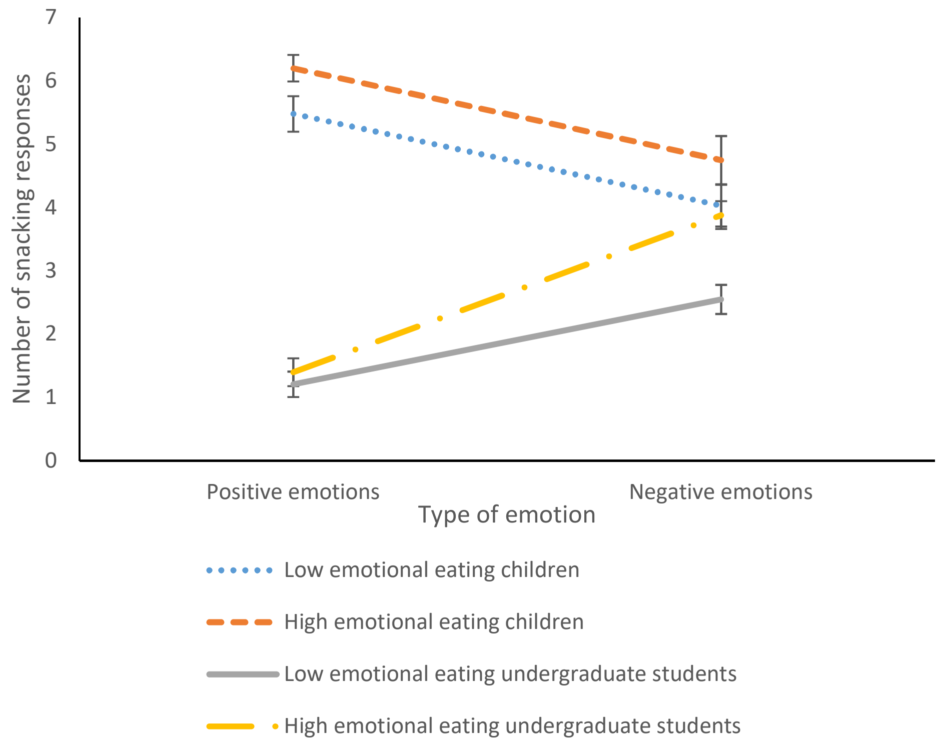

Figure 3.3. Profile plot illustrating the three-way interaction between high and low emotional eaters, age and type of emotion (the error bars display standard error values).

To further explore this significant three-way interaction between type of emotion, age group and emotional eating group, data between the two age groups was compared. To compare the two groups, two two-way interactions examining type of emotion and emotional eating group were conducted. The findings identified that children did not report significantly different ($F(1, 51) = 3.70$, $p = 0.06$) levels of (total) snack responses across emotions (i.e., positive versus negative) and level of emotional eating (i.e., levels of low or high emotional eating). However, undergraduate students were found to provide significantly different amounts of (total) snack responses across emotions and levels of emotional eating ($F(1, 70) = 11.40$, $p = 0.001$). Post-hoc t-tests identified that the low emotional eating group gave significantly different total snack responses to the high emotional eating group for positive emotions ($t(142) = 2.92$, $p = 0.004$) and negative emotions ($t(142) = 8.37$, $p < .0001$).

3.6.16 Effects of Age, Type of Emotion, Emotional and External Eating Styles on Healthy Snacking Responses

In the second ANOVA, the impact of emotion type, age, emotional and external eating styles on the healthy snacking responses was examined. As Table 3.3. illustrates there are two main effects, one for age, and the second for positive versus negative emotion. Exploring these main effects, the effect of age was found to reflect the fact that younger children reported eating more healthy snacks compared to the undergraduate students in response to positive and negative emotion. The main effect for type of emotion was found to reflect the fact that more healthy snacks responses were reported for positive emotions compared to negative emotions. No other main effects or interactions were identified within this ANOVA.

Table 3.3. Summary of the four-way ANOVA exploring type of emotion, age group, emotional and external eating styles and healthy snacking responses.

	df	Mean Square	F	*p*
Main effects:				
Type of emotion	1, 110	11.79	11.05	.001
Age	1, 110	203.23	150.57	.000
Emotional eating behaviour	1, 110	0.23	0.17	0.68
External eating behaviour	1, 110	0.06	0.04	0.84
Interaction: Two-way effects:				
Type of emotion * emotional eating behaviour	1, 110	0.23	0.22	0.64
Type of emotion * external eating behaviour	1, 110	0.44	0.41	0.52
Age * emotional eating behaviour	1, 110	0.13	0.10	0.76
Age * external eating behaviour	1, 110	0.33	0.24	0.62
Emotional eating behaviour * external eating behaviour	1, 110	2.51	1.86	0.18
Interaction: Three-way effects:				
Type of emotion * age * emotional eating behaviour	1, 110	0.23	0.22	0.64
Type of emotion * age * external eating behaviour	1, 110	0.06	0.05	0.94
Type of emotion * emotional eating behaviour * external eating behaviour	1, 110	0.83	0.78	0.38
Age * emotional eating behaviour * external eating behaviour	1, 110	3.16	2.34	0.13

3.6.17 Effects of Age, Type of Emotion, Emotional and External Eating Styles on Unhealthy Snacking Responses

Next, for unhealthy snacking, the influence of type of emotion, age, emotional and external eating styles were explored. As Table 3.4. shows, there were four significant main effects: positive versus negative emotion, age, emotional eating behaviour and lastly, external eating behaviour. The effect of type of emotion indicated that participants reported more unhealthy snack responses for negative compared to positive emotions. In terms of age, children gave more unhealthy snack responses for both positive and negative emotion compared to the undergraduate students. Finally, rates of unhealthy snacking responses for positive and negative emotion was greater for high versus low levels of emotional and external eating styles.

Table 3.4. Summary of the four-way ANOVA exploring type of emotion, age group, emotional and external eating styles and unhealthy snacking responses

	df	**Mean Square**	**F**	**p**
Main effects:				
Type of emotion	1, 110	22.06	12.71	0.001
Age	1, 110	30.24	15.58	0.000
Emotional eating behaviour	1, 110	15.32	7.89	0.006
External eating behaviour	1, 110	10.66	5.49	0.02
Interaction: Two-way effects:				
Type of emotion * age	1, 110	127.03	73.18	0.0005
Type of emotion* emotional eating behaviour	1, 110	9.25	5.25	0.054
Type of emotion * external eating behaviour	1, 110	1.84	1.06	0.31
Age * emotional eating behaviour	1, 110	1.40	0.72	0.40
Age * external eating behaviour	1, 110	5.08	2.62	0.11
Emotional eating behaviour * external eating behaviour	1, 110	0.02	0.01	0.92
Interaction: Three-way effects:				
Type of emotion * age * emotional eating style	1, 110	9.40	5.33	0.23
Type of emotion * age * external eating behaviour	1, 110	5.56	3.20	0.08
Type of emotion * emotional eating behaviour * external eating behaviour	1, 110	0.40	0.23	0.63
Age * emotional eating behaviour * external eating behaviour	1, 110	0.76	0.39	0.53

These main effects were qualified by one significant two-way interaction between type of emotion and age (see Figure 3.4.) which was further analysed using post-hoc t-tests. For positive emotions, children provided significantly ($t(123) = 9.76$, $p < .0001$) more unhealthy snack responses compared to the undergraduate students. However, the opposite pattern was found for negative emotions, where undergraduate students gave significantly ($t(123) = 3.03$, $p = .003$) more unhealthy snack responses than children. Additionally, amongst children there was also a significant difference ($t(123) = 3.03$, $p = .003$) between the number of snack responses given for positive compared to negative emotions. For undergraduate students, there was a significant difference ($t(123) = 8.62$, $p = .0001$) between the number of snack responses given for positive compared to negative emotions, although the difference was in the opposite direction to that for children. Within this analysis, there were no significant three-way interaction effects.

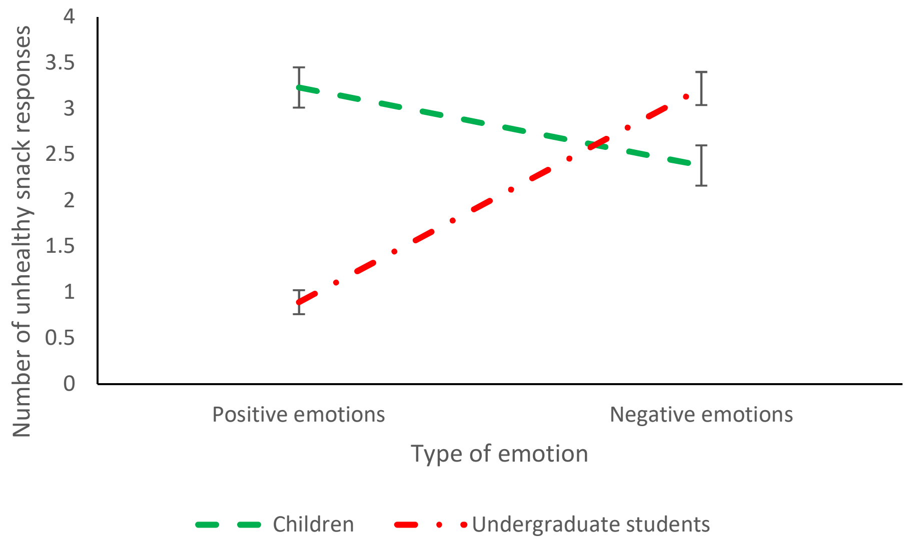

Figure 3.4. A profile plot illustrating the significant two-way interaction between type of emotion and age for unhealthy snacking responses (the error bars display standard error values).

There was also one marginally significant two-way interaction between type of emotion and emotional eating behaviour (*p* = 0.054) which is illustrated in Figure 3.5. For participants in the low emotional eating group, similar numbers of unhealthy snack responses were given in response to both positive and negative emotions. However, for those with high emotional eating, fewer unhealthy snack responses were given in response to positive versus negative emotions.

In regards to snacking in response to positive emotions, there was a significant difference between the low and high emotional eating groups ($t(123) = 1.08$, p =.29). However, in response to negative emotions, there was a significant difference between the low and high emotional eating groups ($t(123) = 3.41$, p <.0009).

When comparing the low to high emotional eating groups unhealthy snack responses across both positive and negative emotions, post-hoc t-tests identified that there was no significant difference when participants were responding to positive emotion ($t(123) = 0.76$, p =.45). However, a positive significant difference ($t(123) = 4.03$, p =.0001) was identified when comparing the low and high emotional eating groups' responses in the presence of negative emotions.

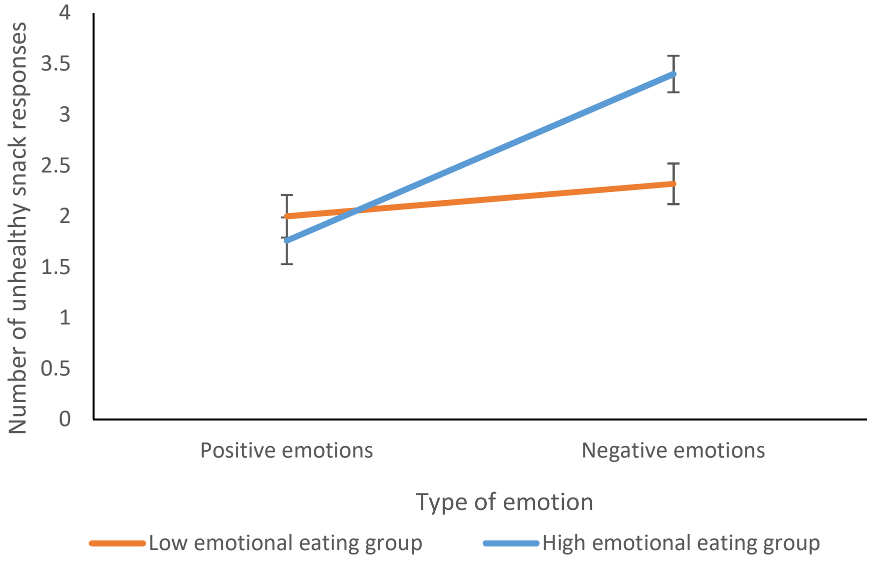

Figure 3.5. A profile plot illustrating the marginally significant two-way interaction between type of emotion and low and high emotional eating groups for unhealthy snacking responses (the error bars display standard error values).

Lastly, Table 3.4 illustrates that there is a three-way interaction between age, type of emotion and emotional eating behaviour that is trending towards significance (p = 0.08).

3.6.18 Discussion

3.6.18.1 Summary of Findings

Study 1 aimed to identify and explore whether there was a relationship between positive and negative emotions and the hypothetical snacking responses of 9-10 year old children and undergraduate students. This study additionally examined the moderating role of emotional and external eating styles within this emotion based snacking relationship.

Overall, this study found that children reported a higher frequency of snacking responses compared to the undergraduate students, with children found to report more snacking responses for positive emotions, while the undergraduate students reported more for negative emotions. More specifically, children provided more healthy and unhealthy snack responses for positive emotions compared to negative emotions. Children also reported more snack responses in response to emotions compared to the undergraduate students. Undergraduate students were found to report significantly different levels of (total) snack responses across different emotions and different levels of emotional eating group (i.e., low versus high).

It was hypothesised that both age groups would report more unhealthy snack responses for negative emotions compared to positive emotions. The study findings were not able to fully support this hypothesis, because it was found that only the undergraduate students were reporting eating more snacks in response to negative emotions. There was however a main effect of emotion type across both healthy and unhealthy snacking responses, with more healthy and unhealthy snack responses chosen for negative emotions.

A main effect of emotional eating was identified within both overall levels of snacking and unhealthy snacking responses, where the group with high emotional eating style was found to report more snacking responses compared to those with low emotional eating style. One main effect of external eating style was found for unhealthy snacking responses, where those high in external eating style were found to give more unhealthy snacking responses.

3.6.18.2 Relating the Current Findings to Existing Literature

The study findings do share some parallels with previous findings in adults, by identifying that undergraduate students chose more unhealthy snacks in response to negative emotions. In this respect, it seems that undergraduate students have similar eating behaviours to adults because research has identified that adults often increase their consumption of unhealthy food when experiencing stress (e.g., O'Connor et al., 2008; Evers, Marijn Stok & de Ridder, 2010). Hyperphagia allows individuals to divert their attention away from themselves or their stressful situation so they can focus on consuming food. In this way, eating acts as a tool that provides the individual with a stimulus on which they can focus all their attention. This behaviour also provides comfort for the individual, subtly reinforcing their decision to overconsume (Evers et al., 2010).

It is possible to use this conceptual idea to ascertain why undergraduate students provided more unhealthy snack responses for negative emotions. However, using this perspective, it becomes difficult to understand why children were found to have opposing behaviours, in terms of their increased level of healthy and unhealthy snack responses.

Children gave a higher number of healthy snack responses compared to the unhealthy snack responses chosen by undergraduate students. Children may be starting to use food as a means of ‘comfort’, to divert attention away from their current situation, as the undergraduate students here and adults from existing literature have done.

However, the reasons that children choose to consume healthy foods are seemingly manifold and O'Dea (2003) found that some include improving cognitive performance ('focusing better'), providing a positive physical feeling ('feeling cleaner') and providing psychological benefits ('feeling like you have done something good for you'). These reasons could help explain why healthy snacks were chosen more amongst children compared to the undergraduate students. The reward based eating theory (Adam & Epel, 2007) also provides support for this increase in the consumption of snacks. More specifically, this theory could lend itself to the current study by explaining that children's snack responses were acting as a hypothetical (because actual snack consumption was not measured) reward when positive emotions were present.

The influence an experimenter has on proceedings should not be forgotten, particularly because evidence suggests that experimenter effects can alter eating behaviours. This was evident in the work by Herman, Polivy and Silver (1979) where participants' food consumption was found to differ when an observer was present. In the current study, it is possible that participants changed their snacking responses in response to the presence of the experimenter. This could have led to either under or over-reporting of snack responses. To understand if such experimenter effects were present, it would be useful to measure participants' snack responses under conditions when an experimenter was both absent and then present.

Children's snacking behaviours may not reflect individual choice as much as the snacking behaviours of undergraduate students. For 9-10 year old children (i.e., those within the current study), it is likely that additional factors will influence their snacking behaviour. For example, age restrictions limit the food/s children have access to because parents are able to choose what food is bought and made available to them (Wardle, 1995). Children are additionally limited because of the structure of the school day. Children are only given access to snacks/food at certain times of the school day. This inadvertently restricts the amount of snack/food consumption that a child can engage in.

The current study asked participants about hypothetical scenarios to identify which scenarios would elicit a snacking response. This questionnaire subsequently gave individuals the option to choose both whether they believed they would consume a snack, and if so, what snack this would be. Both elements within each question subtly imply that participants have a choice in regards to their snacking behaviour. It may have been inappropriate to presume that each individual has choice about what snacks or food they consume (which may not be the case for low SES individuals). The SES group of an individual may therefore have influenced the snack responses reported, supporting the use of measuring SES in future research.

The early work of Ganley (1989) explores the role of negative emotion in the development of obesity, and focuses primarily on the influence of negative emotion, however, it also acknowledges that positive emotion has been found to ‘precipitate’ eating. For example, healthy foods were chosen by university students for positive emotions (Lyman, 1982), a finding that mirrors the fact that here, children also chose (more) healthy snacks (in this instance) in the presence of positive emotions. Lyman (1982) explains this selection by stating that it comes down to the mood or feelings of an individual. For example, if an individual feels good, they will choose healthy food/s when they are experiencing a positive emotion, with the reverse pattern seen when an individual feels down. This pattern acts in a ‘circular’ manner, creating a bidirectional stance on the way food interacts with mood (Lyman, 1982).

3.6.18.3 Possible Theoretical Influences

This food mood theory could have played a part in the results of this current study, however, it is imperative to note that collectively, children were found to choose more healthy snacks compared to the undergraduate students. Lyman's (1982) theory may still be the sole reason behind this, however, because of their age it is likely that parents/caregivers will choose the foods that are bought and made available to their children at home. As a consequence, children may have been predisposed to choosing healthy foods more frequently as a result.

3.6.18.4 Study Limitations

With regards to the current study's findings, although a pilot study was conducted, it is difficult to ascertain the degree to which all children understood and experienced the emotions within the study emotion measure. Children reported more snack responses for positive emotions, so it could be possible that the increased frequency of responses meant that children experience positive emotions more frequently than negative emotions. However, it could be that negative emotions are simply not discussed or understood as well as positive emotions, consequently affecting the types of emotion children divulge (Fivush, Hazzard, McDermott Sales, Sarfati & Brown, 2003).

As Table 3.1. shows, children gave more snack responses across all but one of the different categories. It is hard to determine whether these snacking responses are a valid reflection of their typical diurnal eating behaviours. Children may be over-reporting their snack consumption because of the nature of the questionnaire in terms of being asked specifically about certain emotions, possibly encouraging children to write an answer for each question even if they feel they would not consume a snack for a certain emotion. This may have been due to the use of intentional language within the questionnaire (see Section 3.6.8). It is therefore possible that using volitional language may have altered the findings that have been identified here.

However, due to a lack of literature within the domain, the stress-eating relationship in children remains under explored, so the current study aids this paucity of understanding to try and provide a base on which to build.

Based on the current study, the following conclusions can be made in terms of an appropriate direction for forthcoming research. Due to the concern with regards to the consumption of unhealthy foods (i.e., in regards to the increasing prevalence of obesity and stress-related eating), children gave more unhealthy snack responses for positive emotion/s, whereas undergraduate students gave more unhealthy snack responses in the presence of negative emotion/s. These contrasting responses emphasise the importance of exploring age within the stress-eating relationship.

There were several differences identified across the child and undergraduate student samples and although the age of undergraduate students varied from 18 to 24 years of age, the child participants were either 9 or 10 years old. This provides scope for further research to explore a larger age range of children, to try and determine at what specific age these differences arise.

There seems to be a lack of focus on positive emotion, with stress research primarily looking at the negative impact/side effects of stress. However, the current study illustrates that negative emotion is not the only influential emotion, with positive emotion also initiating snacking responses. It would therefore be useful to explore this emotion further.

The use of the study emotion measure in the current study is restrictive because participants were not able to freely report what specific emotions/feelings initiate a snacking response in their experience. The study emotion measure is directive, and consequentially, could be missing some emotions that are associated with snacking behaviours.

The current study measured hypothetical snack responses which is important to acknowledge is different to actual snack consumption. As a consequence, this measure of snacking behaviour is a limitation within the current study because it is not clear whether participants' hypothetical behaviour is indicative of their actual snacking behaviour. To remove the use of hypothetical emotive scenarios, future research could try to induce different emotions in participants in order to measure subsequent snack consumption. However, Adolphs (2017) acknowledge that it is difficult to induce an emotion state just by thinking of the emotion itself. This process is typically 'insufficient' for inducing a specific emotion (Adolphs, 2017) which would suggest that a different means of inducing emotion would need to be sought if this method of conceptualising stress was chosen for future research.

3.6.18.5 Conclusion

This study has identified that positive and negative emotions are related to the snacking responses of children and undergraduate students in opposing ways. More specifically, children provided more (healthy and unhealthy) snack responses for positive emotions, and provided more unhealthy snack responses for positive emotion. Undergraduate students however, gave more unhealthy snack responses for negative emotion scenarios. This finding amongst children is the antithesis of the stress-eating relationship identified within adult literature, and as such, may suggest that detrimental snacking behaviours are more prevalent for children when experiencing positive emotions. Future research could explore the retrospective snacking consumption of both ages to compare this with their subjective reporting of stress experiences. This would provide a more ecologically valid method for exploring the stress-eating relationship amongst children and undergraduate students.

3.7 Study 2: Understanding how the occurrence of daily hassles and uplifts influences the daily snack consumption of children and undergraduate students

3.7.1 Study Context

Within this chapter thus far, a summary of the ways in which both stress and eating behaviours have been measured in adult literature has been presented (see Sections 3.1 and 3.2). Due to the paucity of literature within the child domain, the adult literature has guided the development of suitable studies for use with both children and undergraduate students. For example, the adult literature presents an array of stress measures which acknowledges the presence of multiple facets within this variable. Although this means that it is more difficult to understand the findings from across the adult stress-eating literature, it enabled age appropriate stress measures to be chosen for use here when examining children's stress experiences.

Study 1 utilised positive and negative emotions as a measure of subjective stress to identify what impact such emotion had on participants' hypothetical snack responses. This section of Chapter 3 presents Study 2 where stress was measured using daily hassles and uplifts.

3.7.2 Study Aim

This study aimed to explore how the occurrence of daily hassles and uplifts affected the daily snacking behaviours of both children aged 8-11 years old and undergraduate students. More specifically, this study aimed to explore the retrospective occurrence of hassles and uplifts that were experienced in the previous 24 hours, to compare these with any snacks that were consumed across the same period. This study aimed to expand on the main finding identified in Study 1, where unhealthy snacks were chosen most for positive emotions amongst children, but within negative emotions for undergraduate students.

3.7.3 Hypotheses

It was hypothesised that there would be a significant positive relationship between the frequency of snacks consumed and the frequency of daily hassles experienced, particularly in regards to individuals' unhealthy snack consumption. In addition, it was hypothesised that there would be a positive relationship between the frequency of uplifts reported and the frequency of snack consumption across both age groups. Lastly, it was hypothesised that emotional eating style would be indicative of the total number of snacks reported.

3.7.4 Method

3.7.4.1 Power Calculation

In a similar manner to Study 1, the research team did not deem it necessary to conduct a power calculation to help determine a suitable sample size for this study. However, the research team decided to try and recruit equal numbers of participants across both age groups. Study 1's target of recruiting 50 participants was similarly deemed suitable for use here within Study 2 and became the target sample size.

3.7.5 Participants

This study focused on gathering data from two groups of participants of different ages. The first group of participants consisted of 8-11 year old children, the second group consisted of undergraduate students who were aged 18 and above. Using experience from Study 1, we aimed to gather similar sized samples of data from each participant group. Although our final total of participants consisted of a total of 21 children and 160 undergraduate students. (Note: no data about the ethnicity of participants was gathered. This question was incorrectly omitted from participants' consent forms).

3.7.5.1 Participants – Child sample

To recruit 8-11 year old children several means of recruitment were utilised: 25 primary schools were contacted (these schools were contacted because they either took part in Study 1 or showed interest in taking part in Study 1), email invitations were sent to Mednet (a University of Leeds research mailing list) for parents to invite their children (if this was of something of interest to them), a study advertisement was placed on the Call for Participants website, a brownie group and five after-school clubs were contacted and the primary researcher additionally advertised the study by word of mouth.

A final total of 21 children took part. In this total, one school took part in this study, with this generating a total of six participants. One Brownie group took part, and this group yielded a further five participants. One participant taking part in Study 3 saw the advertisement for Study 2 and took part in this study after completing Study 3. A further total of nine participants completed the study online (using the

Jisc Online Surveys tool) after seeing one of the study advertisements via email and/or the Call for Participants website.

3.7.5.2 Participants – Undergraduate student sample

In a similar way to the child recruitment methods used, undergraduate students were recruited using several means: the study was advertised on the Call for Participants and Survey Circle websites and the primary researcher invited potential participants from several study locations (e.g., an IT computer room) around the School of Psychology. A final total of 160 undergraduate students took part. Within this total, 109 took part online after seeing the advertisements on the Call for Participants and Survey Circle websites, and 51 undergraduate students were recruited by the primary researcher within the School of Psychology.

3.7.6 Ethical Approval

This study was given ethical approval by the School of Psychology's Research Ethics Committee (at the University of Leeds) for both samples (date: 07-02-2018, reference number: PSC-273).

3.7.7 Study Design

This study used an exploratory design to investigate whether the hassles and uplifts that an individual experienced in the previous 24 hours were associated with the snacks that were consumed over the same period. The retrospective questionnaire design was used to capture participants' experiences and snacking behaviours over the past 24 hours.

3.7.8 Study Measures

The questionnaire that was given to children was also given to undergraduate students (both versions were identical). This questionnaire was administered to all participants using either a paper (i.e., print based) or an online format. All participants were given a study information sheet, a consent form (for children, their parents/caregivers were also required to consent to allow their child to take part) and were given the opportunity to ask questions in person (or in the case of those who completed the questionnaire online, they were given details of how to contact the primary researcher/research supervisors if they had further questions). The online version of the questionnaire would allow the participant to begin the questionnaire if they had agreed to all the statements on the consent form (for children, their parents/caregivers also had to consent this way).

3.7.9 Study Questionnaires

The study questionnaire consisted of two sections, the first consisted of an adapted version of the DEBQ and the second a retrospective diary style section.

3.7.10 Section One of the Questionnaire - An Adapted Version of the DEBQ

It was decided that the DEBQ questionnaire should be utilised here, as it was in Study 1. In the original DEBQ measure (van Strien et al.,1986), there are 13 emotional eating items, but only 11 of the 13 original emotional items were selected because the research team deemed two to be unsuitable. One of these two items (‘do you want to eat when you are disappointed?) was removed because it was very similar to another item (‘do you want to eat when somebody disappoints you?’). The second item that was removed was as follows: ‘do you want to eat when you are irritated?’. This item was removed because ‘irritated’ was a word that was not understood by all the children measured during the pilot phase of Study 1. This resulted in a total of 11 questions (see Appendix C).

Participants were able to answer each of the 11 questions by choosing one of the 5-point Likert scale options: never (i.e., a score of 1 as it was in the original measure), seldom (e.g., 2/‘rarely’), sometimes (3), often (4) and very often (5). A Cronbach’s alpha value exploring the reliability amongst the positive and negative emotion questions illustrated that there was a strong level of internal consistency present (α = 0.72).

It is worth noting that due to the paucity of influence that external eating style had on the stress-eating relationship for children in Study 1, it was deemed more appropriate not to measure this eating style within the current study. Therefore, it was decided that emotional eating style should be the primary moderator here, additionally because there were concerns over the length of the questionnaire for the children, if the external eating items had been included alongside the new positive emotion items.

3.7.11 Section Two of the Questionnaire – Retrospective Diary Section

This section was created specifically for this study, and consisted of two main parts (see Appendix C). The first asked participants to think about the previous 24 hours and tell us of any positive or negative experiences that occurred. Participants were given the space to report up to 3 positive and 3 negative experiences. Participants were given the space to report up to 3 positive and 3 negative experiences because the research team deemed this total suitable for capturing the day's prominent experiences, particularly because it needed to be age appropriate for child participants (and increasing this total may have made it more imposing for this participant group to recall what had occurred that day).

Participants were asked when they had these experiences (in the morning, afternoon or evening), and were also asked to rate (on a 5-point Likert scale) how positive or negative each experience was. This scale ranged from 1: not at all (positive/negative) to 5: very (positive/negative), with scores 2, 3 and 4 increasing in strength of positivity/negativity from 2 to 4.

These specific emotions were chosen to try and capture participants' daily experiences in terms of the level of stress that may have been experienced. Existing research shows that daily hassles and uplifts are often measured to conceptualise stress (e.g., Newman et al., 2007). Therefore, within this study, positive experiences were measured as daily uplifts, and negative experiences as daily hassles. The focus on emotion was deemed necessary for the age of the child participants.

The second element of this retrospective section asked participants to report any food or drink between-meal snack that they had consumed in the previous 24 hours, and at what time of day (morning, afternoon or evening) they consumed these snacks.

This section concluded by asking participants to report how typical the size of their meals over the previous 24 hours were. For example, did they eat 'much less than usual' or 'much more than usual'? Participants were asked to give one answer for each meal (i.e., breakfast, lunch, dinner), and were given a 7-point Likert scale ranging from ‘ate much less than usual’ to ‘never eat this’ to choose from. Participants were also asked to rate how healthy and unhealthy they thought their snack consumption (over the previous 24 hours) was, along with how many portions of fruit and vegetables they ate.

Inter-rater reliability coefficients were calculated to assess agreement on the coding of the snack items (high in fat and or high in sugar). The inter-rater reliability values were $\alpha = 0.73$ for agreement amongst snacks deemed to be high fat, and $\alpha = 0.89$ for agreement amongst the snacks deemed high sugar. These values are deemed substantial, with the agreement for high sugar seen to show almost ‘perfect agreement’ (McHugh, 2012). If, however, there were disagreements between raters (the primary researcher and DH), a discussion took place to ascertain further information about the item in question, to allow the raters to come to an agreement. Disagreements between raters were found to be more frequent when a participant had given little detail about the snack item they had consumed (e.g., biscuits or 2 packets of crisps).

3.7.12 Data Processing

After data collection, a complete dataset was created by combining data exported from Jisc Online Surveys and data manually inputted from participants recruited in person. The dataset was exported to an SPSS data file, where IBM SPSS Statistics Version 24 was used. This dataset was screened for missing data, where the percentage of missing data was obtained and a suitable strategy for treating such omissions was chosen. Reported snack items were coded as being either healthy or unhealthy and 10% of the total snack items were second coded (by DH) to test inter-rater reliability. After any necessary alterations, hierarchical multiple regression analyses were conducted to sequentially explore the effect that total hassles, total uplifts, age and emotional eating style plus interactions had on the amount of total, healthy and unhealthy snacks reported.

3.7.13 Coding Reported Snack Items

In a similar way to the process utilised in Study 1, reported snack items were coded as being either healthy or unhealthy. However, because this study contained a large proportion of participants who were of adult age (i.e., 18 and above), it was deemed appropriate to initially code snack items in terms of whether they contained high levels of sugar and or fat. These categorisations were made using food composition tables from the work of McCance and Widdowson (2014). For example, a food classified as being high in (total) fat consisted of more than ‘17.5 grams of fat per 100 grams of food’ (Department of Health (DOH), 2016). For sugar, a food that contains high levels will contain ‘over 22.5 grams of sugar per 100 grams of food’ (DOH, 2016).

For drinks, high fat or high sugar status was given to drinks that were deemed high for the specific nutrient using guidelines from the DOH (2016). A drink is deemed high in fat if it contains more than 8.75 grams of fat per 100 millilitres of liquid, and a drink is deemed high in sugar if it contains more than 11.25 grams of sugar (DOH, 2016).

As such, if a food/drink was high in these categories, it was deemed as being high in either fat or sugar for participants, although it is important to appreciate that children should have reduced levels of both nutrients within their diet (NHS, 2015).

Snacks were then categorised as being either unhealthy or healthy. Snack items were deemed unhealthy if they consisted of high levels of fat and/or sugar, and if the item was processed (e.g., a cheesestring would be classified as processed whereas an apple would not).

3.7.14 Treatment of Missing Data

Across the dataset, there were a total of 51 missing data points. Blank responses for the stressors, uplifts or snack questions were treated as zero rather than missing because such an event may not have occurred, and no food snacks may have been consumed. Consequentially, the frequency of missing data points were as follows: one age data point, 11 DEBQ answers, 14 for acknowledging whether their snacks had been either healthy or unhealthy, 12 for totalling the number of fruit portions, and 13 for the number of vegetable portions consumed. To ascertain whether such data was missing at random, a Little's Missing Completely at Random (MCAR) test (Little, 1988) was conducted. This test showed that the data was missing at random, $X^2 = 430.69$, $p = 0.242$. In this instance, the missing data was replaced by inputting the appropriate column mean values.

3.7.15 Statistical Analysis

Hierarchical linear regression analyses were conducted to explore the relationship and the strength of the relationship between the number of hassles and uplifts reported and the consumption of snacks. Specifically, three individual linear regression analyses were conducted:

1. To explore the relationship between hassles, uplifts plus moderators and the number of total snacks consumed.

2. To explore the relationship between hassles, uplifts plus moderators and the number of healthy snacks consumed.

3. To explore the relationship between hassles, uplifts plus moderators and the number of unhealthy snacks consumed.

Within each of the regression analyses, age and emotional eating style were examined as potential moderators of relationships. Emotional eating style was assessed by categorising participants' emotional eating score into a low or high group. The median split was used to determine where the groups were split in two.

In each regression, three stages of analyses were conducted. In step one, the independent variable (IV) and dependent variables (DV) were entered into the model, in step two the potential moderating variables were entered, and lastly, in step three, interactions between the IV, moderators and DV variables were examined.

3.7.16 Results

3.7.17 Descriptive Statistics of Participant Characteristics

As Table 3.5. illustrates, the majority of participants (n = 160) were undergraduate students, with a smaller proportion of the sample consisting of children (n = 21). See Table 3.5. for additional participant characteristics.

Table 3.5. Descriptive statistics of participant characteristics, moderator and main study variables.

Descriptive statistics	**Children** **N**	**UGs** **N**
Total number of participants	21	160
Female	10	112
Male	11	48
Moderator variables	**M (SD)** ***Range***	
Age (years)	9.19 (0.98) *8-11*	23.69 (4.99) *18-49*
Emotional eating style (frequency score)	26.52 (6.03) *17-38*	35.61 (7.81) *12-54*
Main study variables	**Children** **M (SD)** ***Range***	**UGs** **M (SD)** ***Range***
Total hassles (n)	2.57 (2.46) *0-8*	4.13 (2.77) *0-9*
Total uplifts (n)	4.67 (2.65) *0-9*	5.40 (2.65) *0-9*
Total snacks (n)	2.81 (1.60) *0-5*	2.54 (1.77) *0-9*
Healthy snacks (n)	1.05 (0.74) *0-2*	0.77 (1.02) *0-4*
Unhealthy snacks (n)	1.76 (1.22) *0-4*	1.77 (1.34) *0-6*

3.7.18 Independent t-test Analyses to Compare Descriptive Statistics Between Groups

Independent t-tests were conducted to explore whether any of the descriptive statistics were significantly different between the two groups (children versus undergraduate students). The analyses illustrated that the groups only had significantly different levels of total hassles, $t(179) = -2.45$, $p = 0.02$. The groups were not found to report significantly different levels of total uplifts, $t(179) = -1.19$, $p = 0.24$, total snacks, $t(179) = 0.67$, $p = 0.51$, healthy snacking behaviour, $t(179) = 1.21$, $p = 0.13$ or unhealthy snacking behaviour, $t(179) = -0.02$, $p = 0.98$.

3.7.19 Exploratory Analysis using Pearson's Correlation to Explore the Relationship between Snacking Behaviours, Daily Hassles, Daily Uplifts, Age and Emotional Eating Style

Table 3.6. below illustrates that total hassles ($r = 0.26$) and emotional eating style ($r = 0.18$) were strongly correlated with the total number of snacks consumed ($p < .01$). Total hassles ($r = 0.14$) and total uplifts ($r = 0.13$) were both significantly correlated with the number of healthy snacks consumed ($p < .05$). Lastly, total hassles and total uplifts were both correlated with unhealthy snacking behaviour but the correlation was strongest for total hassles ($r = 0.24$, $p < .01$) and unhealthy snacking behaviour ($r = 0.13$, $p < .05$).

Table 3.6. A summary of the Pearson's correlations conducted between total, healthy and unhealthy snacking behaviours with total hassles, uplifts, age and emotional eating style.

	Total snacking	**Healthy snacking**	**Unhealthy snacking**	**M**	**SD**
Total hassles (n)	0.26**	0.14*	0.24**	3.95	2.78
Total uplifts (n)	0.17	0.13*	0.13*	5.31	2.65
Age (years)	-0.03	-0.03	-0.02	22	6.61
Emotional eating score	0.18**	0.10	0.16	34.56	8.15
M	2.57	0.80	1.77	-	-
SD	1.75	0.10	1.33	-	-

Note. *denotes significance at the p<.05 level, ** at the p<.01 level.

3.7.20 Hierarchical Linear Regression

Hierarchical linear regression was conducted to explore the variability in levels of total, healthy and unhealthy snacking behaviours. The independent and moderator variables were entered into the model in a stepwise manner. The potential moderator variables age and emotional eating style were entered into the model at step 2. The research team decided to enter age in this step (and not in step 1) because this focus mirrored the theme within the primary hypothesis set out in Section 3.7.3 – that snack consumption would be positively related to the frequency of daily hassles.

Table 3.7. A regression summary illustrating the step 1, step 2 and interactions between hassles, uplifts, age and emotional eating style.

Predictor variables	Total snacks					Healthy snacks					Unhealthy snacks				
	B	**SE**	**β**	**R^2**	**Change in R^2**	**B**	**SE**	**β**	**R^2**	**Change in R^2**	**B**	**SE**	**β**	**R^2**	**Change in R^2**
Step 1				0.07	0.07				0.02	0.15				0.06	0.003*
Hassles (n)	0.19	0.07	0.30**			0.04	0.04	0.11			0.15	0.05	0.31**		
Uplifts (n)	-0.03	0.07	-0.05			0.02	0.04	0.04			-0.05	0.05	-0.10		
Step 2				0.10	0.04*				0.04	0.28				0.08	0.12
Hassles (n)	0.17	0.07	0.27*			0.03	0.04	0.10			0.14	0.05	0.29**		
Uplifts (n)	-0.00	0.07	-0.01			0.03	0.04	0.07			-0.03	0.05	-0.06		
Age (years)	-0.03	0.02	-0.13			-0.01	0.01	-0.09			-0.02	0.02	-0.10		
Emotional eating score	0.04	0.02	0.17*			0.01	0.01	0.11			0.02	0.01	0.14		
Step 3: Interactions				0.11	0.79				0.05	0.60				0.09	0.97
Hassles (n)	0.10	0.35	0.16			-0.07	0.21	-0.19			0.17	0.27	0.35		
Uplifts (n)	-0.28	0.36	-0.42			-0.04	0.21	-0.10			-0.24	0.28	-0.48		
Age (years)	-0.09	0.05	-0.32			-0.04	0.03	-0.26			-0.05	0.04	-0.23		

Predictor variables	Total snacks					Healthy snacks					Unhealthy snacks				
	B	**SE**	**Β**	**R^2**	**Change in R^2**	**B**	**SE**	**β**	**R^2**	**Change in R^2**	**B**	**SE**	**β**	**R^2**	**Change in R^2**
Step 3 continued:				0.11	0.79				0.05	0.60				0.09	0.97
Interactions:															
Emotional eating score	0.02	0.04	0.09			0.01	0.02	0.07			0.01	0.03	0.06		
Hassles * age group	0.00	0.01	0.10			0.00	0.01	0.18			0.00	0.01	0.00		
Hassles * emotional eating score	0.00	0.01	0.02			0.00	0.01	0.15			-0.00	0.01	-0.09		
Uplifts * age group	0.01	0.01	0.32			0.00	0.01	0.22			0.00	0.01	0.25		
Uplifts * emotional eating score	0.00	0.01	0.21			0.00	0.01	0.01			0.00	0.01	0.28		

Table 3.7. shows that total hassles predicted total number of snacks consumed ($\beta = 0.30$, $p < .01$). This predictive effect of total hassles remained significant even when total uplifts, age and emotional eating score entered the model ($\beta = 0.27$, $p < .05$). Emotional eating score was also found to predict the total number of snacks consumed ($\beta = 0.17$, $p < .05$).

Similarly, total hassles was found to also predict unhealthy snacking behaviours ($\beta = 0.31$, $p < .01$), and this predictive effect remained significant when total uplifts, age and emotional eating score entered the model ($\beta = 0.29$, $p < .01$). In step 3, there were 2 negative main effects between total uplifts and age with total snacks consumed. For healthy snack consumption, there were 3 negative main effects with total hassles, total uplifts and age. Lastly, for unhealthy snack consumption there were two negative main effects with total uplifts and age. A negative three-way interaction between total hassles, emotional eating style and unhealthy snack consumption was also identified.

Table 3.7 additionally illustrates the significance of variability by stating the R^2 and R^2 change within each step of the model. The table illustrates that for total snacks, entering age and emotional eating score at step 2 makes the model significant ($p = 0.04$). For unhealthy snacking, the change in R^2 illustrates that the model is significant at step 1 ($p = 0.003$).

3.7.20.1 Discussion

This study aimed to further understand the relationship between the presence of hassles and uplifts and the consumption of snacks. To extend the findings of Study 1, this study similarly recruited children and undergraduate students to explore the influence that age had on individual stress-eating behaviours. Age and emotional eating style were examined as potential moderating variables within this stress-eating relationship.

This study found that the total number of hassles reported was predictive of the total number of snacks consumed. More specifically, total hassles predicted total snacks and unhealthy snacks but not healthy snacks reported. It was found that there were significant correlations between total uplifts and both healthy and unhealthy snacking behaviours. There was also a positive relationship between total uplifts and healthy snacking but a negative relationship between total uplifts and unhealthy snacking. Age was not found to explain any variability in the relationship between total hassles and total snack consumption. Participants' emotional eating style was however predictive of their total snack consumption – those with low emotional eating ate slightly fewer total snacks compared to those with high emotional eating.

It was found that only total hassles was a predictor of change in total, healthy and unhealthy snacking behaviours when accounting for other variables (e.g., age and emotional eating style). It is worth acknowledging that the positive effect of total hassles, and the negative effect of total uplifts on total snack consumption was also identified in unhealthy snack behaviour. The patterns of eating in healthy snacking behaviour however, did not mirror these findings. Although children reported consuming more total snacks than the undergraduate students, interestingly, there were no significant differences of age when exploring this variable as a moderator. However, the uneven sample size of the two groups may have largely influenced this insignificant finding. The findings identified that emotional eating style was not a significant moderator within any of the regression interactions.

It was however, identified that total hassles and emotional eating style status were significantly correlated with the total number of snacks consumed. Such findings are in line with research like the work of O'Connor et al. (2008) who found that daily hassles were associated with an increased consumption of high fat and high sugar snacks.

Although the current findings mirror existing literature, it may have been possible that participants were engaging in such behaviours to comfort themselves. Zellner et al. (2006) identified such a participant response, where participants chose to consume certain foods because they ‘made them feel better’. Locher, Yoels, Maurer and van Ells (2005) explored the characteristics relating to the foods that individuals identified as ‘comfort foods’ (e.g., cookies, crisps and chocolate). Such foods provided ‘comfort’ and a boost when individuals claimed they needed them. These foods were often identified as being those that were consumed when an individual was on their own because feelings of ‘guilt’ often ensued. If the current participants consumed snacks to provide comfort, it is possible that their snack consumption reporting may not have been entirely accurate if feelings of guilt were present.

O'Connor et al. (2008) found that participants perceived their consumption of vegetables and main meals had reduced when they had experienced daily hassles. This could be true for the current study participants, in that participants felt they had less time to consume meals and prepare healthy food options, so resorted to snacking. This finding is emphasised by observing the negative relationship that was identified between total uplifts and unhealthy snacking. Emotional eating style was also found to predict total snacking behaviours, with those high in emotional eating more likely to have more frequent snacking behaviours. This lends support to the ‘comfort eating’ hypothesis identified in the work of Tomiyama, Finch and Cummings (2015). This hypothesis illustrated that individuals experiencing ‘adverse life events’ and events that they perceived to be stressful were found to engage in ‘comfort eating’.

No variable was found to be predictive of healthy snacking, even though children consumed more healthy snacks than the undergraduate students. However, this effect may have been overshadowed by the dominance of undergraduate students within the sample. The work of Ogden, Reynolds and Smith (2006) found that children increased their consumption of healthy snacks when overt parental control was used. This factor may have been present for the children within the current study, and may ultimately have affected how many healthy snacks participants consumed and or reported they had consumed.

It is well documented that although stress can initiate both hypo- and hyperphagic responses, hyperphagic food responses seem to be more frequently reported (Stone & Brownell, 1994). Individuals may engage in hyperphagic eating behaviours for a variety of reasons, although it is necessary to highlight the ‘stress-induced food reward’ that Adam and Epel (2007) state is behind the ‘psychoneuroendocrine basis’ to stress-related eating (refer to Section 2.10). This model explains the psychological ‘reward pathways’ that become highly sensitive to the situations that an individual perceives as being stressful. Such pathways can make eating highly palatable (and often highly calorific) foods seem more appealing, ultimately leading to an overconsumption of food (Adam & Epel, 2007). The current study findings therefore support such existing literature.

It is useful to explore why children reported high levels of snacking behaviours, particularly in comparison to the undergraduate students. Adolescents have been found to engage in more positive dietary behaviours (i.e., higher levels of vegetable consumption) when in the presence of a parent (Videon & Manning, 2003). Such behaviour may alter however, as they gain more independence and become a young adult. In this regard, it seems surprising that it was the children who reported consuming more snacks. This could be because children are in fact consuming more snacks than the undergraduate students.

For example, it has been found that children consume more palatable snacks after a period of snack restriction (Jansen, Mulkens & Jansen, 2007). Parental dietary behaviour was not measured in the current study, but it could be possible that restrictive parental dietary practices were leading some children to report, or actually consume higher numbers of snacks. Within the study design adopted here, it was not possible to ascertain what snacks were actually consumed versus those that they wanted to consume (of which some may have still been reported).

For adults, snacks are often consumed between-meals to help stave off hunger before their next meal (Hess, Jonnalagadda & Slavin, 2016). However, for children in America, it seems that snacks are a large part of their daily dietary consumption. Piernas and Popkin (2010) identified that 27% of children's daily energy intake came from the consumption of snacks. Although it is difficult to determine if this dietary behaviour was present for children in the current study, it is a factor that may have been influencing the high levels of snacking identified.

The current study did not define what a 'snack' was, other than it being a food/drink item that was consumed in between meals. This ambiguity may have influenced participants' snacking consumption. For example, Chamontin, Pretzer and Booth (2003) identified that adults reported different levels of eating when questions asked individuals about their 'snacks', 'snacking' and 'snackfood' consumption. A 'snack' was found to be related to the consumption of food around lunchtime, with Chamontin et al. (2003) acknowledging that this confirms the belief that a 'snack' is often used to report the consumption of a 'light meal'. This example supports the fact that individuals' perceptions of what determines a 'snack' will ultimately influence what food/s are reported when questioning snack consumption. As a consequence, within the current study, it would have proven useful to conduct more detailed exploratory pilot work. This may have allowed a better understanding of the way in which children and undergraduate students view the term 'snacks'.

There are however, some limitations to the current study that require comment. For example, the cognitive capabilities that are needed to recall dietary intake are complex, and as such, research has acknowledged that for children under the age of 12, it can be difficult to ascertain the accuracy of the information provided by such children (Livingstone et al., 2004). However, by the age of 7-8 years old, children have been found to give a more accurate free dietary recall than children of a younger age. Although, this recall is only found to be accurate when asking about their dietary habits over the last 24 hours (Livingstone et al., 2004). As such, this method of measuring dietary behaviours amongst young children needs to be treated carefully because of the possibility that over and under-estimation is present within their recall.

The absence of an effect of age may be accounted for by the small number of children in the study. Due to difficulties in recruitment, the number of children within the study was lower than initially anticipated and, as such, was disproportionate to the number of undergraduate students in the study. A power calculation was not conducted for this study. The research team decided that it would be suitable to use the sample size of Study 1 as a template for this study given the paucity of literature within the domain. In the future, it would be useful to provide age-appropriate incentives to encourage more children to take part in similar research.

Future research should try to have equal proportions of the different age groups within the sample. To obtain a larger amount of ecologically valid data it would be useful to obtain more retrospective diary data. However, the accuracy of recalling several days’ worth of dietary behaviours may not be as accurate as gathering 24 hour recall data from a larger number of participants. As such, the benefits and disadvantages of such approaches should be considered.

3.7.20.2 Conclusion

This study identified that the presence of hassles were predictive of both the total amount of snacks consumed, and the number of unhealthy snacks consumed. Such behaviours were measured across the past 24 hours, to aid the recall of both children and undergraduate students. Children were found to consume more total snacks and more healthy snacks than the undergraduate students. Participants’ healthy snacking behaviour was significant different between children and undergraduate students.

3.7.20.3 General Discussion

This chapter summarises the first two empirical questionnaire based studies conducted as part of this thesis. Study 1 measured participants' hypothetical snacking choices and Study 2 measured participants' retrospective snacking behaviour. In Study 1, stress was explored by manipulating emotion, through the use of positive and negative words. In Study 2, stress was conceptualised in terms of being either a hassle or an uplift. In both studies, samples of children and undergraduate students were used to examine the moderating effect of age.

Overall, both studies found that stress, either in the form of emotions (Study 1) or hassles (Study 2) were related to a change in eating behaviour. Interestingly, across both studies, age was seen to be largely influential in terms of the amount and type (healthy/unhealthy) of snacks consumed. Children were found to report higher levels of snack consumption within both studies, even though Study 1 highlighted that it was the presence of positive emotions that were most influential for this age group.

This finding, although seemingly the antithesis of existing stress-eating literature, was supported by Study 2 where again, children ate more snacks than undergraduate students, but here, undergraduate students experienced more hassles than the children. This suggests something else other than stress/negative emotion is influencing the initiation of eating behaviours for children. It is possible therefore that positive emotions/uplifts are important for this group.

Both studies indicate that stress is related to snacking behaviour change, and as such further research should now continue to explore this relationship. It would be useful to continue to explore the moderating effect of age, to understand when certain behaviours alter or become present. Although it is important to acknowledge that as children grow they have larger energy requirements as they age (Gidding et al., 2005), so their snacking behaviours may naturally increase because of this. Due to the age of participants, it is possible that children will have less control over the snacks they choose to consume. For example, parents/caregivers will be choosing and purchasing their child's food and their own eating behaviour may affect what behaviour/s they encourage in their children (Scaglioni, Salvioni & Galimberti, 2008). As a consequence, this parental control has been found to influence both the short and long term food intake of children (Scaglioni et al., 2008). Children may therefore be less able to express a response to stress through food. However, the findings from Studies 1 and 2 suggest that children's eating responses and eating behaviours differ to those of undergraduate students, providing support for further exploration.

Although cross-sectional methods are useful for examining the way that stress and eating behaviours interact, longitudinal methods can provide a more illustrative picture of the way in which such variables interact over a longer period of time. Objective stress measures capture the physiological changes that occur in response to stress, thus providing researchers a more comprehensive view of the way in which stress influences eating behaviour. In this instance, such measures could consist of gathering cortisol, by measuring saliva, blood or urine (Levine, Zagoory-Sharon, Feldman, Lewis & Weller, 2007).

Within existing literature, there is a paucity of the use of both longitudinal studies and objective stress measures. This therefore promotes the recommendation for the use of such methodology within Studies 3 and 4.

Chapter 4. Exploring how daily hassles and salivary cortisol relates to the between-meal snack consumption of 8-11 year old children and undergraduate students

4.1 Introduction

It is widely understood that stress can influence the choice of food and the frequency with which individuals engage in certain eating behaviours (Oliver & Wardle, 1999). In existing literature, different measures of stress have been explored (e.g., perceived and objective), and as such, certain measures have been found to influence eating behaviours. Perceived stress for example, is related to unhealthy eating behaviours (Sims et al., 2008), such as an increase in the amount of snacks consumed (Conner et al., 1999) and a reduction in the amount of fruit and vegetables consumed (O'Connor et al., 2008). It is possible to measure stress objectively by measuring individuals' cortisol, blood pressure or heart rate (Kristenson, Garvin & Lundberg, 2012). One example within the stress-eating domain measured stress objectively by measuring individuals' cortisol responses, where it was found that those with high cortisol levels consumed an increased amount of snacks (Newman et al., 2007).

Some research measures stress using two forms of measurement concurrently within the same study. For example, using both subjective and objective stress measures to obtain a more illustrative picture of participants' stress experience (Newman et al., 2007). Stress is frequently measured by capturing the current stress individuals are experiencing, however, stress can also be induced. To induce stress, stress induction tasks can be given (e.g., the TSST, Kirschbaum et al., 1993) to initiate a stress response amongst individuals and subsequent physiological responses can then be measured.

4.1.1 Measuring Subjective Stress

In Study 1 (Chapter 3), the subjective stress response to positive and negative emotions was explored. Positive emotions were found to encourage children to give both healthy and unhealthy snacking responses when asked if such an emotion would make them want to eat a snack. Within existing stress-eating literature there is a focus on the impact that negative emotion has on subsequent eating behaviours, however, this finding from Study 1 highlights the importance of positive emotion. Evers et al. (2013) found that the consumption of snacks was frequently 'preceded' by the presence of positive emotions.

Evers et al. (2013) appreciate that within society, food and emotion, particularly positive emotion are inextricably linked. For example, an abundance of food is often available at gatherings full of friends and family. Andrade (2005) acknowledges that positive emotions are often present when an individual's surrounding environment is safe. Such characteristics have consequently been associated with an increase in food consumption. However, Evers et al. (2013) highlight that the term 'positive emotion' should not be used without appreciating that there are many 'types' of positive emotion. These different 'types' may be present to varying degrees, ultimately making the presence of one emotion more important than another at any one time (examples of positive emotion include: joy, interest and pride).

In this respect, when measuring positive emotion it is important to give participants as much freedom as possible when reporting their own experience of positive emotion. Daily diaries are one method of measuring subjective stress that use self-report questions to give participants more freedom in the way they respond, something which, in the case of children is beneficial because it enables the exploration of quantitative concepts to be kept to a minimum (Beidel, Neal & Lederer, 1991).

The use of daily diaries (as a measure of subjective stress) improves the validity of participants' responses, a factor that hampers questionnaires that ask participants to recall their behaviour over a long period of time (Almeida, 2005). However, Almeida (2005) believes that the use of daily diaries allows both within and between individual factors to be investigated. These positive features of daily diary methodology allow it to be a useful tool for measuring daily subjective stress.

4.1.2 Conceptualising Eating Behaviours

Within previous research, snacks have frequently been explored within the stress-eating relationship. Conner et al. (1999) acknowledge that it is a 'discrete' form of eating behaviour that is often reported accurately by participants, particularly if participants are asked to report their daily snacking behaviours. As the findings from Studies 1 and 2 illustrate, there are age differences in the choice and frequency with which snacks are chosen. This shows that not only is it a suitable method of measuring stress-related eating change in both children and undergraduate students, but that it would serve as a useful tool to explore whether daily stress affects subsequent daily snacking behaviours, something that Roemmich et al. (2002) acknowledges is underexplored amongst children.

4.1.3 Measuring Physiological Markers of Stress

Stress can be measured physiologically by measuring blood pressure, heart rate (Cohen et al., 1995) or cortisol (Buchanan et al., 1999). The adrenal glands produce cortisol and are located above the kidneys, deep in the abdomen (Hine & Martin, 2016). Cortisol can be measured by taking samples of saliva, blood or urine (Kristenson et al., 2012).

Higher levels of cortisol are released when an individual experiences stress, and as such, could act as an important tool to explore the stress-eating relationship. Newman et al. (2007) examined the relation between daily hassles and snack intake using individuals' cortisol reactivity levels as a moderator of this association. This study found that those who were high reactors (those who had increased levels of cortisol between their baseline and post stressor samples) reported a higher frequency and intensity of daily hassles along with a greater consumption of snacks across the two-week study. Newman et al. (2007) acknowledge that such a response may therefore be visible when testing participants in their everyday environment, outside the laboratory setting.

4.1.4 Physiological Responses to Stress

When stress is experienced, two physiological systems are activated. The first is known as the sympathetic adrenal medullary system (SAM). This system is activated as soon as an individual feels frightened or threatened. This process causes the adrenal glands to release noradrenaline. Noradrenaline prepares the body for responding to the imposing threat by making physical changes to the body (e.g., slowing digestion and increasing heart rate).

The second activated system is the hypothalamic-pituitary-adrenal axis (HPA) system. As well as the SAM response, if an individual feels an experience is stressful, the hypothalamus releases the chemical, corticotrophin releasing factor. Once in the blood stream, it causes the pituitary gland to release adrenocorticotrophic hormone. Lastly, this hormone travels to the adrenal cortex (located on top of the adrenal glands) where the stress hormone cortisol is released.

Stress has additionally been found to indirectly influence other physiological processes such as sleep and level of physical activity (e.g., Cartwright & Wood, 1991). Although Cartwright and Wood (1991) state that stressful events (e.g., life events) have often led to the belief that periods of ‘poor’ (reduced) sleep will follow. Sadeh, Keinan and Daon (2004) report that many different features of disrupted sleep may also arise (e.g., difficulty getting to sleep, nightmares and ‘fragmented’ sleep).

Individuals often engage in physical activity to try and mitigate some of the negative effects of stress (Fox, 1999). However, it has been reported that ‘stress impairs’ individuals’ ability to engage in regular physical activity (Stults-Kolehmainen & Sinha, 2014), suggesting that such avenues would be interesting to explore.

4.1.5 When is it Best to Measure Cortisol Levels?

Human cortisol levels behave in a ‘pulsatile fashion’, where levels are naturally higher or lower depending on the time of day. Across 24 hours, there are a total of 15 cortisol peaks that can be seen across an ‘undisturbed’ individual (Kirschbaum & Hellhamer, 1989). This diurnal pattern gives cortisol levels their highest peak in the morning, on awakening, and their lowest point in the evening (Kirschbaum & Hellhamer, 1989). This natural increase in the morning is part of what is termed the ‘cortisol awakening response’ (CAR, Fries, Dettenborn, & Kirschbaum, 2009), and as such, samples must be taken at times that will not be affected by this natural increase, or if samples are taken close to waking, the results need to be assessed accordingly (i.e., by taking the individual’s CAR into account).

If longer periods of stress response are to be measured, taking diurnal samples (i.e., those taken across a 24 hour period) may be more useful. Cortisol reactivity is defined in Section 1.8 and often forms part of laboratory studies, when stress is measured in and around a particular time or event (e.g., The TSST, Kirschbaum et al., 1993). Such stress induction mechanisms allow individual stress responses to be measured at various time points post stressor. This method of stress measurement allows a greater understanding of the way in which an individual’s body responds to the stress task. For example, the TSST (Kirschbaum et al., 1993) measured cortisol levels at 10, 20 and 30 minutes post stressor to ascertain how each individual was physiologically responding to the task.

4.1.6 What can Affect Cortisol Levels?

There have been many different influential factors that have been identified as having the potential to affect the level of cortisol that is present in the body. Before the birth of a child, it has been reported that the level to which free, unbound cortisol levels are present decreases when a woman is at different stages of her menstrual cycle (Kirschbaum, Kudielka, Gaab, Schommer & Hellhammer, 1999).

Early on in life, the type of care a child receives has been found to impact on the level of cortisol produced by their body. For example, elevations in cortisol are only identified in children who have a negative (i.e., ‘insecure’) relationship with their parent/caregiver, even when this parent/caregiver is present alongside the presence of a stressor (Gunnar & Donzella, 2002). Similarly, when a child has entered the foster system, Dozier et al. (2006) identify that these children are likely to show ‘atypical’ cortisol responses when responding to a stressor.

A child’s background, or more specifically, their socio-economic status (SES) has been found to affect a child’s individual cortisol response. Lupien, King, Meaney, and McEwen (2001) report that low SES children have a ‘significantly higher’ salivary cortisol response when compared with their similarly-aged high SES counterparts.

The food that we eat also has the ability to initiate a change in cortisol response. Hanrahan, McCarthy, Kleiber, Lutgendorf, and Tsalikian (2006) acknowledge two reasons for this change. One: foods have the ability to change the oral environment (having the ability to cause incorrect low/high saliva readings) and two: the foods themselves can impact on the degree to which the HPA system activates within the body. One example of a food that stimulates cortisol 'secretion' are high sugar foods (e.g., sweet breakfast cereals). Michels et al. (2013) illustrated that higher cortisol levels in children were related to higher subjective stress levels as well as high levels of unhealthy food consumption. This finding, Michels et al. (2013) believes helps to provide support for the 'cortisol-stimulated association' with comfort foods.

Hanrahan et al. (2006) appreciate that there are both specific medications and conditions/diseases that can influence changes in cortisol levels. For example, steroid medication is often used to alleviate asthma symptoms and has been directly found to affect cortisol levels (Hanrahan et al., 2006).

4.1.7 What are the Detrimental Effects of Elevated Cortisol?

Longitudinally, it has been identified that elevated cortisol levels can have a detrimental impact on the health of an individual. Melamed et al. (1999) found that elevated cortisol levels were highly significant with levels of chronic burnout; which has been linked to a reduction in the emotional, physical and cognitive well-being of an individual.

Additionally, further physiological impact has been found with respect to cardiovascular health, with higher urinary cortisol levels shown to link to an increased risk of cardiovascular mortality (Vogelzangs et al., 2010). The consequences of physiological stress on the body (in terms of elevated cortisol levels) seem to be manifold, and as such, although this thesis focuses on eating behaviours, it is crucial not to underestimate the impact that cortisol has for the rest of the human body.

4.1.8 Expanding Upon Studies 1 and 2

In this chapter, Studies 3 and 4 build on the stress-eating associations that were identified in Studies 1 and 2. As such, Studies 3 and 4 explored stress by allowing participants to report their subjective stress experiences through the use of stressful events for children, and daily hassles and uplifts for undergraduate students. For all participants, snack consumption was recorded using daily diary methodology. To appreciate the diverse nature of stress, measures of salivary cortisol were taken in both studies to explore the possibility that cortisol was acting as a moderating variable in the stress-eating relationship.

4.1.9 Chapter Overview

This chapter presents two studies that explore the relationship between subjective stress and snacking behaviours. Both studies examined this relationship using change in cortisol as a moderating variable in this association. Study 3 measured the subjective stress of 8-11 year old children to compare this with their between-meal snack consumption over the duration of a week. Study 4 explored the subjective stress of undergraduate students to explore whether or not this is associated with their between-meal snack consumption across 4 days.

Both studies utilised daily diary methodology for capturing subjective stress and between-meal snack consumption, along with the use of the swab method to collect salivary cortisol. Study 3 measured cortisol reactivity, measuring participants' cortisol responses to a stress-induction task, whereas Study 4 measured diurnal cortisol levels by measuring three cortisol samples per day for each participant.

4.2 Study 3: Exploring the relationship between the subjective stress and snacking behaviours of 8-11 year old children

4.2.1 Study Aims

This study aimed to explore the impact of stress, on the between-meal snacking behaviours of children aged 8-11 years old. The study explored the relationship between stress induction and post stress snack consumption, as well as the presence of subjective stress and how such stress affects the quantity and choice of snack foods consumed over seven days.

4.2.2 Hypotheses

It was hypothesised that children who report more stressful events across the week will be those who consume the most between-meal snacks, and that such a relationship will be moderated by their cortisol response, with those who have high cortisol reactivity found to consume more between-meal snacks across the study week.

4.2.3 Method

4.2.4 Power Calculation

During the design stage of this study, the primary researcher conducted a power calculation to identify a suitable sample size. The Neyman and Pearson power calculation method was used (Sedlmeier & Gigerenzer, 1989), where alpha and power levels, effect size and one/two-tailed side information was inserted into the model. A G Power based online power calculator (using the Fisher's Z test for Pearson correlation) was used and generated a target sample size of 153 participants. Taking the cost of the salivary cortisol samples into consideration, the target sample size for this study was therefore 150 children. However, soon after recruitment began, the research team realised that within the time restraints it was not going to be possible to reach this total. To address this, the research team discussed decreasing this total to 20 children, to allow for an additional cortisol study (Study 4) using undergraduate students to be funded.

4.2.5 Participants

Participants were recruited from a summer camp, an after school club and by word of mouth (through colleagues within the School of Psychology), in and around the Leeds, West Yorkshire area and through invitation using the University's Mednet research email mailing list.

An internet search was made to identify suitable summer camps for contacting within this area. Suitable primary schools were identified through the use of a list obtained directly from contact with Leeds City Council.

In total, 13 summer camps were invited to take part, of which one responded and engaged with us for this study. A total of 68 primary schools were invited to take part, however none took part in the study. Unfortunately, no school responded to our study invitation, therefore, it is not clear why the vast majority of schools did not want to take part. Study recruitment for this study took place in the last few months of the year, leading up to Christmas (i.e., October – December) and in the New Year (January onwards). This time of year avoided the busy start and end of the school academic year, however, it quickly became apparent that anytime during the school year proved challenging for recruitment. Therefore, it is possible that the extended nature of the study (along with the salivary cortisol component) discouraged schools from wanting to get involved.

In the summer camp, four children were recruited, two were recruited from the after-school club and the remaining 14 children were recruited by word of mouth, and by advertising the study using the University based Mednet email mailing list. This resulted in a total of 20 participants, of which 12 were female and eight were male. The participants were all 8-11 years old, with the cohort's mean age at 9.45 years. All parents/caregivers provided details about which ethnic group their child identified with, showing that 15 participants identified as being White, 2 participants identified as belonging to mixed/multiple ethnic groups and 3 participants identified as being Asian/Asian British. A total of 95% of the parents/caregivers provided details about which ethnic group they identified with, of which 16 identified as being White, and 3 identified as being Asian/Asian British.

4.2.6 Ethical Approval

Ethical approval was given by the School of Psychology's Research Ethics Committee (at the University of Leeds, date: 19.10.2017, reference number: 17-0506).

4.2.7 Study Design

This study utilised a repeated measures design, and had an exploratory focus to understand the relationship between stress levels (measuring induced stress and subjective daily stress) and snack consumption (measuring consumption post stress-induction and diurnally). The study induced stress by giving participants a laboratory stress induction task. The Trier Social Stress Task for Children (TSST-C, Buske-Kirschbaum et al., 1997) was administered to participants so that individual stress responses could be measured by salivary cortisol samples taken before, during and after the task. This stress induction took place on day one of the study.

For the next seven days participants were given a daily diary (see Section 4.2.14) to complete each evening. The diary asked participants to report the stressful events that occurred that day, along with any in-between snacks that they consumed. In addition to the diary, participants were given a mobile phone that they could use to take pictures of the snacks they consumed. Snack consumption was measured both post induction task, when specific snacks were provided and diurnally using the daily diary across the remaining seven study days.

The study (in its entirety) was piloted on one child (age: 10 years) before additional participants were recruited. This child was recruited by word of mouth within the School of Psychology. The research team deemed one child to be suitable for this pilot because of the extended nature of the study (where it was not deemed appropriate to recruit a larger sample because of the possibility that study measures may have needed to be altered subsequently if certain elements needed to be changed). This pilot aimed to test the study procedure to ensure the selected measures were appropriate and comprehensive for the target age. During the pilot, the study testing session (on day one) took approximately 1 hour to complete, and this child's parent informed the primary researcher that it took their child no longer than 30 minutes each evening to complete each daily diary.

4.2.8 Study Measures

This study comprised of several different study measures, the majority of which were paper-based questionnaires. The remaining study element asked participants to provide saliva samples before, during and after the stress induction task.

4.2.9 Study Information Pack

This pack was distributed to any child aged between 8-11 years old that expressed interest in taking part. The pack contained 11 print-based questionnaires and forms, some of which were to be completed by the child themselves, others, by the child's parent/caregiver. The pack contained a stamped, addressed envelope to enable the child's parent/caregiver to return the completed forms to the primary researcher.

The pack contained the following questionnaires and forms: child and parent/caregiver information sheets, child and parent/caregiver consent forms, and the following questionnaires (see Appendix D): a demographics questionnaire and the DEBQ (van Strien et al., 1986). The information sheets, consent forms and demographics questionnaire were all study specific materials that were created for use in this study.

The DEBQ (van Strien et al., 1986) is a pre-existing 33 item questionnaire that explores three different types of eating styles: emotional, external and restrained eating. It was utilised here as it was in Study 1 (see Section 3.6.10).

4.2.10 Study Testing Session (Day 1)

On day one of the study, participants were asked to complete several tasks that included the following: a hunger questionnaire, the TSST-C (Buske-Kirschbaum et al., 1997), a snack liking questionnaire and the provision of four saliva samples. (The hunger and snack liking questionnaires were administered but are not analysed within this thesis. The hunger questionnaire was not analysed because this measure ended up not sitting closely with the primary focus of my study hypotheses. The snack liking questionnaire was not analysed because it was used to distract participants and encourage them to eat snacks post TSST-C). Table 4.1 illustrates the order of the test day procedures.

Table 4.1. An illustration of the test procedures involved in the testing session on day 1.

Testing session (Day 1) **Order of testing procedures:**
1. Offered a drink of water and a wipe to clean their hands
2. Given the first hunger questionnaire
3. Height and weight measurements taken
4. Asked to provide saliva sample 1
5. An explanation of the TSST-C task was given
6. The TSST-C task starts
7. +10 minutes: saliva sample 2
8. + 20 minutes: saliva sample 3
9. +30 minutes: saliva sample 4
10. Given the second hunger questionnaire
11. Given the snack liking questionnaire with two bowls of snacks
12. The remaining study components (daily diary and mobile phone) were explained to the participant

4.2.10.1 The TSST-C Task

The TSST-C, originally presented by Buske-Kirschbaum et al. (1997) presents children with two tasks, a creative story task and an arithmetic task. Both of these tasks are to be completed by the participant, in front of a panel of two people. These people are unknown to the child, and are used to try and initiate a stress response. The tasks (chosen to be age-appropriate) are deemed challenging, but mirror the type of tasks children are given in school (so consequentially, are not seen as being inappropriately stressful or demanding).

The creative story task takes up to 10 minutes to complete, children are read the paragraph to a story (see Appendix D), and are asked to prepare an exciting ending to this story, they are given 5 minutes to do so. After this time, they are led into another room to present their story ending to the panel. They had up to 5 minutes to do this, and they were given prompts, and questions by the panel if they struggled. The panel kindly asked participants to stop at any time during this 5 minutes, once they felt the child had given as much of a story ending as they were able to.

The arithmetic task took 4 minutes to complete. The panel provided instructions on this task as soon as the creative story task had finished. This task required children to count down in 7s from 758 for a duration of 4 minutes. If they got a number wrong, they were asked to start again from the beginning, at number 758. At the end of the task, the primary researcher asked the children to return to another room to complete the remaining part of the session.

Prior to explaining the TSST-C task, the primary researcher asked participants to give their first saliva sample. During the TSST-C task, participants were then asked to give three more saliva samples at 10 minute intervals. The timings for the samples are: baseline, +10 minutes, + 20 minutes and +30 minutes (following the timings utilised in the original TSST-C by Kirschbaum et al., 1993).

After the TSST-C and final saliva sample, two snacks were given to each participant to allow children to complete the liking questionnaire. Participants were given 10 minutes to complete this questionnaire, whilst having access to two snacks (maltesers and cheese and onion crisps). These snacks were selected for their high desirability (e.g., the high fat maltesers are more pleasurable physically, with them providing a 'hedonic' reward for the brain (Mizushige, Inoue & Fushiki, 2007)) to encourage participants to consume snacks should they feel they want to, post stressor. Participants were not given a choice of snacks because of the cost associated with providing an array of items for each participant. The research team discussed possible food items, and decided to provide one sweet and one savoury snack item for each child. Maltesers and cheese and onion crisps were arbitrarily chosen because the research team deemed these to be popular snack items.

The snacks were given to participants in two plastic tubs. Each tub contained two packets of each item (i.e., providing a larger than normal portion of each) and participants were informed that they could consume as much of either snack as they wished during this 10 minute period.

It is important to note, that the snack liking questionnaire was not specifically utilised to determine how much a participant liked each snack. The questionnaire itself was utilised to help distract participants from the focus of the task which aimed to identify the quantity of snacks consumed post TSST-C. It was predicted that high reactor participants would consume more snacks post TSST-C than the low reactor participants (e.g., Newman et al., 2007).

4.2.11 Cortisol

4.2.11.1 Measuring Salivary Cortisol

In order to objectively measure stress, this study utilised salivary cortisol to capture the change in biological responses before, during and after the stress induction task (known as cortisol reactivity). This method is one of a few biological methods (e.g., blood pressure and heart rate monitoring) that can be utilised to measure the way in which the body responds to stress.

Salivary cortisol measures the free, unbound cortisol plasma levels present in the saliva within the body (Schmidt, 1997). These free, unbound components within salivary cortisol are biologically ‘active’, meaning that they have an effect on the physical body, and due to their distinct properties, the compounds are not influenced by any increases of cortisol binding-globulin, which can affect the interpretation of cortisol within serum samples. This, along with the fact that obtaining salivary cortisol is easier for participants means that it is often the preferred choice for obtaining physiological information about cortisol (Vining, McGinley, Maksvytis & Ho, 1983).

4.2.11.2 Intra and Inter Assay Sample Analysis

The samples were measured and analysed individually, and were assayed twice (duplicate assay) to improve measurement accuracy. The samples were compared with one another by using both intra- and inter-assay values. Both calculations look at the average coefficient difference, however, the intra-assay calculation explores the variation ‘between duplicate’ assays, with the inter-assay calculation exploring the variability from each plate mean (Schultheiss & Stanton, 2009).

4.2.12 How was Cortisol Measured in this Study?

Salivary cortisol was measured before, during and after participants engaged in the TSST-C task. Participants were asked to take four samples, with each sample consisting of a cotton swab that needed to be kept under the tongue for two minutes. The samples were taken at the following times: baseline (0) and at 10, 20 and 30 minutes after baseline. The TSST-C task was started after baseline, and the subsequent three samples (at 10, 20 and 30 minutes) were taken at the corresponding times during the TSST-C. For using the samples in subsequent analyses, the four different timed samples were used to generate an area under the curve (AUC) measurement with respect to ground (AUCg). This formula was generated using the formula from the work of Pruessner, Kirschbaum, Meinlschmid, and Hellhammer (2003). The AUCg measure was chosen because it captures the level of cortisol secreted over the given time period, which in this instance was the most effective method of summarising the salivary cortisol.

4.2.13 Study Days 2 - 8

At the end of the study session on day one, the primary researcher gave participants instructions for the remainder of the study. The final part consisted of a daily diary booklet and a mobile phone.

4.2.14 Daily Diary Booklet

The children were asked to complete one daily diary at the end of each evening across the seven day study week (starting on the day after the TSST-C task (day 2) and across the next 7 days (study days 2-8). The seven diary entries were identical to one another, and asked participants to answer questions on: the day's events, snacks consumed, their feelings and whether or not they remembered to take pictures of the snacks they had consumed (that day) using the mobile phone provided.

The diary entries used tick box questions for the events, snacks, feelings and photograph sections, to aid completion and to provide consistency of question type across daily diary days. To complete these questions, participants were asked to put a tick in the box that best described the event, snack, or feeling that they experienced/ate on that particular day (see Appendix D).

The events section contained 11 statements where participants had to specify whether or not that particular event had occurred for them that day. A total of 10 of these statements were taken from the statements evoking hassle style situations used in the Children's Hassle Scale by Kanner, Feldman, Weinberger and Ford (1987, for example, 'your brother or sister bugged you'). The remaining statement was created for use here ('you could not do what you wanted to do') because the research team felt that this would be a useful additional hassle style situation that was not covered within the selected 10 statements.

Within the snacks question, 15 food and drink snacks were listed, and participants were asked to tick whether or not they consumed that particular item, and if so, at what time during the day they consumed this item. The list of snacks was chosen specifically for use within this study, and consisted of seven healthy (e.g., vegetables (carrot or cucumber sticks)) and eight unhealthy (e.g., chocolate or sweet) items. The research team selected what was deemed to be an appropriate array of both healthy and unhealthy snacks, unfortunately this resulted in an uneven number of snacks within each category. These snacks were identified as being unhealthy if they were high in both sugar and fat (per 100g of that food type, classified using the food composition tables by McCance and Widdowson (2014) and were a highly processed item (e.g., cake)).

In both the events and snack questions, there were two additional spaces for any other events or snacks that participants wanted to include. This space allowed participants to freely write any event or snack that they may have experienced/eaten that day.

In the feelings question, participants were asked both how happy and sad they were feeling at different times of the day (in the morning, afternoon and evening). The last section asked participants to inform us of whether or not they were able to take pictures of all of the snacks they had eaten that day.

4.2.15 Mobile Phone Picture Taking

During the study, participants were given a mobile phone to take pictures of any food or drink that they ate across the seven day study. They were only asked to photograph a snack if they consumed it in between their daily meals (i.e., identified as a separate snack, and not food they consumed as part of a meal). Due to the age of participants, and the decision to focus on children’s snacking behaviours, the research team decided not to request that pictures of main meals were taken. Participants were asked to take a picture using the phone before they consumed the food or drink item. The mobile phone device was selected because it was thought that it would be convenient for participants to carry with them and use. The mobile phone captured the picture, the time and date that it was taken (enabling study compliance to be tested).

4.2.16 Mobile Phone Pictures Taken

There were a total of 301 food snack photographs taken by participants across the study week. Of these 301 pictures, 21 were duplicate images (taken on the same date and at the same time as another image), resulting in a final total of 280 photographs. The number of photographs taken by children (across the entire week) ranged from 1 to 47 pictures. These photographs acted as a means of retaining the interest of participants because it was a fun and exciting task for the children to use the phones in this way, and as outlined above, it aimed to increase compliance of the study protocol. Participants were asked to capture images of any between-meal snack that was consumed. However, in hindsight, it is possible that snacks may have formed the basis of some participants' meals. In this respect, the current focus on between-meal snacks would have omitted the reporting of any snack items that were consumed as part of, or as a main meal. For future research, it could be useful to gather pictures of all daily food consumed, to avoid missing snacks consumed at other times of the day other than between-meals.

4.2.17 Treatment of Missing Data

The following number of answers were missing: 42 responses to the happy and sad feeling questions and 2 from the DEBQ. To treat this missing data, column mean values were inserted into any missing responses. Subsequent analyses were then conducted.

4.2.18 Statistical Analysis

Data was entered into IBM SPSS Statistics Version 22. Descriptive statistics were conducted in SPSS, and multi-level modeling analysis was conducted in the Hierarchical Linear and Nonlinear Modeling (HLM) Student Version 7 software program. Within HLM, the main effects and moderation effects of demographic and experimental variables (e.g., emotional eating style) were calculated. Significant moderator variables were decomposed to reveal the significant cross-level interactions within the low and high levels of each moderator variable (e.g., low and high external eating styles).

In HLM, data was inputted using a two-tier hierarchical structure. In the first level, variables that explored within-subject variability were inserted. These variables included total hassles, total uplifts and total snacks (consumed) for example. In level two of the model, between-subject variables were inputted. Example variables included cortisol variability and emotional eating style. The IV variables (e.g., total hassles) inputted at level one were group mean centred. Similarly, the moderator variables entered at level two were also group mean centred. These variables were group mean centred because the variables were found to span over a wide range (e.g., the range of total snacks consumed spanned from 0-24).

Using the group mean centre for such variables allowed participant variability to be less influential when analysing such variables within the model (Kreft, De Leeuw & Aiken, 1995). Analysis in HLM was broken into two parts. First, the effects of the level one within-subject variables were examined to explore the effect they had on the eating behaviour outcomes. The following eating behaviour outcomes were explored: total snacks, healthy snacks, unhealthy snacks as well as high fat snacks and high sugar snacks. The research team believed it would be interesting to further explore the effects of stress on unhealthy snack consumption by examining the impact that stress had on high fat and high sugar snacks separately. Categorising unhealthy snacks in this way aimed to provide further information about the relationship between stress and unhealthy snack consumption. Secondly, the impact of the level two between-subject variables were explored to see the impact such variables had on the eating behaviour outcomes of focus. If any significant level two between-subject interactions were identified in HLM at this stage, they were then decomposed using the intercept, slope and significance calculator developed by Preacher, Curran and Bauer (2018).

4.2.19 Results

4.2.19.1 Descriptive Statistics

Table 4.1. summarises the descriptive characteristics of the study sample. A total of 12 participants were girls (M age = 9.67) and eight were boys (M age = 9.13). The mean BMI was similar across both girls and boys, 17.60 -17.61 kg/m^2 respectively. Participants' cortisol levels were within the range identified by existing literature as being normal for healthy children within this age range (Maguire et al., 2007; Michels et al., 2013).

Table 4.2. Descriptive statistics for main study variables.

	All participants N = 20	Girls n = 12	Boys n = 8
M age (years, SD)	9.45 (0.83)	9.67 (0.65)	9.13 (0.99)
Range	*8-11*	*9-11*	*8-11*
Mean BMI (kg/m², SD)	17.61 (2.02)	17.60 (2.30)	17.61 (1.67)
Range	*14.6-22.1*	14.6-22.1	*14.8-19.8*
		M (SD) *Range*	
Total hassles* (n)	2.75 (3.09) *0-17*	3.52 (3.39) *0-17*	1.59 (2.13) *0-10*
Positive mood* (n)	11.71 (2.38) *6-15*	12.19 (2.23) *6-15*	10.98 (2.44) *6-15*
Negative mood* (n)	3.93 (1.95) *3-15*	4.11 (1.96) *3-11*	3.66 (1.92) *3-15*
Total snacks** (n)	5.61 (3.55) *0-24*	6.24 (3.27) *2-24*	4.66 (3.77) *0-20*
Healthy snacks (n)	5.21 (2.71) *2-18*	5.56 (2.56) *2-18*	4.70 (2.85) *2-13*
Unhealthy snacks (n)	1.03 (0.83) *0-3*	1.10 (0.77) *0-3*	0.93 (0.91) *0-3*
Emotional eating score	2.12 (0.67) *1.39 – 3.92*	1.94 (0.57) *1.39 – 3.31*	2.39 (0.75) *1.54 – 3.92*
External eating score	3.31 (0.74) *2.1 – 4.7*	3.26 (0.51) *2.5 – 4.1*	3.39 (1.04) *2.1 – 4.7*
		M (SD) *Range*	
	All participants N = 20	**Girls n = 12**	**Boys n = 8**
AUCg*** (nmol/L)	47.36 (28.33) *11.04-103.88*	47.06 (27.83) *11.04-103.32*	47.80 (31.00) *18.76-103.88*
Baseline (nmol/L)	1.70 (0.75) *0.36-3.17*	1.75 (0.81) *0.36-3.17*	1.62 (0.70) *0.36-2.73*
+ 10 minutes (nmol/L)	1.60 (1.14) *0.39-4.91*	1.68 (1.28) *0.39-4.91*	1.50 (0.98) *0.50-3.23*
+ 20 minutes (nmol/L)	1.49 (1.14) *0.30-4.39*	1.46 (1.06) *0.36-3.73*	1.53 (1.32) *0.30-4.39*
+ 30 minutes (nmol/L)	1.60 (1.22) *0.36-3.97*	1.40 (0.10) *0.36-3.97*	1.89 (1.52) *0.39-3.75*

Note. *Scores for total hassles, positive and negative mood have been averaged across the 7 study days. **Snacks have been averaged across all seven study days. ***Measured using 'area under the curve with respect to ground' (AUCg).

4.2.20 Independent t-test Analyses to Explore the Effect of Gender

Independent t-test analyses were conducted to explore the influence that gender had on the mean: total hassles, total snacks, healthy and unhealthy snack totals, positive and negative mood totals as well as total emotional and external eating scores. Analyses revealed that gender led to significant differences in the number of total hassles ($t(137.60) = 4.15$, $p < .001$) and total snacks reported ($t(138) = 2.63$, $p = 0.01$). Gender also explained significant differences in levels of positive mood ($t(110.46) = 2.97$, $p = 0.004$).

4.2.21 Correlation Analysis Exploring Food Consumed Post TSST-C

Participants were given the option to consume two snacks after the TSST-C task, of which the quantity consumed was measured. To assess the relationship between the amount consumed post TSST-C, emotional and external eating styles and cortisol reactivity, a Pearson's correlation was conducted. Table 4.3. summarises the findings.

Table 4.3. A summary of the Pearson's correlations conducted between the amounts of food consumed post TSST-C, emotional and external eating styles and cortisol reactivity.

	Food consumed post TSST-C (grams)	**M**	**SD**
Emotional eating style	0.41	-0.01	8.66
External eating style	0.28	-0.01	7.43
Cortisol reactivity:			
AUCg	0.17	0.00	28.33
Baseline	-0.01	0.06	0.03
+10 minutes	-0.11	0.06	0.04
+20 minutes	-0.25	0.05	0.04
+30 minutes	-0.16	0.06	0.05
M	59.17	-	-
SD	30.86	-	-

Table 4.3. shows that there were no significant correlations between emotional and external eating styles, cortisol reactivity and food consumed post TSST-C task. However, it is interesting to note that the correlation between emotional eating style and food consumption was trending towards significance (r = 0.41, p = 0.075). Although non-significant, this finding is in line with existing stress-eating literature amongst adults.

4.2.22 Exploratory Analysis

HLM was utilised to explore the relationship between the IV and DV variables. Table 4.4. summarises the main effects of the IVs: total hassles, positive mood and negative mood on the DVs: total snacks, healthy snacks, unhealthy snacks, high fat snacks and high sugar snacks. This resulted in a total of 15 separate analyses. Within these analyses, none of the effects were significant at the $p <.05$ level (i.e., the level 1 slopes seen in Table 4.4.). However, two of these relationships were heading towards significance and support the direction of findings from Study 1. These findings identified: a positive relationship between positive mood and unhealthy snacks (p = 0.09) and a (trend towards a significant) negative relationship between total hassles and healthy snacks (p = 0.07).

Table 4.4. The effects of the level 1 within-subject variables on snacking behaviour.

IV	DV		Symbol	Coefficient	SE	P value
Total hassles	Total snacks	Intercept	β_{00}	5.47	0.56	<.001
		Level 1 slope	β_{10}	0.10	0.09	0.27
Positive mood	Total snacks	Intercept	β_{00}	5.47	0.56	<.001
		Level 1 slope	β_{10}	0.12	0.11	0.29
Negative mood	Total snacks	Intercept	β_{00}	5.47	0.56	<.001
		Level 1 slope	β_{10}	-0.06	0.13	0.67
Total hassles	High fat snacks	Intercept	β_{00}	2.18	0.23	<.001
		Level 1 slope	β_{10}	0.02	0.09	0.86
Positive mood	High fat snacks	Intercept	β_{00}	2.18	0.23	<.001
		Level 1 slope	β_{10}	0.02	0.05	0.65
Negative mood	High fat snacks	Intercept	β_{00}	2.18	0.23	<.001
		Level 1 slope	β_{10}	-0.05	0.05	0.39
Total hassles	High sugar snacks	Intercept	β_{00}	1.80	0.16	<.001
		Level 1 slope	β_{10}	0.04	0.05	0.51
Positive mood	High sugar snacks	Intercept	β_{00}	1.80	0.16	<.001
		Level 1 slope	β_{10}	0.04	0.02	0.13
Negative mood	High sugar snacks	Intercept	β_{00}	1.80	0.16	<.001
		Level 1 slope	β_{10}	0.03	0.03	0.33
Total hassles	Healthy snacks	Intercept	β_{00}	5.11	0.45	<.001
		Level 1 slope	β_{10}	-0.09	0.05	0.07
Positive mood	Healthy snacks	Intercept	β_{00}	5.11	0.45	<.001
		Level 1 slope	β_{10}	0.08	0.07	0.31
Negative mood	Healthy snacks	Intercept	β_{00}	5.11	0.45	<.001
		Level 1 slope	β_{10}	0.01	0.03	0.61
Total hassles	Unhealthy snacks	Intercept	β_{00}	1.03	0.13	<.001
		Level 1 slope	β_{10}	0.02	0.03	0.58
Positive mood	Unhealthy snacks	Intercept	β_{00}	1.03	0.13	<.001
		Level 1 slope	β_{10}	0.04	0.02	0.09
Negative mood	Unhealthy snacks	Intercept	β_{00}	1.03	0.13	<.001
		Level 1 slope	β_{10}	0.01	0.03	0.61

Moderation analysis was also conducted in HLM, and explored whether the relationships between daily stress/mood variables and eating outcomes were moderated by emotional and external eating styles and cortisol reactivity (AUCg). Tables 4.5., 4.6. and 4.7. show the main effects and interactions between the IVs and moderating variables. Table 4.5. focuses on the moderator emotional eating style, Table 4.6. examines external eating style and Table 4.7. examines AUCg.

Table 4.5. Examining the moderating effect of emotional eating style on the daily stress/mood-eating relationships.

	Total snacks				**Healthy snacks**				**Unhealthy snacks**			
	Symbol	**Coefficient**	**SE**	**P value**	**Symbol**	**Coefficient**	**SE**	**P value**	**Symbol**	**Coefficient**	**SE**	**P value**
Intercept	β_{00}	5.47	0.52	<.001	β_{00}	5.11	0.38	<.001	β_{00}	1.03	0.12	<.001
Emotional eating style	β_{01}	0.11	0.05	0.057	β_{01}	0.13	0.04	0.006*	β_{01}	-0.01	0.01	0.370
Level 1 slope: Total hassles	β_{10}	0.15	0.10	0.147	β_{10}	-0.06	0.05	0.242	β_{10}	0.06	0.06	0.349
Total hassles * Emotional eating style	β_{11}	-0.01	0.01	0.062	β_{11}	-0.01	0.00	0.017*	β_{11}	0.00	0.00	0.912
Intercept	β_{00}	5.47	0.56	<.001	β_{00}	5.11	0.38	<.001	β_{00}	1.03	0.12	<.001
Emotional eating style	β_{01}	-0.02	0.09	0.057	β_{01}	0.13	0.04	0.006	β_{01}	-0.01	0.01	0.370
Level 1 slope: Positive mood	β_{10}	0.16	0.09	0.089	β_{10}	0.09	0.07	0.218	β_{10}	0.04	0.02	0.061
Positive mood * Emotional eating style	β_{11}	0.05	0.02	0.007**	β_{11}	0.02	0.01	0.169	β_{11}	0.01	0.00	0.097
Intercept	β_{00}	5.47	0.52	<.001	β_{00}	5.11	0.38	<.001	β_{00}	1.03	0.12	<.001
Emotional eating style	β_{01}	0.11	0.05	0.057	β_{01}	0.13	0.04	0.006	β_{01}	-0.01	0.01	0.370
Level 1 slope: Negative mood	β_{10}	-0.04	0.10	0.716	β_{10}	-0.11	0.05	0.048	β_{10}	0.03	0.03	0.432
Negative mood * Emotional eating style	β_{11}	-0.05	0.02	0.054	β_{11}	-0.02	0.01	0.080	β_{11}	-0.01	0.01	0.185

Note. * denotes that these significant interactions were further decomposed, ** denotes that these interactions were significant at $p < .01$.

Table 4.6. Examining the moderating effect of external eating style on the daily stress/mood-eating relationships.

	Total snacks				Healthy snacks				Unhealthy snacks			
	Symbol	**Coefficient**	**SE**	**P value**	**Symbol**	**Coefficient**	**SE**	**P value**	**Symbol**	**Coefficient**	**SE**	**P value**
Intercept	β00	5.47	0.56	<.001	β00	5.11	0.45	<.001	β00	1.03	0.12	<.001
External eating style	β01	-0.02	0.09	0.840	β01	-0.02	0.07	0.793	β01	0.01	0.02	0.559
Level 1 slope: Total hassles	β10	0.23	0.09	0.019	β10	-0.04	0.05	0.428	β10	0.06	0.05	0.266
Total hassles * External eating style	β11	-0.03	0.01	0.058	β11	-0.02	0.01	0.009**	β11	-0.01	0.01	0.313
Intercept	β00	5.47	0.56	<.001	β00	5.11	0.45	<.001	β00	1.03	0.12	<.001
External eating style	β01	-0.02	0.09	0.840	β01	-0.02	0.07	0.793	β01	0.01	0.02	0.559
Level 1 slope: Positive mood	β10	0.12	0.11	0.266	β10	0.08	0.07	0.253	β10	0.04	0.02	0.080
Positive mood * External eating style	β11	0.02	0.01	0.151	β11	0.02	0.01	0.067	β11	0.00	0.00	0.561
Intercept	β00	5.47	0.56	<.001	β00	5.11	0.45	<.001	β00	1.03	0.12	<.001
External eating style	β01	-0.02	0.09	0.840	β01	-0.02	0.07	0.793	β01	0.01	0.02	0.559
Level 1 slope: Negative mood	β10	-0.23	0.20	0.253	β10	-0.17	0.10	0.083	β10	0.00	0.04	0.948
Negative mood * External eating style	β11	-0.03	0.02	0.155	β11	-0.02	0.01	0.355	β11	-0.01	0.00	0.114

Note. * denotes that these significant interactions were further decomposed, ** denotes that these interactions were significant at *p <.01*.

Table 4.7. Examining the moderating effect of AUCg on the daily stress/mood-eating relationships.

	Total snacks				Healthy snacks				Unhealthy snacks			
	Symbol	**Coefficient**	**SE**	**P value**	**Symbol**	**Coefficient**	**SE**	**P value**	**Symbol**	**Coefficient**	**SE**	**P value**
Intercept	β_{00}	5.61	0.62	<.001	β_{00}	5.21	0.50	<.001	β_{00}	1.03	0.13	<.001
AUCg	β_{01}	0.01	0.02	0.771	β_{01}	-0.00	0.01	0.807	β_{01}	-0.00	0.00	0.836
Level 1 slope: Total hassles	β_{10}	0.14	0.08	0.096	β_{10}	-0.05	0.04	0.247	β_{10}	0.07	0.05	0.178
Total hassles * AUCg	β_{11}	0.01	0.00	0.004**	β_{11}	0.00	0.00	0.395	β_{11}	0.00	0.00	0.011*
Intercept	β_{00}	5.61	0.62	<.001	β_{00}	5.21	0.50	<.001	β_{00}	1.03	0.13	<.001
AUCg	β_{01}	0.01	0.02	0.771	β_{01}	-0.00	0.01	0.807	β_{01}	-0.00	0.00	0.836
Level 1 slope: Positive mood	β_{10}	0.21	0.18	0.267	β_{10}	0.19	0.13	0.163	β_{10}	0.03	0.02	0.281
Positive mood * AUCg	β_{11}	-0.00	0.01	0.867	β_{11}	0.00	0.00	0.587	β_{11}	-0.00	0.00	0.046*
Intercept	β_{00}	5.61	0.62	<.001	β_{00}	5.21	0.50	<.001	β_{00}	1.03	0.13	<.001
AUCg	β_{01}	0.01	0.02	0.771	β_{01}	-0.00	0.01	0.807	β_{01}	-0.00	0.00	0.836
Level 1 slope: Negative mood	β_{10}	-0.07	0.19	0.713	β_{10}	-0.13	0.11	0.280	β_{10}	0.03	0.02	0.179
Negative mood * AUCg	β_{11}	0.00	0.01	0.675	β_{11}	0.00	0.00	0.907	β_{11}	0.00	0.00	0.042*

Note. * denotes that these significant interactions were further decomposed, ** denotes that these interactions were significant at *p <.01*.

Table 4.5. examined the moderating influence of emotional eating style, and the findings show that there were four significant effects, specifically, two significant main effects and two significant interaction effects. Within the total snack analysis, there was only one significant interaction between positive mood, emotional eating and total snacks (β = 0.05, p = 0.01). However, for healthy snacks, there were two significant main effects, one for emotional eating (β = 0.13, p = 0.01) and one for negative mood (β = -0.11, p = 0.05). For emotional eating, the effect indicated that those with higher emotional eating ate more healthy snacks. For negative mood, the effect indicated that those with a high negative mood consumed fewer healthy snacks. There was also a significant interaction effect between total hassles, emotional eating style and healthy snacks (β = -0.01, p = 0.02).

Table 4.6. explored the influence of the external eating style. Within these analyses, there was only one significant interaction, that of total hassles, external eating style and healthy snacks (β = -0.02, p = 0.01).

Lastly, Table 4.7. shows the moderating influence of AUCg, where there were four significant interactions, one between total hassles, AUCg and total snacks (β = 0.01, p = 0.00), the second between total hassles, AUCg and unhealthy snacks (β = 0.00, p = 0.01), another between positive mood, AUCg and unhealthy snacks (β = -0.00, p = 0.05) and the last between negative mood, AUCg and unhealthy snacks (β = 0.00, p = 0.04).

4.2.23 Decomposing Significant Moderator Interactions

These seven significant interactions (identified in Tables 4.5., 4.6. and 4.7. with an *) were examined using the intercept, slope and significance calculator (Preacher et al., 2018). The 'Case 3' calculator that was selected was used to examine the interaction between the IV in the level 1 model and the moderator variable entered within the level 2 model. This type of interaction uses a 'slopes as outcomes' model (Preacher et al., 2018). These additional analyses showed that only three of the seven significant interactions remained statistically significant at the p <.01 level following decomposition (identified in Tables 4.5., 4.6. and 4.7. by **). (Note: the p <.01 level was chosen over p <.05 because it was deemed appropriate to look for effects that were more significant due to the small nature of the sample).

4.2.24 Significant Interactions

The three interactions found to be significant were further explored using Preacher et al. (2018)'s calculator for simple slopes analyses. These interactions were examined using mean centred variables for the IV and moderator variables.

Decomposition of the first significant interaction between positive mood and emotional eating style on total snacks indicated that positive mood was strongly positively related to total snacks at high levels (M + 1 SD) of emotional eating (β = 0.96, p = 0.01), while this effect was positive but not significant at moderate levels of emotional eating (β = 0.27, p = 0.07) and was negative and significant at low levels (M – 1 SD) of emotional eating style (β = -0.42, p = 0.04). These simple slope relationships are shown in Figure 4.1.

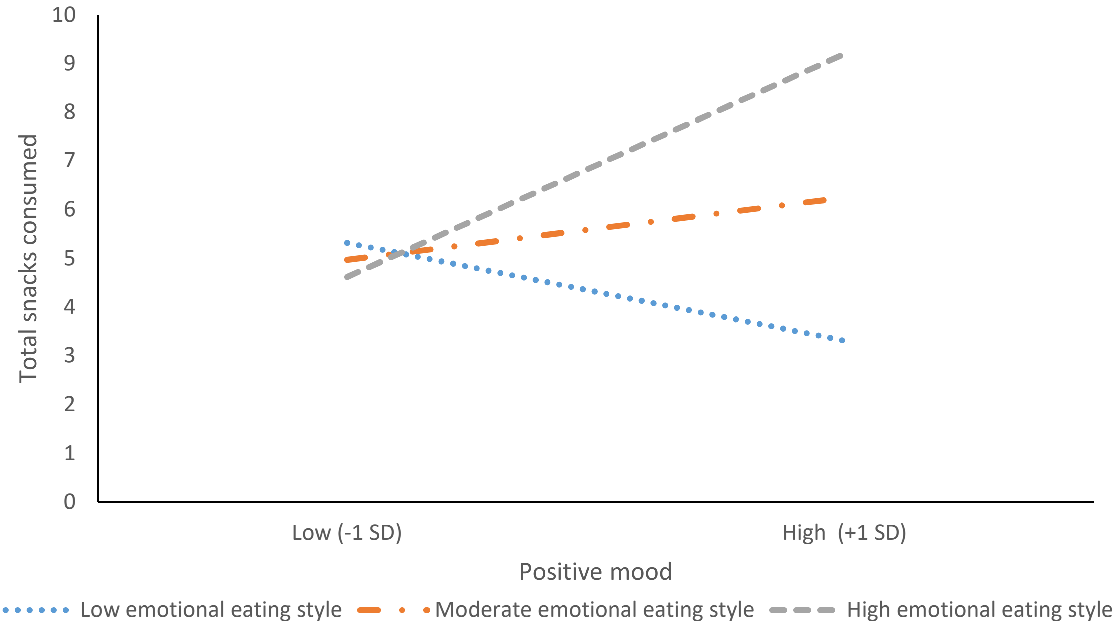

Figure 4.1. The relationship between positive mood and the frequency of snacks consumed at different levels of emotional eating style.

By decomposing the second significant interaction between total hassles and external eating on healthy snack consumption, it was found that none of the levels of external eating style were significant. In addition, it was found that total hassles did not impact the overall consumption of healthy snacks (β = 0.27, p = 0.07).

Lastly, decomposition of the third significant interaction between total hassles and cortisol reactivity (AUCg) on total snacks consumed illustrated that total hassles were strongly positively related to snack consumption at high levels of cortisol reactivity (β = 3.20, p = 0.01). This indicates that those who had higher cortisol reactivity consumed more snacks when they experienced a large number of hassles. This significance however, was not present for those with moderate (β = 1.76, p = 0.10) or those with low cortisol reactivity (β = -1.05, p = 0.31). These relationships are illustrated in Figure 4.2.

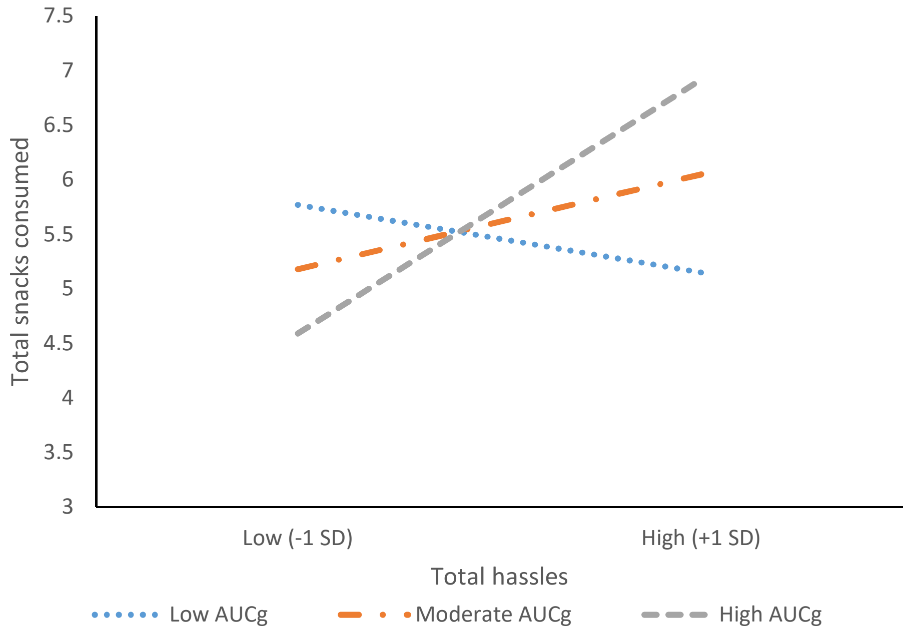

Figure 4.2. The relationship between total hassles and total snacking behaviours at different levels of cortisol reactivity (AUCg).

4.2.25 Discussion

This study aimed to explore how subjective stress levels were related to between meal snack consumption amongst children aged 8-11 years old using a daily diary methodology. This study measured emotional and external eating styles along with salivary cortisol levels to examine what moderating role these factors had on this form of stress-eating relationship.

Overall, this study identified that there were no significant effects of total hassles on total snack consumption. However, main effect analyses illustrated that positive mood was significantly positively related to total snack consumption. A significant negative relationship was also found for total hassles and healthy snacks, showing that the more hassles a person experienced, the less healthy snacks they consumed.

It was hypothesised that children who reported experiencing more hassles (stressful events) would be those who consumed more snacks. Unfortunately, the current findings do not support this, because the corresponding main effect, although positive, was not significant. This pattern continues when the findings identified a further three trending main effects. Two of these effects showed a negative stress-eating relationship, one between negative mood on healthy snack consumption and the other between total hassles and healthy snack consumption.

Although these main effects were not significant, they support behaviour patterns that have been seen before. For example, the negative stress-eating relationship has been frequently seen in adult literature and the positive relationship between positive mood and unhealthy snacks (trending towards significance, $p = 0.09$) supports the findings from Study 1.

Unfortunately, existing research does not support why total hassles were not significantly related to the number of total snacks consumed. Current literature suggests that the opposite pattern would emerge - the number of total hassles corresponds with the number of between-meal snacks consumed (O'Connor et al., 2008). It is believed that the lack of significance within these effects may be because of the study’s small sample size. The fact that many of these effects are trending provides evidence to suggest that a larger sample (providing more power) would help identify significance within the suggested main effects.

The current study also uncovered a negative relationship between negative mood and high fat snacks suggesting that those experiencing a negative mood more frequently consumed less high fat snacks. The direction of this relationship conflicts existing literature that presents findings suggesting that the presence of negative mood induces 'comfort-eating' amongst adults (Gibson, 2012). Comfort-eating acts as a tool to reduce the 'negative emotions or negative affect' experienced by an individual (Gibson, 2012). Tomiyama et al. (2015) present a conceptual model of comfort-eating that proposes that strong eliciting emotions encourage individuals to consume foods high in fat and sugar. This model subsequently suggests that negative mood would presumably be positively related to high fat snacks.

Existing research does however provide support for the negative interaction that was identified for total hassles and healthy snacks. Such research illustrates that stress has a seemingly negative influence on healthy eating behaviours. For example, O'Connor et al. (2008) found that participants reported consuming less vegetables in the presence of daily hassles. Similarly, individuals with higher levels of perceived stress were found to consume less fruit than those with lower perceived stress levels (Mikolajczyk, El Ansari & Maxwell, 2009).

There were however, two positive effects that again are the antithesis of findings within existing literature. The current study found that positive mood was positively related to both total snacks and high fat snacks. These findings contradict existing findings that show negative emotions often encourage individuals to increase the amount of food they consume (Gibson, 2012) as well as increase the likelihood of consuming unhealthy foods (e.g., those high in sugar, fat and or salt (Dallman et al., 2003)). The results identified in the current study contradict the 'food mood theory' proposed by Lyman (1982). Lyman (1982) acknowledged that food was often identified as being a 'determiner' for an individual's mood. However, their findings revealed that undergraduate students chose healthy foods when experiencing positive emotions and junk food when experiencing negative emotions. Lyman (1982) suggests that mood may predispose individuals to select a certain type of food (e.g., healthy or unhealthy) but, appreciate that there may be a ‘circular effect’ influencing choice. An initial mood state may encourage an individual to choose a food for consumption, but then the consumption of that food may reinforce or change the individual’s mood as a consequence (Lyman, 1982). Lyman (1982) therefore presents the possibility that a bidirectional relationship is present between food choice and mood.

Interestingly, although these unsupported positive effects contradict existing literature, they follow the pattern of snacking responses identified in Study 1. Study 1 identified that children provided more snacking responses than the undergraduate students, specifically, showing higher levels of snacking for positive emotions. For this age group, it seems that the presence of positive and or negative emotions influence children’s snacking behaviours.

There were three significant interactions that were explored further, the first identified that emotional eating was a significant moderator within the relationship between positive mood and total snacks. More specifically, low emotional eating style was found to be negatively significantly related to positive mood and total snack consumption, but high emotional eating changed the relationship to be positively significant. As Figure 4.1. shows, those with high emotional eating style were seen to eat approximately five more snacks per day. This finding supports existing literature, for example, O'Connor et al. (2008) found individuals with high emotional eating consumed more between meal snacks compared to those with low emotional eating. It is possible that food associations could have been formed if parental reward strategies were used. Parents may encourage their children to adopt desired behaviours (e.g., appropriate social or healthy eating behaviours) by providing them with a dietary ‘reward’ for doing so. For example, ‘finish drinking your milk and then you can watch television’ (Birch, Birch, Marlin & Kramer, 1982). Birch et al. (1982) appreciate that such techniques may result in the child developing preference for the food used as a reward because its consumption resulted in positive adult praise and attention. This interaction may therefore help to explain the relationship between positive mood and snack consumption, as evidenced within the current study. This confirms the importance of individual differences particularly when exploring stress-eating relationships.

The second significant interaction that explored the effect of total hassles and external eating on healthy snack consumption, found that external eating was not a significant moderator at any level. Interestingly, in decomposition, total hassles was not found to significantly influence healthy snack consumption. This interaction has not been found in existing literature and does not follow the pattern that often links the presence of a stressor with an increase in eating behaviour. It may have initially been significant because of the small sample size (i.e., this behaviour was present in the small sample), however, as existing literature would suggest, it is likely not to remain significant when explored within a larger sample. Within this interaction, external eating was not found to be a significant moderator. This supports existing literature that similarly was not able to find external eating influential. For example, Wardle (1987) found that normal weight and overweight women had similar levels of external eating. Looking closely at the significant interaction that was initially identified by the current study, it is important to appreciate that participants may have had difficulty finding healthy foods within their environment. Although healthy options are slowly becoming more widespread, within the external environment unhealthy options are usually more frequently marketed (Penney, Almiron-Roig, Shearer, McIsaac & Kirk, 2014). This may suggest why further significance was not found in decomposition.

The last significant interaction explored the influence of total hassles and cortisol reactivity on snack consumption. Within this study, it was found that total hassles significantly predicted total snacks for those with high cortisol reactivity. These findings mirror those of Michels et al. (2013) even though cortisol within this study was measured at home. It does however, confirm that such a relationship is present when stress is induced by the TSST-C task in a laboratory setting, and reinforces the importance of measuring cortisol when exploring the stress-eating relationship.

Within the identified significant effects, it is possible that parental influence is having an impact on children's snacking responses. For example, in Study 3, it became apparent that negative mood did not positively correspond with high fat snacks. This pattern opposes that found within existing literature, raising the possibility that something other than age could be influencing snacking behaviours.

It is vital to acknowledge the influence that parents have on the development of children's food preferences and food choices. For example, food availability and parents' food preferences are factors that will undoubtedly affect what food parents buy and make available for their children (Scaglioni et al., 2008).

The influence of parents could be affecting why children are choosing to consume more snacks, particularly those that are high in fat when they are in a positive mood. When children are having a celebration in a classroom environment, Isoldi, Dalton, Rodriguez and Nestle (2012) acknowledge that children often bring in and choose to consume high calorie, nutrient void foods. This pattern frequently occurs in society, where we are often found to celebrate with ‘treat’ food/s (Lupton, 1994). The celebratory nature that is associated with lower nutrient foods may help to explain the reasoning behind children’s choices of snacks that are chosen in the presence of positive mood.

Although it is important to explore the reasons behind children’s eating behaviour, it is similarly imperative to appreciate any methodological choices that could have been influential. For example, the study is believed to have been underpowered because there was no significant association between total hassles and total snacks, an interaction that literature suggests would have been present. In this regard, it was difficult to recruit children because of the extended duration of the diary component (across seven days) and because of the need to provide saliva samples. Many parents did not allow their child to take part primarily because of the saliva sample component, and for many, they held the incorrect understanding that providing samples would mean their child had given us access to their genetic material (e.g., deoxyribonucleic acid (DNA)).

If further research were to utilise similar methods of gathering data in such similarly aged children, it would be useful to dispel parents’ misconceptions about what the cortisol samples are used for, and what information can be obtained from the samples. Providing specific detailed information like this during the recruitment stages is anticipated to have a positive impact on participant recruitment.

Although the snack consumption of children post TSST-C was not analysed, it is important to appreciate that participants' food preferences were found to influence the amount of snacks consumed. For example, three children verbally informed the primary researcher that they did not like one/both of the snacks. This subsequently influenced how much these children ate. If snack provision was to be utilised within future research, providing children with a choice of snack would be more beneficial for measuring consumption levels post stressor.

Finally, it is important to note that the daily diary used here was study-specific. As a consequence, it was difficult to understand the degree to which it was suitable for 8-11 year olds. Although a pilot was carried out, certain concerns about children's responses became present during testing. The daily diaries asked children to report the number of fruit and vegetable portions they ate in a day. In the diaries, children seemed to over-estimate their consumption of fruit and vegetables. These portions ranged from a minimum of 0 to 17 portions per day (across participants), making it likely that these portions have also been overestimated. Bogers, Brug, van Assema, and Dagnelie (2004) inform us that people often have 'an unrealistically optimistic' opinion in regards to their fruit and vegetable intake. This research explored the behaviours of adults, so it is possible that this trait may be present in children or may simply be due to the fact that children of this age struggle to conceptualise portions of fruit and vegetables objectively. As such, this data was not subsequently analysed.

The current study helps provide recommendations for future research. For example, the lack of significance between the total hassles and total snack interaction would suggest that the study was underpowered. As a result, further research could try to create more incentives and remove any potential barriers for parents/caregivers to improve recruitment.

The daily diary data from the current study may have been affected by participants' overestimation, and subsequently it could be useful to ask parents/caregivers to help children complete their diaries. This could result in data that is more valid.

In a similar pattern to Studies 1 and 2, here Study 3 also illustrates the importance of including positive emotion when exploring emotions within the stress-eating relationship amongst children. In this study, it became apparent that positive mood was positively related with total snacks, as well as high fat snacks. This shows the importance this emotion has for this age group and emphasises the need to continue to examine further.

Using cortisol in this study has been beneficial because it was found to be a significant moderator in the relationship between total hassles and total snack consumption. This supports the importance of cortisol reactivity, particularly because it has been shown to predispose individuals to behave differently when engaging in stress-eating behaviours. The influence of low and high AUCg here, provides support for the distinction between 'low' and 'high' reactors (e.g., Epel et al., 2001). More specifically, the effect of total hassles and AUCg on snack consumption has been evidenced in existing literature (Newman et al., 2007; Michels et al., 2013). Although the findings here further confirm the pattern seen in earlier literature, the reasoning behind 'how' cortisol is influential remains elusive. For example, it is not clear what mechanisms within cortisol reactivity instigate a hyperphagic response in eating behaviours.

O'Connor (2018) states that it could be because cortisol naturally works against the hunger suppressing hormone, leptin. If such a mechanism is present, it could help to explain why high cortisol and hyperphagic eating behaviours have often been found to co-exist. However, then the difference between low and high reactors in this regard becomes less easy to understand. For example, it remains difficult to understand the level at which cortisol begins to instigate a response of hyperphagic eating behaviours. It may then be possible that each individual has a different low and high cortisol reactivity threshold. Such factors warrant further exploration.

These findings support the continued use of cortisol within future research. Ideally, longitudinal cortisol measures would be used so that a more detailed diurnal cortisol pattern of children's stress responses could be examined (O'Connor, 2018). Using both subjective and physiological stress measures would allow researchers to pair such responses with children's eating behaviours, allowing a more illustrative picture to be depicted.

4.2.26 Conclusion

Overall, this study has shown that the effect of hassles on snacking is moderated by cortisol reactivity, with high reactors found to consume the most snacks. Findings also highlighted that a positive relationship between positive mood, emotional eating and total snack consumption was present at high levels of emotional eating style. Although the latter relationship follows the pattern of behaviour within existing literature, the unexpected finding involving positive mood and total snacks provides evidence to support the need of including positive emotion within further stress-eating research. The dominant focus in stress-eating research currently stems around negative emotion and uncovering the change that such emotion elicits in eating behaviour. However, this study provides justification for including both types of emotion when exploring the stress-eating relationship.

4.3 Study 4: Exploring the relationship between the subjective stress and snacking behaviours of undergraduate students

4.3.1 Study Context

The primary focus of the current chapter was to expand upon the stress-eating relationships identified in Studies 1 and 2 by exploring the way in which stress can be measured objectively through the use of salivary cortisol. Salivary cortisol has been used in existing adult stress-eating literature where it has been found to be a significant moderator of this relationship (see Section 4.1.3). In addition, existing literature suggests that high cortisol levels are associated with increased levels of snacking behaviour (Newman et al., 2007). The use of cortisol within this stress-eating literature supported the reasoning behind its inclusion within this chapter.

Study 3 measured children's cortisol reactivity while measuring their experience of daily hassles and uplifts alongside their daily snacking behaviour. This section of Chapter 4 now presents Study 4 where the diurnal cortisol of undergraduate students was measured in addition to their experience of daily hassles and uplifts and daily snacking behaviour.

4.3.2 Study Aims

This study aimed to identify whether there was an association between the subjective stress and diurnal salivary cortisol levels on the consumption of between-meal snacks amongst undergraduate students.

4.3.3 Hypotheses

It was hypothesised that the undergraduate students who reported experiencing more hassles would also report consuming more snacks. More specifically, for these students, it was anticipated that they would consume high levels of unhealthy snacks, and that high levels of diurnal cortisol would moderate this relationship.

4.3.4 Method

4.3.5 Power Calculation

It was not possible to utilise a power calculation to guide the size of the sample within this study. This was because of the difficulties in recruitment in Study 3 (see Section 4.2.5) which led to a reduced sample size and the formation of the current study. Once a sample size for Study 3 had been determined, it was then possible to calculate a feasible sample size for the current study. Unfortunately this calculation had to be governed by the remaining funding within this PhD (to fund the necessary salivary cortisol materials and assay costs) which resulted in a total of 50 participants.

4.3.6 Participants

Participants were recruited from the undergraduate student cohort within the School of Psychology at the University of Leeds. All year 1 and 2 undergraduate students within the School of Psychology were eligible and were invited to take part through the department's 'participant pool scheme'.

A total of 52 participants took part in the study, of which two had to be withdrawn from further analysis (one due to illness and one because of a lack of appropriate saliva sample storage), leaving a final total of 50 participants. Within this total, one male took part, and 49 female undergraduate students took part. Participants had a mean age of 19.12 years, and identified with the following ethnic groups: 41 individuals identified as being White, 3 identified as belonging to mixed/multiple ethnic groups and 6 identified as being Asian/Asian British.

4.3.7 Participant Eligibility

Participants were excluded from taking part in the study if they: smoked, took recreational drugs and/or steroid medication (e.g., asthma treatment). It has been identified that these factors can initiate unnecessary change in cortisol, with research supporting the presence of change for each factor (smoking (Steptoe & Ussher, 2006), recreational drugs, specifically ecstasy (Parrott, 2009) and steroid medication (Brown, Blundell, Greening & Crompton, 1992)).

4.3.8 Ethical Approval

This study was given ethical approval by the School of Psychology's Research Ethics Committee (at the University of Leeds, date: 27-10-2017, reference number: 17-0252).

4.3.9 Study Design

This study used a repeated measures design by using a 4 day daily diary component to explore participants' snacking behaviours and subjective stress levels. Participants took salivary cortisol samples independently over the 4 study days to provide a physiological measure of their diurnal cortisol levels. Diurnal cortisol was explored as a potential moderator within the stress-eating relationships measured.

4.3.10 Study Duration

The study took five days to complete and the first day consisted of a study testing session, where the demographics questionnaire was administered and study protocol details were distributed. The remaining four days consisted of elements that were to be completed in participants' own time. The four study days were always scheduled to take place during the working week, to avoid the weekend. This was because week days were believed to be more representative of participants' usual eating behaviour (weekend days typically allow individuals to change their usual eating behaviours making these days a less reliable indicator of participants' usual snacking behaviours, e.g., binge eating becomes more frequent on a weekend day as opposed to a week day (Allison & Timmerman, 2007)).

4.3.11 Study Measures

4.3.12 Screening Session

During this session, a screening questionnaire (see Appendix E) was administered, where participants were asked to confirm their eligibility to participate. If participants were eligible, they were asked to complete a demographics questionnaire that asked questions about their ethnicity, medication-taking behaviour and emotional and external eating behaviour styles.

As such, the following existing questionnaire was utilised: the DEBQ (van Strien et al., 1986). Additionally, participants' height and weight were measured during this session so that body mass index (BMI) could be calculated. BMI has been identified as a highly suitable method of measuring children's weight change across a period of time (Cole, Faith, Pietrobelli & Heo, 2005). Due to the fact that change in weight was not of interest here (due to the cross-sectional nature of the study), the research team decided to measure BMI to explore whether this was a moderator variable in the relationship between stress and snacking behaviour. At the end of this session, participants were informed of the remaining study requirements, and had an activity watch programmed for use.

4.3.13 Activity Watch

At the end of the study session, every participant was given a pre-programmed GeneActiv accelerometer watch (worn on their non-dominant (non-writing) wrist) to allow recordings of participants' sleep and physical activity to be measured over the (remaining) 4 study days. Participants were asked to leave the watch on for the full duration of the study (i.e., not to remove when sleeping/showering) to enable continuous physiological readings to be gathered. This data aimed to observe individuals' sleep patterns and their engagement in physical activity. However, due to a lack of detail within the line graphs obtained from the watches, the research team deemed it most appropriate not to analyse the findings further.

4.3.14 Online Daily Diaries

Participants were asked to complete four online daily diaries, one every evening across the study (see Appendix E). These diaries asked participants to state any hassles and uplifts they experienced that day, along with any snacks they ate. Participants were allowed to report up to five hassles, uplifts and snacks for any one given day (limiting participants to a specific number of hassles/uplifts/snacks has been a previously adopted procedure, and can be seen in the work of Conner et al., 1999). Participants were asked to complete each diary before they went to bed each evening. The online survey system recorded the date and time that each questionnaire was completed, allowing back dated questionnaires (any questionnaire that was completed after 3am the day after required) to be identified and removed (of which there were 11).

4.3.15 Diurnal Cortisol Samples

Participants were required to take 12 saliva samples over the 4 day study, 3 samples per day. Participants were given a test sample during the initial testing session to familiarise themselves with the sample process. Over the 4 day study, participants were asked to take samples immediately upon waking (at whatever time), 30 minutes post-waking and lastly, 12 hours post-waking. Participants were given a sheet to report the times that they collected their saliva, to show how closely this protocol was adhered to. After collection, participants were told that it would be best to store their samples in their kitchen freezer (/fridge if freezer space was not available) in advance of returning the samples to the primary researcher. After the primary researcher had received completed participant samples, they were stored in the departmental laboratory freezer until they were couriered to an external laboratory (at Anglia Ruskin University) for assaying.

4.3.15.1 Operationalising Cortisol

The salivary cortisol samples were measured in nmol/L (e.g., Newman et al., 2007), and were taken three times a day (as specified in section 4.3.15). To analyse these samples, three calculations on all samples were conducted, and these were as follows: one: the mean of the 3 samples, two: cortisol awakening response (CAR) = sample 2 minus sample 1 and three: wake peak (sample 2) minus 12 hour sample (sample 3, WP-12). All three calculations were used to examine the impact of cortisol within both the descriptive statistics and exploratory analyses.

4.3.16 Treatment of Missing Data

Within this dataset, the salivary cortisol sample data points were screened for missing data. The following variables: snacks, hassles and uplifts were not screened for missing data because the nature of recording such information meant that it was not compulsory to give such information, unless they had experienced a hassle/uplift or consumed a snack.

In total, 600 saliva samples were sent off for assay, however, 33 samples (5.5%) were returned without a saliva reading. Within these missing samples, 25 (4.17%) contained insufficient content so could not be assayed (this could have been due to an absence of/or insufficient amount of saliva within each sample). In addition to these insufficient samples, 8 further samples gave readings that the laboratory advised we treat with caution, 5 of which had low levels of cortisol (very close to or below the lower limits of assay reading) and 3 that had exceptionally high readings (and were likely due to contamination of either the sample or due to the fact that the participant was taking a medication that interacts with cortisol).

To treat these missing sample readings, two different strategies were employed. For the 25 insufficient samples, the appropriate column mean values were inserted. Roth (1994) stated that this approach of ‘mean substitution’ is suitable because it reduces the influence of ‘variance estimations’ that can arise if a different strategy for treating missing data is chosen. The remaining 8 samples that were deemed either too low or high for use were treated by truncating the sample using the formula ‘column mean +/- 2.5x SD’. For the 5 samples that were too low for assay, the truncation subtracted 2.5 times the (sample) SD value, however, for the last 3 samples that contained samples that were too high, the truncation added 2.5 times the (sample) SD value on to the sample mean. This strategy was chosen so that these data points did not have to be removed from analysis, and because it allowed these data points to be included without affecting the data in an extreme way.

4.3.17 Statistical Analysis

The daily diary responses were recorded on Jisc Online Surveys and were exported to Microsoft Excel where they were ordered according to day and participant response. This data was then moved to the IBM SPSS Statistics Version 22 software where the remaining data (i.e., demographics and cortisol data) had been inputted.

Data was checked for missing values at this stage, and missing values were replaced with column mean values wherever necessary. HLM was utilised to examine the interactions between the IV and DV variables (as it was in Study 3). Data was inputted using a two-tier structure, where within-subject variables were entered in the first step. In this study, such variables included total hassles and total uplifts. In step two, the between-subject variables emotional and external eating style and cortisol reactivity (all 3 calculations) were entered. In a similar manner to Study 3, here, both IV and moderator variables were group mean centred before they were inserted into the model. The effects of the within-subject variables were examined first, after which between-subject (level 2) interactions were explored. If any of these interactions were significant, they were decomposed using the intercept, slope and significance calculator (Preacher et al., 2018).

4.3.18 Results

4.3.19 Descriptive Statistics

Table 4.8. displays a summary of the descriptive characteristics of participants within this study. A total of 50 undergraduate students took part, of which there were 49 female and one male. (Due to the relatively small size of the sample, the research team decided to keep data from the one male. It is worth acknowledging however, that this data will only be useful within the context of the group as a whole (i.e., providing an additional set of participant data), and will not be suitable for making gender comparisons. The mean age of the group was 19.12 years and the mean BMI was 21.32 kg/m^2. The mean BMI was in the healthy range (identified by NHS, 2016), showing that weight variability across participants was small (i.e., there was not a large variation in weight amongst individuals). It was therefore decided (by the research team) that it would not be of interest to further

explore the impact of BMI as a moderator within further analyses, so this section will be the only one to include BMI. Overall, participants displayed higher levels of emotional eating style (M = 34.76) than external eating (M = 31.26). The group's salivary cortisol levels were within the normal range for adults (O'Connor et al., 2009; Pruessner et al., 2003). Looking at participants' mean cortisol samples in Table 4.8. it seems that levels of cortisol were lowest 12 hours after waking, a pattern that has been frequently identified within existing literature (e.g., Dowd et al., 2010; Šupe-Domić, Milas, Drmić Hofman, Rumora & Martinović Klarić, 2016).

Table 4.8. Descriptive statistics for main study variables.

	All participants N = 50	**Female n = 49**	**Male n = 1**
M age (years, SD)	19.12 (0.88)	19.12 (0.89)	19 (0.00)
Range	*18 - 21*	*18 - 21*	-
M BMI (kg/m², SD)	21.32 (4.13)	21.27 (4.16)	23.90 (0.00)
Range	*5 - 29.40*	*5 - 29.40*	-
		M (SD) *Range*	
Total hassles	1.81 (1.13)	1.82 (1.13)	1.00 (1.41)
	0 - 5	*0 - 5*	-
Total uplifts	1.92 (1.07)	1.91 (1.07)	2.00 (0.00)
	0 - 5	*0 - 5*	-
Total snacks	1.72 (1.38)	1.70 (1.37)	3.50 (0.71)
	0 - 5	*0 - 5*	-
Healthy snacks	1.55 (1.61)	1.55 (1.60)	2.00 (2.83)
	0 - 6	*0 - 6*	-
Unhealthy snacks	2.23 (1.81)	2.20 (1.80)	4.00 (2.83)
	0 - 6	*0 - 6*	-
Emotional eating score	34.76 (9.67)	34.55 (9.66)	45 (N/A)
	18 - 54	*18 - 54*	-
External eating score	31.26 (6.48)	31.18 (6.52)	35 (N/A)
	15 - 46	*15 - 46*	-
Cortisol:			
Mean of samples*	8.04 (3.17)	8.06 (3.18)	6.48 (2.41)
	1.72 - 17.95	*1.72 - 17.95*	-
CAR**	6.47 (5.39)	6.45 (5.42)	8.10 (1.85)
	0.08 - 28.94	*0.08 - 28.94*	-
Weak-Peak – 12 hour sample***	11.62 (6.37)	11.61 (6.40)	12.91 (4.33)
	-3.15 - 34.38	*-3.15 - 34.38*	-
Baseline	7.60 (3.94)	7.63 (3.96)	5.38 (2.61)
	1.32 - 18.73	*1.32 - 18.73*	-
+ 30 minutes	14.07 (6.22)	14.08 (6.25)	13.48 (4.47)
	3.26 - 35.48	*3.26 - 35.48*	-
+ 12 hours	2.45 (2.54)	2.47 (2.55)	0.57 (0.14)
	-5.74 - 13.35	*-5.74 - 13.35*	-

Note. Cortisol has been measured using the following methods: * mean of samples: mean of all three daily samples, ** CAR (cortisol awakening response): change in cortisol that occurs between samples 1 and 2, *** Wake peak – 12 hour sample (WP-12): the 2nd sample minus sample 3 measured for each study day.

4.3.20 Exploratory Analysis

To explore the relationship between the IV and DV variables within this study, HLM was used to examine the impact that total hassles and total uplifts had on total snacks, healthy snacks and unhealthy snacks. Table 4.9. summarises these analyses and shows the four significant main effects that were identified at this stage.

Table 4.9. Level 1 analyses (within HLM), exploring the relationship between IV and DV variables.

IV	DV		Symbol	Coefficient	SE	P value
Total hassles	Total snacks	Intercept	β_{00}	1.70	0.14	<.001
		Level 1 slope	β_{10}	0.33	0.13	0.011
Total hassles	Healthy snacks	Intercept	β_{00}	1.63	0.18	<.001
		Level 1 slope	β_{10}	-0.01	0.10	0.959
Total hassles	Unhealthy snacks	Intercept	β_{00}	2.21	0.18	<.001
		Level 1 slope	β_{10}	0.57	0.13	<.001
Total uplifts	Total snacks	Intercept	β_{00}	1.71	0.14	<.001
		Level 1 slope	β_{10}	0.46	0.11	<.001
Total uplifts	Healthy snacks	Intercept	β_{00}	1.63	0.18	<.001
		Level 1 slope	β_{10}	-0.13	0.11	0.223
Total uplifts	Unhealthy snacks	Intercept	β_{00}	2.21	0.18	<.001
		Level 1 slope	β_{10}	0.64	0.14	<.001

Table 4.9. shows that four significant main effects were found: one between total hassles and total snacks ($\beta = 0.33$, $p = 0.011$), one between total hassles and unhealthy snacks ($\beta = 0.57$, $p <.001$), one between total uplifts and total snacks

($\beta = 0.46$, $p < .001$) and lastly, one between total uplifts and unhealthy snacks ($\beta = 0.64$, $p < .001$). These effects all illustrate a positive relationship between the stressor and type of snacking behaviour, showing that when the frequency of a stressor increases, the frequency with which snacks are consumed also increases.

These four significant main effects were further explored in HLM by examining the interaction between these IV and DV variables and the potential moderating variables: diurnal cortisol levels (CAR, mean levels, WP–12), emotional and external eating styles. Within these analyses, the IV and moderator variables were mean centred. This was calculated so the *y* intercept better represented the snacking behaviour measurement that was being examined. Tables 4.10., 4.11. and 4.12. illustrate the main effects and interactions associated with the cortisol moderators. Table 4.13. shows the main effects and interactions focusing on the moderator emotional eating style, and Table 4.14. shows the main effects and interactions focusing on the moderator external eating style.

Table 4.10. Exploring the moderating effect of CAR on the stress/snacking behaviour relationships.

	Total snacks				Healthy snacks				Unhealthy snacks			
	Symbol	**Coefficient**	**SE**	**P value**	**Symbol**	**Coefficient**	**SE**	**P value**	**Symbol**	**Coefficient**	**SE**	**P value**
Intercept	β_{00}	1.70	0.14	<.001	β_{00}	1.64	0.18	<.001	β_{00}	2.20	0.17	<.001
CAR	β_{01}	0.01	0.02	0.709	β_{01}	-0.05	0.02	0.033	β_{01}	0.06	0.02	<.001
Level 1 slope:												
Total hassles	β_{10}	0.30	0.13	0.021	β_{10}	0.03	0.09	0.743	β_{10}	0.55	0.13	<.001
Total hassles x CAR	β_{11}	0.02	0.01	0.175	β_{11}	-0.03	0.01	0.006	β_{11}	0.03	0.01	0.02
Intercept	β_{00}	1.71	0.14	<.001	β_{00}	1.64	0.18	<.001	β_{00}	2.20	0.17	<.001
CAR	β_{01}	0.01	0.02	0.792	β_{01}	-0.05	0.02	0.034	β_{01}	0.07	0.02	<.001
Level 1 slope:												
Total uplifts	β_{10}	0.44	0.10	<.001	β_{10}	-0.11	0.10	0.275	β_{10}	0.60	0.14	<.001
Total uplifts x CAR	β_{11}	0.02	0.02	0.176	β_{11}	-0.02	0.01	0.04	β_{11}	0.04	0.01	0.003

Table 4.11. Exploring the moderating effect of mean cortisol on the stress/snacking behaviour relationships.

	Total snacks				Healthy snacks				Unhealthy snacks			
	Symbol	**Coefficient**	**SE**	**P value**	**Symbol**	**Coefficient**	**SE**	**P value**	**Symbol**	**Coefficient**	**SE**	**P value**
Intercept	β_{00}	1.70	0.14	<.001	β_{00}	1.63	0.18	<.001	β_{00}	2.21	0.18	<.001
Mean cortisol	β_{01}	0.01	0.04	0.797	β_{01}	-0.09	0.05	0.045	β_{01}	0.03	0.05	0.582
Level 1 slope:												
Total hassles	β_{10}	0.34	0.13	0.009	β_{10}	-0.00	0.09	0.975	β_{10}	0.58	0.13	<.001
Total hassles x Mean cortisol	β_{11}	-0.04	0.03	0.213	β_{11}	-0.07	0.02	<.001	β_{11}	-0.02	0.04	0.566
Intercept	β_{00}	1.71	0.14	<.001	β_{00}	1.64	0.18	<.001	β_{00}	2.21	0.18	<.001
Mean cortisol	β_{01}	0.01	0.04	0.790	β_{01}	-0.09	0.05	0.046	β_{01}	0.03	0.05	0.562
Level 1 slope:												
Total uplifts	β_{10}	0.46	0.11	<.001	β_{10}	-0.14	0.09	0.127	β_{10}	0.63	0.15	<.001
Total uplifts x Mean cortisol	β_{11}	0.01	0.03	0.824	β_{11}	-0.09	0.03	0.004	β_{11}	-0.00	0.05	0.994

Table 4.12. Exploring the moderating effect of WP–12 on the stress/snacking behaviour relationships.

	Total snacks				Healthy snacks				Unhealthy snacks			
	Symbol	**Coefficient**	**SE**	**P value**	**Symbol**	**Coefficient**	**SE**	**P value**	**Symbol**	**Coefficient**	**SE**	**P value**
Intercept	β_{00}	1.70	0.14	<.001	β_{00}	1.63	0.18	<.001	β_{00}	2.21	0.17	<.001
WP-12	β_{01}	-0.00	0.02	0.908	β_{01}	-0.04	0.02	0.052	β_{01}	0.03	0.02	0.134
Level 1 slope:												
Total hassles	β_{10}	0.32	0.13	0.014	β_{10}	-0.01	0.09	0.917	β_{10}	0.57	0.13	<.001
Total hassles x WP-12	β_{11}	0.01	0.02	0.520	β_{11}	-0.02	0.02	0.132	β_{11}	0.01	0.02	0.534
Intercept	β_{00}	1.71	0.14	<.001	β_{00}	1.64	0.18	<.001	β_{00}	2.21	0.17	<.001
WP-12	β_{01}	-0.00	0.02	0.893	β_{01}	-0.04	0.02	0.053	β_{01}	0.03	0.02	0.131
Level 1 slope:												
Total uplifts	β_{10}	0.45	0.10	<.001	β_{10}	-0.13	0.09	0.184	β_{10}	0.63	0.15	<.001
Total uplifts x WP-12	β_{11}	0.03	0.02	0.060	β_{11}	-0.04	0.02	0.075	β_{11}	0.03	0.02	0.218

Table 4.13. Exploring the moderating effect of emotional eating style on the stress/snacking behaviour relationships.

	Total snacks				Healthy snacks				Unhealthy snacks			
	Symbol	**Coefficient**	**SE**	**P value**	**Symbol**	**Coefficient**	**SE**	**P value**	**Symbol**	**Coefficient**	**SE**	**P value**
Intercept	β_{00}	1.70	0.14	<.001	β_{00}	1.63	0.18	<.001	β_{00}	2.21	0.17	<.001
Emotional eating style	β_{01}	-0.01	0.01	0.504	β_{01}	-0.03	0.02	0.155	β_{01}	0.03	0.02	0.047
Level 1 slope:												
Total hassles	β_{10}	0.33	0.13	0.012	β_{10}	-0.01	0.11	0.926	β_{10}	0.57	0.14	<.001
Total hassles x Emotional eating style	β_{11}	0.00	0.01	0.830	β_{11}	-0.00	0.01	0.777	β_{11}	0.01	0.01	0.544
Intercept	β_{00}	1.71	0.14	<.001	β_{00}	1.63	0.18	<.001	β_{00}	2.21	0.17	<.001
Emotional eating style	β_{01}	-0.01	0.01	0.496	β_{01}	-0.03	0.02	0.157	β_{01}	0.03	0.02	0.045
Level 1 slope:												
Total uplifts	β_{10}	0.46	0.11	<.001	β_{10}	-0.15	0.10	0.130	β_{10}	0.62	0.16	<.001
Total uplifts x Emotional eating style	β_{11}	0.00	0.01	0.898	β_{11}	-0.00	0.01	0.681	β_{11}	-0.00	0.02	0.903

Table 4.14. Exploring the moderating effect of external eating style on the stress/snacking behaviour relationships.

	Total snacks				Healthy snacks				Unhealthy snacks			
	Symbol	**Coefficient**	**SE**	**P value**	**Symbol**	**Coefficient**	**SE**	**P value**	**Symbol**	**Coefficient**	**SE**	**P value**
Intercept	β_{00}	1.70	0.14	<.001	β_{00}	1.64	0.18	<.001	β_{00}	2.21	0.17	<.001
External eating style	β_{01}	0.02	0.02	0.419	β_{01}	-0.04	0.02	0.065	β_{01}	0.04	0.02	0.088
Level 1 slope:												
Total hassles	β_{10}	0.33	0.13	0.012	β_{10}	-0.01	0.10	0.896	β_{10}	0.57	0.13	<.001
Total hassles x External eating style	β_{11}	-0.00	0.02	0.948	β_{11}	-0.02	0.01	0.187	β_{11}	0.02	0.02	0.353
Intercept	β_{00}	1.70	0.14	<.001	β_{00}	1.64	0.18	<.001	β_{00}	2.21	0.17	<.001
External eating style	β_{01}	0.02	0.02	0.409	β_{01}	-0.04	0.02	0.063	β_{01}	0.04	0.02	0.089
Level 1 slope:												
Total uplifts	β_{10}	0.45	0.11	<.001	β_{10}	-0.15	0.10	0.118	β_{10}	0.62	0.14	<.001
Total uplifts x External eating style	β_{11}	0.02	0.02	0.435	β_{11}	-0.02	0.01	0.127	β_{11}	0.03	0.02	0.223

Table 4.10. summarises the influence of CAR on total snacks, and healthy and unhealthy snacks. This table illustrates that there were two significant main effects; one showing a negative relationship between CAR and healthy snacks ($\beta = -0.05$, $p = 0.033$) and the other showing a positive relationship between CAR and unhealthy snacks ($\beta = 0.06$, $p < .001$). In addition, Table 4.10. highlights four significant interactions. These interactions were as follows: total hassles, CAR and healthy snacks ($\beta = -0.03$, $p = 0.006$), total hassles, CAR and unhealthy snacks ($\beta = 0.03$, $p = 0.02$), total uplifts, CAR and healthy snacks ($\beta = -0.02$, $p = 0.04$) and lastly, total uplifts, CAR and unhealthy snacks ($\beta = 0.04$, $p = 0.003$).

Table 4.11. summarised the influence of cortisol in the form of mean cortisol sample on the daily hassles-snacking relationship. There were two significant interactions: one between total hassles, mean cortisol and healthy snacks ($\beta = -0.07$, $p < .001$) and the other between total uplifts, mean cortisol and healthy snacks ($\beta = -0.09$, $p = 0.004$). In addition, one main effect was found to be significant: the relationship between mean cortisol and healthy snacks ($\beta = -0.09$, $p = 0.045$), such that those with higher mean cortisol were found to consume fewer healthy snacks.

In Table 4.12., cortisol was also explored using the WP-12 sample, where no significant main effects or interactions were present. However, one main effect was trending towards significance ($\beta = -0.04$, $p = 0.052$), and two interactions were similarly trending towards significance: total uplifts, WP-12 and total snack consumption ($\beta = 0.03$, $p = 0.06$) and total uplifts, WP-12 and healthy snack consumption ($\beta = -0.04$, $p = 0.075$).

Interestingly, comparing the different measures of cortisol, the findings illustrate that the effects of cortisol are not limited to the CAR measure. As the findings above illustrate, the significant interactions between both total hassles, diurnal cortisol and healthy snacks, and total uplifts, diurnal cortisol and healthy snacks were significant for both CAR and mean cortisol measures.

In Table 4.13., the moderator emotional eating style has been explored. This table illustrates that one significant main effect between emotional eating style and unhealthy snacks ($\beta = 0.03$, $p = 0.047$) was present. The relationship between emotional eating and unhealthy snacks ($\beta = 0.03$, $p = 0.047$) was however trending towards significance.

Lastly, Table 4.14. examined the impact that external eating style had as a moderator in the stress-snacking relationships, and identified that no significant main effects or interactions were present. Two main effects were trending towards significance: external eating and healthy snacks ($\beta = -0.04$, $p = 0.065$) and external eating and unhealthy snacks ($\beta = 0.04$, $p = 0.088$).

4.3.21 Decomposing Significant Moderator Interactions

The six significant interactions identified within the HLM analyses above were then further examined using the intercept, slope and significance calculator (Preacher et al., 2018). Like the analysis in Study 3, the ‘Case 3’ calculator was selected to examine the influence that the potential moderator variables had, and such variables were inserted in the level 2 model of the calculator.

4.3.22 Significant Interactions

The six significant interactions were examined further at moderation level to identify the shape of the relationship at different levels of the moderator variable. Following the strategy used for Study 3 analysis, mean centred variables of the IV and moderator variable were additionally used here.

Exploration of the first significant interaction between total hassles and CAR on unhealthy snack consumption identified that total hassles were positively associated with unhealthy snack consumption at high levels (M + 1 SD) of CAR (β = 0.75, p = 0.00), but moderate (β = 0.56, p = 0.0001) levels were slightly less significant. Low (M – 1 SD) levels of CAR (β = 0.36, p = 0.421) remained positive but were no longer significant. These simple slope relationships are shown in Figure 4.3.

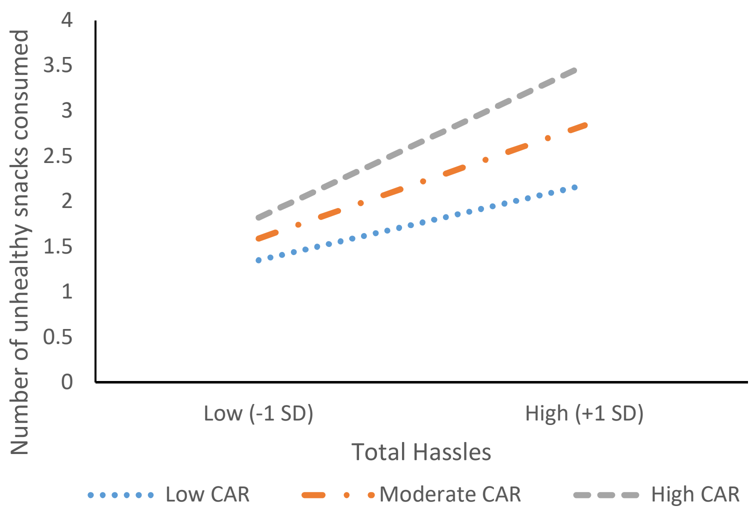

Figure 4.3. The relationship between total hassles and unhealthy snacks consumed at different levels of CAR.

The next interaction was decomposed, and it was found that total hassles and CAR were negatively related to healthy snack consumption at high levels of CAR (β = -0.17, *p* = 0.07). There were positive relationships between total hassles, CAR and healthy snack consumption at both moderate (β = 0.03, p = 0.79) and low (β = 0.22, *p* = 0.09) levels of CAR, however, both slopes were not found to be significant. These interactions are illustrated in Figure 4.4.

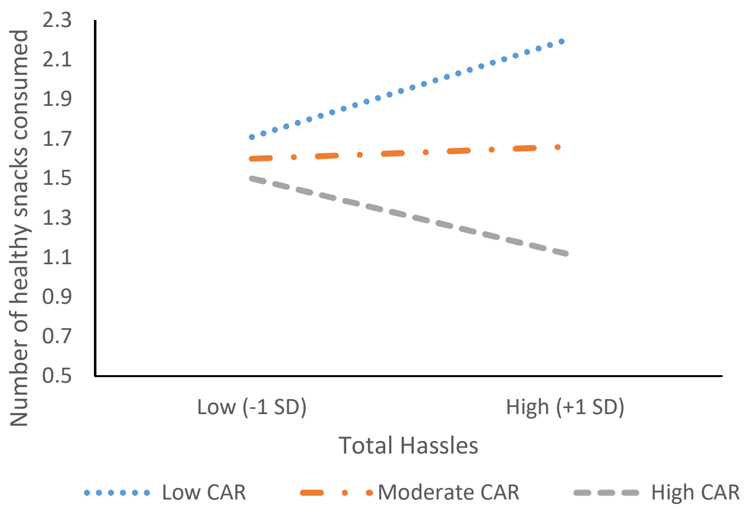

Figure 4.4. The relationship between total hassles and healthy snacks consumed at different levels of CAR.

Decomposition of the third significant interaction between total uplifts and CAR on unhealthy snack consumption found that total uplifts were strongly positively related to unhealthy snack consumption, at high levels of CAR (β = 0.86, *p* <*.001*), with this association remaining positive at moderate levels (β = 0.61, *p* = 0.0001) and low levels of CAR (β = 0.35, *p* = 0.0481). These interactions can be seen in Figure 4.5.

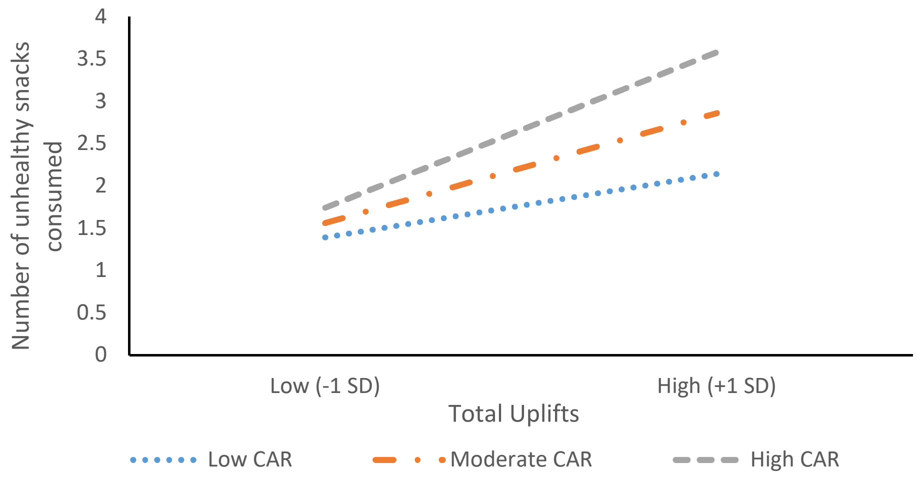

Figure 4.5. The relationship between total uplifts and unhealthy snacks consumed at different levels of CAR.

Decomposition of the fourth interaction found that total uplifts and CAR were strongly negatively significant with healthy snack consumption at levels of high CAR (β = -0.24, *p* = 0.02*)*. The interaction remained negative for moderate CAR levels, but this interaction was not significant (β = -0.11, *p* = 0.24*)*. Lastly, for those with low CAR, the interaction became positive, but remained non-significant (β = 0.01, *p* = 0.91). These interactions are illustrated in Figure 4.6.

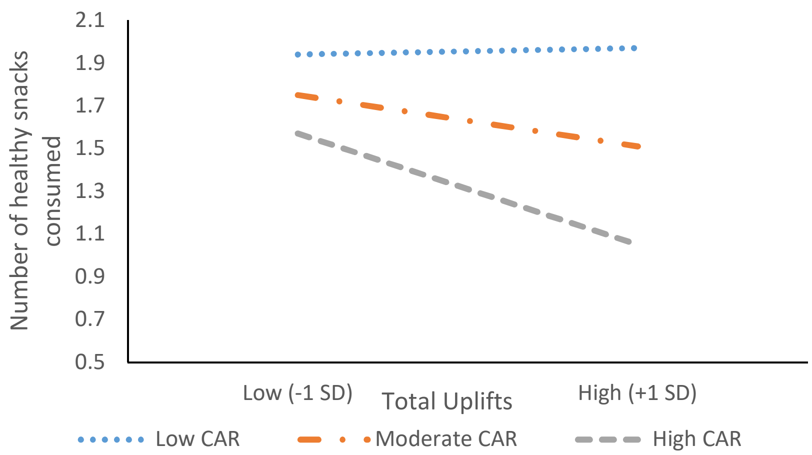

Figure 4.6. The relationship between total uplifts and healthy snacks consumed at different levels of CAR.

The fifth significant interaction was decomposed, and it was found that total uplifts were significantly negatively related to healthy snack consumption, with the strongest association at high levels of mean cortisol (β = -0.21, p = 0.04). There was also a negative relationship present for participants with moderate mean cortisol (β = -0.00, p = 0.98), although this relationship was not significant. For participants with low mean cortisol there was a positive, but non-significant relationship present (β = 0.21, p = 0.07). These interactions can be seen in Figure 4.7. below.

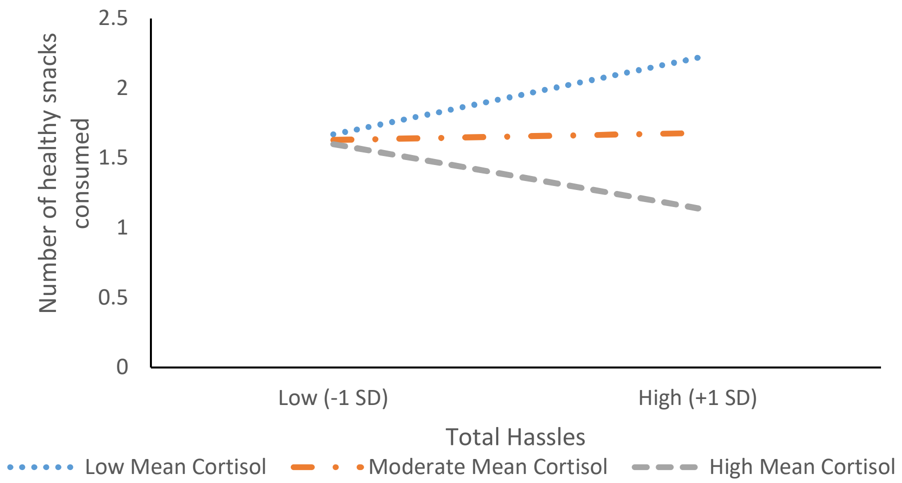

Figure 4.7. The relationship between total hassles and healthy snacks consumed at different levels of mean cortisol.

The last significant interaction focused on the examination of total uplifts and healthy snack consumption, and decomposition of this interaction identified that there was a strong significant negative relationship for those with high mean cortisol (β = -0.40, p = 0.01). However, for those with moderate mean cortisol, the relationship became non-significant, but remained negative (β = -0.12, p = 0.20). For participants with low mean cortisol, decomposition identified that a positive, non-significant interaction was present (β = 0.17, p = 0.15). These relationships can be seen in Figure 4.8.

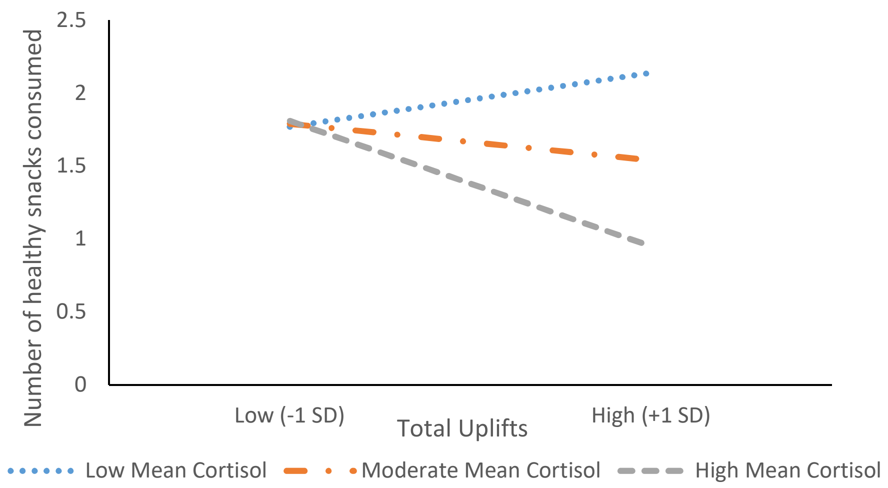

Figure 4.8. The relationship between total uplifts and healthy snacks consumed at different levels of mean cortisol.

4.3.23 Discussion

This study aimed to examine how the presence of hassles and uplifts were related to the snacking behaviours of undergraduate students. Diurnal cortisol levels and emotional and external eating styles were examined as potential moderating variables to further explore the influence of such factors within this stress-eating relationship.

Overall, it was found that the number of total hassles were significantly related to the number of total snacks consumed. In addition, total hassles were also related to the number of unhealthy snacks consumed. However, the number of uplifts reported was also significantly related to total snack and unhealthy snack consumption. This suggests that the undergraduate students who report high frequencies of hassles and or uplifts are likely to display high levels of snacking behaviours for either snacks in general, or more specifically, unhealthy snacks. Looking at Table 4.8, it is evident that the frequencies of total hassles and total uplifts are very similar to one another. This implies that it is the nature of emotion (i.e., either negative or positive) within the concepts of daily hassles and uplifts that led to the consumption of (total) snacks.

It was hypothesised that undergraduate students who reported high numbers of hassles would also report consuming more snacks across the four-day study. This hypothesis can be accepted because the findings have identified a significant main effect between total hassles and total snacks. In addition, it was hypothesised that such students would also report consuming a high frequency of unhealthy snacks, within their snacking behaviours. The study findings support this hypothesis too, because a significant main effect between total hassles and unhealthy snacks was identified.

However, it is worth acknowledging that there were also main effects for total uplifts with both total snacks and unhealthy snacks. This supports the findings of Study 1 where it was found that children reported consuming snacks across high levels of both positive and negative emotions. Such findings provide evidence to suggest that experiencing emotion, either positive or negative, can instigate an increase in individual snacking behaviours. The significant relationships between both total hassles and total uplifts with unhealthy snack consumption seem to be driving the significant relationships that were identified between both total hassles and total uplifts with total snack consumption. For both variables, the relationship with healthy snacks was non-significant, emphasising the importance of the strongly significant associations that were identified between total hassles and total uplifts with unhealthy snacks.

This study further explored these significant main effects, and found that diurnal cortisol (in the form of CAR) was a significant moderator of the relationship between total hassles and both healthy and unhealthy snacks. More specifically, CAR was found to moderate the negative relationship identified between total hassles and healthy snacks. For individuals with low and moderate CAR, there was a positive relationship between hassles and healthy snacks, but the relationship was only significantly moderated for those with low CAR. For those with high CAR, total hassles and healthy snacks were negatively related, and this relationship was found to be non-significant. For the relationship between total hassles and unhealthy snack consumption, the relationships were positive for those with low, moderate and high CAR, however, this relationship was only significantly moderated by those with moderate and high CAR.

Existing research supports the findings identified here, particularly the research by Conner et al. (1999) who found that total hassles were significantly correlated with the amount of snacks undergraduate students consumed. Similarly, research by O'Connor et al. (2008) found that participants who experienced more daily hassles were found to increase their consumption of both high fat and high sugar snacks. Looking more closely within existing cortisol reactivity literature, Newman et al. (2007) found that for ‘high (cortisol) reactors’, the level to which they experienced hassles was positively related to their snack consumption. Interestingly, this study identified that this positive relationship became more significant when the level of hassle intensity was taken into consideration. Work by Epel et al. (2001) found that ‘high reactors’ were found to consume significantly more sweet foods. The current study extends this finding by identifying the nature of variability within the consumption of healthy versus unhealthy snacks. For example, when a high frequency of total hassles was experienced, those with high CAR had a more positive (i.e., a stronger) relationship with unhealthy snacks (i.e., when hassles were frequently experienced, high numbers of unhealthy snacks were consumed). This pattern was similarly displayed for those with moderate and low levels of CAR, however, the relationship was not as positive. In contrast, when the relationship between total hassles and healthy snacks was examined, the level of CAR seemed to have the opposite effect. For individuals with high CAR, total hassles was negatively related to the number of healthy snacks consumed. However, for those with moderate and low CAR a positive relationship between total hassles and healthy snacks was present.

Both the relationships between total hassles and unhealthy/healthy snack consumption show that high CAR levels lead to detrimental patterns of snacking behaviour. In particular, high levels of unhealthy and low levels of healthy snack consumption (when experiencing high levels of total hassles) were displayed. These patterns expand upon the work of Epel et al. (2001) by showing the nature of interaction between different levels of cortisol.

The current study has highlighted the importance of measuring diurnal cortisol, emphasising the role of individual differences and more specifically, the additional information that salivary cortisol can provide. Such significant moderator interactions show directly how this physiological mechanism interacts with, in this case, individual snacking behaviours, particularly because CAR was also found to be a significant moderator within the total uplift, unhealthy snacking relationship. This indicates that individuals that were experiencing more uplifts, subsequently consumed more unhealthy snacks. More importantly, it seems that the influence of individual CAR moderates the level to which the presence of uplifts results in unhealthy snacking. For those with high CAR levels, the nature of this relationship was more detrimental because more uplifts led to higher levels of unhealthy snacking. For individuals with low CAR, experiencing uplifts led to the consumption of fewer unhealthy snacks. Interestingly, such findings would suggest that CAR in this instance may not be a moderator, but may in fact be mediating the relationship between hassles, uplifts and snacking behaviours. CAR may not be the sole mediator in this relationship, but such findings illustrate that this measure of cortisol variability may, in part be a mediator for affecting these snacking behaviours. Baron and Kenny (1986) acknowledge that a mediator influences the IV-DV relationship because it has a transformational nature that is 'internal' to the organism. This definition aligns with the use of cortisol within this study, where CAR responses are 'internal' to each individual.

To try and understand why CAR is so influential in this relationship, it is important to remember that cortisol, in this form is naturally raised at the start of the day. In Study 3, cortisol reactivity was measured in the afternoon post TSST-C, however, here, this cortisol measurement tells us who is a low or high reactor soon after waking. As the research by Newman et al. (2007) shows, it is now well evidenced that for 'high reactors', the level to which hassles are experienced greatly affects subsequent snacking behaviour.

In light of such research, it therefore seems implausible that such a cortisol response would be present when high numbers of uplifts are experienced. Such a response would be unlikely because as literature (O'Connor et al., 2009) shows, cortisol is released in response to a stressor, experiences which one would presume would be inherently different to an uplift. However, it is important to acknowledge that O'Connor et al. (2009) found that psychological stress was associated with lower CAR levels. Although Schlotz, Hellhammer, Schulz and Stone (2004) identified that CAR levels were higher on working days, this has been further supported by Hellhammer et al. (2007) who found CAR was influenced more by ‘situational factors’ than individual ‘traits’. These literary examples highlight the variability of CAR and provide support for its inclusion in future research.

Looking at the implications of the influence that CAR has on unhealthy snack consumption, it is understandably concerning that such a finding has arisen. Previous literature suggests that experiencing a large amount of stressors is related to a subsequent increase in hyperphagic eating behaviours (Araiza & Lobel, 2018). The current study, suggests the antithesis that the presence of uplifts corresponds with the frequency to which unhealthy snacks are consumed. This illustrates that detrimental hyperphagic eating behaviours can increase in the presence of both hassles and uplifts. This is of concern not simply because the two emotions could vastly lead to the overconsumption of food, but because of the obesity epidemic that is currently present across the world (WHO, 2018).

This study measured uplifts to ascertain the frequency of positive experiences experienced by individuals. In light of this, it was not anticipated that levels of uplifts, and CAR would be associated with levels of unhealthy snacking. However, it is possible that higher levels of CAR, predispose individuals to higher levels of cortisol throughout the day. Such increased cortisol may subsequently influence individual snacking behaviours (as suggested by the current study findings), and for high reactors, the presence of an uplift or a stressor may be strong enough to initiate the effects of cortisol, irrespective of the nature of the emotion. This highlights the importance of measuring both negative and positive emotions when exploring the stress-eating relationship.

It is important to acknowledge that cortisol was found to be a significant moderator within both studies, even though Study 3 focused on cortisol reactivity to stress and this study focused on diurnal cortisol. This shows the importance of measuring cortisol, and illustrates that this has been a consistent moderator across the two age groups, thus emphasising the need to continue to focus on this physiological measure in future stress-eating research.

The current study has a few shortcomings, one of which stems from the measure of salivary cortisol. In this study, 7.17% of saliva samples (43 of 600) were not taken at the correct time, because there was no increase between participants' first and second samples. This suggests that some participants were not adherent to the study protocol, because, as research suggests (Fries et al., 2009), evidence of the CAR should result in an increase between an initial wake up sample and a subsequent sample taken soon after. Such samples are not believed to have been taken upon waking, so were removed from analysis. Non-adherence is a difficult factor to reduce, particularly when, participants were required to complete the majority of the study in their own time. However, to try and reduce the influence of non-adherence, it would be useful to obtain a larger sample.

In a similar manner to non-adherence, it could have been effective to use two ways of reminding participants to complete their evening diaries. Email reminders were sent out at 5pm each evening to participants during the study, however, mobile text reminders could have been a useful addition to this protocol, particularly because mobile phones are likely to be checked/seen more frequently than emails (Kaplan & Haenlein, 2010).

Future research could utilise more diurnal cortisol samples to further examine the ways in which cortisol fluctuates over a day. This would provide more information about when participants choose to snack, so that these behaviours could be tracked against any changes in cortisol. It would be interesting to measure daily meal consumption in addition to snacking behaviours so that a more complete picture of stress-related eating could be obtained.

4.3.23.1 Conclusion

Overall, this study has identified that total hassles are significantly related to the snacking behaviours of undergraduate students. More specifically, it was found that total hassles were also predictive of unhealthy snack consumption. Moderation analysis found that CAR was a significant moderator within the interactions of total hassles and healthy snacks as well as total hassles and unhealthy snacks. Mean cortisol samples were also found to be a significant moderator for the relationship between total hassles and healthy snacks and total uplifts and healthy snacks. No significant interactions were found for the other potential moderators: emotional or external eating style or the WP–12 hour sample. These findings support existing adult and undergraduate student literature, and provide support for utilising cortisol as an objective stress measure in future stress-eating research.

4.3.24 General Discussion

This chapter summarises the third and fourth studies conducted as part of this thesis. Both studies used daily diary measures to examine the hassles and uplifts experienced by the children and undergraduate students. Stress was operationalised through the use of exploring hassles and uplifts and eating behaviours were explored by examining diurnal snacking consumption. Both studies explored the potential moderating influence of emotional and external eating styles as well as salivary cortisol. Study 3 used cortisol reactivity to examine cortisol in children, whereas Study 4 examined cortisol by measuring diurnal salivary cortisol.

Overall, both studies found a significant relationship between total hassles and total snacks, however in Study 3, amongst children, this relationship was only significant when AUCg (cortisol reactivity) was added as a moderator within the model. Interestingly, children reported higher levels of external eating whereas undergraduate students showed stronger levels of emotional eating style. In a similar way, children reported consuming more healthy snacks, but for undergraduate students, they reported consuming more unhealthy snacks.

It seems that the overarching theme of results, like in Studies 1 and 2, is that stress has been found to be related to snacking behaviours amongst both children and undergraduate students. However, here, Studies 3 and 4 have shown that cortisol has been found to be an influential moderator. This was particularly evident in Study 3 where the hassles snacking interaction only became significant when cortisol was added as a moderator. This shows that cortisol was able to explain some of the variability between participants, showing one of the ways in which individual differences can influence the stress-eating relationship. Moving forwards, the two studies presented here support the inclusion of measuring cortisol when examining how stress affects eating behaviours, and as such, provide evidence for its inclusion within future research.

Chapter 5. General discussion

5.1 The Focus of this Thesis

Today, it is evident that obesity is highly prevalent and detrimental to the health of all age groups, both nationwide and globally. Research now indicates that being overweight or obese increases individuals' 'all-cause mortality' (The Global BMI Mortality Collaboration, 2016). Past and current literature plays a pivotal role in understanding how and why obesity is so prevalent. A bidirectional association between obesity and stress-related eating has been suggested (Araiza & Lobel, 2018). This thesis has focused on exploring the presence of stress-related eating amongst children aged 8-12 and young adults. More specifically, this thesis has examined the influence that both positive and negative emotions, and uplifts and hassles had on the subsequent snacking behaviours of both children and undergraduate students.

5.2 Summarising Study Findings in Relation to the Thesis Aims

Aim 1: To synthesise the existing evidence relating to the stress-eating relationship in children aged 8-12 years and to identify the moderators of this relationship.

The systematic review and meta-analysis presented in Chapter 2 identified that stress was significantly associated with the eating behaviours of children aged 8-12 years old. Analysis revealed that type of eating behaviour was a significant moderator in the stress-eating relationship. Other moderators of this relationship were difficult to identify because of the small number of appropriate studies found within current literature.

Aim 2: To identify and explore whether there was a relationship between positive and negative emotions and snacking responses in 9-10 year old children and undergraduate students.

In Study 1 (Chapter 3), hypothetical emotion scenarios were found to relate to the snacking responses of both children and undergraduate students. More specifically, it was found that children responded more to positive emotions using both healthy and unhealthy snack responses. However, undergraduate students responded more to negative emotions using unhealthy snack responses.

Aim 3: To understand how the occurrence of daily hassles and uplifts affected the daily snacking behaviours of both children (aged 8-11 years) and undergraduate students.

In Study 2 (Chapter 3), the frequency of reported total hassles was found to predict both total snack and unhealthy snack consumption. Children reported eating more snacks overall and more healthy snacks than the undergraduate students. However, undergraduate students reported eating more unhealthy snacks than the children.

Aim 4: To explore the impact of subjective and objective stress on the between-meal snacking behaviours of children aged 8-11 years.

In Study 3 (Chapter 4), both subjective and objective measures of stress were found to be associated with the between-meal snacking behaviours of 8-11 year old children. In this study, it was found that the interaction between positive mood and total snack consumption was moderated by emotional eating style. In addition, the relationship between total hassles and total snack consumption was moderated by AUCg.

Aim 5: To explore the impact of subjective stress and diurnal salivary cortisol on the consumption of between-meal snacks amongst undergraduate students.

Study 4 (Chapter 4) identified that subjective stress and diurnal salivary cortisol interacted with the between-meal snack consumption of undergraduate students. In particular, the interaction between total hassles and unhealthy snack consumption was found to be moderated by AUCg. The relationship between total uplifts and unhealthy snack consumption was also moderated by AUCg.

5.3 Identifying Gaps within Current Literature that Remain Underexplored

The thesis aims highlighted the current gaps within existing literature before further research was carried out. After conducting the research presented within this thesis, it has become apparent that many of these aims have been supported by study findings identified in this research. However, after conducting this research, it is important to acknowledge that evidence of significant moderators within the stress-eating relationship amongst children remains underexplored. Although emotional eating style (in Study 3) and type of eating behaviour (within the systematic review and meta-analysis) were both found to be significant moderators of the stress-eating relationship in children, no other significant moderators were identified. This suggests that continuing to examine the influence of moderator variables within the stress-eating relationship would be important for future research to focus on.

Within this thesis, Study 1 identified that there was a relationship between the hypothetical positive and negative emotions and hypothetical snack responses of both children and undergraduate students. Although an emotion-snacking relationship was present here, it is important to appreciate that both emotions and snacking responses were hypothetical, and consequentially were not measuring the presence of actual emotions or actual snacking behaviour. In light of this, future research could record what emotions participants' experience to identify if there is a relationship between the presence of these emotions and participants' snacking behaviours.

5.4 Overarching Study Findings Identified

In this thesis, there were some overarching themes identified within the findings. Total hassles were found to be associated with both total snack consumption and unhealthy snack consumption. More specifically, individuals who experienced more hassles were found to engage in more snacking behaviours.

Interestingly, total hassles and total uplifts were found to be associated with both healthy and unhealthy snacking behaviours. A change in healthy snacking was seen across two studies. In Study 2, this relationship was present, although it is worth acknowledging that neither variable significantly predicted healthy snack consumption when both variables were entered at step one of the regression analysis. However, in Study 4, it was also found that total hassles and total uplifts were associated with healthy snack consumption. In addition, within these relationships in Study 4, the total hassles-healthy snacking relationship was moderated by CAR. Within this interaction, positive relationships between total hassles, CAR and healthy snacking were present at low and moderate levels of CAR. However, a negative relationship between total hassles, CAR and healthy snacking was present at high levels of CAR. Additionally, the total uplifts-healthy snacking relationship was moderated by mean cortisol. Within this interaction, a positive relationship between total uplifts, mean cortisol and healthy snacking was present at low levels of mean cortisol. However, negative relationships between total uplifts, mean cortisol and healthy snacking were present at both moderate and high levels of mean cortisol. This shows that the consideration of cortisol can help to further explain the way in which total hassles and total uplifts interact to affect healthy snacking behaviour. In terms of unhealthy snacking, Study 2 found that total hassles positively predicted unhealthy snacking, even when accounting for two potential moderating variables (age and emotional eating style). Such findings illustrate that the presence of hassles was found to instigate change within both healthy and unhealthy snacking behaviours.

There were some similarities in findings when measuring stress using positive emotion and positive mood. Both these measures were associated with an increased level of snacking behaviour. In Study 1, children were found to respond to positive emotion by engaging with both healthy and unhealthy snacking behaviours. Similarly, in Study 3, positive mood was found to be associated with total snack consumption, and this relationship was moderated by emotional eating style. These findings emphasise the importance of experiencing and feeling positivity, either when experiencing positive mood or positive emotion.

In terms of snacking behaviour, children were frequently found to report higher levels of snacking behaviour in comparison to the undergraduate students. In Study 1, children reported eating more snacks for both positive and negative emotions compared to the undergraduate students. Similarly, in Study 2, children were also found to consume more snacks overall.

Across these studies, healthy, unhealthy and total snacking behaviours were found to increase as a result of experiencing stress. The findings highlight the impact that stress had on the snacking behaviours of both children and undergraduate students. More specifically, amongst children, total hassles, and positive mood were found to interact with total snack consumption. In undergraduate students, total hassles and total uplifts were found to interact with healthy and unhealthy snack consumption. In light of this, there are parallels between these two populations, namely, that both groups were found to increase their frequency of hypothetical snack responses (Study 1) and total snack consumption (Study 2) in response to stress (in the form of positive/negative emotions in Study 1 and daily hassles and uplifts in Study 2). Similarly, in Studies 3 and 4, stress (in the form of total hassles) was found to significantly interact with total snack consumption (Study 3) and unhealthy snack consumption (Study 4). Both interactions (across Studies 3 and 4) were moderated by cortisol (reactivity in Study 3 and CAR in Study 4).

5.5 How do the Current Findings Relate to Existing Literature?

The findings presented within this thesis have some similarities and differences with existing literature. The similarities stem primarily from the dominant finding that total hassles were found to be significantly related with the level of total snacks consumed. This finding has been presented within many studies focusing on adult eating behaviour (e.g., O'Connor et al., 2008; Conner et al., 1999). This pattern of behaviour provides support for the ‘reward based stress’ eating theory proposed by Adam and Epel (2007).

This theory originally proposed that it was the presence of repeated stressors that encouraged individuals to engage in reward style eating behaviours. For example, eating food/s that provide pleasurable feelings to ‘reward’ yourself. However, the findings presented in this thesis suggest that this theory may now need expanding. Positive emotion here, was found to induce hyperphagic eating behaviours amongst children. The current theory focuses on the presence of stressors or hassles, occurrences which stem from negative emotion. The theory however, could be more encompassing by including both positive and negative emotions. The reasons behind why children are choosing to ‘reward’ themselves with food when positive emotion is present remains unclear. However, it is important to acknowledge that this finding does support the ‘positive emotion, food indulgence’ association that Evers et al. (2013) identified. Evers et al. (2013) found that the presence of positive emotion induced indulgent eating behaviours (i.e., behaviours that were not deemed to be normal for an individual). This relationship, Evers et al. (2013) believed could stem from the tendency we have, as a society, of celebrating positive occasions (e.g., birthdays) with an abundance of food. However, the precise ‘theoretical mechanisms’ (Evers et al., 2013) behind why such eating behaviours are chosen still requires further exploration.

The current findings identified that undergraduate students responded more to hassles and negative emotion by consuming unhealthy foods. This finding also supports existing research where similar findings were identified (Conner et al., 1999), and is consistent with the reward based eating theory frequently seen in adult stress-eating literature (Adam & Epel, 2007). Interestingly, children reported consuming higher frequencies of snacks when compared to the undergraduate students. This would be useful to explore further, to ascertain whether this eating style occurs as a result of experiencing more hassles (stress), or whether children just have the tendency of consuming more snack foods as opposed to foods in main meals. This difference in snacking behaviour further emphasises the importance of examining age when exploring stress-eating behaviour interactions, and provides support for simultaneously measuring two different aged samples when conducting future research.

There are however, some novel findings that were identified within these studies. It was found that positive emotion played an important role in initiating snacking responses in children. More specifically, this research identified that children responded more to positive emotion using both healthy and unhealthy snacking responses. This highlights the importance of measuring both positive and negative emotion to see how the different emotions elicit change amongst eating behaviours. Current literature needs to shift its focus from concentrating solely on negative emotion, and appreciate that research has now identified positive emotion to be influential for eating behaviour amongst children.

Moreover, cortisol reactivity was found to significantly moderate the relationship between total hassles and total snack consumption in children, and in undergraduate students. CAR was found to moderate the relationship between total hassles and healthy and unhealthy snacks respectively. To the best of our knowledge, this is the first time these effects have been observed, and therefore, they represent a novel contribution to the stress-eating domain. Both CAR and cortisol reactivity (AUCg) were found to be significant moderators, findings which support the use of measuring cortisol in future research.

Lastly, it remains imperative to appreciate the challenge of examining the stress-eating behaviour relationship. Araiza and Lobel (2018) acknowledge that conceptualising the stress concept is particularly difficult. This, Araiza and Lobel (2018) argue, is because stress is a multi-dimensional concept. Past research has tried to conceptualise stress using a variety of different stress 'measures' (e.g., subjective and objective measures), however, it is this plethora of conceptualisations that causes the problem. The multitude of ways in which stress is conceptualised causes difficulty in comparing and summarising findings both within and across different literature sources. Araiza and Lobel (2018) state that such a variety of measures actually 'impedes' the conclusions that authors make about the way in which stress influences eating behaviours. Further research therefore needs to take place to help eradicate these conceptual issues so that comparing findings within and between studies is more straightforward. With this in mind, it would be useful for future research to examine stress using methods that have been evidenced as influencing eating behaviours (e.g., using measures of perceived stress). Once a method of measuring stress has been chosen, using measures that have evidenced high levels of construct validity would enable more equal comparisons (in terms of findings) between studies to be made.

5.6 Limitations of the Current Research and Corresponding Methodological Recommendations for Future Research

When exploring the stress-eating relationships amongst children, it has come to light that many difficulties will be faced. Due to their age, children are often prevented from consuming the food or drink that they desire. As such, it is possible that exploration of parents/caregivers' behaviours should take place. Comparisons could then be made between the behaviour of a child and the behaviour of their parent/caregiver. This understanding helped shape the current research, and explains why the research focused on measuring the snacking behaviours of children (see Section 3.2).

However, there may still be strict rules in regards to what snacks are brought in to and allowed to be consumed in the home, so measuring parents' child feeding practices could provide useful information on the level of control surrounding the family's eating behaviours. An example of a suitable questionnaire would be the 'comprehensive feeding practices questionnaire' (Musher-Eizenman & Holub, 2007) that assesses parents/caregivers' eating related practices.

Within Studies 3 and 4, children were asked how many portions of fruit and vegetables they ate daily. Although both verbal and written explanations were given, the number of portions reportedly eaten ranged from 0-17 portions (a day) across both fruit and vegetables. This high number of portions seems likely to have been inflated somewhat, particularly because the majority of children also reported that they consumed additional snacks between meals on that specific day. Unfortunately, this meant that this data was not further explored, but it is in line with existing literature that has found children struggle to report their food consumption in portion sizes (Livingstone et al., 2004).

It is worth acknowledging that it was not only number of portions that children had difficulty reporting. In Study 3, children seemed to report similarly unrealistic numbers of consumed daily snacks. For example, on one day, one child reported eating a total of 24 snacks in between their main meals. This seems unlikely, however, it is difficult to ascertain how much of this reporting is indeed correct, and how much could be desired consumption (i.e., representing the food that children wish they could consume). This finding relates closely with the concerns that Baxter, Thompson, Davis and Johnson (1997) raised. These concerns acknowledged that children's memory for 'autobiographical' information is often unreliable because many factors have the potential to interfere with the accuracy of memory recall. Such factors could include the interaction of an experimenter or errors in memory caused by an inability to recall necessary information or an intrusion of other similar information. To conclude, Baxter et al. (1997) suggest that suitable cues should be developed to help children self-report food intake more accurately to reduce the presence of under or over-reporting.

To try and remove the level to which food is over-reported, it may be possible to ask children's parents/caregivers to sit with them when they complete their diary entry to help them complete the snack section. However, children may have consumed some food that their parents were unaware of, potentially making this strategy of reporting difficult for children to be honest. To alleviate over-reporting however, it may be possible for parents/caregivers to confirm whether their child's self-report is accurate by objectively observing any snacking behaviours that their child engages in. This concept however, could be difficult if they are not with their child for that particular study day/s.

Klesges, Klesges, Brown and Frank (1987) explored the accuracy of parent reporting for understanding children's dietary intake. Their findings illustrated that parental reports correlated highly with the amount (in weight) of food consumed by the children. However, Klesges et al. (1987) note that the setting in which a child consumes food was found to influence the accuracy of parental reports (e.g., in the home environment versus outside the home). Eck, Klesges and Hanson (1989) also identified that the accuracy of parental dietary recall was improved when two parents reported the food consumed by their child. Such literature supports the use of parental reporting for understanding children's dietary behaviours, although, these points acknowledge that certain details with the use of parental reports need to be considered. Simons-Morton and Baranowski (1991) conclude that the use of parental reports seems to be a promising approach, suggesting that it may be a useful addition for measuring children's eating behaviour in future stress-eating research.

Within the current research, in Study 3, children were given mobile phones to take pictures of the snack food/drink items they consumed across the study. This technique was used because it was believed it would encourage children to remember to record their snack consumption. If this technique proved useful, it could have reduced the amount of over-reporting present. However, this technique was not utilised effectively by the majority of participants. Multiple pictures of the same food item (taken on the same date and at the same time) were given by some, and for others, the number of snacks reported on their daily diary did not correspond with the number of pictures taken.

This tool is therefore believed to be useful to develop further. For example, it may be possible to increase the validity of gathered data by altering the method of retrieval. Instead of utilising a retrospective diary design for gathering stress and information about eating behaviours, it may be better to obtain daily, cross-sectional data that gathers information about current stress and dietary behaviours. A method for facilitating accurate recall can be seen in the work by Gibbons, Finlayson, Dalton, Caudwell and Blundell (2014) where portable handheld computer devices were given to participants to measure levels of hunger and satiety at various times throughout the day. Such portable devices could prove useful for measuring the occurrence of stress and for tracking specific eating behaviours because these devices can additionally be set up with alarms to act as a reminder for tracking such behaviours. This particular methodology could strengthen the validity of the stress and eating data obtained, making it a viable option for future research.

Looking at the moderators that were examined, it is imperative to appreciate that the DEBQ measure used was not created for use in children. Although there is a child specific DEBQ measure, the current research team deemed it to be more suitable to use the adult DEBQ so that the measure could be more age appropriate for both groups of participants. Slight wording adaptations were made to the original DEBQ before use however, to ensure that the children were able to understand the meaning and question within each statement. These alterations were tested when the DEBQ measures were piloted by appropriately aged children prior to use. However, it is not completely understood how well the changes mapped on to the original item measures. In this respect, it is unclear what the level of construct validity is, and as a consequence, future research may decide to use the child-specific DEBQ even if different aged participants are simultaneously being measured.

5.7 Limitations of Exploring the Stress-Eating Domain Amongst Children

The current research has tried to operationalise stress so that the concepts are clear for 8-12 year old children, who were the primary focus here within this thesis. The questionnaire materials were all piloted before use with appropriately aged children before being administered to the study participants, however, during testing, some children were unsure of some of the words used to depict positive and negative emotions (e.g., lively). Although verbal explanations were given in all of these situations, it raises a concern of whether or not all children were fully aware of what each of the words meant. It is possible that those words that were more clearly understood, and possibly more often used could have been those that were paired with a snacking response more frequently. Further testing should be carried out to explore the level of understanding held by the age of children in question. Extended pilot work (involving trial run study sessions for obtaining individual feedback) would allow unsuitable language or question styles (e.g.., Likert versus open-ended) to be removed from further testing. As a consequence, it would be anticipated that the findings from subsequent research would be a more valid reflection of children's stress-eating behaviours.

Due to the nature of research that was undertaken, participants are often very interested in getting information about their results (particularly their salivary cortisol readings). All participants within these studies took part anonymously (i.e., their identity was kept separate from their completed study materials), which prevented individual data summaries from being given to participants. If some level of participant feedback could be given (i.e., either individual or group based feedback), it may encourage more participants to want to get involved in the research.

As is frequent in research, participants often look for tangible benefits that they can get as a result of participating. For example, providing some kind of data feedback and prize incentive are two relatively simple strategies to use to encourage study participation and reduce participant attrition. Within this current research, we found that providing small but guaranteed rewards (in the form of Love to Shop vouchers) for completing Study 3 encouraged children to complete all study components.

5.8 Further Directions for Future Research

In the studies conducted as part of this thesis, it has become evident that there are advantages in using both self-report and physiological measures for conceptualising stress, particularly when exploring children’s behaviours. For example, the subjective (self-report) questionnaire measures allowed stress to be broken down in to positive and negative emotions which were deemed age appropriate for 8-12 year old children. These measures also allowed the children to be actively involved within the study, and it gave them the opportunity to think about what sorts of foods they were consuming in an array of different situations.

This was an important element to the study, and one that was behind our recruitment strategy to help ‘build healthier communities’.

Physiologically, stress was measured using salivary cortisol samples and this was shown to be a useful method for illustrating how individual variability can affect the way stress interacts with individual eating behaviours. Therefore, it is believed to be important to include both subjective and physiological measures in future stress-eating research.

There currently seems to be a paucity of questionnaires that focus on measuring the stress that children experience. This was something that was encountered by our research team, and as a consequence, resulted in the development of several new study specific measures. Although this was useful, it did prevent us from understanding how valid and reliable these measures were, ultimately creating a level of uncertainty in regards to the degree to which the questionnaire and daily diary measures were age appropriate. In light of this, it would be useful to validate such new stress measures, and this could be done by looking to see how well the new measure ‘converges’ (corresponds) with existing (and validated) stress measures (Morgeson & Humphrey, 2006). Morgeson and Humphrey (2006) acknowledge that it is possible to validate a questionnaire by identifying whether a range of behaviours have been detected by the new measure. In this instance, a new stress measure should be able to identify differing levels of stress across participants. This variety would show that the measure is effective in measuring the varying degrees of stress experienced across individuals. Lastly, Wardle (1987) reports that validity can be tested by giving a new measure to participants of different ages in order to appreciate the way in which it measures stress across individuals.

The studies within this thesis focused on measuring snacking behaviours because this type of eating behaviour was deemed to be most influenced by the children themselves (over their parents/caregivers). However, to obtain a more comprehensive understanding of the way in which stress affects eating, it would be useful to measure children's meal consumption along with their fruit and vegetable intake. In this instance, it may be necessary to obtain information from children's parent/caregivers to allow more objective and accurate reports to be gathered.

Overall, it is therefore believed to be important to use a combination of both subjective and physiological measures when examining the way in which stress affects the eating behaviours of children. More specifically, future studies could replicate the use of daily diary methodology amongst a larger sample of children to see whether the patterns identified in Study 3 remained present. Within such a study, it would be possible to use diurnal cortisol samples to expand on the cortisol reactivity data obtained in Study 3. Both strategies would provide a more comprehensive understanding of the stress-eating relationships in 8-12 year old children. In terms of continuing to use the undergraduate students as a comparison group (with the children), it would be useful to mirror any study procedure conducted in children within this group too. This would allow direct comparisons between the stress-eating behaviours of such participants to be made because identical forms of stress and eating behaviour data would be gathered.

5.9 Contributions of this Thesis

The research studies presented within this thesis have highlighted several important points that need to be acknowledged. Study 1 has shown the importance of measuring positive emotion. The strengths of utilising this concept have been twofold, firstly, it has been shown to be a concept that 8-12 year old children understand, and secondly, it has provided evidence to suggest the importance of this emotion within this age group. Existing adult literature seems to focus primarily on how stress and negative emotion instigate change in eating behaviours. However, Study 1 here emphasises the importance of looking at positive emotion too. Although positive emotion did not initiate snacking behaviour so readily amongst the undergraduate students, positive emotion was found to lead to an increase in snacking in children. This suggests that the presence of strong emotion, either positive or negative is influential for the snacking behaviour of 8-12 year old children, and suggests that further research should continue to explore further.

Emotional eating style has been found to be influential amongst children, moderating the way positive mood affects total snack consumption. In particular, it was identified that children with strong (i.e., high) positive mood and high emotional eating style, were found to consume more snacks compared to those with low emotional eating style. It has been stated that this research highlights the importance of positive emotion, however, this interaction further emphasises the pivotal role that emotion plays in stress-eating relationships. For example, it is not simply whether or not an individual feels positive or negative, or whether they are experiencing positive or negative emotions, but if they engage in low or high emotional eating behaviours (e.g., whether or not they choose to eat in response to certain emotions). This finding provides support for using individuals' emotional eating style as a moderating variable in future research.

The use of salivary cortisol in Studies 3 and 4 has been important because it was found to be a significant moderator in the relationship between total hassles and total snacks for both children and undergraduate students. This finding replicates existing adult literature, and expands upon the paucity of current stress-eating literature in children. To our knowledge, this research is the only work currently to have shown the importance that diurnal cortisol and cortisol reactivity has with the stress-eating behaviour relationship in children. More specifically, this research identified that amongst children, the relationship between the presence of hassles and the frequency of snacking was moderated by cortisol reactivity. Children who were 'high reactors' were found to consume more snacks when they experienced a high frequency of hassles. This finding consolidates the importance of measuring cortisol in children within this stress-eating behaviour context.

In all 4 studies, new measures of either stress and/or eating behaviour were created. After viewing the literature in Chapter 2 within the systematic review and meta-analysis, it became clear that there was a lack of age-appropriate stress measures for measuring stress in children. This may have been why there was a paucity of literature identified within this review. Existing stress-eating literature in adults (see Section 1.6) appreciates the multi-dimensional nature of stress (Araiza & Lobel, 2018). This consequentially encouraged our research team to develop stress measures that used two different conceptualisations of stress (i.e., positive/negative emotion and daily hassles and uplifts). The findings from

Studies 1 and 3 showed that both positive and negative emotions and daily hassles and uplifts were related to differences in snacking responses and actual snack consumption. These findings suggest that these variables are suitable for measuring stress in children. Future research may therefore want to continue developing appropriate stress methodology using both emotion and daily hassles and uplifts when exploring the stress experiences of children.

5.10 Concluding Remarks

This research has illustrated that stress affects the snacking behaviours of both 8-12 year old children and undergraduate students. Children were found to respond more to positive emotion whereas undergraduate students responded more to negative emotion with snacking behaviours. Across more than one research study, it has been found that total hassles are predictive of the total number of snacks consumed. Both cortisol reactivity and diurnal cortisol have been found to moderate the hassle, snacking relationship in children and undergraduate students.

The findings acknowledge that stress-eating behaviours are present amongst both children and undergraduate students, and that many of the stress-eating behaviours identified are detrimental to the health of the individual. To try and reduce the harmful nature of negative stress-eating behaviours, it would be useful to explore alternative coping strategies so individuals felt better able to identify and cope with any stress experienced. Suitable coping strategies could include using stress management techniques (e.g., mindfulness) or mindful eating practices. Such strategies could be used across different aged individuals. However, for children, there is the possibility that parents/caregivers could be used to help their children identify the presence of stress experiences to become aware of any altered subsequent eating behaviours. This thesis explored the possibility that other factors (e.g., emotional and external eating styles) were moderating the stress-eating relationship in children and undergraduate students. There are however, other potential moderator variables such as gender, BMI, SES and ethnicity that could now be explored.

Overall, this thesis has identified that stress-eating behaviour relationships are present amongst children and undergraduate students. Future research should now examine these relationships further by continuing to use both subjective and objective stress measures. In addition, it would be useful to measure a wider range of eating behaviours such as main meal and fruit and vegetable consumption. Gathering larger samples of participants would assist in measuring the possibility that gender, BMI, SES and ethnicity were interacting as moderators within the stress-eating behaviour relationship. To conclude, the findings presented within this thesis confirm the importance of investigating the stress-eating relationship further in both children and undergraduate students.

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Appendices

Appendix A: Systematic review and meta-analysis: Search strategy

Keyword search strategy for the systematic review and meta-analysis presented in Chapter 2. This search strategy was used for the review presented in Chapter 2 that focused on exploring the stress-eating behaviours of children aged 8-12.

Stress measurement:	**Eating behaviour measurement:**		**Children:**
1. Stress* 2. Hyperphagi* 3. Daily hassle* 4. Daily stress* 5. Hypophagi* 6. Cortisol* 7. Saliva* adj cortisol 8. Stress reactive* 9. Worry* 10. Distress* 11. Coping 12. Perceive* stress* 13. Life event* 14. Life stress* 15. Trier social stress test 16. Initiated stress* 17. Distressing event*	18. Snack* 19. Eat* 20. Stress adj eat* 21. Eating behavio* 22. Unhealthy adj diet 23. Unhealthy adj food* 24. Unhealthy adj eat* 25. Healthy adj diet* 26. Healthy adj food* 27. Healthy adj eat* 28. Food habit* 29. Eat* behavio* 30. Main meal* 31. Overeat* 32. Undereat* 33. Food consum* 34. Vegetable* 35. Fruit* 36. Fast adj food* 37. Junk adj food* 38. Calorie*	39. Food intake 40. Kilocalorie* 41. Diet* 42. Eat* pathology 43. Diet* restrain* 44. Attitude* 45. Sugar* 46. Emotion* eat* 47. BMI 48. Body mass index 49. Adiposity 50. Fat 51. Snack* 52. Meal 53. Between-meal snack* 54. Stress-induced eat* 55. Eating habit* 56. Food consum* 57. Food intake 58. Between adj meal*	59. Healthy adolescent* 60. Healthy young adult* 61. Teenager* 62. Adolescen* 63. Young adult 64. Youth 65. Preadult 66. Child* 67. Juvenile 68. School children* 69. Minor 70. Teen 71. School* 72. Student*
Combined Terms			
1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17.	18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57 or 58.		59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72.
Notes: * = missing letter **adj** = adjective.			

Appendix A: Systematic review and meta-analysis: Search status

This ‘search status’ summarises the number of items identified within each level of the search. This search status is showing the search conducted in the Global Health database (as an example).

Global Health <1910 to 2019 Week 22>

Search history sorted by search number ascending			
	Searches	**Results**	**Type**
1	exp children/ or exp school children/	337170	Advanced
2	(healthy adolescent* or healthy young adult* or teenager* or adolescen* or young adult or youth or preadult or child* or juvenile or school children* or minor or teen or school* or student*).mp. [mp=abstract, title, original title, broad terms, heading words, identifiers, cabicodes]	548062	Advanced
3	1 or 2	548062	Advanced
4	exp stress analysis/ or exp oxidative stress/ or exp stress/ or exp work stress/	44963	Advanced
5	(((stress* or hyperphagi* or daily hassle* or daily stress* or hypophagi* or cortisol* or saliva*) adj cortisol) or stress reactive* or worry* or distress* or coping or perceive* stress* or life event* or life stress* or trier social stress test or initiated stress*).mp. [mp=abstract, title, original title, broad terms, heading words, identifiers, cabicodes]	28019	Advanced
6	4 or 5	70973	Advanced
7	exp eating/	2716	Advanced
8	((((((((((((((((((snack* or eat* or stress) adj eat*) or eating behavio* or unhealthy) adj diet) or unhealthy) adj food*) or unhealthy) adj eat*) or healthy) adj diet) or healthy) adj food*) or healthy) adj eat*) or food habit* or eat* behavio* or main meal* or overeat* or undereat* or food consum* or vegetable* or fruit* or fast) adj food*) or junk) adj food*) or calorie* or food intake or kilocalorie* or hypophagi* or hyperphagi* or diet* or eat* pathology or diet* restrain* or eat* or attitude* or sugar* or emotion* eat* or BMI or body mass index or adiposity or fat).mp. [mp=abstract, title, original title, broad terms, heading words, identifiers, cabicodes]	755063	Advanced
9	7 or 8	755063	Advanced
10	3 and 6 and 9	3164	Advanced
11	limit 10 to updaterange="cagz(20190530134440-20190606131931]"	10	Advanced

Appendix B: Study 1: Child information sheet

UNIVERSITY OF LEEDS

<u>Which snacks will you choose?</u>

Participant study information sheet

You have been invited to take part in a study that a team of researchers in the School of Psychology is carrying out.

It is important that you understand what you will be asked to do, if you and your parent/guardian decide that you would like to take part.

If you have any questions, please contact Rachael Moss (0113 343 9197, ps14rhm@leeds.ac.uk). Thank you for reading this information.

<u>Focus of this study:</u>

This study is trying to understand which snack foods children choose in different situations. Our team is looking to see if stress affects the types of foods that you choose to eat. A lot of research has found that stress changes the types of food that adults eat, however, not much research in this area has been carried out in children, so this is why we feel it is important to investigate.

<u>Taking part</u>

You have been invited to take part in this study because you are in the age group that we are focusing on, and also because your school has agreed to help us.

It is up to you and your parent/guardian to decide if you want to take part in this study. If you do decide to take part, but later decide that you want to stop participating, you will be allowed to stop at any point.

<u>What will happen if I decide to take part?</u>

The study will take place in your classroom (at your school), over two sessions, and each session will take no longer than 30 minutes to complete. We will ask you to complete two questionnaires, and will come to your school twice so that we can gather your answers.

In the first questionnaire, the researcher will read you some questions, and you will have a sheet to record your answers on. These questions will ask you to write down ONE snack food that you would most like to choose for each situation. Please listen carefully to the researcher's instructions and complete the questionnaire on your own, and without talking to any of your classmates. If you get stuck, there will be a researcher there to help you.

In the second session, we will ask you to complete the second questionnaire which will ask you to circle the response that most suits how you feel in regards to each sentence. After you have completed both of these questionnaires, you will have finished taking part in our study.

You can stop taking part in the study at any time **during the study**, however, you will not be able to ask for your questionnaire answers to be removed from our research **after the study** because all questionnaires will be completed anonymously (so we will not know who completed what questionnaire).

Keeping your details safe

This study follows rules that are set by the main body of psychology in the UK (the British Psychological Society). All the choices that you provide us with will be treated with respect at all times, and will only be looked at by people within this study research team. After you and your parents/guardians agree to help us with this study, you will be given a unique code so that the research team can use this to store the answers you give during the study (instead of using your name). All the information that link your details to your unique code will only be stored on a password protected computer.

If you have any questions please speak to your parent/guardian who may be able to help, however, if you would like to speak with one of our research team, please ask your parent/guardian to get in touch with us.

This study has been approved by the School of Psychology Research Ethics Committee, and was approved on 08-12-16, and has an ethics code of 16-0382.

Thank you.

Contact details:

Primary researcher:

Rachael Moss 0113 343 9197 ps14rhm@leeds.ac.uk

Research supervisors:

Professor Daryl O'Connor 0113 343 5727 d.b.oconnor@leeds.ac.uk

Professor Mark Conner 0113 343 5720 m.t.conner@leeds.ac.uk

Appendix B: Study 1: Child consent form

UNIVERSITY OF LEEDS

<u>Which snacks will you choose?</u>

Consent form - For participants

Thank you for being interested in taking part in our study. If you have read the participant study information sheet, and are still interested in participating, please complete the following form. Please tick one box to answer each question ('Yes' or 'No').

If you have any questions about taking part in this study, please contact the primary researcher, Rachael Moss (0113 343 9197, ps14rhm@leeds.ac.uk) or research supervisors: Professor Daryl O'Connor (0113 343 5727, d.b.oconnor@leeds.ac.uk) or Professor Mark Conner (0113 343 5720, m.t.conner@leeds.ac.uk).

	Yes	No
I have read and understood the study information sheet.		
I have been given the chance to ask questions.		
I understand that I can stop taking part in the study at any time.		
I understand what the study will involve.		
I understand that the answers I give will not be traced back to me.		
I understand that any members of this research team at the University of Leeds can look at the answers that I give.		
I understand that I can stop taking part in this study at any point, but cannot ask for my data to be removed from the study, after the study has taken place.		
I agree to take part in this study.		

Please write your name on the line below once you have finished completing this form. Thank you

______________________________ Date: ______________

This study was approved by the School of Psychology Research Ethics Committee (on 08-12-16, reference 16-0382).

Appendix B: Study 1: Parent information sheet

UNIVERSITY OF LEEDS

Which snacks will you choose?

Parent/guardian study information sheet

Your child has been invited to take part in a research study that is being conducted by a team within the School of Psychology at the University of Leeds. It is vital that you understand what your child will be asked to do should both you and your child agree that their participation is appropriate.

If you have any questions/concerns, please do not hesitate to contact the primary researcher, Rachael Moss (0113 343 9197, ps14rhm@leeds.ac.uk). We thank you for taking the time to read this information.

Aim

This study is being conducted to understand what types of snack food children choose when presented with a variety of situations. It has been found that stress and stressful situations can change the types of food that an individual eats. These findings have been found in research conducted in adults, however, not much research in this area has focused on children, so this is why we feel it is important to investigate.

Recruitment

Your child has been invited to take part because they are 9 or 10 years old, and their school has agreed to take part in this health focused research study.

It is up to both you and your child to decide whether or not your child would like to take part. The exclusion criteria are as follows:

- Children above or below the ages of 9 and 10
- If they cannot speak and read English.

However, if you do decide to allow your child to participate, your child is still able to withdraw from the study at any point during the study, but will not be able to have their data removed at any point after the study sessions because all questionnaires will be completed anonymously.

What will happen if my child takes part?

The study will take place in a classroom at your child's primary school, and will be led by the primary researcher (Rachael Moss). It is anticipated that each of the two study sessions will take no longer than 30 minutes to complete. All participants that agree to take part will complete each study session in a large group.

Before the study: if you and your child agree to take part, you will be asked to complete the food frequency questionnaire and the demographic form that is included within this study information pack. Once you have read the study materials, and signed the consent form, please complete these items if you have no questions or concerns. The food frequency questionnaire will ask you some questions regarding how often your child has eaten certain foods over the last 4 weeks. Try to be as accurate as possible and return the questionnaire along with the consent forms (x2) and the demographic form to the research team **within a week** of your child receiving the study information pack.

The study procedure: the study will involve asking participants to complete two simple questionnaires. They will be asked to sit and listen to the researcher read out some simple instructions, and the list of questions. They will need to complete the task without talking to their peers. The first questionnaire will consist of 20 questions, and will ask participants to choose one snack food, as an answer for each question. The questions will ask participants which snack foods they would like to choose in a range of different situations. (For example, if you were feeling happy, which snack would you choose?). Participants will be given a food image sheet that will show an array of snack food items, and will be asked to answer the questions, using either an item on this image sheet, or a snack that they have thought of themselves.

After completion, each child will be given a second questionnaire that will ask them the degree to which they agree with certain food behaviour questions (for example, can you resist eating delicious foods?). This questionnaire will be the last step in the study, and after completion all students will be able to return to their lessons as usual. The study will be presented to the children over two separate sessions. One questionnaire will be given to participants in the first session, with the other presented in the second, it is not anticipated that either of the sessions will take more than 30 minutes to complete.

Consent

Written consent will be obtained from you and your child, prior to study commencement. Any questions/concerns can be asked at any point and will be addressed as soon as possible.

Confidentiality

This study follows the guidelines that are set out by the British Psychological Society. All the data that your child provides will be treated in the strictest of confidence at all times, and will only be used for the purposes of this research. When the research team receive your completed demographics and consent forms (x2 – parent/guardian and child) along with your completed food frequency questionnaire, this personal information will be stored on a password protected computer.

The results from the study will be used towards the primary researcher's PhD research. The data may therefore be published, but participants will not be identifiable from details in any reports, presentations or scientific publications. Data will be stored for up to 5 years, to allow time to complete all the research involved in this study, and to allow for any potential publication.

Who has reviewed this study?

All research is looked at by an independent group of people called a Research Ethics Committee, to protect your interests. This study has been approved by The School of Psychology Research Ethics Committee: Reference 16-0382 on (08-12-16).

If you have any questions or require any further information, please do not hesitate to contact the primary researcher, or one of my academic supervisors using the contact details below.

We thank you for taking the time to read this information.

PLEASE RETURN: the two consent forms, the demographic form and the food frequency questionnaire by placing them in the envelope provided. Please bring let your child bring the envelope back into school with them no later than the _______________ in order to allow your child to participate.

Primary researcher = Rachael Moss 0113 343 9197 ps14rhm@leeds.ac.uk

Research supervisors =

Professor Daryl O'Connor 0113 343 5727 d.b.oconnor@leeds.ac.uk
Professor Mark Conner 0113 343 5720 m.t.conner@leeds.ac.uk

Appendix B: Study 1: Parent consent form

UNIVERSITY OF LEEDS

Which snacks will you choose?

Informed consent form

For parents/guardians

Thank you for taking an interest in this 'Stress, eating and dietary choice' study. If you have read the study information sheet, and are willing to allow your child to take part in this research, please continue to read and complete the following statements. Please tick the appropriate box that corresponds with your answer to each statement: 'Yes', 'No' or 'N/A' (Non-applicable). If you have any questions or concerns please do not hesitate to contact the primary researcher, Rachael Moss (0113 343 9197, ps14rhm@leeds.ac.uk) or research supervisors: Professor Daryl O'Connor (0113 343 5727, d.b.oconnor@leeds.ac.uk) or Professor Mark Conner (0113 343 5720, m.t.conner@leeds.ac.uk).

	Yes	No
I have read and understood the parental study information sheet, whic outlines the study.		
I have been given time, and the means to contact the researcher to ask any questions that I may have.		
If I asked questions, I have been given satisfactory answers to all.		
I understand that I have the right to withdraw my child and their data from this study at any time during the study, however, data will not be able to be removed at any point after the study sessions.		
I understand that I will need to complete and return the food Frequency questionnaire included in this study information pack before my child can take part.		
I am aware that both my child and I will be fully debriefed about the nature of the study upon completion.		

	Yes	No
I understand that all data will be anonymised, except the demographic questionnaire that will contain personal details (e.g., age/ethnicity).		
I understand that all data will be kept confidential throughout the study and thereafter.		
I understand that the study data may be viewed by all members of the research team (at the University of Leeds). I give my consent to these individuals accessing my data.		
I give consent for my child to participate in this study.		

Parent/guardian signature: ______________________________ Date: ____________

Printed name (BLOCK CAPITALS): ____

Thank you

This study was approved by the School of Psychology Research Ethics Committee (on 08-12-16, reference 16-0382).

Appendix B: Study 1: UG information sheet

UNIVERSITY OF LEEDS

Study Title: Stress and food snacking behaviour

Which snacks will you choose?

Undergraduate student information sheet

You have been invited to take part in a research study that is being conducted by a team within the School of Psychology at the University of Leeds. It is vital that you understand what you will be asked to do if you agree to take part.

If you have any questions/concerns, please do not hesitate to contact the primary researcher, Rachael Moss (0113 343 9197, ps14rhm@leeds.ac.uk). We thank you for taking the time to read this information.

Aim

This study is being conducted to understand what types of snack food children choose when presented with a variety of situations. It has been found that stress and stressful situations can change the types of food that an individual eats. These findings have been found in research conducted in adults, however, not much research in this area has focused on children, so this is why we feel it is important to investigate. Although primary school children are our primary focus within this study, we want to obtain the snack food choices of undergraduate students in order to be able to compare what eating patterns different age groups display.

Recruitment

You have been invited to take part because you are an undergraduate student here within the department.

It is up to you to decide whether or not you would like to take part. The exclusion criteria are as follows:

- Anyone who is not an undergraduate student.
- If they cannot speak and read English.

However, if you do decide to participate, you are still able to withdraw from the study at any point during the study, but will not be able to have your data removed at any point after the study session because all questionnaires will be completed anonymously.

What will happen if you take part?

The study will take place now in this computer laboratory/seminar classroom (either within the department or within a building on campus (here at the University of Leeds), and will be led by the primary researcher (Rachael Moss). It is anticipated that the study session will take no longer than 30 minutes to complete.

Before the study: if you agree to take part, you will be asked to complete the food frequency questionnaire and the demographic form that is included within this study information pack. Once you have read the study materials, and signed the consent form, please complete these items if you have no questions or concerns. The food frequency questionnaire will ask you some questions regarding how often you have eaten certain foods over the last 4 weeks. Try to be as accurate as possible and return the questionnaire along with the consent form and the demographic form to the research team **now during this session.**

The study procedure: the study will involve asking participants to complete two simple questionnaires. They will be asked to sit and listen to the researcher read out some simple instructions. They will need to complete the task without talking to their peers. The first questionnaire will consist of 20 questions, and will ask participants to choose one snack food, as an answer for each question. The questions will ask participants which snack foods they would like to choose in a range of different situations. (For example, if you were feeling happy, which snack would you choose?). After completion, each child will be given a second questionnaire that will ask them the degree to which they agree with certain food behaviour questions (for example, can you resist eating delicious foods?). This questionnaire will be the last step in the study, and after completion all students will be free to leave.

Consent

Written consent will be obtained from you, prior to study commencement. Any questions/concerns can be asked at any point and will be addressed now.

Confidentiality

This study follows the guidelines that are set out by the British Psychological Society. All the data that you provide will be treated in the strictest of confidence at all times, and will only be used for the purposes of this research. When the research team receive your completed demographics and consent form along with your completed food frequency questionnaire, this personal information will be stored on a password protected computer.

The results from the study will be used towards the primary researcher's PhD research. The data may therefore be published, but participants will not be identifiable from details in any reports, presentations or scientific publications. Data will be stored for up to 5 years, to allow time to complete all the research involved in this study, and to allow for any potential publication.

Who has reviewed this study?

All research is looked at by an independent group of people called a Research Ethics Committee, to protect your interests. This study has been approved by The School of Psychology Research Ethics Committee: Reference 17-0093 on (03-03-17).

If you have any questions or require any further information, please do not hesitate to contact the primary researcher, or one of my academic supervisors using the contact details below.

We thank you for taking the time to read this information.

Primary researcher:-

Rachael Moss 0113 343 9197 ps14rhm@leeds.ac.uk

Research supervisors:-

Professor Daryl O'Connor	0113 343 5727	d.b.oconnor@leeds.ac.uk
Professor Mark Conner	0113 343 5720	m.t.conner@leeds.ac.uk

Appendix B: Study 1: UG consent form

UNIVERSITY OF LEEDS

Study Title: Stress and food snacking behaviour

Which snacks will you choose?

Consent form - For participants

Thank you for being interested in taking part in our study. If you have read the participant study information sheet, and are still interested in participating, please complete the following form. Please tick one box to answer each question ('Yes' or 'No'). If you have any questions about taking part in this study, please contact the primary researcher, Rachael Moss (0113 343 9197, ps14rhm@leeds.ac.uk) or research supervisors: Professor Daryl O'Connor (0113 343 5727, d.b.oconnor@leeds.ac.uk) or Professor Mark Conner (0113 343 5720, m.t.conner@leeds.ac.uk).

	Yes	No
I have read and understood the study information sheet.		
I have been given the chance to ask questions.		
I understand that I can stop taking part in the study at any time.		
I understand what the study will involve.		
I understand that the answers I give will not be traced back to me.		
I understand that any members of this research team at the University of Leeds can look at the answers that I give.		
I understand that I can stop taking part in this study at any point, but cannot ask for my data to be removed from the study, after the study has taken place.		
I agree to take part in this study.		

Please write your name on the line below once you have finished completing this form. Thankyou.

____________________________________ Date: ____________________

Appendix B: Study 1: Demographics questionnaire

Demographic questionnaire (parent/caregiver to complete)

UNIVERSITY OF LEEDS

Which snacks will you choose?

For parent/caregiver to complete

Parent/caregiver name: ____

Child's name: _______________________________ Date of birth: __________

Questions about your child (please answer by circling yes or no to each question):

(The answers you give to the questions below will help us to understand the background of our participants).

Does your child receive free school meals? YES / NO

Does your child have any anxiety concerns? YES / NO
(If yes, please specify on the line below)

____

Would you say that your child is a 'picky' eater? (i.e. do they display any certain problems around food or when eating?) YES / NO
(If yes, please explain briefly on the lines below)

____

____

Have you noticed your child eating certain foods when they are stressed/worried?
(If yes, please explain briefly on the lines below) YES / NO

____

____

What ethnicity is your child? (Please tick the most appropriate box below).

White:

English/Welsh/Scottish/Northern Irish/British ☐

Irish ☐

Gypsy or Irish Traveller ☐

Any other White background, please write on the line below:

____

Mixed/multiple ethnic groups:

White and Black Caribbean ☐

White and Black African ☐

White and Asian ☐

Any other Mixed/multiple ethnic background, please write on the line below:

____

Asian/Asian British:

Indian ☐

Pakistani ☐

Bangladeshi ☐

Chinese ☐

Any other Asian background, please write on the line below:

____

Black/African/Caribbean/Black British:

African ☐

Caribbean ☐

Any other Black/African/Caribbean background, please write on the line below:

____

Other ethnic group:

Arab ☐

Any other ethnic group, please write on the line below:

____

Questions about yourself (please write your answers on the lines provided below):

Your ethnicity (please state, using one of the above categories): ____________________

Contact details:

Primary researcher: Rachael Moss 0113 343 9197
ps14rhm@leeds.ac.uk

Research supervisors:

Professor Daryl O'Connor	0113 343 5727	d.b.oconnor@leeds.ac.uk
Professor Mark Conner	0113 343 5720	m.t.conner@leeds.ac.uk

This study was approved by the School of Psychology Research Ethics Committee (on 03-03-17, reference 17-0093).

Appendix B: Study 1: DEBQ

Please answer the following questions. Read each question and CIRCLE the appropriate number. *(Note: emotional eating style questions are in red text and external eating style questions are in black text. However, such detail was omitted from participants).*

	Never	Rarely	Sometimes	Often	Very often
1. If food tastes good to you, do you eat more than you usually do?	1	2	3	4	5
2. Do you find you want to eat when you have nothing to do?	1	2	3	4	5
3. Do you find you want to eat when you are fed up?	1	2	3	4	5
4. If food smells and looks good, do you eat more than you usually do?	1	2	3	4	5
5. Do you want to eat when you are feeling lonely?	1	2	3	4	5
6. If you see or smell something delicious, do you want to eat it?	1	2	3	4	5
7. Do you want to eat when somebody disappoints you?	1	2	3	4	5
8. If you have something delicious to eat, do you eat it straight away?	1	2	3	4	5
9. Do you want to eat when you are cross?	1	2	3	4	5
10. Do you want to eat when you are expecting something to happen?	1	2	3	4	5
11. If you walk past the baker do you see to buy something delicious?	1	2	3	4	5
12. Do you want to eat when you are anxious, worried or tense?	1	2	3	4	5

	Never	Rarely	Sometimes	Often	Very often
13. If you walk past a café, do you want to buy something delicious?	1	2	3	4	5
14. Do you want to eat when things are going against you or when things have gone wrong?	1	2	3	4	5
15. If you see others eating, do you also want to eat?	1	2	3	4	5
16. Do you want to eat when you are frightened?	1	2	3	4	5
17. Do you want to eat when you are disappointed?	1	2	3	4	5
18. Can you resist eating delicious food?*	1	2	3	4	5
19. Do you eat more than usual when you see others eating?	1	2	3	4	5
20. Do you want to eat when you are upset?	1	2	3	4	5
21. When you see someone preparing a meal, does it make you want to eat something?	1	2	3	4	5
22. Do you want to eat when you are bored or restless?	1	2	3	4	5

Note. * Question 18 was reverse scored after participant completion.

Appendix B: Study 1: FFQ

Food Frequency Questionnaire- Please tick the box that relates to how often your child eats each of the following foods. Try to think over the past 4 weeks to help you answer.

Food	**Never/less than once a week**	**1-3 times a week**	**4-6 times a week**	**1 time per day**	**2 times per day**	**3 times per day**	**4 or more times per day**	**I have no idea**
Vegetable, cooked								
Potatoes, fried								
Vegetable, raw								
Fruit, fresh, without sugar								
Fruit, fresh, sugar added								
Water								
Fruit juice								
Soft drink, sugar added								
Soft drink, diet								
Breakfast cereals, sugar added								
Breakfast cereals, no sugar								
Milk, no sugar								
Milk, sugar added								
Yoghurt, no sugar								
Yoghurt, sugar added								
Fish, not fried								
Fish, fried								

Cold cuts, sausage								
Meat, not fried								
Meat, fried								
Egg, fried								
Egg, boiled								
Mayonnaise								
Meat replacement products								
Cheese								
Honey, jam								
Chocolate, nut-based spread								
Butter, margarine on bread								
Bread, white								
Bread, wholemeal								
Pasta, rice								
Cereals, milled								
Pizza, main dish								
Hamburger, hot dog, falafel								
Nuts, seeds, dried fruit								
Salty snacks								
Savoury pastries								
Chocolate								
Candy, non-chocolate								
Cake, pudding, cookies								
Ice cream								

Appendix B: Study 1: Study questionnaire

Study answer sheet

Please listen to each question carefully and write your answers on this sheet.

For each question you will be asked if you would like to choose a snack food to eat. Please tick 'yes' or 'no' depending on whether you feel you would eat a snack in each situation.

If you **would like** to eat a snack after hearing a certain question, please write the snack you would choose on the lines provided. You can look at the food picture sheets to help you.

1. If you were feeling happy, would you eat a snack?

   Yes ☐ Which snack would you choose?

   No ☐ ____________________________

2. If you were feeling bored, would you eat a snack?

   Yes ☐ Which snack would you choose?

   No ☐ ____________________________

3. If you were playing with your friends, would you choose to eat a snack?

   Yes ☐ Which snack would you choose?

   No ☐ ____________________________

4. If someone was being nice to you, would you eat a snack?

   Yes ☐ Which snack would you choose?

   No ☐ ____________________________

5. If you were feeling excited, would you eat a snack?

   Yes ☐ Which snack would you choose?

   No ☐ ____________________________

6. If you had just fallen out with your friends, would you eat a snack?

Yes ☐ Which snack would you choose?

No ☐ ____________________________

7. When you are at home over the weekend, would you usually eat a snack?

Yes ☐ Which snack would you choose?

No ☐ ____________________________

8. If you were feeling scared, would you eat a snack?

Yes ☐ Which snack would you choose?

No ☐ ____________________________

9. If you were feeling cheerful, would you eat a snack?

Yes ☐ Which snack would you choose?

No ☐ ____________________________

10. If you were feeling sad, would you eat a snack?

Yes ☐ Which snack would you choose?

No ☐ ____________________________

11. When you get home after being at school, would you eat a snack?

Yes ☐ Which snack would you choose?

No ☐ ____________________________

12. If you were feeling upset, would you eat a snack?

Yes ☐ Which snack would you choose?

No ☐ ____________________________

13. If you were feeling energetic, would you eat a snack?

Yes ☐ Which snack would you choose?

No ☐ ____________________________

14. If you were feeling lonely, would you eat a snack?

Yes ☐ Which snack would you choose?

No ☐ ____________________________

15. Do you normally choose to eat snacks?

Yes ☐ Which snack would you choose?

No ☐ ____________________________

16. When you are feeling hungry, would you choose to eat a snack?

Yes ☐ Which snack would you choose?

No ☐ ____________________________

17. If you were feeling nervous, would you eat a snack?

Yes ☐ Which snack would you choose?

No ☐ ____________________________

18. Sitting here in your classroom, would you eat a snack?

Yes ☐ Which snack would you choose?

No ☐ ____________________________

19. If you were feeling lively, would you eat a snack?

Yes ☐ Which snack would you choose?

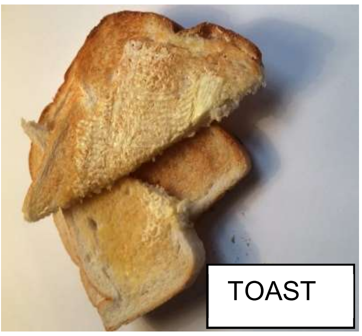
No ☐ ____________________________

20. If you were feeling relaxed, would you eat a snack?

Yes ☐ Which snack would you choose?

No ☐ ____________________________

Appendix B: Study 1: Food picture sheet



TOAST

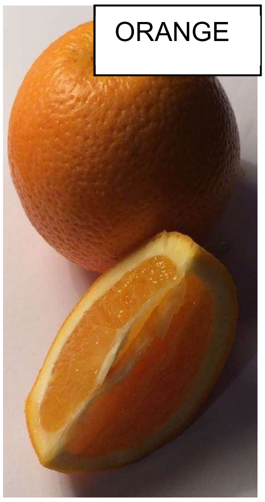
MILK

YOGHURT & HONEY

CRISPS

POPCORN

MINTS

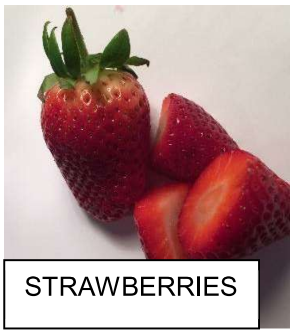


ORANGE

PEPERAMI

NUTS

SALSA



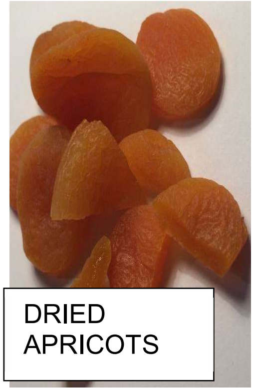
STRAWBERRIES

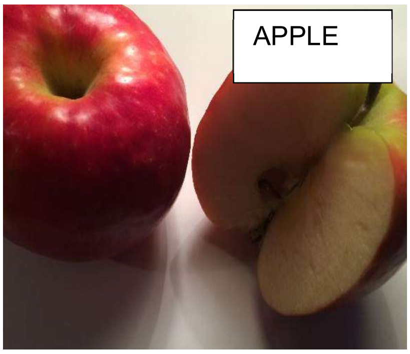
RAISINS


HOUMOUS


SWEETS

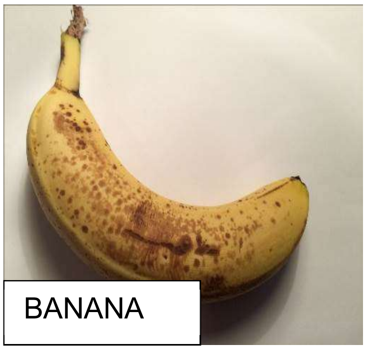
CHEESESTRING


DRIED APRICOTS


APPLE


CHEESE & BREADSTICKS

CHOCOLATE


BANANA


CUCUMBER STICKS

FIZZY DRINK


BISCUITS


CAKE

Appendix B: Study 1: Child debrief sheet

UNIVERSITY OF LEEDS

Which snacks will you choose?

End of study information sheet for participants

Thank you for taking part in our study. By completing the questionnaire, you have helped us to understand what types of snack foods you like to consume. Based on previous research, we think that feeling stressed and or upset may influence the type and or the amount of food that you consume when you choose to eat a snack. We are examining this area of stress and eating, and this study is helping us to carry out research in this particular area.

The food choices you chose in the questionnaire will help us begin to get an understanding of the way in which stressful situations affect eating patterns.

We thank you for participating. If you have any questions, please contact Rachael Moss (0113 343 9197, ps14rhm@leeds.ac.uk).

Research supervisors:

Professor Daryl O'Connor	0113 343 5727	d.b.oconnor@leeds.ac.uk
Professor Mark Conner	0113 343 5720	m.t.conner@leeds.ac.uk

This study has been approved by the School of Psychology Research Ethics Committee on 08-12-16), with a reference of 16-0382.

Appendix B: Study 1: Parent debrief sheet

UNIVERSITY OF LEEDS

Which snacks will you choose?

Debrief sheet for parents/guardians

We thank you for allowing your child to act as a participant in our research. This study was conducted to explore the snack choices of children (aged 9-10) in a variety of different scenarios.

The main theme of this research is to investigate the way in which stress influences eating choices in a wide variety of children. This study is the first study in this area conducted by this particular research group, and it will help us to design further studies to explore this area further.

The aim of this particular study is to investigate how a range of 'stress' eliciting emotions (i.e. being upset) affects children's choice of food snack. We anticipate that these 'stress' inducing emotions will cause a difference in the amount of healthy food snacks chosen. For example, if we asked children to imagine that they were feeling upset, we believe that the emotion within this question could cause a higher number of unhealthy snacks to be chosen. By allowing your child to participate, you have helped us begin to explore this highly relevant and crucial area within stress and health research.

We thank you for your time. If you have any further questions, please contact Rachael Moss (0113 343 9197, ps14rhm@leeds.ac.uk).

Research supervisors:

Professor Daryl O'Connor 0113 343 5727 d.b.oconnor@leeds.ac.uk

Professor Mark Conner 0113 343 5720 m.t.conner@leeds.ac.uk

This study has been approved by the School of Psychology Research Ethics Committee

on 08-12-16), with a reference of 16-0382.

Appendix C: Study 2: Child information sheet

UNIVERSITY OF LEEDS

Emotions and snacking behaviour

Participant information sheet for children

You have been invited to take part in a study that a team of researchers within the School of Psychology is carrying out. Please read this information sheet with your parent/guardian to help you decide if you want to take part in the study.

If you have any questions, please ask the researcher, Rachael in person or by email (ps14rhm@leeds.ac.uk).

Thank you for reading this information.

Focus of this study:

This study is trying to explore how our emotions are linked to our eating behaviours, and this study is focusing on snacking behaviours. Our team is investigating whether stress affects the types of foods you consume. A lot of research has found that stress in adults can lead to changes in their eating behaviours, but much less research has explored how stress affects the eating of both children and young adults. Therefore, we feel it is important to conduct this research.

Taking part

You have been invited to take part in this study because you are of an appropriate age to take part. It is up to you and your parent/guardian to decide if you want to take part in this study. If you do decide to take part, but you later decide that you want to stop taking part, you can do stop taking part, at any time during the study (and you do not have to give a reason).

However, you will not be able to remove your questionnaire answers from our study after you have handed your questionnaires in to the researcher (this is because you do not write your name on the questionnaires so once we have collected them in we will not know what questionnaire belongs to what participant).

We hope that you decide to take part because it will help give us more information about children's eating behaviours and we feel it will be interesting for you to complete, because it will give you more information about your eating behaviours and what sorts of snacks you are consuming.

What will happen if I decide to take part?

The study will take place during one session at your school. The session will last no longer than 30 minutes. During this session, we ask that you complete 2 questionnaires. One of these questionnaires will ask you how often you would like to engage in eating behaviours when you are in a given situation, and the other questionnaire will ask you about your snacking/eating behaviours over the past day.

Although it may be difficult for you to remember what you ate yesterday, please try your best. Once you have finished all 2 questionnaires, you will have finished taking part in this study.

You can stop taking part in this study at any time **during the study**, however, you will have up to one week after the study has finished to ask for your data to be removed. After this time, you will no longer be able to remove your data from the study.

Keeping your details safe

This study follows guidelines set by the main body of psychology in the UK (the British Psychological Society). All choices/responses given by you will be treated with respect at all times, and will only be looked at by people within this study research team. After you have signed the consent form to take part, you will be assigned a participant number, after which, all your responses will be referred to using this number (as opposed to any personal details). All the information that you provide us with in the demographics questionnaire will be stored on a password protected computer.

If you have any questions, please get in touch with one of the research team (details below).

This study has been approved by the School of Psychology Research Ethics Committee, and was approved on 07-02-2018, reference: PSC-273.

<u>Contact details:</u>

Primary researcher: Rachael Moss ps14rhm@leeds.ac.uk

Research supervisors:

Professor Daryl O'Connor	0113 343 5727	d.b.oconnor@leeds.ac.uk
Professor Mark Conner	0113 343 5720	m.t.conner@leeds.ac.uk

Appendix C: Study 2: Child consent form

UNIVERSITY OF LEEDS

Study Title: Emotions and snacking behaviour

Consent form for child participants

Thank you for your interest in this study. If you have read the participant study information sheet, and are still interested in participating, please complete the following form. Please tick one box to answer each question ('Yes' or 'No').

If you have any questions please contact the researcher, Rachael Moss (ps14rhm@leeds.ac.uk) or research supervisors: Professor Daryl O'Connor (0113 343 5727, d.b.oconnor@leeds.ac.uk) or Professor Mark Conner (0113 343 5720, m.t.conner@leeds.ac.uk).

	Yes	No
I have read and understood the study information sheet.		
I have been given the chance to ask questions.		
I understand that if there are any questions I do not want to answer, I do not have to answer them.		
I understand what the study will involve.		
I understand that I have chosen to take part in this study.		
I understand that none of the questionnaire answers will be traced back to me.		
I understand that the findings of this study may be published in a scientific journal or put online on a scientific website, but if this happens, no participant details will be used.		
I understand that any members of this research team at the University of Leeds can look at the answers given by participants.		
I understand that I can stop taking part at any time during the study session, but cannot stop taking part after the questionnaires have been handed in to the researcher.		

Please sign below. Thank you.

Sign: ______________________ Date: ______________

Please print your name here:

____

This study was approved by the School of Psychology Research Ethics Committee (on 07-02-2018, reference PSC-273).

Appendix C: Study 2: Parent information sheet

UNIVERSITY OF LEEDS

Emotions and snacking behaviour

Participant information sheet for parents/caregivers

Your child has been invited to take part in a study that a team of researchers within the School of Psychology is carrying out. Please read this information sheet to help you decide if you want your child to take part in the study. If you have any questions, please ask the researcher, Rachael (ps14rhm@leeds.ac.uk).

Thank you for reading this information.

Focus of this study:

This study is trying to explore how our emotions are linked to our eating behaviours, and, here in this study, the focus is on snacking behaviours. Our team is investigating whether stress affects the types of foods you consume. A lot of research has already identified that stress in adults can lead to changes in their eating behaviours, but much less research has explored how stress affects the eating of both children and young adults. This is why we feel it is important to conduct this research.

Taking part

Your child has been invited to take part in this study because they are of an appropriate age to take part. It is up to you to decide if you want your child to take part in this study. You and your child will be asked to complete a consent form if you want your child to take part in this study.

Your child will be able to stop taking part in the study during the study session (and they do not have to give a reason why they want to withdraw), however, after they have completed the questionnaires and handed them in to the researcher, they will be unable to ask for their data to be removed (this is because all questionnaires will be completed anonymously, and will ask for no identifiable information from your child).

It is possible that your child may find some of the questions sensitive because the questions ask your child about their eating behaviours, however, if there are any questions that your child does not want to answer, they can leave these blank.

We hope that your child decides to take part in this study. We believe that your child will find it interesting to take part because it will give them more information about their eating behaviours (including what sorts of snacks they choose to consume). It is also important because it will provide us with information to understand the factors and situations that trigger eating behaviours.

What will happen if your child decides to take part?

The study will take place during one session at your child's school. The session will last no longer than 30 minutes. During this session, we ask your child to complete 2 questionnaires. During this session, we ask that you complete 2 questionnaires. One of these questionnaires will ask you how often you would like to engage in eating behaviours when you are in a given situation, and the other questionnaire will ask you about your snacking/eating behaviours over the past day.

Although it may be difficult for you to remember what you ate yesterday, please try your best. Once you have finished all 2 questionnaires, you will have finished taking part in this study.

We appreciate that it may be difficult for your child to remember their eating behaviours that they had yesterday, however, all we ask is that your child try their best to remember and be as accurate as possible. Once your child has finished the questionnaires, they will have finished taking part in this study.

Your child can stop taking part in this study at any time **during the study**, however, your child will not be able to remove their questionnaire data any time after they have handed the questionnaires in to the researcher. This is because the questionnaires will be completed anonymously (i.e. with no identifiable information on them, so they will not be able to be identified and removed after they have been handed in).

Keeping your details safe

This study follows guidelines set by the British Psychological Society. All choices/responses given by you will be treated with respect at all times, and will only be looked at by people within this study research team. After you have signed the consent form to take part, you will be assigned a participant number, after which, all your responses will be referred to using this number (as opposed to any personal details). All the information that you provide us with in the demographics questionnaire will be stored on a password protected computer.

Destroying study data

We will destroy your signed consent forms, and questionnaire data after data analysis (up to no more than 5 years after you take part in the study). The data will be destroyed using appropriate confidential methods using university procedures.

Publishing the study data

It is possible, that the research team may publish the findings that we find in this study. If they decide to do this, they may do so, but it is important to note that no personal/identifiable information will be used in the scientific paper that we write, should we decide to try and publish these study findings.

If you have any questions, please get in touch with one of the research team (details below).

This study has been approved by the School of Psychology Research Ethics Committee, and was approved on 07-02-2018, reference: PSC-273.

Contact details:

Primary researcher: Rachael Moss ps14rhm@leeds.ac.uk

Research supervisors:

Professor Daryl O'Connor	0113 343 5727	d.b.oconnor@leeds.ac.uk
Professor Mark Conner	0113 343 5720	m.t.conner@leeds.ac.uk

Appendix C: Study 2: Parent consent form

UNIVERSITY OF LEEDS

<u>Study Title: Emotions and snacking behaviour</u>

Consent form for parents/caregivers

Thank you for your interest in this study. If you have read the participant study information sheet, and would still like your child to take part, please complete the following form. Please tick one box to answer each question (‘Yes’, ‘No’ or ‘N/A’ (Non-applicable)).

If you have any questions, please contact the primary researcher, Rachael Moss (ps14rhm@leeds.ac.uk) or research supervisors: Professor Daryl O’Connor (0113 343 5727, d.b.oconnor@leeds.ac.uk) or Professor Mark Conner (0113 343 5720, m.t.conner@leeds.ac.uk).

	Yes	**No**
I have read and understood the study information sheet.		
I have been given the chance to ask questions.		
I understand that my child may find some of the questions uncomfortable to answer, but they may leave these or any other questions which they do not want to answer.		
I understand what the study will involve.		
I understand that none of the questionnaire answers will be able to be traced back to my child.		
I understand that my child has voluntarily chosen to take part in this study.		
I understand that the findings of this study may be published in a scientific journal or be put on a scientific website but no individual participant details will be used.		

	Yes	No
I understand that any members of this research team at the University of Leeds will look at the questionnaire data.		
I understand that my child can withdraw from the study at any time during the study, but once they hand their questionnaires in, it is not possible to withdraw at this stage.		

I agree to let my child take part.

Please sign below. Thank you.

Sign: ______________________ Date: ______________

Please print your name here:

____

This study was approved by the School of Psychology Research Ethics Committee (on 07-02-2018, reference PSC-273).

Appendix C: Study 2: UG information sheet

UNIVERSITY OF LEEDS

Emotions and snacking behaviour

Participant information sheet for undergraduate students/young people

You have been invited to take part in a study that a team of researchers within the School of Psychology is carrying out. Please read this information sheet to help you decide if you want to take part in the study. If you have any questions, please ask the researcher, Rachael in person or by email (ps14rhm@leeds.ac.uk).

Thank you for reading this information.

Focus of this study:

This study is trying to explore how our emotions are linked to our eating behaviours, and, here in this study, the focus is on snacking behaviours. Our team is investigating whether stress affects the types of foods you consume. A lot of research has already identified that stress in adults can lead to changes in their eating behaviours, but much less research has explored how stress affects the eating of both children and young adults. This is why we feel it is important to conduct this research.

Taking part

You have been invited to take part in this study because you are of an appropriate age to take part. It is up to you to decide if you want to take part in this study. If you do decide to take part, but you later decide that you want to stop taking part, you can do so, at any time during the study (and you do not have to give a reason). However, please note that you will not be able to withdraw your questionnaire data after you have handed your questionnaires in to the researcher.

It is possible that you may find some of the questions uncomfortable to answer (however in our experience, this is unlikely), because they are asking you about your eating behaviours and your day to day experiences. If this happens, please note that you can leave any questions blank that you do not wish to answer.

We hope that you decide you want to take part, if you do, you will be helping us understand the factors and situations that trigger eating behaviours. We also feel that it will be interesting for you to complete, because it will give you more information about your eating behaviours and what sorts of snacks you are consuming.

What will happen if I decide to take part?

The study will take place during one session at the School of Psychology/your school (I will delete as appropriate). The session will last no longer than 30 minutes. During this session, we ask that you complete 2 questionnaires. One of these questionnaires will ask you how often you would like to engage in eating behaviours when you are in a given situation, and the other questionnaire will ask you about your snacking/eating behaviours that you engaged in yesterday.

We appreciate that it may be difficult for you to remember yesterday's eating behaviours, however, please try your best to remember and be as accurate as possible. Once you have finished all 2 questionnaires, you will have finished taking part in this study.

You can stop taking part in this study at any time **during the study**, however, you will not be able to remove your questionnaire data from the study any time after you have handed the questionnaires in to the researcher. This is because the questionnaires will be completed anonymously (i.e. with no identifiable information on them, so they will not be able to be identified and removed after they have been handed in).

Keeping your details safe

This study follows guidelines set by the British Psychological Society. All choices/responses given by you will be treated with respect at all times, and will only be looked at by people within this study research team. After you have signed the consent form to take part, you will be assigned a participant number, after which, all your responses will be referred to using this number (as opposed to any personal details). All the information that you provide us with in the demographics questionnaire will be stored on a password protected computer.

Destroying study data

We will destroy your signed consent forms, and questionnaire data after data analysis (up to no more than 5 years after you take part in the study). The data will be destroyed using appropriate confidential methods using university procedures.

Publishing the study data

It is possible, that the research team may publish the findings that we find in this study. If they decide to do this, they may do so, but it is important to note that no personal/identifiable information will be used in the scientific paper that we write, should we decide to try and publish these study findings.

If you have any questions, please get in touch with one of the research team (details below).

This study has been approved by the School of Psychology Research Ethics Committee, and was approved on 07-02-2018, reference: PSC-273.

Contact details:

Primary researcher: Rachael Moss ps14rhm@leeds.ac.uk

Research supervisors:

Professor Daryl O'Connor 0113 343 5727 d.b.oconnor@leeds.ac.uk

Professor Mark Conner 0113 343 5720 m.t.conner@leeds.ac.uk

Appendix C: Study 2: UG consent form

UNIVERSITY OF LEEDS

Study Title: Emotions and snacking behaviour

Consent form for undergraduate students

Thank you for your interest in this study. If you have read the participant study information sheet, and would still like to take part, please complete the following form. Please tick one box to answer each question (‘Yes’, ‘No’ or ‘N/A’ (Non-applicable)).

If you have any questions, please contact the primary researcher, Rachael Moss (ps14rhm@leeds.ac.uk) or research supervisors: Professor Daryl O’Connor (0113 343 5727, d.b.oconnor@leeds.ac.uk) or Professor Mark Conner (0113 343 5720, m.t.conner@leeds.ac.uk).

	Yes	No
I have read and understood the study information sheet.		
I have been given the chance to ask questions.		
I understand that I may find some of the questions uncomfortable to answer, but I can leave these or any other questions which I do not want to answer.		
I understand what the study will involve.		
I understand that I have voluntarily chosen to take part.		
I understand that none of the questionnaire answers will be able to be traced back to me.		
I understand that the findings of this study may be published in a scientific journal or be put on a scientific website but no individual participant details will be used.		
I understand that any members of this research team at the University of Leeds will look at the questionnaire data.		

	Yes	No
I understand that I can withdraw from the study at any time during the study, but once I hand my questionnaires in, it is not possible to withdraw from the study.		
I agree to take part.		

Please sign below. Thank you.

Sign: ______________________ Date: ______________

Please print your name here:

____

This study was approved by the School of Psychology Research Ethics Committee (on 07-02-2018, reference PSC-273).

Appendix C: Study 2: Study questionnaire

How old are you? ______________________ What is your gender? Male □ Female □

	Never	Seldom	Sometimes	Often	Very often
1. Do you find you want to eat when you are irritated?					
2. Do you want to eat when you are calm and relaxed?					
3. Do you find you want to eat when you are busy?					
4. Do you find you want to eat when you are pleased?					
5. Do you want to eat when you are cross?					
6. Do you want to eat when something good happens?					
7. Do you want to eat when things are going against you or when things have gone wrong?					
8. Do you want to eat when you are with friends?					
9. Do you want to eat when you are happy?					
10. Do you want to eat when you are frightened?					
11. Do you want to eat when you are disappointed?					
12. Do you find you want to eat when you are fed up?					
13. Do you want to eat when you are feeling calm?					
14. Do you find you want to eat when you have nothing to do?					
15. Do you want to eat when someone pleases you?					
16. Do you want to eat when somebody disappoints you?					
17. Do you want to eat when you are anxious, worried or tense?					
18. Do you want to eat when you are feeling confident?					
19. Do you want to eat when you are feeling lonely?					

	Never	Seldom	Sometimes	Often	Very often
20. Do you want to eat when you are feeling full of energy?					
21. Do you want to eat when you are expecting something to happen?					
22. Do you want to eat when you are upset?					
23. Do you want to eat when things are going well or when you are having a good day?					
24. Do you want to eat when you are bored or restless?					

Positive and negative experiences

Please complete the following questions about any positive and negative events, thoughts or situations that you have experienced. You can report up to 3 positive and 3 negative experiences at each time point.

Please describe each positive and negative event, thought or situation that you had, tell us the time of day you had it, and how **positive or negative** it was.

Please answer these questions and think about: yesterday.

Negative experiences are:

Events, thoughts or situations which can make you feel down, annoyed or worried.

For example: finding out you have a test at the last minute or missing your bus.

Positive experiences are:

Events, thoughts, or situations which can make you feel good, happy or excited.

For example: going to a friend's house or watching a movie.

Time of day: please tell us what time of day you had the positive/negative experience, as well as what time of day you ate a snack/s.

For example, in the **morning** (when you wake up – 12pm lunchtime), **afternoon** (12pm lunchtime – 6pm) or **evening** (6pm – when you go to bed).

Rate your experiences: Please rate each experience you had on the scale of 1 to 5 to show how positive or negative you felt it was.

Not at all positive/negative *Very positive/negative*

1 *2* *3* *4* *5*

Between-meal snacks

We will also ask you about any snack that you have eaten in between your meals. This includes any food or drink you may have eaten. Please state what food/drink you ate, as well as how much of this snack you ate.

YESTERDAY Morning (when you wake up to 12pm lunchtime):

	What positive experiences did you have yesterday morning?	**How positive was it?**				
		Not at all				Very
1		1	2	3	4	5
2		1	2	3	4	5
3		1	2	3	4	5
	What negative experiences did you have yesterday morning?	**How negative was it?**				
		Not at all				Ver y
1		1	2	3	4	5
2		1	2	3	4	5
3		1	2	3	4	5
	Did you eat any snacks yesterday morning?	**Yes**		**No**		
	If so, what food or drink was it?	How much did you eat? For example, one chocolate bar				
1						
2						
3						

YESTERDAY Afternoon (12pm lunchtime to 6pm):

	What positive experiences did you have yesterday afternoon?	**How positive was it?**				
		Not at all				Very
1		1	2	3	4	5
2		1	2	3	4	5
3		1	2	3	4	5
	What negative experiences did you have yesterday afternoon?	**How negative was it?**				
		Not at all				Very
1		1	2	3	4	5
2		1	2	3	4	5
3		1	2	3	4	5
	Did you eat any snacks yesterday afternoon?	**Yes**		**No**		
	If so, what food or drink was it?	How much did you eat? For example, one chocolate bar				
1						
2						
3						

YESTERDAY Evening (6pm to when you go to bed):

	What positive experiences did you have yesterday evening?	**How positive was it?** Not at all				Very
1		1	2	3	4	5
2		1	2	3	4	5
3		1	2	3	4	5
	What negative experiences did you have yesterday evening?	**How negative was it?** Not at all				Very
1		1	2	3	4	5
2		1	2	3	4	5
3		1	2	3	4	5
	Did you eat any snacks yesterday evening?	**Yes**		**No**		
	If so, what food or drink was it?	How much did you eat? For example, one chocolate bar				
1						
2						
3						

YESTERDAY :

Please tick the box that shows how much you ate at breakfast, lunch and dinner yesterday:

Meal consumption:

Meal	Ate much less than usual	Ate less than usual	Ate usual amount	Ate more than usual	Ate much more than usual	Did not eat this today	Never eat this
Breakfast							
Lunch							
Dinner							

YESTERDAY (all day):

- How healthy were the snacks you ate yesterday?

Not at all 1 2 3 4 5 6 7 Very healthy

- How unhealthy were the snacks you ate yesterday?

Not at all 1 2 3 4 5 6 7 Very unhealthy

- How many portions of fruit did you eat yesterday? (A portion counts as the amount that you can fit in your hand).

____

- How many portions of vegetables did you eat yesterday? (A portion counts as the amount that you can fit in your hand).

____

Appendix B: Study Two: Child debrief sheet

UNIVERSITY OF LEEDS

Study title: Emotions and snacking behaviour

Debrief sheet for children

Thank you for taking part in this study. This study is exploring the relationship between positive and negative emotions and how this affects the snacks we eat.

A lot of research focuses on looking at how negative emotion changes eating behaviour, and we wanted to explore the impact that positive emotion had on eating behaviour.

Some of our earlier research in this area found that children chose to eat snacks when they were thinking about positive emotions. This was not what we expected to find, but this has made us want to explore further.

At this stage, we do not know what results we will get from this study, but by taking part, you have allowed us to begin to explore how positive emotion affects eating behaviour.

Thank you. If you feel that you need any help following participation in this study, please get in touch with the primary researcher who will be able to provide details to appropriate resources. If you have any questions, please contact Rachael Moss (ps14rhm@leeds.ac.uk).

Research supervisors:

Professor Daryl O'Connor 0113 343 5727 d.b.oconnor@leeds.ac.uk

Professor Mark Conner 0113 343 5720 m.t.conner@leeds.ac.uk

This study has been approved by the School of Psychology Research Ethics Committee on 07-02-2018), with a reference of PSC-273.

Appendix C: Study 2: Parent debrief sheet

UNIVERSITY OF LEEDS

Study title: Emotions and snacking behaviour

Debrief sheet for children's parents/guardians

Thank you for letting your child take part in this study. This study is exploring the relationship between positive and negative emotions and how this affects the snacks we eat.

A lot of existing research focuses on exploring the impact negative emotion has on eating behaviour, and we identified that there was a lack of focus on positive emotion, so decided to explore the presence of positive emotion on eating behaviour within this study. Some of our earlier research in this area found that children chose to consume snacks when they were thinking about positive emotions, a finding that prompted us to explore this emotion in more detail.

At this stage, we are not able to anticipate the findings of this study, but by taking part, you have allowed us to begin to explore how positive emotion affects eating behaviour.

Thank you. If you have any questions, please contact Rachael Moss (ps14rhm@leeds.ac.uk).

Research supervisors:

Professor Daryl O'Connor	0113 343 5727	d.b.oconnor@leeds.ac.uk
Professor Mark Conner	0113 343 5720	m.t.conner@leeds.ac.uk

This study has been approved by the School of Psychology Research Ethics Committee on 07-02-2018), with a reference of PSC-273.

Appendix C: Study 2: UG debrief sheet

UNIVERSITY OF LEEDS

Study title: Emotions and snacking behaviour

Debrief sheet for undergraduate students/young people

We thank you for participating in our research. This study is exploring the relationship between positive and negative emotions and how this impacts on individuals' snacking behaviour.

A lot of existing research focuses on exploring the impact negative emotion has on eating behaviour, and we identified that there was a lack of focus on positive emotion, so decided to explore the presence of positive emotion on eating behaviour within this study. Some of our earlier research in this area found that children chose to consume snacks when they were thinking about positive emotions, a finding that prompted us to explore this emotion in more detail.

At this stage, we are not able to anticipate the findings of this study, but by taking part, you have allowed us to begin to explore how positive emotion affects eating behaviour.

We thank you for your time.

If you feel that you need any appropriate resources/help following participation in this study, please get in touch with the primary researcher who will be able to provide details to appropriate resources. If you have any further questions, please contact Rachael Moss (ps14rhm@leeds.ac.uk).

Research supervisors:

Professor Daryl O'Connor	0113 343 5727	d.b.oconnor@leeds.ac.uk
Professor Mark Conner	0113 343 5720	m.t.conner@leeds.ac.uk

This study has been approved by the School of Psychology Research Ethics Committee on 07-02-2018), with a reference of PSC-273.

Appendix D: Study 3: Child information sheet

UNIVERSITY OF LEEDS

Personality and Eating Study

Participant study information sheet

You have been invited to take part in a study that a team of researchers in the School of Psychology is carrying out.

It is important that you understand what you will be asked to do, if you and your parent/guardian decide that you want to take part.

If you have any questions, please contact Rachael Moss (ps14rhm@leeds.ac.uk). Thank you for reading this information.

NOTE: unfortunately, you will NOT be able to take part if you take any steroid medication, have a food allergy or food intolerance.

Focus of this study:

This study is trying to see if how you feel every day is linked to what you eat. A lot of research has found that stress changes the types of food that adults eat, however, not much research in this area has been carried out in children, so this is why we feel it is important to carry out research in this area.

Taking part

You have been invited to take part in this study because you are in the age group that we are focusing on, and also because your after school club has agreed to help us.

It is up to you and your parent/guardian to decide if you want to take part in this study. If you do decide to take part, but later decide that you want to stop participating, you will be allowed to stop at any point up to one week after the study has finished.

What will happen if I decide to take part?

The study will take place in the School of Psychology over two sessions, these sessions will last for no longer than 1 hour. We will first ask you to complete two simple tasks. These tasks will get you to do things similar to the activities that you do at school.

During the tasks, we will ask you to give 4 saliva samples, so that we can measure the level of stress hormone in your body. The researcher will help you with this. This is very easy – you will just be asked to chew on a cotton swab.

After the task, we will ask you to do two tasks at home for a week to help us with the study.

We will give you a daily diary booklet, which we will ask you to fill in once each evening for a week. We will also give you a mobile phone, which we would like you to carry around for a week. We would like you to use this mobile phone to take pictures of any food or drink snack that you eat in between meals over the week.

After the week is up, the researcher will meet you/your parent at the School of Psychology to collect the study mobile phone and diaries. Once you have finished the study, and handed all the study materials back, you will be given a £10 Love to Shop voucher to thank you for taking part.

You can stop taking part in the study **any time during the study**, and you can ask for your information to be removed from the study up to **one week after the study has finished**.

Keeping your details safe

This study follows rules that are set by the main body of psychology in the UK (the British Psychological Society). All the information that you provide us with will be treated with respect at all times, and will only be looked at by people within this study research team. After you and your parents/guardians agree to help us with this study, you will be given a unique code so that the research team can use this to store the answers you give during the study (instead of using your name). All the information that link your details to your unique code will only be stored on a password protected computer.

If you have any questions please speak to your parent/guardian who may be able to help, however, if you would like to speak with one of our research team, please ask your parent/guardian to get in touch with us.

This study has been approved by the School of Psychology Research Ethics Committee, and was approved on 19-10-2017, and has an ethics code of 17-0506.

Thank you.

Contact details:

Primary researcher: Rachael Moss ps14rhm@leeds.ac.uk

***Research supervisors:**

Professor Daryl O’Connor	0113 343 5727	d.b.oconnor@leeds.ac.uk
Professor Mark Conner	0113 343 5720	m.t.conner@leeds.ac.uk

Appendix D: Study 3: Child consent form

UNIVERSITY OF LEEDS

Study title: Personality and Eating Study

Consent form - For participants

Thank you for being interested in taking part in our study. If you have read the participant study information sheet, and are still interested in taking part, please complete the following form. Please tick one box to answer each question (‘Yes’ or ‘No’).

If you have any questions about taking part in this study, please contact the primary researcher, Rachael Moss (ps14rhm@leeds.ac.uk) or research supervisors: Professor Daryl O’Connor (0113 343 5727, d.b.oconnor@leeds.ac.uk) or Professor Mark Conner (0113 343 5720, m.t.conner@leeds.ac.uk).

	Yes	No
I have read and understood the study information sheet.		
I have been given the chance to ask questions.		
I understand that I can stop taking part in the study at any time during the study.		
I understand what the study will involve.		
I understand that the information I give will not be traced back to me.		
I understand that any members of this research team at the University of Leeds can look at the information that I give.		
I understand that I can stop taking part in this study at any point, but only have up to **one week after the study has finished** to ask for my information to be removed (if you want this).		
I agree to give 4 saliva samples as part of this study by chewing on 4 cotton swabs.		
I DO NOT have any food allergies and there are no foods I cannot eat.		
I DO NOT take any medication for asthma.		
I agree to take part in this study.		

Please write your name on the line below once you have finished completing this form. Thank you.

____ Date: _________________________

This study was approved by the School of Psychology Research Ethics Committee (on 19-10-2017, reference 17-0506).

Appendix D: Study 3: Parent information sheet

UNIVERSITY OF LEEDS

Study title: Personality and Eating Study

Parent/guardian study information sheet

Your child has been invited to take part in a research study that is being conducted by a team in the School of Psychology at the University of Leeds. It is vital that you understand what your child will be asked to do should both you and your child agree that their participation is appropriate.

If you have any questions/concerns, please do not hesitate to contact the primary researcher, Rachael Moss (ps14rhm@leeds.ac.uk). We thank you for taking the time to read this information.

NOTE: unfortunately, your child will NOT be able to take part if they take any steroid medication, have a food allergy or food intolerance.

Aim

This study aims to try and understand how levels of daily stress relate to the amount and to the types of food snacks that children choose to eat. It has been found that stress and stressful situations can change the types of food that an individual eats. These findings have been found in research conducted in adults, however, not much research in this area has focused on children, so this is why we feel it is important to investigate further.

Recruitment

Your child has been invited to take part because they are between the ages of 8-11 years old, and their after school club has agreed to take part in this health focused research study.

It is up to both you and your child to decide whether or not your child would like to take part. The exclusion criteria are as follows:

- Children above or below the ages of 8, 9, 10 or 11
- If they cannot speak and read English
- If they have a food allergy or intolerance
- If they take any type of steroid medication.

However, if you do decide to allow your child to participate, your child is still able to withdraw from the study at any point during the study, and will have up to ONE WEEK after they have finished the study to be able to ask for their data to be removed (if requested). If, after this week you want your child's data to be removed, it unfortunately will not be able to be removed, but will remain anonymous in further analysis.

<u>What will happen if my child takes part?</u>

The study will take place at the School of Psychology, and will be led by the primary researcher (Rachael Moss). The study will take place over two sessions, one session is the study session and will last approximately 1 hour, and the second is just a drop off session. All participants that agree to take part will complete the main study session (that will last for up to an hour) in pairs.

Before the study: if you and your child agree to take part, you will be asked to complete the demographic form, the food frequency questionnaire, the strengths and difficulties questionnaire, the personality questionnaire and the eating behaviour questionnaire that are included within this study information pack. Once you have read the study materials, and signed the consent form, please complete these items if you have no questions or concerns.

The demographic questionnaire will ask you some about some background questions (e.g. what ethnic group your child relates to). The food frequency questionnaire will ask you some questions regarding how often your child has eaten certain foods over the last 4 weeks. The strengths and difficulties questionnaire will ask you questions about your child's behaviour over the last 6 months or over the last school year. The personality questionnaire will ask you questions about your child's personality. There will be two versions of this questionnaire, please complete the parent/caregiver version, and give the child version to your child to complete. There are also two versions of the eating behaviour questionnaire, please get your child to fill in one version (i.e. about their eating behaviour), and please ensure you complete the other version (in regards to their eating behaviour).

All questionnaires that are to be completed are clearly marked, and state who needs to complete them at the top of each one. Please try to be as accurate as possible and return all the questionnaires along with the consent forms (x2) and the demographic form to the research team **within ONE week** of your child receiving the study information pack. Please ensure that you place all of the completed questionnaires and consent forms in the attached sealable envelope that is labelled for the primary researcher Rachael.

The study procedure: the study will involve two tasks. One of these tasks will take place at the School of Psychology, and the other will require your child to complete some tasks at home. The study will take a week to complete, and the first task will take place on day 1 of your child's study week.

The task that your child will complete at the School of Psychology and it will be completed by pairs of participants, and they will be asked to complete two activities that are similar to the tasks they complete at school. Before and after this task, participants will be asked to give 4 saliva samples, in order to measure any change in their stress hormone (cortisol) level. The primary researcher will be present for this, and will give clear instructions and guidance on how to provide such samples (your child will need to just chew on a cotton swab). After this task, your child will be offered two snacks as a ‘thank you’ for taking part.

At the end of this session, your child will be given the materials to complete for the rest of the study at home. The researcher will give your child a daily diary booklet and a study mobile phone. The daily diary booklet is to be completed once each day, at the end of each evening before your child goes to bed. The mobile phone is to be carried by your child each day (over the 7 days) so that your child can use the phone to take pictures of all the food and drink snacks that they eat across the week. The day after your child has finished the study, the researcher will meet with your child either at their after school club to collect the daily diary booklet and study mobile phone. If your child completes the study, they will get a £10 Love to Shop Voucher to thank them for their time, and will be given the voucher at this final session.

Consent

Written consent will be obtained from you and your child, prior to study commencement. Any questions/concerns can be asked at any point before or during the study, and will be addressed as soon as possible.

Confidentiality

Participant names will not be linked to any of the data given in the study. This study follows the guidelines that are set out by the British Psychological Society. All the data that your child provides will be treated in the strictest of confidence at all times, and will only be used for the purposes of this research. When the research team receive your completed demographics and consent forms (x2 – parent/guardian and child) along with your completed questionnaires (x5), this personal information will be stored on a password protected computer.

The results from the study will be used towards the primary researcher’s PhD research. The data may therefore be published, but participants will not be identifiable from any details in reports, presentations or scientific publications. Data will be stored for up to 5 years, to allow time to complete all the research involved in this study, and to allow for any potential publication.

Who has reviewed this study?

All research is looked at by an independent group of people called a Research Ethics Committee, to protect your interests. This study has been approved by The School of Psychology Research Ethics Committee: Reference 17-0506 on (19-10-2017).

If you have any questions or require any further information, please do not hesitate to contact the primary researcher, or one of my supervisors using the contact details below.

We thank you for taking the time to read this information.

PLEASE RETURN the following completed materials: the two consent forms, the demographic form and the 6 questionnaires by placing them in the self-addressed and stamped envelope and send them to the researcher. Once the researcher has received these forms, your child will be able to take part.

Primary researcher = Rachael Moss ps14rhm@leeds.ac.uk

Research supervisors =

Professor Daryl O'Connor	0113 343 5727	d.b.oconnor@leeds.ac.uk
Professor Mark Conner	0113 343 5720	m.t.conner@leeds.ac.uk

Appendix D: Study 3: Parent consent form

UNIVERSITY OF LEEDS

Study title: Personality and Eating Study

Informed consent form

For parents/guardians

Thank you for taking an interest in this 'Daily stress and snack choice' study. If you have read the study information sheet, and are willing to allow your child to take part in this research, please continue to read and complete the following statements. Please tick the appropriate box that corresponds with your answer to each statement: 'Yes', 'No' or 'N/A' (Non-applicable). If you have any questions or concerns please do not hesitate to contact the primary researcher, Rachael Moss (ps14rhm@leeds.ac.uk) or research supervisors: Professor Daryl O'Connor (0113 343 5727, d.b.oconnor@leeds.ac.uk) or Professor Mark Conner (0113 343 5720, m.t.conner@leeds.ac.uk).

	Yes	No
I have read and understood the parental study information sheet, which outlines the study.		
I have been given time, and the means to contact the researcher to ask any questions that I may have.		
If I asked questions, I have been given satisfactory answers to all.		
I understand that I have the right to withdraw my child and their data from this study at any time during the study, however, you will only have up to one week to remove data from the study after the study has finished (if desired).		
I understand that I will need to complete and return the 6x questionnaires included in this study information pack before my child can take part.		
I am aware that both my child and I will be fully debriefed about the nature of the study upon completion.		
I understand that all data will be anonymised, except the demographic questionnaire, that will contain personal details (e.g., age/ethnicity).		
I understand that all data will be kept confidential throughout the study and thereafter.		

	Yes	No
I understand that the study data may be viewed by all members of the research team (at the University of Leeds). I give my consent to these individuals accessing my data.		
I give consent for my child to give 4 saliva samples as part of this study.		
My child does NOT have any food allergies or food intolerances.		
My child does NOT take any steroid medication/s.		
I give consent for my child to participate in this study.		

Parent/guardian signature: ______________________________ Date: _______________

Printed name (BLOCK CAPITALS): ____

Thank you

This study was approved by the School of Psychology Research Ethics Committee (on 19-10-2017, reference 17-0506).

Appendix D: Study 3: FFQ (for parents to complete)

*FOR PARENTS TO COMPLETE: Food Frequency Questionnaire- Please tick the box that relates to how often your child eats each of the following foods. Try to think over the **past 4 weeks** to help you answer.*

Food	Never/less than once a week	1-3 times a week	4-6 times a week	1 time per day	2 times per day	3 times per day	4 or more times per day	I have no idea
Vegetable, cooked								
Potatoes, fried								
Vegetable, raw								
Fruit, fresh, without sugar								
Fruit, fresh, sugar added								
Water								
Fruit juice								
Soft drink, sugar added								
Soft drink, diet								
Breakfast cereals, sugar added								
Breakfast cereals, no sugar								
Milk, no sugar								
Yoghurt, no sugar								
Yoghurt, sugar added								
Fish, not fried								
Fish, fried								
Cold cuts, sausage								
Meat, not fried								

Food	Never/less than once a week	1-3 times a week	4-6 times a week	1 time per day	2 times per day	3 times per day	4 or more times per day	I have no idea
Meat, fried								
Egg, fried								
Egg, boiled								
Mayonnaise								
Meat replacement products								
Cheese								
Honey, jam								
Chocolate, nut-based spread								
Butter, margarine on bread								
Bread, white								
Bread, wholemeal								
Pasta, rice								
Pizza, main dish								
Hamburger, hot dog, falafel								
Nuts, seeds, dried fruit								
Salty snacks								
Savoury pastries								
Chocolate								
Candy, non-chocolate								
Cake, pudding, cookies								
Ice cream								

Appendix D: Study 3: SDQ (for parents to complete)

For each item, please tick the box for Not True, Somewhat True or Certainly True. It would help us if you answered all items as best you can even if you are not absolutely certain or the item seems daft! Please give your answers on the basis of the child's behaviour **over the last six months or over the past school year.**

Behaviour	Not true	Somewhat true	Certainly true
Considerate of other people's feelings			
Restless, overactive, cannot stay still for long			
Often complains of headaches, stomach aches or sickness			
Shares readily with other children (treats, toys, pencils etc.)			
Often has temper tantrums or hot tempers			
Rather solitary, tends to play alone			
Generally obedient, usually does what adults request			
Many worries, often seems worried			
Helpful if someone is hurt, upset or feeling ill			
Constantly fidgeting or squirming			
Has at least one good friend			
Often fights with other children or bullies them			
Often unhappy, down-hearted or tearful			
Generally liked by other children			
Easily distracted, concentration wanders			
Nervous or clingy in new situations, easily loses confidence			
Kind to younger children			
Often lies or cheats			
Picked on or bullied by other children			
Often volunteers to help others (parents, teachers, other children)			
Thinks things out before acting			
Steals from home, school or elsewhere			
Gets on better with adults than with other children			
Many fears, easily scared			
Sees tasks through to the end, good attention span			

Appendix D: Study 3: BFQ-C (for children to complete)

The Big-Five – Children personality measure:

Participant: Please read each sentence, and tick the box that shows your answer to each:

Item	1 Almost never	2	3	4	5 Almost always
I do my school work without carelessness and inattention					
I get nervous for silly things					
I am in a bad mood					
I do my own duty					
I work hard and with pleasure					
I easily get angry					
I engage myself in the things I do					
I quarrel with others					
During class time I concentrate on the things I do					
I argue with others with excitement					
My room is in order					
I am sad					
I respect the rules and the order					
I easily get offended					
It is unlikely that I divert my attention					
I worry about silly things					
When I finish my homework, I check it many times to see if I did it correctly					
I play only when I have finished my homework					
I easily lose my calm					
I like to keep all of my school things in order					
I am not patient					
I weep					
If I take an engagement I keep it					
I do things with agitation					
If I want to do something, I am not capable of waiting and I do have to do it immediately					
When I start to do something, I have to finish it at all costs					

Appendix D: Study 3: BFQ-C (for parents to complete)

Please read each sentence, and tick the box that shows your answer to each:

Item	**1 Almost never**	**2**	**3**	**4**	**5 Almost always**
I do my school work without carelessness and inattention					
I get nervous for silly things					
I am in a bad mood					
I do my own duty					
I work hard and with pleasure					
I easily get angry					
I engage myself in the things I do					
I quarrel with others					
During class time I concentrate on the things I do					
I argue with others with excitement					
My room is in order					
I am sad					
I respect the rules and the order					
I easily get offended					
It is unlikely that I divert my attention					
When I finish my homework, I check it many times to see if I did it correctly					
I worry about silly things					
I play only when I have finished my homework					
I easily lose my calm					
I like to keep all of my school things in order					
I am not patient					
I weep					
If I take an engagement I keep it					
I do things with agitation					
If I want to do something, I am not capable of waiting and I do have to do it immediately					
When I start to do something, I have to finish it at all costs					

Appendix D: Study 3: DEBQ (for children to complete)

Eating behaviour questionnaire – For children to complete: Please answer the following questions. Read each question and CIRCLE the appropriate number.

	Never	Rarely	Sometimes	Often	Very often
1. Do you find you want to eat when you are irritated?	1	2	3	4	5
2. If food tastes good to you, do you eat more than you usually do?	1	2	3	4	5
3. Do you find you want to eat when you have nothing to do?	1	2	3	4	5
4. Do you find you want to eat when you are fed up?	1	2	3	4	5
5. If food smells and looks good, do you eat more than you usually do?	1	2	3	4	5
6. Do you want to eat when you are feeling lonely?	1	2	3	4	5
7. If you see or smell something delicious, do you want to eat it?	1	2	3	4	5
8. If you have something delicious to eat, do you eat it straight away?	1	2	3	4	5
9. Do you want to eat when you are cross?	1	2	3	4	5
10. Do you want to eat when you are expecting something to happen?	1	2	3	4	5
11. If you walk past the baker do you want to buy something delicious?	1	2	3	4	5
12. Do you want to eat when you are anxious, worried or tense?	1	2	3	4	5
13. If you walk past a café, do you want to buy something delicious?	1	2	3	4	5
14. Do you want to eat when things are going against you or when things have gone wrong?	1	2	3	4	5
15. If you see others eating, do you also want to eat?	1	2	3	4	5
16. Do you want to eat when you are frightened?	1	2	3	4	5
17. Do you want to eat when you are disappointed?	1	2	3	4	5
18. Can you resist eating delicious food?	1	2	3	4	5

	Never	Rarely	Sometimes	Often	Very often
19. Do you eat more than usual when you see others eating?	1	2	3	4	5
20. Do you want to eat when you are upset?	1	2	3	4	5
21. When you see someone preparing a meal, does it make you want to eat something?	1	2	3	4	5
22. Do you want to eat when you are bored or restless?	1	2	3	4	5

Appendix D: Study 3: DEBQ (for parents to complete)

Eating behaviour questionnaire – FOR PARENT/CAREGIVER to complete (in regards to their child's behaviour). Please answer the following questions. Read each question and CIRCLE the appropriate number.

	Never	Rarely	Sometimes	Often	Very often
1. Do you find you want to eat when you are irritated?	1	2	3	4	5
2. If food tastes good to you, do you eat more than you usually do?	1	2	3	4	5
3. Do you find you want to eat when you have nothing to do?	1	2	3	4	5
4. Do you find you want to eat when you are fed up?	1	2	3	4	5
5. If food smells and looks good, do you eat more than you usually do?	1	2	3	4	5
6. Do you want to eat when you are feeling lonely?	1	2	3	4	5
7. If you see or smell something delicious, do you want to eat it?	1	2	3	4	5
8. Do you want to eat when somebody disappoints you?	1	2	3	4	5
9. If you have something delicious to eat, do you eat it straight away?	1	2	3	4	5
10. Do you want to eat when you are cross?	1	2	3	4	5
11. Do you want to eat when you are expecting something to happen?	1	2	3	4	5
12. If you walk past the baker do you want to buy something delicious?	1	2	3	4	5
13. Do you want to eat when you are anxious, worried or tense?	1	2	3	4	5
14. If you walk past a café, do you want to buy something delicious?	1	2	3	4	5
15. Do you want to eat when things are going against you or when things have gone wrong?	1	2	3	4	5
16. If you see others eating, do you also want to eat?	1	2	3	4	5
17. Do you want to eat when you are frightened?	1	2	3	4	5
18. Do you want to eat when you are disappointed?	1	2	3	4	5

	Never	Rarely	Sometimes	Often	Very often
19. Can you resist eating delicious food?	1	2	3	4	5
20. Do you eat more than usual when you see others eating?	1	2	3	4	5
21. Do you want to eat when you are upset?	1	2	3	4	5
22. When you see someone preparing a meal, does it make you want to eat something?	1	2	3	4	5
23. Do you want to eat when you are bored or restless?	1	2	3	4	5

Appendix D: Study 3: Demographics questionnaire

UNIVERSITY OF LEEDS

Study title: Personality and Eating Study

Demographics questionnaire

For parent/guardian to complete

Please write your answers on the lines below, and tick the box that corresponds to the gender of your child:

Parent/guardian name: ______________________________________

Child's name: ____

Gender: Male ☐ Female ☐

Child's age: _________

Questions about your child:

(The answers you give to the questions below will help us to understand the background of our participants).

What school does your child go to? ____

What is your house postcode? ____

Does your child take any prescribed medication? YES/NO

(If yes, please specify on the line below)

____

Does your child receive free school meals? YES / NO

Does your child have any anxiety concerns? YES / NO

(If yes, please specify): ____

PLEASE TURN OVER →

Would you say that your child is a ‘picky’ eater? (i.e. do they display any certain problems around food or when eating?) YES / NO

(If yes, please explain briefly on the lines below)

____

____

____

Have you noticed your child eating certain foods when they are stressed/worried?

(If yes, please explain briefly on the lines below) YES / NO

____

____

____

What ethnicity is your child? (Please tick the most appropriate box below).

White:

English/Welsh/Scottish/Northern Irish/British ☐

Irish ☐

Gypsy or Irish Traveller ☐

Any other White background, please write on the line below:

____

Mixed/multiple ethnic groups:

White and Black Caribbean ☐

White and Black African ☐

White and Asian ☐

Any other Mixed/multiple ethnic background, please write on the line below:

____

Asian/Asian British:

Indian ☐

Pakistani ☐

Bangladeshi ☐

Chinese ☐

Any other Asian background, please write on the line below:

____

Black/African/Caribbean/Black British:

African ☐

Caribbean ☐

Any other Black/African/Caribbean background, please write on the line below:

____

Other ethnic group:

Arab ☐

Any other ethnic group, please write on the line below:

____

Questions about yourself (please write your answers on the lines provided below):

Your ethnicity (please state, using one of the above categories): ___________________________

Contact details:

Primary researcher: Rachael Moss		ps14rhm@leeds.ac.uk
Research supervisors:		
Professor Daryl O'Connor	0113 343 5727	d.b.oconnor@leeds.ac.uk
Professor Mark Conner	0113 343 5720	m.t.conner@leeds.ac.uk

This study was approved by the School of Psychology Research Ethics Committee (on 19-10-2017 reference 17-0506).

Appendix D: Study 3: Hunger questionnaire

Please answer each question by marking a line that corresponds to how you feel now.

1. How hungry do you feel now?

Not at all hungry ________________________ Very hungry

2. How full do you feel now?

Not full at all ________________________ Very full

3. How much would you like to eat now?

Nothing at all ________________________ A lot

Appendix D: Study 3: TSST-C story paragraph

Yesterday my best friend Robert and I went home from school. Suddenly, we had the idea to visit Mr. Greg who lived in the big old house located in the dark forest near our town. Mr. Greg was a crazy old man and our parents didn't like the idea that we sometimes went visiting him. There was a rumor in town that there was a mystery about the old house. When we arrived at the house we were surprised that the door was open. Suddenly we heard a strange noise and cautiously, we entered the dark hall. . .

(*Note: the primary researcher read this paragraph to participants at the start of the TSST-C).

Appendix D: Study 3: Daily diary questionnaire

(Includes Day 1 as an example).

Daily Diary Questionnaire Booklet

....

Is taking part in the 'Personality and Eating Study' and is helping research at the

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We thank you for participating. If you have any questions, please contact the primary researcher, **Rachael Moss (ps14rhm@leeds.ac.uk / 0113 343 4283)**

Research Supervisors

Professor Daryl O'Connor	0113 343 5727	d.b.oconnor@leeds.ac.uk
Professor Mark Conner	0113 343 5720	m.t.conner@leeds.ac.uk

This study has been approved by the School of Psychology Research Ethics Committee
on
with a reference of

What day is it today? ______________________

DIARY DAY 1 EVENTS

Please put a tick in each row to show whether or not you experienced this situation today:

(You can put more than one tick in every row if you need to. For example, if the same event happened morning and evening, tick both).

You can use the empty rows at the bottom to put any other situations you experienced today which are not already in the list.

Situation	Morning	Afternoon	Evening	Did Not Happen
Children at school teased you				
You lost something				
Your brother or sister annoyed you				
Another child could do something better than you could				
Your Mum, Dad or Guardian were ill				
You didn't know the answer when the teacher called on you				
Your school work was too hard				
You got told off when you did something wrong				
You had to clean your bedroom				
You had to go to bed when you didn't feel like it				
You could not do what you wanted to do				

Once you have completed this page, please PHOTOGRAPH ME

Please be honest when you complete this diary. The only people that see this booklet are the researchers working on this study.

If you are worried about anything, you can talk to your parents/ guardians/school teachers or the researcher, Rachael.

Diary Instructions

- ***Please complete one diary each evening before you go to sleep.***
- ***In each diary, you will need to tick the situations and feelings that you experienced today. You will also be asked about the snacks you ate today.***
- ***Please read the instructions carefully – they will tell you how many ticks you will need to put in each row of each table.***
- ***In each diary, the first table will ask you about the situations you experienced today, the second table will ask you about the snacks you ate today, and the third table will ask you about how you felt today.***
- ***Each table will have two blank rows at the bottom, where you can write any additional situations or feelings that you experienced that day. The snack table will also have two blank rows where you can write any other snack/s you ate that day.***

DIARY DAY 1 SNACKS

Please put a tick in each row to show whether or not you ate any of these snacks today:

(You can put more than one tick in every row if you need to. For example, if you ate the same snack in the morning and evening, tick both).

You can use the empty rows at the bottom to put any other snacks you ate which are not already in the list.

Snack	Morning	Afternoon	Evening	Did Not Eat
A Piece of Fruit				
Crisps				
Nuts				
Cake				
Chocolate or sweets				
Vegetables e.g. carrot or cucumber sticks				
Ice-cream				
Biscuit or cookie				
Yoghurt				
A Glass of Milk				
Chips				
Dips e.g. houmous				
Fizzy drink				
Cheese				
Pizza slice				

Once you have completed this page, please PHOTOGRAPH ME

DIARY DAY 1 FEELINGS

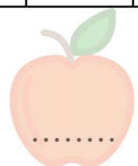
Please put a tick in each row to show how you felt throughout the day:

Did you Feel...	Not At All	A Little	Moderately	Quite a Bit	Extremely
happy this morning?					
happy this afternoon?					
happy this evening?					
sad this morning?					
sad this afternoon?					
sad this evening?					

DIARY DAY 1 FRUIT & VEG

Please answer the questions to the right:

How many portions of fruit did you eat today?



How many portions of vegetables did you eat today?

1 portion counts as the amount you can fit in your hand

Once you have completed this page, please PHOTOGRAPH ME

DIARY DAY 1 PHOTOS

Did you remember to take a picture of ALL the food snacks that you ate today using the mobile phone?

Please tick your answer below:

	Yes, I took pictures of all the snacks I ate
	Yes, I took pictures of some snacks I ate
	No, I forgot to take pictures of any snacks I ate

Please remember to return this daily diary questionnaire booklet and the study mobile phone to Rachael (the primary researcher) when she visits your school.

Thank You!

Appendix D: Study 3: Snack liking questionnaire

Please tell us how much you like each of these two snacks by completing the following questions. Please tick the box that shows your answers:

You can eat as little or as much of the snacks as you like to help you answer the questions.

Maltesers	**Not at all**	**A little**	**A lot**
How much do you like maltesers?			
How much do you like the taste of maltesers?			
How much do you like the appearance of maltesers?			
How much do you like the taste of the chocolate on the maltesers?			
How much do you like the biscuit centre of the maltesers?			
Crisps			
How much do you like crisps?			
How much do you like the taste of crisps?			
How much do you like the appearance of crisps?			
How much do you like the flavour of these crisps?			
How much do you like the crunchiness of these crisps?			

Appendix D: Study 3: Mobile phone collection form

UNIVERSITY OF LEEDS

Study title: Personality and Eating Study

Study mobile phone collection form and instructions

I am signing this form to say that I have received a study mobile phone, and understand it must be returned to Rachael at the end of the study.

Name: ______________________________________

Date: _______________________________________

Instructions for taking pictures with the mobile phone:

- Please use this mobile phone **just** to take pictures of any food or drink snack that you eat in between your meals
- Please carry the phone with you when you go out so that you can easily take pictures of any snack that you eat
- Please take pictures of your snacks for a week
- After the week is finished, please make sure you give this mobile phone and the diary booklet back to the researcher Rachael

If you have any problems or questions during this week, please get in touch with the researcher Rachael by email on ps14rhm@leeds.ac.uk or by telephone on 0113 343 4283.

Research supervisors:

Professor Daryl O'Connor	0113 343 5727	d.b.oconnor@leeds.ac.uk
Professor Mark Conner	0113 343 5720	m.t.conner@leeds.ac.uk

This study has been approved by the School of Psychology Research Ethics Committee on 03-07-2017), with a reference of 17-0186.

Appendix D: Study 3: Child debrief sheet

UNIVERSITY OF LEEDS

Study title: Personality and Eating Study

End of study information sheet for participants

Thank you for taking part in our study. By completing this study, you have helped us begin to understand more about how daily stress affects what snacks you choose to consume.

The story and maths task that you took part in was given to you to give you a challenge, and we measured your saliva (to measure your level of stress hormone) around this task to see how your body responded to this stressful challenge. The diary and mobile phone was given to you to try and see how your weekly snacking behaviour was linked to the amount of stress that you reported.

Based on previous research, we think that feeling stressed or upset may influence the type and or the amount of food that you consume when you choose to eat a snack. We are examining this area of stress and eating in children, and by taking part, you have helped us explore this area more.

We thank you for participating. If you have any questions, please contact Rachael Moss (ps14rhm@leeds.ac.uk, 0113 343 4283).

Research supervisors:

Professor Daryl O'Connor	0113 343 5727	d.b.oconnor@leeds.ac.uk
Professor Mark Conner	0113 343 5720	m.t.conner@leeds.ac.uk

This study has been approved by the School of Psychology Research Ethics Committee on 03-07-2017), with a reference of 17-0186.

Appendix D: Study 3: Parent debrief sheet

UNIVERSITY OF LEEDS

Study title: Personality and Eating Study

Debrief sheet for parents/guardians

We thank you for allowing your child to act as a participant in our research. This study is exploring the daily stress of children (aged 8-11) and how this was associated with their snacking behaviours (i.e. what snack foods and drinks did they choose to consume?).

The main theme of this research is to investigate the way in which stress influences eating choices in a wide variety of children. This study is the second study in this area conducted by this particular research group, and it will help us further determine the patterns of behaviour associated with stress and eating in children.

Within this study, we anticipate that the children who report a higher level of daily stress will consume more unhealthy snacks in between their daily meals. We also anticipate that the children who show high levels of cortisol (stress hormone) within their saliva samples will be the children that report higher levels of daily stress and snacking behaviour.

By allowing your child to participate, you have helped us begin to explore this highly relevant and crucial area within stress and health research.

We thank you for your time. If you have any further questions, please contact Rachael Moss (ps14rhm@leeds.ac.uk, 0113 343 4283).

Research supervisors:

Professor Daryl O'Connor	0113 343 5727	d.b.oconnor@leeds.ac.uk
Professor Mark Conner	0113 343 5720	m.t.conner@leeds.ac.uk

This study has been approved by the School of Psychology Research Ethics Committee on 03-07-2017), with a reference of 17-0186.

Appendix E: Study 4: Participant information sheet

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<u>Cortisol and Eating Behaviour Study</u>

Participant study information sheet

You have been invited to take part in a study that a team of researchers in the School of Psychology is carrying out.

It is important that you understand what you will be asked to do, if you decide that you want to take part.

If you have any questions, please contact Rachael Moss (ps14rhm@leeds.ac.uk). Thank you for reading this information.

Note: you CANNOT take part if any of the following applies to you:

- *You take steroid medication*
- *You are a smoker*
- *You take recreational drugs.*

<u>Focus of this study:</u>

This study will explore the relationship between cortisol (a hormone that is released when we are stressed), and eating behaviours. A lot of research has found that stress changes the types of food that adults eat, however, not much research has directly explored the association between daily cortisol levels and meal and snack eating behaviours.

<u>Taking part</u>

You have been invited to take part in this study because you are an undergraduate student here at the University of Leeds. It is up to you to decide if you want to take part in this study.

If you do decide to take part, but later decide that you want to stop participating, you will be allowed to stop at any point up to one week after the study has finished.

<u>What will happen if I decide to take part?</u>

The study will involve two sessions in the School of Psychology, however, the main component of the study will take place at home.

In session one, you will be invited to the School where you will meet with the primary researcher. During this session you will be asked to complete several background questionnaires. These questionnaires will ask you some questions about you, your eating habits and your personality. You will also be asked to have your height and weight measured during this session (the primary researcher will take these measurements, but they will not be disclosed).

The primary researcher will then explain the three components within this study.

- One: we would like you to take 3 saliva samples a day for 4 days. The timings of these samples are explained on the cortisol saliva sheet. Please take the samples at the times specified, this is a vital step. Once you have taken your samples, we would like you to put them either in a fridge or in a freezer as soon as possible (this will help preserve the samples before you hand the samples back in to the primary researcher). The primary researcher will give you a sample to take during this session so that you can have a practice sample to get a feel of how we want the samples taking.
- Two: we would like you to complete an online diary each evening, on each of the 4 days of the study. The diary will ask you about your daily hassles and uplifts, and will ask you to provide some information about your eating behaviours. Please complete the diary as late as you can each evening, before you go to bed. If however, you are going out for the evening, and know you will be drinking alcohol, it is alright for you to complete that evening's diary before you go out. The primary researcher will email you a link to each evening's diary every afternoon of the study.
- Three: during this session, the primary researcher will programme, issue and fit you with an activity monitoring watch. This watch will monitor your activity over the 4 day study. You will need to wear the watch at all times during the study -

please do not take it off - the watch is waterproof, so can be worn during showering or swimming (for example).

You can stop taking part in the study **any time during the study**, and you can ask for your information to be removed from the study up to **one week after the study has finished**.

Keeping your details safe

This study follows rules that are set by the main body of psychology in the UK (the British Psychological Society). All the information that you provide us with will be treated with respect at all times, and will only be looked at by people within this study research team. After you agree to help us with this study, you will be given a unique code so that your data will not be personally identifiable.

If you have any questions please get in touch with the primary researcher, Rachael, ps14rhm@leeds.ac.uk.

This study has been approved by the School of Psychology Research Ethics Committee, and was approved on 27-10-2017, and has an ethics code of 17-0252.

Thank you.

Contact details:

Primary researcher: Rachael Moss ps14rhm@leeds.ac.uk

Research supervisors:

Professor Daryl O'Connor 0113 343 5727 d.b.oconnor@leeds.ac.uk

Professor Mark Conner 0113 343 5720 m.t.conner@leeds.ac.uk

Appendix E: Study 4: Participant consent form

UNIVERSITY OF LEEDS

Study title: Cortisol and Eating Behaviour Study

Informed consent form

Thank you for taking an interest in this study. If you have read the study information sheet, and are willing to take part in this research, please continue to read and complete the following statements. Please tick the appropriate box that corresponds with your answer to each statement: 'Yes', 'No' or 'N/A' (Non-applicable). If you have any questions or concerns please do not hesitate to contact the primary researcher, Rachael Moss (ps14rhm@leeds.ac.uk) or research supervisors: Professor Daryl O'Connor (0113 343 5727, d.b.oconnor@leeds.ac.uk) or Professor Mark Conner (0113 343 5720, m.t.conner@leeds.ac.uk).

	Yes	No
I have read and understood the study information sheet, which outlines the study.		
I have been given time, and the means to contact the researcher to ask any questions that I may have.		
If I asked questions, I have been given satisfactory answers to all.		
I understand that I have the right to withdraw my data from this study at any time during the study, however, you will only have up to one week to remove data from the study after the study has finished (if desired).		
I understand that I will need to return the activity watch and 12 saliva samples after the study has finished.		
I confirm that once I have taken each saliva sample, I will put it either in a fridge or freezer (if you put it in a fridge, please put it in a freezer as soon as possible afterwards) as soon as possible, and will keep them in the freezer until you bring them back in to the primary researcher.		
I understand that all data will be kept confidential throughout the study and thereafter.		
I understand that the study data may be viewed by all members of the research team (at the University of Leeds). I give my consent to these individuals accessing my data.		

	Yes	No
I give consent to give 12 saliva samples as part of this study.		
I give consent to participate in this study.		

Signature: ________________________________ Date: ____________________

Printed name (BLOCK CAPITALS): _____________________________________

Thank you

This study was approved by the School of Psychology Research Ethics Committee (on 27-10-2017, reference 17-0252).

Appendix E: Study 4: Screening questionnaire

Demographics

Name: ______________________________________

Age: _______________________________________

Gender: _____________________________________

Participant pool ID number: _____________________

Participant ID: In order to complete the evening daily diaries, you will need to create a unique participant ID number. This number consists of the following: the first 2 letters of your mother's maiden name, followed by the day and month of your birth (e.g., Smith, 3rd July would be SM0307).

Please create your participant ID using this method, and write it on the line below:

____

(Remember: you will need to use your participant ID when you fill in each daily diary).

Ethnicity: What is your ethnicity? (Please tick the most appropriate box below):

White:

English/Welsh/Scottish/Northern Irish/British ☐

Irish ☐

Gypsy or Irish Traveller ☐

Any other White background, please write on the line below:

____

Mixed/multiple ethnic groups:

White and Black Caribbean ☐

White and Black African ☐

White and Asian ☐

Any other Mixed/multiple ethnic background, please write on the line below:

____

Asian/Asian British:

Indian ☐

Pakistani ☐

Bangladeshi ☐

Chinese ☐

Any other Asian background, please write on the line below:

____

Black/African/Caribbean/Black British:

African ☐

Caribbean ☐

Any other Black/African/Caribbean background, please write on the line below:

____

Other ethnic group:

Arab ☐

Any other ethnic group, please write on the line below:

____

Questions about yourself (please write your answers on the lines provided below):

Your ethnicity (please state, using one of the above categories): ____________________

Medication:

- Are you taking any prescription medication?
  If so, please state which medication on the line below:

  ____

- If you are female - Are you currently taking the oral contraceptive pill?

  Yes ☐ No ☐

Eating behaviour: Please answer the following questions in regards to your eating and diet behaviour.

- Are you currently on a diet? Yes ☐ No ☐

  If so, what diet are you on? _________________________________

- Do you engage in physical activity? Yes ☐ No ☐

  If so, what type of activity do you do? _________________________

And approximately, how many minutes of physical activity do you engage in each week?

____

Once you have reached this stage, please let the researcher know. You will then be asked to have your height and weight measured.

Contact details:

Primary researcher: Rachael Moss ps14rhm@leeds.ac.uk

Research supervisors:

Professor Daryl O'Connor 0113 343 5727 d.b.oconnor@leeds.ac.uk

Professor Mark Conner 0113 343 5720 m.t.conner@leeds.ac.uk

This study was approved by the School of Psychology Research Ethics Committee (on 27-10-2017 reference 17-0252).

This section is for the researcher to complete:

Height: ____________________ cms

Weight: ____________________ kgs

BMI:________________________

Please answer the following questions as carefully and honestly as possible. Read each question and CIRCLE the appropriate number.

		Never	Seldom	Sometimes	Often	Very often
1.	If you have put on weight, do you eat less than you usually do?	1	2	3	4	5
2.	Do you have a desire to eat when you are irritated?	1	2	3	4	5
3.	If food tastes good to you, do you eat more than you usually do?	1	2	3	4	5
4.	Do you try and eat less at meal times than you would like to eat?	1	2	3	4	5
5.	Do you have a desire to eat when you have nothing to do?	1	2	3	4	5
6.	Do you have a desire to eat when you are fed up?	1	2	3	4	5
7.	If food smells and looks good, do you eat more than you usually do?	1	2	3	4	5
8.	How often do you refuse food or drink offered because you are concerned about your weight?	1	2	3	4	5
9.	Do you have a desire to eat when you are feeling lonely?	1	2	3	4	5
10.	If you see or smell something delicious, do you have a desire to eat it?	1	2	3	4	5
11.	Do you watch exactly what you eat?	1	2	3	4	5
12.	Do you have a desire to eat when somebody disappoints you?	1	2	3	4	5
13.	If you have something delicious to eat, do you eat it straight away?	1	2	3	4	5
14.	Do you deliberately eat foods that are slimming?	1	2	3	4	5
15.	Do you have a desire to eat when you are cross?	1	2	3	4	5
16.	Do you have a desire to eat when you are expecting something to happen?	1	2	3	4	5
17.	If you walk past the baker do you have a desire to buy something delicious?	1	2	3	4	5
18.	When you have eaten too much, do you eat less than usual on the following days?	1	2	3	4	5
19.	Do you get a desire to eat when you are anxious, worried or tense?	1	2	3	4	5

	Never	Seldom	Sometimes	Often	Very often
20. If you walk past a snack bar or café, do you have a desire to buy something delicious?	1	2	3	4	5
21. Do you deliberately eat less in order not to become heavier?	1	2	3	4	5
22. If you see others eating, do you also have a desire to eat?	1	2	3	4	5
23. How often do you try not to eat between meals because you are watching your weight?	1	2	3	4	5
24. Do you have a desire to eat when you are frightened?	1	2	3	4	5
25. Can you resist eating delicious foods?	1	2	3	4	5
26. How often in the evening do you try not to eat because you are watching your weight?	1	2	3	4	5
27. Do you have a desire to eat when you are disappointed?	1	2	3	4	5
28. Do you eat more than usual when you see others eating?	1	2	3	4	5
29. Do you think about how much you weigh before deciding how much to eat?	1	2	3	4	5
30. Do you have a desire to eat when you are upset?	1	2	3	4	5
31. When you see someone preparing a meal, does it make you want to eat something?	1	2	3	4	5
32. Do you have a desire to eat when you are bored or restless?	1	2	3	4	5

Appendix E: Study 4: Participant information sheet (for home section of the study)

Information sheet for home component of the 4 day study:

You have now completed the first component of this study – the starting session. The remaining 3 parts of the study are things we ask you to complete at home (in your own time) over the next 4 days.

The remaining components are:

1. Take 12 saliva samples across the 4 days. Please take 3 saliva samples each day (we will inform you when we want you to take them below).
2. Complete 4 online daily diaries. One each evening, before you go to bed.
3. Continue to wear the activity watch that we have set and programmed for you. You will not need to do anything to this watch. Please LEAVE IT ON, and DO NOT take it off at any time over the 4 days. You can wear it while asleep at night, and it is waterproof so you can wear it while showering/swimming etc.

Saliva samples:

- Please take 3 saliva samples each day (in the same way that we instructed you during the starting session for your practice sample).
- Please take the samples at the following times EVERYDAY (for the 4 days):
  1. When you WAKE UP – it does not matter at what time you wake up, but it must be as soon as you wake up. Please leave the sample tube and swab next to your bed, so that you can take the sample without getting out of bed.
  2. 30 minutes AFTER your first sample. Please ensure you take note of the time in which you take your first sample, so that you can take sample 2, 30 minutes after.
  3. +12 hours – 12 hours after your first sample (i.e., 12 hours after you woke up). For example: if you woke up at 7am, your first sample would be at 7am, and the last at 7pm).
- Please complete the following table in regards to when you woke up (each day) and when you took your saliva samples. This table is to be used to help remind you to take your samples at the correct times. Please use it and report as accurately as possible.

Day	Date	What time did you wake up?	What time did you take sample 1?	What time are you due to take sample 2?	What time did you take sample 2?	What time are you due to take sample 3?	What time did you take sample 3?

Example: wake up: 6am – take sample 1, 6.30am: sample 2, 6pm: sample 3.

- Directions for taking a sample: please DO NOT eat or drink any foods at least 30 minutes before doing a sample. DO NOT drink or eat anything in between samples 1 and 2 (days 1-4) – e.g., your morning coffee. If you need a drink, you may have a small sip of water straight after you have done sample 1 (but then ensure no further water/drink/food is consumed until after you have done sample 2).
- When you are ready to take the sample, open the sample tube, and take the cotton swab out of the packet. Put the cotton swab in your mouth, under your tongue. Close your mouth, and keep the swab under your tongue for 2 minutes (please time this).
- Once the 2 minutes is up, please take the swab out your mouth and put it in the open sample tube, and push the lid on tightly.
- Please now put this sample in the fridge (ideally the freezer) straight away. (Note: if you put it in the fridge, please put this sample in the freezer as soon as you can).
- Repeat these steps for all 12 samples, ensuring that you take them at the specified times above.

Online daily diaries:

- You will need to complete 4 online diaries across the 4 day study.
- We ask that you complete one online diary each day, one every evening, just before you go to bed.
- We will email you a link that will take you to the online diary for that day (note: you will get one email each day across the 4 day study).
- You will need to input your participant ID code at the start of each diary (you will be reminded of the 3 components within this code each time, but please remember to report this code in exactly the same format as you have done from the start of the study).

Activity watch:

- You will have had an activity watch fitted and programmed for you at the starting session.
- You DO NOT need to do anything with this over the duration of the 4 day study. Please just continue to wear the watch over these 4 days.

- DO NOT take the watch off at any time over the 4 days. It is waterproof so you can wear it when showering/swimming, and can wear it when you sleep overnight too.

If you have any questions, please get in touch:

Thank you.

Contact details:

Primary researcher: Rachael Moss ps14rhm@leeds.ac.uk

Research supervisors:

Professor Daryl O'Connor 0113 343 5727 d.b.oconnor@leeds.ac.uk

Professor Mark Conner 0113 343 5720 m.t.conner@leeds.ac.uk

This study has been approved by the School of Psychology Research Ethics Committee on 27-10-2017), with a reference of 17-0252.

Appendix E: Study 4: Daily diary questionnaire

Cortisol and Eating Behaviour Study

0% complete

Page 1: Log In

Thank you for taking part in this study.

Please complete all sections in this daily diary and ***do not* back fill** on any missed diary days. **It is important that you complete this daily diary in the evening, *just before you go to bed.***

1. What day of the study is it? (i.e., one, two, three or four). * *Required*

   Please select ▾

2. What day of the week is it? * *Required*

   Please select ▾

3. Please enter your **unique participant code.** This consists of the first 2 letters of your mother's maiden name followed by your day and month of birth (e.g. Smith, 2nd June would be SM0206). * *Required*

   More info

4. At what time did you wake up this morning?

   Times need to be in the format 'HH:MM', for example 15:43.

   (hh:mm)

Next ›

Page 2: Daily Hassles/Stressors

Please complete the following questions about the daily stressors or hassles you have experienced today. Space has been provided for reporting 5 separate daily hassles, only use as many as you need, you are not expected to fill them all.

Provide a brief description of each hassle/stressor you have experienced today, the time when you experienced it, and rate its **intensity** from *1 (Not at all Intense) to 5 (Very Intense)*. Intensity is defined here as: *how severe/extreme your feelings were while you were experiencing the hassle.*

Daily hassles are defined as:

Events, thoughts or situations which, when they occur, produce negative feelings such as annoyance, irritation, worry or frustration, and/or make you subjectively aware that your goals and plans will be more difficult or impossible to achieve as a result.

This could be a hassle such as a physical injury to you or a loved one, missing a bus and being late for an appointment, or having a disagreement with a friend.

Daily Hassles/Stressors

5. **Stressor 1:** Description of stressor

a. What time did you experience this stressor (in 24 hour clock format)?

More info

Times need to be in the format 'HH:MM', for example 15:43.

(hh:mm)

This part of the survey uses a table of questions, view as separate questions instead?

b. How intense was this stressor?

Please don't select more than 1 answer(s) per row.

	1	2	3	4	5	
Not at all Intense	☐	☐	☐	☐	☐	Very Intense

Page 3: Daily uplifts

Please complete the following questions about the daily uplifts you have experienced today. Space has been provided for reporting 5 separate daily uplifts, only use as many as you need, you are not expected to fill them all.

Provide a brief description of each uplift you have experienced today, the time when you experienced it, and rate its **intensity** from *1 (Not at all Intense) to 5 (Very Intense)*. Intensity is defined here as: *how strong your feelings were while you were experiencing the uplift.*

A ***daily uplift*** is described as:

'being the opposite to a daily hassle - a positive experience such as the joy derived from manifestations of love, relief at hearing good news, the pleasure of a good night's rest, and so on...'

10. Uplift 1: Description of uplift

a. What time did you experience this uplift (in 24 hour clock format)?

Times need to be in the format 'HH:MM', for example 15:43.

(hh:mm)

This part of the survey uses a table of questions, view as separate questions instead?

b. How intense was this uplift?

Please don't select more than 1 answer(s) per row.

	1	2	3	4	5	
Not at all intense	☐	☐	☐	☐	☐	Very Intense

Page 6: Meals & Between-Meal Snacks

Please indicate if you ate more / less or the same amount of the following today as you usually do (e.g. if you had a larger than average lunch today, select 'more than usual').

This part of the survey uses a table of questions, view as separate questions instead?

19.

	Ate much less than usual	Ate less than usual	Ate usual amount	Ate more than usual	Ate much more than usual	Did not eat this today	Never eat this
Breakfast	○	○	○	○	○	○	○
Lunch	○	○	○	○	○	○	○
Dinner/Tea	○	○	○	○	○	○	○
Between-Meal Snack/s	○	○	○	○	○	○	○

If you ate a between-meal snack/s today, please list what food/drink you ate, and the time at which you ate each of these snacks (in 24 hour format) below (there is space for you to list up to 5 snacks):

a. Snack 1: What snack did you eat? (Please specify brand of snack and amount you consumed if possible. E.g., One 55 gram packet of skittles was consumed).

Your answer should be no more than 200 characters long.

i. At what time did you eat this snack?

Times need to be in the format 'HH:MM', for example 15:43.

(hh:mm)

20. To what extent have you eaten HEALTHY snacks today? (e.g., apple, banana, dried fruit, carrot sticks, nuts).

Please don't select more than 1 answer(s) per row.

	1	2	3	4	5	6	7	
Not at all	☐	☐	☐	☐	☐	☐	☐	Very much

This part of the survey uses a table of questions, view as separate questions instead?

21. To what extent have you eaten UNHEALTHY snacks today? (e.g., chocolate, crisps, cakes).

Please don't select more than 1 answer(s) per row.

	1	2	3	4	5	6	7	
Not at all	☐	☐	☐	☐	☐	☐	☐	Very much

Page 7: Fruit & Vegetables

22. How many portions of fruit did you eat today? (The following web page describes what is meant by an adult portion of fruit, **please make sure to open in a new tab so that you do not leave the survey page**: http://www.nhs.uk/Livewell/5ADAY/Pages/Portionsizes.aspx)

More info

Please select ▾

23. How many portions of vegetables did you eat today? (The following web page describes what is meant by an adult portion of vegetables, **please make sure to open in a new tab so that you do not leave the survey page:** http://www.nhs.uk/Livewell/5ADAY/Pages/Portionsizes.aspx)

More info

Please select ▾

Appendix E: Study 4: UG debrief sheet

UNIVERSITY OF LEEDS

Debrief sheet

Study title: Cortisol and eating behaviour Study

We thank you for participating in our research. This study is exploring the relationship between daily stress levels (using cortisol levels and the diary hassle/uplift measures) and eating behaviours.

The main theme of this research is to investigate the way in which stress influences eating choices, both in terms of snack consumption and meal size. This study is the second study in this area conducted by this particular research group, and it will help us further determine the patterns of behaviour associated with stress and eating.

Within this study, we anticipate that those who report a higher level of daily stress (seen in their daily cortisol levels and daily hassle responses) will consume more unhealthy snacks in between their daily meals.

By taking part, you have helped us explore this highly relevant and crucial area within stress and health research.

We thank you for your time. If you have any further questions, please contact Rachael Moss (ps14rhm@leeds.ac.uk).

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This study has been approved by the School of Psychology Research Ethics Committee on 27-10-2017), with a reference of 17-0252.