

**Understanding and Improving Chinese Adolescent Snacking  
Using Behaviour Change and A Mindfulness-based Approach**

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The candidate confirms that the work submitted is his/her own and that appropriate credit has been given where reference has been made to the work of others.

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## Abstract

**Background:** Despite the dramatic increase in the prevalence of childhood overweight/obesity in China, there is a lack of high-quality evidence for effective intervention strategies to tackle this issue. Unhealthy snacking has been suggested as a major part of unhealthy diets contributing to overweight/obesity, which is a potential target of weight-loss interventions for Chinese adolescents. Evidence suggests that mindfulness-based approaches have potentials in improving dietary intakes and promoting weight loss.

**Aim:** To generate a better understanding of adolescent snacking, and based on this, to develop and feasibility test a mindfulness-based behaviour change intervention to promote weight loss among overweight Chinese adolescents.

**Method:** Multiple approaches were employed, including a cross-cultural survey and a focus group study aiming at understanding adolescent snacking; a think-aloud study and a validation study aiming at producing a culturally appropriate measure of mindful eating in the Chinese population; and intervention development and a feasibility study to evaluate its feasibility, acceptability and preliminary effects.

**Findings and Conclusions:** This research suggested the importance of mindful eating in predicting and improving adolescent snacking. The theory of planned behaviour showed efficient in explaining adolescent snacking, and cultural context should be taken into account applying this theory. Chinese adolescent snacking is greatly influenced by subjective norms, while snacking of UK adolescents are largely habitual and less influenced by cognitive beliefs. The cultural differences suggest different intervention strategies for each group. A revised Chinese version of Mindful Eating Questionnaire was developed, which exhibited good psychometric properties in a sample of Chinese college students. Finally, a mindfulness-based snacking intervention was developed incorporating components of nutrition education, mindful eating and planning. A feasibility test provided evidence supporting the feasibility, acceptability and preliminary effects of this intervention on decreasing unhealthy snacking and promoting weight loss among overweight Chinese adolescents. A full-scale RCT to examine intervention effectiveness is warranted.

## **Glossary of abbreviations**

ACT:	Acceptance and commitment therapy
ANOVA:	Analysis of Variance
BCTs:	Behaviour change techniques
BCW:	Behaviour Change Wheel
BMI:	Body mass index calculated by dividing weight by height
BSQ:	Beverage and Snack Questionnaire
CBT:	Cognitive and behavioural therapy
CHNS:	China Health and Nutrition Survey
C-MEQ-R:	Chinese version of Mindful Eating Questionnaire - revised
COM-B:	Capability, opportunity, and motivation model of behaviour
DBCIs:	Digital behaviour change interventions
DEBQ:	Dutch Eating Behaviour Questionnaire
E-MBIs:	Mindfulness-based interventions tailored to eating practice
EI:	Energy intake
FCQ-T-r:	Food Craving Questionnaire – Trait - reduced
FFMQ:	Five Facets of Mindfulness Questionnaire
fMRI:	Functional magnetic resonance imaging
FV:	Fruit and vegetable
GCOTF:	Group of China Obesity Task Force
IOTF:	International Obesity Task Force
MAAS:	Mindful Attention Awareness Scale
MANOVA:	Multivariate analysis of variance
MBCT:	Mindfulness-based Cognitive Therapy
MB-EAT:	Mindfulness-based Eating Awareness Training
MBIs:	Mindfulness-based interventions
MBSR:	Mindfulness-based Stress Reduction
ME-CL	Mindful Eating – Conscious Living course

MEQ:	Mindful Eating Questionnaire
NHS:	National Health Service
NICE:	National Institute for Clinical Excellence
PA:	Physical activity
PBC:	Perceived behavioural control
PCA:	Principal component analysis
PSS:	Perceived stress scale
RCT:	Randomised controlled trials
SN:	Subjective norms
SSB:	Sugar-sweetened beverage
TDF:	Theoretical Domains Framework
TPB:	Theory of Planned Behaviour
TRA:	Theory of Reasoned Action

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## Chapter 1. Introduction

### 1.1 Child and adolescent obesity in China

Child and adolescent obesity is a worldwide public health concern. The adverse consequences of child and adolescent obesity include poorer physical and mental outcomes, psychosocial problems, and lower life satisfaction than healthy-weight peers (e.g., Rankin et al., 2016; Sahoo et al., 2015). Overweight and obese youth are also at higher risk of being overweight as adults, as well as more vulnerable to diabetes, cardiovascular diseases and a range of cancers in adulthood (Must & Strauss, 1999; Singh, Mulder, Twisk, Van Mechelen, & Chinapaw, 2008).

Worldwide, prevalence of overweight and obesity in children and adolescents combined rose by 47.1% during the last three decades (Ng et al., 2014). The UK is among the developed countries with large gains in the rate of overweight and obesity. Based on the recent data from the National Child Measurement Programme (NCMP), in England, **22.4%** children aged 4 to 5 years are classified as overweight or obese in 2017/18, and this prevalence increased to **34.3%** among children aged 10 to 11 years (Baker, 2019). The developing countries such as China, although show lower prevalence than did developed countries, are also facing the increasing rate of overweight/obesity and the health risks rising with it. This section outlines the current state of childhood obesity in China, potential causes, as well as measures and intervention efforts to tackle this health issue.

#### Prevalence and trends of childhood overweight and obesity in China

The prevalence of overweight and obesity among Chinese children and youth has substantially increased since 1985 (Zhang et al., 2018). According to a meta-analysis of 41 studies involving 2,016,361 Chinese children and adolescents (Liang, Xi, Song, Liu, & Mi, 2012), the prevalence of overweight and obesity among Chinese children and adolescents increased from **1.8%** (95% CI, 0.4 - 3.1) and **0.4%** (95% CI, 0.1 - 0.8) respectively in 1985, to **13.1%** (95% CI, 11.2 - 15.0) and **7.5%** (95% CI, 6.6 - 8.4) respectively in 2010, with an average increase of **8.3%** and **12.4%** respectively. The prevalence rates in the metropolis populations are higher. For example, a study

(Wu, Li, & Zong, 2016) involving 99,542 Chinese children and youth aged 6 to 19 years in Beijing found that when using the International Obesity Task-force (IOTF) standard, the prevalence rates of overweight and obesity in 2011 were 18.1% and 8.6%. From 2011 to 2015, according to a recently published study (Zhang et al., 2018) using data of 2,542 youth aged 7-18 years from 12 provinces of China, the prevalence of obesity has stabilized in children but not in adolescents. In 2015, based on the IOTF standard, the prevalence of overweight and obesity among 7-18 years old was **13.1%** (95% CI, 13.7 – 17.2) and **5.7%** (95% CI, 4.5 – 6.8). Boys showed significantly higher prevalence rates of obesity than girls, and northern youth showed a higher prevalence of overweight and obesity than their southern peers. Although the prevalence of overweight and obesity among youth in China is still relatively low compared to many developed countries, the actual population is very large. In 2015, China had the highest number of obese children and adolescents younger than 20 years of the world (Collaborators, 2017).

### **Causes of the childhood overweight and obesity epidemic in China**

Obesity could be a result of the complex interactions between genetic predisposition, environment, and human behaviours (Sahoo et al., 2015). In the last three decades, China has experienced rapid economic development, accompanied by dramatic changes in social environment as well as residents' lifestyles. The changes of dietary patterns, such as the increased consumption of fast food, sugar-sweetened beverages (SSBs) and snacks, have been suggested as a main contributor to the obesity epidemic in China, particularly among children and adolescents (Huang & Qi, 2015; Pan, Zhang, & Shi, 2011; Xu, Short, & Liu, 2013; Shang, Liu, & Zhang, 2012; Shan et al., 2010). The social attitudes towards body fatness could also be contributing to the obesity epidemic (Wu et al., 2006). As a result of long-term poverty and malnutrition, the traditional belief that fatness in childhood presents health and happiness is still widespread in China, which might be leading to overfeeding of children (Li, Adab, & Cheng, 2015; Wang & Zhai, 2013). In addition, due to the one-child policy that lasted for 35 years, China has 150 million one-child families today (Feng, Gu & Cai, 2016). These only children become the focus of attention of the whole family, and their parents tend to spend more money and provide more high energy-dense food for them (Zhang, Xu, & Liu, 2016). These factors contribute to the high energy intake of Chinese children and



adolescents.

In the meanwhile, the daily energy expenditures of Chinese children have decreased due to low physical activity levels and sedentary lifestyles, particularly among adolescents (Dearth-Wesley et al., 2017; Lu et al., 2017). Chinese middle and high school students (12 to 18 years) spend long hours every day on academic work during and after school time, which leaves very limited opportunities for exercise and sports (Tudor-Locke et al., 2007). Those who have more leisure time after school tend to spend the time on sedentary activities such as computer use and television watching (Dearth-Wesley et al., 2017). Taken together, the imbalance of energy intake and expenditure results in a high prevalence of childhood overweight and obesity in China.

### **Measures and interventions to tackle childhood obesity in China**

About two decades ago the Chinese government began to implement public health regulations and guidelines for obesity prevention, with a focus on promoting physical activity and nutrition education (Wang & Zhai, 2013). For example, the National Fitness Regulations was issued in 2009 targeting the physical activity of Chinese citizens, from children to adults. The Dietary Guidelines for Chinese Residents was published in 2007 and revised in 2016 by the Chinese Nutrition Society, as an attempt to improve population nutrition knowledge and dietary habits (Wang, Lay, Yu, & Shen, 2016). The School-aged Children and Teenagers Overweight and Obesity Prevention and Control Guidelines were also published in 2007 by the Bureau of Disease Control, aiming to help professionals in public health better understand and work to reduce obesity in children and young people (Chen, 2008).

Numerous intervention programmes for childhood obesity have been implemented or are ongoing. Most are school-based programmes targeting individual behaviour change with multiple components such as physical activity, health education, dietary improvement and psychological counseling (Feng et al., 2017; Gao, Griffiths, & Chan, 2007; Kong, Liu, & Tao, 2015; Li, Li, Baur, & Huxley, 2008; Shi, Liu, Tian, & Li, 2004). Feng et al. (2017) reviewed 76 effectiveness studies of school-based interventions for childhood obesity prevention and treatment in mainland China. The reviewed studies were published between 1990 and 2015, most of which (66 out of 76) were published in Chinese and involved a total of 72,620 Chinese children and youth aged 6 to 19 years.

The review showed that most (85%) treatment interventions targeting overweight and/or obese children and more than half (58.3%) prevention interventions for general students were effective in reducing or maintaining the BMI values of participants. However, most of the reviewed interventions have only been piloted on a small scale for a short duration. One exception is the Take Ten programme that involves 10min PA every weekday organised by schoolteachers (Li, Hu, & Schouten et al., 2010). This programme started with a pilot study in Beijing in 2004 and has been expanded to primary schools in 10 cities and provinces (Wang & Zhai, 2013). In addition, there remain several important gaps in our understanding of effective interventions for reducing childhood obesity in China.

First, although many of the interventions involved multiple components (students, parents and/or school environments), few reported the theoretical basis of the intervention, or provided evidence on mechanisms of the intervention effectiveness (Chen, 2008; Chen et al., 2015; Cui & Chen, 2016; Li et al., 2014). This has hampered the accumulation of knowledge about which theories best underpin interventions and active intervention components. For example, physical activity has been suggested as an effective intervention component (Feng et al., 2017). However, studies say little about effective behaviour change techniques or *how* the interventions improved physical activity levels. Thus, further studies are needed which clearly defend and test theory and investigate the mechanisms of change.

Second, most interventions have focused solely or mainly on primary school children with few implemented among adolescents, and even fewer for older adolescents in high school (e.g., Jiang, Pan, & Chen, 2010; Li, 2006). Chinese high school students spend long hours on schoolwork and intensively prepare for the National College Entrance Examination, which leaves them very limited time for other activities. According to a report of China Youth and Children Research Centre, 78% of the high school students in China study more than eight hours daily at school (Zhao, Selman, & Haste, 2015). Parents and the school staff are also under considerable stress linked to educational pressure, making it less likely that they could support implementation of an obesity intervention programme. However, obesity treatment and prevention in adolescents are important. Data from Chinese national surveys conducted in 2011 and 2015 respectively showed that the prevalence of obesity had stabilized in children but not in adolescents, which suggests that adolescents should be the key target of obesity prevention (Zhang et al., 2018). High

school students are in an important transitional period from adolescence to adulthood, and the health behaviours developed in this stage can extend well into adulthood (Frech, 2012). Therefore, it is essential to develop obesity interventions suitable and acceptable to Chinese adolescents, and which do not rely on school or parental resources to implement.

### **Unhealthy Snacking as a potential target of weight-loss interventions for Chinese adolescents**

As reviewed above, it is not yet clear from the current evidence that what the best focus of a weight-loss intervention would be for Chinese adolescents. Among the suggested contributors to childhood overweight/obesity, we proposed unhealthy snacking as a potential target of effective interventions.

The shift in dietary habits and food consumption has been suggested as one of the main causes for the obesity epidemic in China (von Deneen, Wei, Tian, & Liu, 2011; Woo, Cheung, Ho, Sham, & Lam, 2008). One major change in Chinese food habits is a significant increase in snacking, particularly among children and adolescents. Data from the China Health and Nutrition Survey (CHNS) showed that in 1991, only **15.4%** of Chinese children and adolescents aged 2 to 18 years ( $n = 4157$ ) snacked (i.e., food consumption outside three main meals) during the investigated three days (Wang, Zhai, Du, & Popkin, 2008). In 2009, the same survey showed more than **50%** of them snacked during the three-day period (Wang, Zhai, Zhang, & Popkin, 2012). Snacking among Chinese is still increasing (Zhai et al., 2014). According to the data of the CHNS in 2011, collected from 1905 children and adolescents aged 4 to 17 years in 12 provinces, the snack consumption rate was **65% to 76%**. Specifically, adolescents aged 14 to 17 years ( $n = 416$ ) snacked for an average of **0.7 times** per day, which provided **6.1%** of total daily energy intake (Du et al., 2016).

Although the dramatic increase in snacking among Chinese children and adolescents has been suggested as a cause for childhood obesity epidemic, evidence about the relationship between snacking and overweight among Chinese youth is mixed. This is in line with research findings from other cultures (e.g., Miller, Benelam, Stanner, & Buttriss, 2013). For instance, a survey study of 4260 children and adolescents aged 15 to 18 years in northern China found that,

compared to their normal weight peers, obese children and adolescents were more likely to be non-snackers (Guo et al., 2012). Another longitudinal study compared data from the CHNS in 2006, 2009 and 2011, and found that snacking was associated with decreased BMI in overweight/obese children aged 2 to 13 years at baseline (Taillie, Wang, & Popkin, 2016).

One potential explanation for the negative association between adolescent snacking and weight status was the food consumed during snacking. Some studies found that fruit was the most common snack for Chinese youth (Ouyang et al., 2016; Taillie et al., 2016), although unhealthy snack foods, fast foods and sweetened beverages were also frequently consumed (Ouyang et al., 2016; Wang, van der Horst, Jacquier, Afeiche, & Eldridge, 2018; Zhai et al., 2014). A survey study (Li, Dibley, Sibbritt, & Yan, 2010) involving 1804 adolescents aged 11 to 17 years found that snacking frequency and the consumption of fruit were associated with decreased risk of overweight and obesity, while increased consumption of beverages and energy-dense foods such as crisps were associated with increased risk of overweight and obesity. The CHNS conducted in 2004 also found that among 21,198 children aged 2 to 18 years in Beijing, frequent snack consumption (i.e., no less than three times per week) was a significant risk factor for overweight and obesity (Shan et al., 2010). Another interesting longitudinal study (Xu et al., 2018) conducted in 2015 and 2016 found that among 2368 Chinese children aged 6 to 14 years, high self-report weekly snack cost (i.e., money spent on foods and drinks consumed between meals) was significantly correlated with a fast increase in the percentage of body fat over time. Snack cost is a reflection of young people's autonomous choices around snacking and higher costs were significantly correlated with a fast increase in the percentage of body fat over time (Li et al., 2017). Taken together, these findings indicate that obesity interventions should target unhealthy snacking of Chinese youth and help them make healthier snacking choice, particularly for adolescents who are becoming increasingly autonomous in their food choice behaviour.

## **1.2 Snacking as a health-related behaviour**

Following the section above suggesting unhealthy snacking as a target of weight-loss interventions for Chinese adolescents, this section outlines the potential effects of snacking on health, and why it might contribute to overweight/obesity.

## **Defining snacking**

The most commonly used ways of defining snacking/snack foods are:

(1) based on the time of day that foods are consumed. For example, Kerr et al. (2008) defined snacking as eating outside usual meal time slots (06.00 to 9:30, 11:30 to 14.30, and 16:30 to 19:30). The major limitation of this definition is that eating patterns vary according to lifestyle and culture.

(2) based on the time since the last meal was consumed. For example, Piernas and Popkin (2010b) defined snacks as foods ingested more than 15 minutes after a meal.

(3) based on the energy content or nutrient profile of the foods in question, i.e. high quality (e.g., an apple or glass of milk) or low or no quality (e.g., ice cream, candies, tea). Thus, what one eats, not when, is important. However, many foods that are traditionally considered as snacks, such as biscuits and corn crisps, are frequently served as part of a meal. Defining low and high quality snacks is also challenging (Johnson & Anderson, 2010).

(4) In many studies snacking was investigated synonymously as eating frequency. For instance, Howarth, Huang, Roberts, Lin, and Mccrory (2007) explored the effect of snack consumption on body weight by examining the relationship between individuals' eating frequency and body mass index (BMI).

(5) In some studies, no clear guidelines of how to define "snacking" or "snack foods" were given; study participants were expected to decide whether a food was consumed as part of a meal or as a snack by their own standard. In this case, different definitions are potentially used by different population groups.

The lack of clear definition of snacking is a barrier to the interpretation of empirical data and the development of evidence-based dietary recommendations for consumers (Johnson & Anderson, 2010). Throughout this thesis, the ways in which snacking is defined and operationalised in studies will be reported.

## **Prevalence and trends in snacking**

Snacking is a common practice in western society. In the US in 1997-1998 and 2003-2006, the

prevalence of snacking (defined as one or more snacks per day) increased from 71% to 97% for adults (n = 44,754) and from 74% to 98% for children aged 2-18 years (n = 31,337) (Piernas & Popkin, 2010a, 2010b). In Switzerland, more than one third of 6189 adults with a mean age of 54.4 years reported to snack between 7.5 to 20.1 times per week (Christina Hartmann, Siegrist, Horst, & Der, 2013). Snacking is as a significant contributor to overall energy intake (EI), estimated at 24% to 27% of total EI in US adults between 2003-2006 (Piernas & Popkin, 2010a, 2010b), about 21% in Scotland among children aged 5 to 17 in 2006 (Macdiarmid et al., 2009), nearly 20% among Flemish 13-18 years old adolescents (n = 341) in 1997 (Matthys, De, & De, 2003), around 30% among British adolescents aged 13-16 (n = 434) in 1997 (Kerr et al., 2008), and 35% to 40% in Finnish adults (25-64 years of age, n = 2,007) in 2002 (Ovaskainen et al., 2006). The study in Finland also showed that 19% of men and 24% of women adopted a "snack-dominating meal pattern" and obtained more than half of their energy intake from snacks rather than from main meals (Ovaskainen et al., 2006). In summary, snacking is highly prevalent and contributes 15-30% of daily energy in the US and European countries (Mattes, 2018).

Compared to the high prevalence of snacking in some western cultures, snacking plays a relatively small role in the diets of Chinese people (Wang et al., 2012). However, as reviewed above, snacking prevalence in China has been increasing. Wang et al. (2012) reported that the percentage of children and young adults consuming a snack over a three-day period had risen substantially, although this was still less than that identified in European and American populations. Specifically, the prevalence of reported snacking was **58.8%** in 2-6 years old, **54.4%** in 7-12 years old, and **54.4%** in 13-18 years old. Prevalence was considerably lower in adults, namely 38% in 19-44 years old and 35.6% in people aged 45 years and above. Also, snacking contributed a relatively lower proportion of total daily EI, ranging from **12.3%** among young children to just **4.1%** among older adults, representing considerably lower levels of snacking and EI from snacking compared to levels reported in American and European studies.

## **Is snacking good or bad for health?**

### *Snacking and bodyweight*

Snacking has been cited as an important contributor to the increased incidence of overweight and obesity. However, evidence showing associations between snacking and bodyweight remains inconsistent with reports of positive associations, no associations and inverse associations between snacking and bodyweight and/or other parameters of obesity. Among 30 cross-sectional studies reporting correlations between snacking and body weight/parameters of obesity (defining snacking as eating occasions, meal patterns, or consumption of snack foods), 14 studies (covering a sample of  $n = 28,407$  children and  $n = 60,117$  adults) found no association in adults (e.g., Hampl, Heaton, & Taylor, 2003; Kant & Graubard, 2006) or children (e.g., Huang, Howarth, Lin, Roberts, & Mccrory, 2004; Nicklas et al., 2004). Six studies reported inverse associations in children ( $n = 28,137$ ) (e.g., Guo et al., 2012; Larson et al., 2016). Six studies (covering a sample of  $n = 7293$  children and  $n = 7,523$  adults) found positive associations in adults (e.g., Howarth et al., 2007; Keski-Rahkonen et al., 2007) and children (Lioret, Touvier, Lafay, Volatier, & Maire, 2008; Tripicchio et al., 2019). Three studies found no or inverse association between snacking and body weight/parameters of obesity among normal weight individuals, but positive association among obese men, women and adolescent girls (covering a sample of  $n = 15,613$  adults and  $n = 68$  adolescent girls) (Forslund, Torgerson, Sjöström, & Lindroos, 2005; O'Connor, Brage, Griffin, Wareham, & Forouhi, 2015; Yoon & Lee, 2010). Overweight/obese adults also reported to consume more high-calorie snacks and less yogurt and nuts than their normal-weight counterparts (O'Connor et al., 2015). In addition, several intervention studies have also provided additional support for the finding that snacking *per se* is not necessarily related with increased body weight (Vander Wal et al., 2009; Waller et al., 2004).

In conclusion, evidence seemed to show that snacking *per se* is not necessarily related to increased bodyweight. High snack frequency has been found in both healthy and unhealthy dietary behaviours and lifestyle patterns (Hartmann et al., 2013). Snacking appears to be associated with increased intakes of healthy foods such as fruit, whole grain, and fiber (Hampl et al., 2003; Kerr et al., 2008), and with improved dietary quality (Ovaskainen et al., 2006). Snacking

is also associated with increased physical activity (Kerver, Yang, Obayashi, Bianchi, & Song, 2006) and was suggested to help appetite control thus preventing overeating at meals (Leidy & Campbell, 2011; Njike et al., 2016). Thus, the addition of snacks into a daily eating pattern may not increase total EI or increase body weight status. One potential explanation for the positive associations observed in some of the studies is that the snack foods in question were usually high-energy, high-fat foods (Murakami & Livingstone, 2016; O'Connor et al., 2015; Woo, Cheung, Ho, Sham, & Lam, 2008). Therefore, it is not snacking in itself but the nature of the snacks consumption that is of concern (Jinsook & Nanjo, 2010; Llauradó, Albar, Giralt, Solà, & Evans, 2015; O'Connor et al., 2015). The relationship between snacking and weight may differ for different populations based on their food choice, weight status as well as genetic and behavioural traits for weight gain.

#### *Snacking and nutrient intake*

In many literatures, foods related to snacking have been typically considered as energy-dense and nutrient-poor foods (e.g., Weng et al., 2012). However, as noted above, high snack consumption may associated with both healthy and unhealthy dietary behaviour and lifestyle patterns (Hartmann et al., 2013). In fact, snacks could be an important source of essential nutrients (Marangoni et al., 2019). For example, snack foods have been shown to substantially contribute to the intake of vitamins, carotenoids and minerals (Stroehla, Malcoe, & Velie, 2005; Talegawkar et al., 2007; Zizza, Arsiwalla, & Ellison, 2010). Snacking is also associated with a wider variety of food intakes which may result in a more balanced intake of nutrients (Fayet-Moore et al, 2017).

A cross-sectional study investigated the effect of snacking and eating frequency on dietary quality of 884 British adolescents aged 11 to 18 years from the UK National Diet and Nutrition Survey (NDNS) (Llauradó et al., 2016). Snacking frequencies showed no association with dietary quality; but more high-calorie snacking occasions (>210 kJ) was associated with lower dietary index scores. These findings suggested that replacing high-energy foods with low-energy snacks for snacking, rather than reducing snacking frequencies, may be an effective way to improve adolescents' dietary quality.

To conclude, consumption of snacks with high nutritional quality may be associated with a



higher nutrient intake and does not compromise diet quality *per se*.

### **Why snacking still could be problematic**

Despite the inconclusive evidence for the contribution of snacking to weight gain, some researchers argued that snacking still could be problematic. Miller et al. (2013) suggested that caution is needed when interpreting the findings of observational studies on the association between snacking and weight status, as overweight and obese individuals are more likely to under-report their food intake, especially snacks (Livingstone & Black, 2003; McCrory, Howarth Roberts, & Huang, 2011). Several studies have shown that the inverse association between eating/snacking frequency and bodyweight was attenuated or turned into positive after excluding under-reporters (Huang, Roberts, Howarth, & McCrory, 2005; McCrory et al., 2011; Murakami & Livingstone, 2015). Less snacking frequency or fewer snack intakes could also be a result of being overweight, as overweight individuals may intentionally reduce snacking in an attempt to lose weight (Miller et al., 2013). There is strong evidence showing the positive association between snacking frequency and energy intake, indicating that those who have a higher snacking frequency might be at greater risk of weight gain compared to those who eat less frequently (Duffey et al., 2013; Mattes, 2018; Miller et al., 2013).

Another concern about snacking and related health outcomes is that snack items are often highly processed food and high in added sugar, salt and fat (Duffey et al., 2013). The modern food industry has made these products increasingly palatable, accessible and appealing, especially for young people (Duffey et al., 2013; Mattes, 2018; Puggelli & Bertolotti, 2013). In addition, despite the high energy contribution, snacks might exert limited effects on hunger and appetite (Perrigue, Drewnowski, Wang, & Neuhouser, 2016). Evening snack is also found to be associated with increased body mass index among children (Karatzi, Moschonis, Choupi, & Manios, 2017). Overall, although snacking can contribute to important nutrients, it is also associated with a high risk of positive energy balance and weight gain.

### 1.3 Research aims and thesis overview

The fundamental purpose of this doctoral research was to develop a feasible individual-level intervention to decrease adolescent overweight and obesity in China. The literature review outlined above indicated that weight loss interventions for overweight Chinese adolescents might achieve positive outcomes by targeting unhealthy snacking. A series of studies were conducted aiming to generate a better understanding of Chinese adolescent snacking, and based on this, develop and feasibility test a snacking intervention to promote weight loss among overweight Chinese adolescents.

**Chapter 2** reports a cross-cultural survey study aiming to better understand adolescent snacking by exploring potential determinants. Specially, this study examined the role of eating styles (emotional eating, external eating, restrained eating, mindful eating), the Theory of Planned Behaviour (TPB) components (attitudes, subjective norms, perceived behavioural control), and habit strength in predicting snacking in Chinese ( $n = 182$ ) and UK ( $n = 96$ ) adolescents aged 16 to 19 years. This study provides evidence for how individual differences in eating styles and social cognitive variables might shape adolescent snacking, and informed the development of a mindfulness-based snacking intervention. Important determinants indicated by this study were considered as potential avenues for interventions to bring about positive changes in snacking. In addition, cultural and gender differences in snacking and determinants were explored.

Having examined influencing factors of adolescent snacking using a quantitative approach, a qualitative study was then conducted to further understand Chinese adolescent snacking. **Chapter 3** describes a focus-group study aiming to explore several research questions: (1) what do Chinese adolescent snack on and why do they snack? (2) how do Chinese adolescents perceive healthy and unhealthy snacking, and what would influence their snack choice? (3) what are the motives and barriers for Chinese adolescents to snack more healthily? (4) what are Chinese adolescents' attitudes towards, and preferences for, a snacking intervention? Four single-sex groups of the first and the second-year students (16 to 18 years) were recruited for this study. As preparation for intervention development, the findings of this study helped us understand key features of a feasible snacking intervention for Chinese adolescents.

The next stage of this research involved preparation of the measure of a key intervention component (based on findings of the survey study) – mindful eating. **Chapter 4** reports a think-aloud study examining how a sample of Chinese adults (N = 7) and a sample of Chinese adolescents (N = 10) engaged with a Chinese version of the Mindful Eating Questionnaire (MEQ). Based on the findings of this study, the Chinese version of the MEQ was revised. The revised Chinese version of the MEQ was further validated in a sample of Chinese college students (N = 430), as outlined in **Chapter 5**. These two studies generated a culturally appropriate and robust measure of mindful eating, which was used in the subsequent study to explore the effects and potential mechanisms of a mindfulness-based snacking intervention.

**Chapter 6** outlines the development of a digital mindfulness-based snacking intervention. The study draws on understandings of digital interventions, mindfulness-based interventions and planning strategies in promoting health behaviour and weight loss, as well as the findings of our survey and focus group study. The intervention was designed and developed using the Behavioural Change Wheel (BCW) and the COM-B model, followed by user consultation and subsequent refinement. From this process, an online weight loss programme targeting unhealthy snacking incorporating nutrition education, mindful eating strategies and planning was developed.

**Chapter 7** details a feasibility study of the mindful snacking intervention in a group of overweight Chinese adolescents aged 16 to 18 years (N = 46). The feasibility and acceptability of the intervention was evaluated using mixed approaches. Preliminary intervention effects on weight loss, snacking, eating styles, craving and eating self-efficacy were also examined. Follow-up interviews were conducted to understand participants' perceive usefulness of intervention components and meaningful behavioural change. In addition, this study examined the feasibility of combining planning with mindful eating, and whether this added intervention component can bring about greater changes.

**Chapter 8** integrates the key findings of this research, and addresses the theoretical and practical implications. Strength and limitations are discussed in terms of data quality and intervention evaluation, with recommendations for further directions in related research area.

## Chapter 2. Determinants of adolescents snacking: a cross-cultural study

### 2.1 Introduction

When developing behavioural change interventions, it is essential to understand the context and drivers for the targeted users' poor health behaviours (Michie, Atkins & West, 2014). This chapter reports a survey study aiming to better understand adolescent snacking by exploring potential determinants. Adolescents' snacking may be explained by both individual and environmental characteristics. In this chapter, we particularly focused on the influencing factors of adolescent snacking at an individual level, as these may be more amenable to change through psychological intervention. The Theory of Planned Behaviour (TPB) is employed as the theoretical framework to understanding and predicting snacking. This allows us to examine possible social cognitive determinants of snacking, and how these factors predict their snacking. We also examined how eating styles, including emotional eating, external eating, restrained eating and mindful eating, might affect adolescent snacking and body weight. The findings of this study will help us design and develop a healthy snacking intervention targeting overweight Chinese adolescents. In addition, to explore how the influencing factors might differ between Eastern and Western cultures, we conducted a cross-cultural comparison between Chinese and UK adolescents.

#### **How do individual differences variables influence adolescent snacking – the role of eating styles**

*Unhealthy eating styles: Emotional eating, external eating and restrained eating*

Over recent decades, eating style has emerged as an important individual difference characteristic that affects individuals' eating behaviour. Most studies investigating eating styles and dietary practice have focused on three *unhealthy* eating styles: emotional eating, external eating and restrained eating (Keller & Siegrist, 2015; Shukri, Jones, & Conner, 2018).

Overeating stimulated by emotional and environmental cues in the absence of hunger has been suggested as the fundamental cause of human obesity. Kaplan and Kaplan (1957) firstly

proposed their Psychosomatic Theory which considers excessive eating as a reaction to emotional arousal, i.e., *emotional eating*. While many people feel a loss of appetite when they are angry, anxious or irritated, some are more inclined to (over)eat in response to negative emotions. Based on the observations of obese children, Bruch (1964) suggested that these children learned to label negative feelings as hunger. Thus, it has been argued that they cannot distinguish the emotional arousal states from hunger, and develop the habit of overeating as an coping strategy to reduce their negative feelings by eating (Ganley, 1989).

In contrast, the External Theory of obesity (Schachter & Rodin, 1974) focuses on eating in response to external stimuli, such as the smell and taste of food or time of day, regardless of the internal state of hunger or satiety, i.e., *external eating*. According to External Theory, people who tend to eat in response to external cues might have difficulties perceiving their internal cues, and therefore cannot rely on these to direct their intake. As a consequence, they eat in the absence of hunger and consume more than physically needed.

Restraint Theory, however, considers overeating as a consequence of intense dieting (Herman & Polivy, 1975, 1983). According to this theory, those who have a disposition to weight concern and try to restrain food intake repeatedly or in the long-term, will finally experience a relapse when the self-control processes are fatigued. Then, due to the calorie deprivation and the negative feelings about the failure in diet such as guilt, overeating episodes may occur. In addition, continuously ignoring internal cues may make it more difficult for the dieters to recognise their feelings of hunger and satiety, and in turn become more sensitive to external cues. In this sense, emotional eating and external eating can also be considered as consequences of dieting (Herman & Polivy, 1975).

Van Strien, Frijters, Bergers, and Defares (1986) argued that although emotional eating, external eating and restrained eating are originally proposed to explain human obesity, individuals with these unhealthy eating patterns are not necessarily overweight or obese. They developed the Dutch Eating Behaviour Questionnaire (DEBQ) to assess emotional eating, external eating and restrained eating in the general population. The DEBQ consists of 33 items with the response to each question from 1 (never) to 5 (very often). Examples of items on this scale are: “Do you have the desire to eat when you are irritated?” (*emotional eating*); “If you see or smell something delicious, do you have a desire to eat it?” (*external eating*); “How often do you refuse food or

drink offered because you are concerned about your weight?" (*restrained eating*). The DEBQ has shown to have good construct and factorial validity, as well as acceptable internal reliability in adolescent samples (Braet et al., 2008; Wardle et al., 1992), regardless of weight status.

Unlike many of the measures of dietary practice which focus on quite isolated eating behaviours, such as food intake in the last 24 hours or one week, the DEBQ assesses respondents' eating behaviours in general (Braet et al., 2008). As suggested by relevant theories discussed above, *emotional eating*, *external eating* and *restrained eating* represent individuals' tendency of eating which may be affected by early learning experience and personal dispositions. Therefore, in line with many previous studies (Braet et al., 2008; O'Connor et al., 2008; Royal & Kurtz, 2010; Snoek, van Strien, Janssens, & Engels, 2006; Wardle et al., 1992), the present study investigated emotional eating, external eating and restrained eating as dispositional eating styles.

#### *Unhealthy eating styles and adolescent body weight*

Unhealthy eating styles have been found to be associated with body weight and food intake in adults (Adriaanse, de Ridder, & Evers, 2011; Habhab, Sheldon, & Loeb, 2009; Royal & Kurtz, 2010; Van Strien et al., 1986). In the past three decades, increasing research has explored unhealthy eating styles among children and adolescents. Although positive association of the unhealthy eating styles with body weight would be expected according to the original theories, previous studies have shown mixed evidence for children and adolescents.

Evidence is consistent supporting higher *restraint eating* among overweight adolescents. Cross-sectional studies showed a positive association between restraint eating assessed using the DEBQ and weight status or BMI was reported among adolescents in the UK (Wardle et al., 1992), France (Lluch, Herbeth, Mejean, & Siest, 2000), Netherlands (Snoek et al., 2007), Belgium (Braet et al., 2008), Switzerland (Walther & Hilbert, 2016) as well as China (Hou et al., 2013; Wu, Cai & Luo, 2017). This is consistent with the restrained theory of obesity. However, it should be cautious when drawing conclusions from cross-sectional data, as the association may also indicate that individuals with higher BMI or being overweight are more likely to control their diet. To explore the causal relationship between restraint eating and weight, Snoek et al. (2008) conducted a 3-year longitudinal study in a sample of siblings aged 13 to 16 years at baseline from 404 Dutch

families. The results of structural equation modeling supported the predictive effect of the BMI on restrained eating, suggesting that adolescents with higher BMI were more likely to restrain their eating. In a more recent paper, Snoek et al. (2013) reported the findings of a 5-year longitudinal study of the same project, and showed a higher likelihood of adolescents with higher restraint eating of being in the higher BMI trajectories. Taken together, although the association between restraint eating and body weight among adolescents is relatively consistent, its implications should be carefully interpreted.

Evidence for the relationship of emotional eating and external eating with adolescents' body weight is more mixed. Most studies did not find significant associations between *emotional eating* and weight status among adolescents (Wardle et al., 1992; Lluch et al., 2000; Nguyen-Rodriguez et al., 2008; Ledoux et al., 2011; Xie, Cai, & Liu, 2016; Snoek et al., 2013). For example, Wardle et al. (1992) found that the correlation between emotional eating and BMI was non-significant in a sample of 846 British adolescents (439 girls) with a mean age of 14.5 years. For Chinese adolescents, Xie et al. (2016) found the correlation between emotional eating and BMI was not significant among 181 overweight adolescents aged 11 to 17 years ( $M = 14.4$ ;  $SD = 1.25$ ). In contrast, Wu et al. (2017) found that in a sample of 1230 Chinese adolescents with a mean age of 14.6 years, overweight and obese adolescents ( $n = 249$ ) scored significantly higher on emotional eating than their peers with normal weight. Two studies found that the association between emotional eating and BMI differed by gender among adolescents. In a sample of 1016 Belgium adolescents with a mean age of 14.9 years, higher emotional eating was reported only by overweight girls but not boys (Braet et al., 2008). In another study with 10,087 Dutch adolescents aged 11 to 16 years ( $M = 13.0$ ;  $SD = 0.8$ ), however, the result of logistic regression showed a negative association between emotional eating and being overweight for boys but not girls (Snoek et al., 2007).

Concerning *external eating*, several studies found negative associations between external eating and weight statuses among adolescents from China (Hou et al., 2013), the UK (Wardle et al., 1992), Netherlands (Snoek et al., 2007) and the US (Ledoux et al., 2011). Lluch et al. (2000) found a negative correlation between external eating and BMI only for French adolescent girls but not boys. This is in contrast with the external theory of obesity, but could reflect the effect of adolescents' body weight on eating style. In comparison, Wu et al. (2017) found higher external

eating in overweight and obese Chinese adolescents compared to those with normal weight. The positive association between external eating and being overweight was also found in Belgium boys but not girls (Braet et al., 2008). A longitudinal study, however, found no association between external eating and weight status among adolescents (Snoek et al., 2013).

In summary, restrained eating is consistently associated with higher BMI or being overweight, which is consistent with the restrained theory of obesity, but may also indicate that young people with higher BMI are less satisfied with their weight status and more likely to control their diet. Association between external eating and lower BMI could also be a reflection of how young people's eating style was affected by their body weight. Association between emotional eating and the BMI showed inconsistency, with reports of no association, positive association, or associations differ by gender.

#### *Unhealthy eating styles and adolescent dietary intakes*

Theoretically, emotional eating and external eating could lead to excessive food intake as a result of eating in absence of physical hunger. Restraint eating could lead to decreased energy intake for a short period, but overeating and increased energy intake as a long-term outcome. However, a few studies provided mixed empirical evidence for the relations of eating styles with dietary intakes among adolescents, which did not support the hypotheses in all aspects.

Wardle et al. (1992) found that among 846 British adolescents with a mean age of 14.5 years, higher energy intake was associated with higher levels of external eating and lower levels of restraint eating, while no association was found between energy intake and emotional eating. Lluch et al. (2000) reported that among French boys ( $n = 270$ ; mean age = 15.2 years) and girls ( $n = 290$ ; mean age = 15.8 years), external eating was positively correlated with energy intake, restraint eating was positively correlated with energy derived from protein only in girls, while emotional eating was not correlated with energy intake. Snoek et al. (2006) found in Dutch adolescents aged 11 to 16 years ( $n = 10,087$ ; mean age = 13.0 years,  $SD = 0.8$ ), those who scored high on external eating (i.e., above median) and emotional eating, and scored low on restrained eating (i.e., below median) consumed more snacks. In addition, the positive association between television viewing and snacking was stronger in adolescents who scored high on emotional eating



and low on restrained eating, as well as boys scored high on external eating. Nguyen-Michel et al. (2007) examined the relationship between emotional eating and dietary intake in a sample of 512 predominantly Latino adolescents aged 12 to 18 years ( $M = 13.4$ ,  $SD = 0.64$ ), and found that emotional eaters consumed more salty energy-dense foods, as well as fruit and vegetables (FV) (only boys), than non-emotional eaters. In a more recent cross-sectional study (De Cock et al., 2016) with a sample of 1104 Flemish adolescents (mean age = 14.7 years;  $SD = 0.8$ ), the intake of unhealthy snacks and sugar-sweetened beverages (SSBs) was found to be positively correlated with emotional eating and external eating. External eating and emotional eating partially mediated the relation between sensitivity to reward and the intake of unhealthy snacks. In this study, the association between emotional or external eating with unhealthy snack and beverage intake was not moderated by either food availability at home or at school, suggesting that the influence of eating styles on adolescents' snacking was independent of the environment adolescents live in.

Only one cross-sectional study has explored the association between unhealthy eating styles and Chinese adolescent dietary intake. Lu et al. (2016) found that in a sample of Chinese adolescents aged 11 to 17 years, emotional eating was positively correlated with intake of high energy-dense foods among girls ( $r = .117$ ,  $p < .001$ ;  $n = 2145$ ; mean age = 13.5 years,  $SD = 1.6$ ) but not boys ( $n = 2171$ ; mean age = 13.6 years,  $SD = 1.7$ ). Emotional eating also mediated the positive association between suppression and intake of energy-rich food in girls.

In summary, external eating is consistently associated with the intake of high-calorie foods. The association between emotional eating and unhealthy food consumption is more frequently observed among girls. Evidence for the relationship between restraint eating and adolescent dietary intake is insufficient, although one study involving a large sample reported a negative association between restraint eating and unhealthy snacking in both boys and girls.

#### *Unhealthy eating styles and stress-related snacking*

Eating style has also been suggested to explain the relationship between psychological stress and eating behaviour. High levels of stress have been linked to increased food intake, decreased in food intake, and specific food preferences (Cartwright et al., 2003; Habhab et al., 2009; Jääskeläinen et al., 2014; Jeong & Kim, 2007; O'Connor et al., 2008; O'Connor, Armitage, &

Ferguson, 2015). Cartwright et al. (2003) found an association between greater stress and more snacking, more fatty food intake, less FV intake and a reduced likelihood of daily breakfast consumption among 4320 pupils (mean age = 11.83 years) in the UK. In a sample of 350 middle school girls in Korea, 33% reported consuming more snacks when feeling stressed than when not stressed. An association was also observed between high stress and increased snack intake (Jeong & Kim, 2007). In another cross-sectional study (Jääskeläinen et al., 2014), 43% of 3598 Finnish girls and 15% of 3347 boys at the age of 16 years reported trying to make themselves feel better by eating when under stress. Compared to those who never coped with stress by eating, stress-driven eaters had greater BMI, greater waist circumferences, and a higher prevalence of overweight and obesity. These findings provide strong support for the association between stress and unhealthy snacking among adolescents.

High levels of stress can cause negative emotions such as anxiety and depression, undermine self-control processes through which restrained eaters restrict their food intake, and reduce individuals' internal cues to hunger while drawing attention to external cues. Thus, emotional eating, restrained eating and external eating have been considered important individual differences in stress-related eating behaviours accounting for why some people overeat under stress when others do not (Conner, Fitter, & Fletcher, 1999). Conner et al. (1999) conducted a diary study with a sample of 60 students aged 18 to 22 years. The significant positive correlation between number of daily hassles experienced and number of snacks consumed was only observed among those high on *external eating*, while no relationship was found among those low on *external eating*, which indicated that those high on external eating consumed more snacks when under stress. In addition to eating styles, gender is also proposed as an important potential moderator on the relationship between stress and snacking. In a diary study with a sample of 422 adults (mean age = 40.32 years) (O'Connor et al., 2008), associations were found between daily hassles and increased intake of high fat, high sugar snack foods and a perceived reduction in main meals and vegetable consumption. Individuals high on *restrained eating*, *emotional eating*, *external eating* or who were obese or female showed significantly stronger positive associations between daily hassles and snacking, with emotional eating being the pre-eminent moderator of the hassles-snacking relationship. This moderating effect of eating style on hassles-snacking relationship could partly be explained by cortisol reactivity (Newman, O'Connor, & Conner,

2007).

In conclusion, there is strong evidence for the potential effect of eating styles on stress-related snacking. However, the above findings are based on adult samples. Little research has investigated the role of adolescents' eating style on their stress-related snacking.

#### *Healthy eating style: mindful eating*

Mindfulness is a Buddhist-based concept that has received increasing attention in the field of psychology over the last three decades. In the context of modern psychology research, mindfulness is generally defined as the awareness that emerges when purposely paying attention to the moment-to-moment experience without judging or reacting to it (Kabat-Zinn, 1990). Mindfulness with a specific focus on eating behaviour can be termed *mindful eating*. Mindful eating describes a non-judgmental awareness of emotional and physical sensations associated with eating (Framson et al., 2009). Albers (2009) identified three basic aspects of mindful eating: to notice the characteristics of food eaten including its taste, smells, and textures; to recognise one's eating habits and patterns, such as eating while multitasking or eating with thoughts wandering; and to be aware of the triggers for initiating and stopping eating.

Framson et al. (2009) developed the Mindful Eating Questionnaire (MEQ) as the first eating-specific mindfulness scale. The 28-item questionnaire consists of five subscales: (i) *disinhibition*, the inability to stop eating when full; (ii) *awareness*, to what extent an individual notices the characteristics of food and the effects of food on his/her internal states; (iii) *external cues*, eating in response to environmental triggers; (iv) *emotional response*, eating in response to negative emotional states; (v) *distraction*, thinking of other things when eating. In this study (Framson et al., 2009), significant and strong inverse associations of the summary MEQ score and all subscales with BMI was reported in a sample of 303 adult participants (mean age = 42.0 years, SD = 14.4) in the US.

#### *Why is mindful eating a healthy eating style?*

The central features inherent in mindful eating appear to opposite to those associated with unhealthy eating (e.g. overeating, eating in the absence of hunger). Being aware of internal and

external cues may help an individual to be less reactive to negative emotions or to food-related stimuli, and having a non-judgmental attitude could help to reduce an individual's body dissatisfaction and body image concern thus reducing dietary restraint. In line with the conceptualisation of mindfulness, mindful eating can be evaluated as a dispositional eating style of individuals, and can also be developed through training.

Evidence supporting the positive effect of mindful eating on healthy weight and eating comes primarily from intervention studies. Mindfulness-based interventions (MBIs), tailored towards eating practices (E-MBIs), aim to help participants cultivate mindfulness skills related to eating or, in general, to acquire more healthy eating habits. Evidence for their effectiveness on weight management and eating is growing, with moderate to large effects of E-MBIs in reducing calorie intakes, binge eating, emotional eating and external eating (Carrière, Khoury, Günak, & Knäuper, 2018; Dibb-smith, Chapman, & Brindal, 2019; Godfrey, Gallo, & Afari, 2015; Katterman, Kleinman, Hood, Nackers, & Corsica, 2014; O'Reilly, Cook, Spruijt-Metz, & Black, 2014; Ruffault et al., 2017; Schnepfer, Richard, Wihelm, & Blechert, 2019; Tapper, 2017; Warren, Smith, & Ashwell, 2017), and mixed but promising evidence for their effectiveness on weight loss (Carrière et al., 2018; Dunn et al., 2018; Katterman et al., 2014; Olson & Emery, 2015; Ruffault et al., 2017; Warren et al., 2017). Becoming a more mindful eater is the proposed mediator of these outcomes. By far, however, the research has mainly focused on adult populations in Western cultures. Only two studies have shown feasibility of E-MBIs among adolescents, with the effects on weight loss and eating behaviour mixed (Barnes & Kristeller, 2016; Daly et al., 2016). Further studies are needed to explore the application of E-MBIs in adolescents.

A few laboratory studies have explored the role of mindful eating in dietary practice and potential mechanisms. For example, brief instructions of mindful eating showed to decrease the following calorie intake by increasing eating enjoyment of undergraduates in a lab setting (Arch et al., 2016). Hendrickson and Rasmussen (2017) found that brief mindful eating training reduced impulsive food choice in both adults and adolescents. Similar results have also been reported by several other lab studies (Cavanagh, Vartanian, Herman, & Polivy, 2014; Jordan, Wang, Donatoni, & Meier, 2014; Marchiori & Papias, 2014; Seguias & Tapper, 2018). Particularly, two recent studies showed how mindful eating skills might reduce external eating. In one study, Fisher et al.

(2016) found that while participants in a standard attention group experienced an increased level of hunger after being exposed to high-calorie foods, those who completed the task of a 10-min mindfulness induction reported unchanged hunger and increased fullness, as well as less food intake. In another study (Allirot et al., 2018), a mindful eating induction significantly reduced subsequent energy intake and unhealthy food choice in participants who were higher on external eating and lower on mindful eating. In most of these studies, the mindful eating induction involved attentive eating, with participants being instructed to fully attend to their eating experience. These findings indicate the beneficial effects of mindful eating skills, particularly mindfulness attention or attentive eating, on improving healthy food choice, reducing calorie intakes, and decreasing unhealthy eating behaviours such as external eating.

Cross-sectional investigations have also supported the relation of higher dispositional mindfulness or mindful eating with lower body weight, healthier dietary intake and lower levels of unhealthy eating behaviour in adults (Gilbert & Waltz, 2010; Jordan et al., 2014; Mantzios, Egan, Bahia, Hussain, & Keyte, 2018; Mantzios, Egan, Hussain, Keyte, & Bahia, 2018; Moor, Scott & McIntosh, 2013). In a community sample of 171 adults, mindful eating was found to fully mediate the negative association between dispositional mindfulness and serving size of energy dense foods on a daily basis, indicating that self-report mindful eating may have greater influence than dispositional mindfulness on food intake (Beshara, Hutchinson, & Wilson, 2013). A few cross-sectional studies examined the association between mindfulness and unhealthy eating styles. Pidgeon, Lacota, and Champion (2013) found that in a sample of 157 adults, dispositional mindfulness explained a significant proportion of the variance in emotional eating, and moderated the association between psychological distress and engagement in emotional eating, suggesting that mindfulness skills may serve to reduce the tendency to eat in response to stress and negative emotions. Interestingly, in another study with morbidly obese adults, dispositional mindfulness was found to be negatively associated with emotional eating and external eating but positively associated with restraint eating (Ouwens, Schiffer, Visser, Raeijmaekers, & Nyklíček, 2015). Although restraint eating was originally proposed as a problematic eating style that would eventually result in excessive calorie intake and weight gain, it has been suggested that dietary restraint could be adaptive rather than maladaptive when combined with conscious self-regulation and awareness of one's own eating patterns (Kerin, Webb, & Zimmer-Gembeck, 2019).

The findings reviewed above suggest the relation of mindful eating with healthier dietary intake and body weight, which deserves more research attention. The current evidence is mainly from adult populations in western cultures. Mindful eating and its role in eating behaviour among adolescents are still open questions remain to be explored.

### *The role of gender and culture in eating styles*

As reviewed above, the relations of unhealthy eating styles with BMI and dietary intake could differ between boys and girls. What is more frequently observed is the gender differences in the level or prevalence of unhealthy eating styles. Evidence for gender difference in emotional eating and restraint eating is relatively consistent. Compared to boys, girls showed higher levels of emotional eating and restraint eating, or a higher likelihood of being emotional eater and restraining their food intake (Hou et al., 2013; Braet et al., 2008; Wardle et al., 1992; Snoek et al., 2008; Lu et al., 2016). Evidence for external eating is however mixed. Some studies reported no gender difference in external eating among adolescents (Braet, 2008; Wardle, 1992), while Snoek et al. (2008) found a higher level of external eating in boys than girls, and Hou et al. (2013) found Chinese girls are more likely to be external eater (i.e., with scores  $\geq 75^{\text{th}}$  percentile) than boys. The gender difference in unhealthy eating styles could be associated with gender variation in traits and characteristics such as emotion regulation, body image and personality (Conner, Johnson, & Grogan, 2004; Keller & Siegrist, 2015; Lu et al., 2016). For example, higher body dissatisfaction and poorer body esteem have been consistently reported in adolescent girls compared to boys (e.g., Dion et al., 2015), which may contribute to higher prevalence of dieting and cognitive restraint among girls. Accordingly, gender might also play a role in mindful eating among adolescents. One study examined how mindful eating might differ by demographic factors and physical activity level in college students, and found only gender yielded a significant difference in mindful eating assessed using the MEQ, with females scoring higher on *external cues*, *emotional response* as well as the summary score (Berdal, 2012). The role of gender should be taken into consideration when investigating eating styles in adolescents.

It should also be noted that most of the studies exploring the role of eating styles in body weight and dietary intake have mainly focused on western populations. Only in recent years has

research on unhealthy eating styles in Chinese adolescents emerged (Hou et al., 2013; Lu et al., 2016; Wu et al., 2017; Xie et al., 2016). The mixed findings of previous studies indicated that eating styles could be influenced by other individual and social environmental factors. Some of these factors vary greatly across cultures. Therefore, one should be cautious when applying research findings in the context of western cultures in guiding healthy eating interventions for Chinese adolescents. In the present study, we explored eating styles and its role in BMI and snacking among Chinese adolescents. In addition, we compared eating styles between adolescents from China and the UK.

In developed countries such as the UK, the food-abundant environment and the improvement of food marketing and advertising have been suggested to greatly contribute to the obesity epidemic. Being exposed to food-related cues all the time, individuals develop unhealthy eating patterns and consume excessive calories even without realising it (Hill et al., 2008; Cohen & Farley, 2008). Meanwhile, influenced by the ideal slim body shape promoted by the media and society, body dissatisfaction and dieting become very common in both adults and young people regardless of weight status (Montani, Schutz & Dulloo, 2015).

In comparison, China as a developing country has been undergoing this social environmental change for a relatively short term. Traditional Chinese culture and medicine attach considerable importance to food and dietary practice in the context of health and well-being (Yang, Khoo-Lattimore & Lai, 2014; Wu & Liang, 2018), which could influence the views and values of the Chinese regarding food and eating, particularly for older generations. In addition, as East Asian populations tend to have smaller and slimmer bodies compared with White Westerners, it was widely assumed that body dissatisfaction and dietary restraint would be less prevalent among East Asians (Jung, Forbes, & Lee., 2009). Based on these points, one might expect a healthier relationship with food, and a more intuitive and mindful way of eating among the Chinese (Hawks et al., 2004). However, the modernisation and urbanisation of China have greatly changed the food-related environment, and therefore the residents' eating behaviour and dietary patterns in recent years (von Deneen et al., 2011; Wang et al., 2008; Zhang et al., 2015). As the nutrition transition progresses, eating for social and environmental reasons rather than physical needs increases. Particularly, the communal dining approach in China might make Chinese adolescents more susceptible to external cues of eating (Veeck et al., 2014). Moreover, Chinese youth have

grown up with great contact with Western influences. The traditionally Western-cultural emphasis on thinness appears to have exerted influence on Chinese as well as many other Asian cultures (Pike & Dunne, 2015). Recent cross-cultural investigations showed even higher level of body dissatisfaction and eating distress/disordered eating among Japanese and Koreans adolescents compared to their Western peers (June et al., 2009; Maezono et al., 2019). It remains unclear how Chinese and UK adolescents might differ in eating styles.

In the current study, we explored gender and cultural differences in eating styles, and the relationship between eating styles and BMI among adolescents. We also explored how eating styles and stress might influence adolescent snacking, and the role of gender and culture in the relationship between eating styles and adolescent snacking. Specifically, based on the evidence reviewed above, this study examined:

**Hypothesis 1a:** For Chinese and UK adolescents, unhealthy eating styles (i.e., emotional eating, external eating and restraint eating) will be positively, while mindful eating will be negatively correlated with BMI and unhealthy snacking pattern (i.e., high consumption frequency of unhealthy snacks/beverages, low consumption frequency of fruit and vegetables).

**Hypothesis 1b:** Eating styles and perceived stress will predict snacking frequency.

**Hypothesis 1c:** Gender will moderate the relationship between eating styles and snacking frequency. For girls, restrained eating and emotional eating will exert stronger effects on snacking, while for boys, external eating will exert a stronger effect on snacking.

**Hypothesis 1d:** Culture will moderate the relationship between eating styles and snacking frequency. For Chinese adolescents, mindful eating will exert a stronger effect on snacking, while for UK adolescents, unhealthy eating styles will exert a stronger effect on snacking.

### **How do social cognitive variables influence adolescent snacking – the role of TPB**

#### **components**

In addition to eating styles, we were also interested in the role of the TPB variables in adolescent snacking. As a parsimonious model of explaining and predicting behaviour, the Theory of Planned Behaviour (TPB) is amongst the models most commonly used to predict health related behaviours



such as dietary behaviours, physical activity and smoking cessation (McEachan, Conner, Taylor, & Lawton, 2011). The TPB is an extension of the earlier theory of reasoned action (TRA; Ajzen & Fishbein, 1980). According to the TPB (Ajzen, 1991), behaviour is determined by two variables: behavioural intention and perceived behavioural control (PBC). Behavioural intention represents an individual's decision and motivation to perform the behaviour, and is considered to be the proximal determinant of behaviour. Intention is determined by an individual's attitudes, subjective norms, and PBC. Attitudes describe an individual's evaluation of engaging in the behaviour. Subjective norms refer to an individual's perception of significant others' normative beliefs about the behaviour. PBC represents an individual's appraisal of the extent of control he/she has to carry out the behaviour, and is thought to have direct effects on behaviour as well as indirect effects through intentions. Applied to healthy snacking, the TPB would predict that individuals who have more positive attitudes, perceive more pressures from significant others and feel more control over consuming healthy snacks will have a strong intention to eat healthy snacks. This intention along with their perception of capability will determine their actual snacking patterns. The effects of other factors such as social and environmental influences are likely theorised to be mediated by these constructs (McDermott et al., 2015).

Several studies have employed the TPB to understand and predict adolescent dietary behaviour. Riebl et al. (2015) reviewed 34 studies testing the application of the TPB in understanding dietary behaviours in youth, of which 23 studies included adolescent participants aged over 15 years. This review supported the TPB as an effective model in understanding adolescent dietary behaviours, including the consumption of high-calorie snacks and sugar-sweetened beverages (e.g., Astrom & Okullo, 2004), FV (e.g., Ickes & Sharma, 2011), and milk (Conner, Hugh-Jones, & Berg, 2011). Overall, attitudes had the strongest relationship with intention (mean  $r = .52$ ), followed by PBC (mean  $r = .46$ ) and SN (mean  $r = .37$ ). For behaviour, the strongest correlation found in cross-sectional studies was with intention (mean  $r = .49$ ), then attitudes (mean  $r = .39$ ), PBC (mean  $r = .36$ ), and SN (mean  $r = .29$ ). The conclusion of this review was also supported by a more recent systematic review (Philippi et al., 2016). The TPB has also been applied in promoting healthy eating among young people. Hackman and Knowlden (2014) reviewed 11 dietary interventions for adolescents and young adults based on TPB or TRA, of which nine reported dietary behaviour change including increased intake of FV and decreased

intake of unhealthy snacks, with the change in at least one of the TPB/TRA variables as the proposed mechanism.

It should be noted, however, that most studies reviewed above were conducted in western cultures (Philippi et al., 2016; Riebl et al. 2015). Only two studies explored the efficacy of the TPB in understanding healthy eating intentions of Chinese adolescents. Chan and Tsang (2011) found that in a sample of 570 Hong Kong adolescents aged 11 to 19 years, three TPB variables explained 45% of the variance of intention of healthy eating. PBC had the strongest relationship with intention ( $r = .64$ ), followed by attitudes ( $r = .54$ ) and SN ( $r = .35$ ). In a more recent study (Chan, Prendergast & Na, 2016), healthy eating intentions of 635 adolescents from mainland China (mean age = 15.58 years) was predicted by PBC ( $b = .35$ ), SN ( $b = .14$ ) and attitudes ( $b = .10$ ). These findings provided evidence for the efficacy of the TPB in understanding Chinese adolescent healthy eating. However, the dietary behaviour was not assessed in either of the studies.

Overall, the TPB variables appear to be significant predictors of snack consumption among adolescents. Besides intention, attitudes showed the strongest and the most consistent associations with behaviour. PBC is more likely to serve as a predictor of the changes in behaviour, or when the PBC is related to a changing behaviour (e.g., PBC of restricting snacking, rather than PBC of snacking). The correlation between behaviour and SN appears to be weaker compared to attitudes and PBC in most previous studies.

#### *Habit strength as an additional variable of the TPB in explaining adolescent snacking*

Despite the efficacy of the TPB in explaining and predicting adolescent dietary behaviour, there is still a large proportion of the variance unaccounted for by the primary components of the original model. Inclusion of other relevant constructs has been suggested to improve the ability of the TPB model to predict dietary behaviour (Brouwer & Mosack, 2015; Mullan, Wong, & Kothe, 2013). One potential variable in the case of snacking is habit.

*Habits* have been defined as learned sequences of acts which have become automatic responses to specific cues as a result of frequent performance in similar situations (Verplanken & Orbell, 2003). Verplanken and Orbell (2003) suggested past behavioural frequency, automaticity (i.e., lack of awareness, uncontrollability, efficiency) and personal identity (i.e., how habits as a

part of daily life reflect an individual's identity) as three important components of habitual strength. They developed a 12-item index of habit strength to measure these three components.

Frequent snacking, especially unhealthy snacking, could be in large part habitual. As adolescents generally favour the taste of unhealthy snacks, the satisfactory experiences of eating unhealthy snacks may reinforce the behaviour, which in turn increases the habit strength. The impact of habit strength on unhealthy snacking has been found in large samples of both adults (Verhoeven, Adriaanse, Evers, & de Ridder 2012) and adolescents (De Vet, Stok, de Wit, & de Ridder, 2015). Several studies have explored the role of habit strength in adolescent unhealthy snacking within the context of the TPB. In a study with a sample of 1,005 students (mean age = 14.1 years,  $SD = 1.2$ ) from the Netherlands (Tak et al., 2011), habit strength showed stronger associations with soft drink consumption than did attitudes, intention, parental norms and PBC, and partly mediated the associations between environmental variables and behaviour. In another intervention study attempting to reduce adolescents' consumption of SSBs and high calorie snacks by influencing their attitudes, subjective norms, PBC and habit strength (Paw, Singh, Brug, & van Mechelen, 2008), the decreased habit strength was revealed to be significant mediators of the intervention's effect on the consumption of SSBs among boys ( $n = 213$ , mean age = 12.7 years,  $SD = 0.5$ ), but not for girls. Healthy snacking such as FV intake could also be habitual. de Bruijn (2010) found habit strength moderated the intention-behaviour relationship in fruit intake in a sample of college students, suggesting that stronger fruit consumption habits make fruit intake less intentional. A more recent study also suggested that habit strength might play a more important role than did intentions in FV intake of children and adolescents in the UK (Albani, Butler, Traill, & Kennedy, 2018). Overall, preliminary evidence suggests habit strength might explain adolescent snacking over and above the TPB variables. Therefore, adding habit strength to the TPB model has potential to improve its predictive power in adolescent snacking.

#### *The role of gender and culture in utilising the TPB in predicting snacking*

Previous studies have shown gender variation in TPB variables and the pattern of relations in the context of healthy eating. A cross-sectional study found in a sample of 129 college students in the UK, women rated sweet snacks as more pleasurable but less healthy than men. Women's

intentions to eat sweet snacks were predicted by both attitudes and social norms, while men's intentions were predicted only by attitudes (Grogan, Bell, & Conner, 1997). Similarly, in a sample of 167 young American adolescents, for girls subjective norms while for boys attitudes accounted for the most variance of intention to consume unhealthy snacks. Intention better predicted the actual consumption of unhealthy snacks as well as FV for girls than boys (Branscum & Sharma, 2014). It was suggested that females would perceive higher social pressure regarding unhealthy eating and be influenced by it to a greater extent than males, which is likely due to socially prescribed gender roles (Grogan et al., 1997; Conner et al., 2004). For healthy eating, attitudes were found to significantly predict healthy eating intention of Hong Kong boys but not girls (Chan, Ng, & Prendergast, 2014). In contrast, mainland Chinese adolescent girls' intention to eat healthily was more likely to be predicted by their attitudes towards healthy eating, while boys' intention was more likely to be influenced by subjective norms (Chan, Prendergast, & Ng, 2016). Overall, evidence for gender differences in the TPB in explaining adolescent snacking is limited and mixed. Based on the findings cited above, we examined potential gender differences in the TPB variables and their predictive power of adolescent snacking.

In addition, the present study compared the utility of the TPB in snacking between Chinese and UK adolescents. As reviewed above, most studies examining adolescent eating behaviour using the TPB have mainly focused on western populations. It is suggested that cross-cultural research adopting a framework of *collectivism-individualism* can contribute to our understanding of how motivation and cognition influence individual behaviours in different cultures (Markus & Kitayama, 1991). Collectivism is featured by a self-definition based on interdependence and social embeddedness, and an emphasis on maintaining social/group cohesiveness. People from predominately collectivistic cultures, such as China, are highly motivated to adjust themselves according to social norms and values. In contrast, those from individualistic cultures such as the UK define themselves as autonomous and independent, and thus their behaviour is more likely to be shaped by their own attitudes and cognitions (Shukri, Jones, & Conner, 2016; Uchida, Norasakkunkit, & Kitayama, 2004). When adopting this framework to evaluate the TPB, one would expect that social norms exert stronger influence on intention and behaviour for people from collectivistic cultures, while individual views of the behaviour and oneself show greater predictive power for those from individualistic cultures. A few studies examining the efficacy of

the TPB using the cross-cultural approach have partially supported such assumptions. For example, in a cross-cultural study, attitudes were found to significantly predict physical activity intentions only in UK adults, while descriptive norms significantly predicted physical activity intentions only in the Malaysian sample (Shukri, Jones, & Conner, 2016). Compared to a sample of American adults, subjective norms exerted stronger influences on Chinese consumers' intention to purchase green products (Chan & Lau, 2001). Research exploring cultural differences in the predictive effects of the TPB on health behaviour is very limited so far, whereas further studies are needed to clarify this issue and expand our understanding of the TPB and its applications.

In the current study, we explored how the variables of an extended TPB (i.e., attitudes, SN, PBC, and habit strength) predict the consumption of healthy and unhealthy snacks among Chinese and UK adolescents. We also investigated gender and cultural differences in TPB variables regarding adolescent snacking. Specifically, based on the evidence reviewed above, we tested the following hypothesis:

**Hypothesis 2a:** Among Chinese and UK adolescents, TPB variables and habit strength regarding healthy snacking will be predictive of healthy snack consumption, and the TPB variables and habit strength regarding to unhealthy snacking will be predictive of unhealthy snack consumption.

**Hypothesis 2b:** Gender will moderate the relationship between TPB variables and snacking frequency. For girls, social norms will exert a stronger influence on snacking, while for boys, attitudes will exert a stronger influence on snacking.

**Hypothesis 2c:** Culture will moderate the relationship between TPB variables and snacking frequency. For Chinese adolescents, social norms will exert a stronger influence on snacking, while for UK adolescents, attitudes and PBC will exert a stronger influence on snacking.

## 2.2 Method

### Participants and recruitment

This study has been approved by a University of Leeds Research Ethics Committee (Faculty of Medicine and Health. Reference number: 16-0289; Date of Approval: 08, November 2016).

#### *Chinese sample*

Chinese adolescents were recruited from a public high school in Beijing. A psychology teacher was contacted via email, which provided basic information and contact details, and requested permission and assistance of participant recruitment in this school. After obtaining consent from the high school, an e-copy of the survey with an informed consent form was sent to the psychology teacher, who helped to print the surveys and administered the study during psychology class. Students from six classes (two classes for each year) received the informed consent form with the paper survey questionnaire. Participants indicated their agreement with informed consent by returning the survey. It took up to 30 minutes to complete the survey.

Of the 201 returned questionnaires, 17 were excluded from analysis because of unsatisfactory quality (defined as more than 33% of the questions not completed or straight-lining responses), and two were excluded for not providing demographic information. The final sample consisted of 182 adolescents aged 15 to 18 years ( $M = 16.13$  years,  $SD = .87$ ), of which 46.15% are boys ( $n = 84$ ), and 9.9% are from minority ethnic groups ( $n = 18$ ; three participants did not report their ethnicity). Twenty-two participants did not report their height or/and weight (chose “I don’t know” option or skipped related items). The rest of the 160 participants reported a mean BMI of 21.51  $\text{kg/m}^2$  (ranging from 14.87  $\text{kg/m}^2$  to 34.33  $\text{kg/m}^2$ ;  $SD = 3.68$ ), with 4.8% girls ( $n = 4$ ) and no boys falling within underweight group, 25.0% boys ( $n = 19$ ) and 13.1% girls ( $n = 11$ ) falling within overweight group, and 7.9% ( $n = 6$ ) boys and 1.2% girls ( $n = 1$ ) falling within obese group.

#### *UK sample*

UK adolescents were recruited from a state secondary school in Leeds. A psychology teacher was

contacted via email, which provided basic information and contact details, and requested permission and assistance of participant recruitment in this school. Students were invited to fill in the paper questionnaires in psychology class, and then the researchers gave a lecture regarding eating and stress management. Meanwhile, recruitment was also conducted via social media. A link to the survey questionnaire on Online Surveys (<https://www.onlinesurveys.ac.uk>) was posted on Twitter and Facebook, inviting UK adolescents aged over 16 years to fill in the online survey.

We received a total of 82 returned paper-questionnaires and 20 online. Six were excluded for analysis due to unsatisfactory quality. The final sample consisted of 96 adolescents aged 16 to 19 years ( $M = 17.06$  years,  $SD = .74$ ), of which 39.6% are boys ( $n = 38$ ). Forty-one participants did not report their height or/and weight (chose “I don’t know” option or skipped related items). The rest 55 participants reported a mean BMI of  $23.00 \text{ kg/m}^2$  (ranging from  $17.36 \text{ kg/m}^2$  to  $37.97 \text{ kg/m}^2$ ;  $SD = 3.98$ ), with no adolescents falling within underweight group, 20.0% boys ( $n = 5$ ) and 16.7% girls ( $n = 5$ ) falling within overweight group, and 8.0 % ( $n = 2$ ) boys and 6.7% girls ( $n = 2$ ) falling within obese group.

Socio-demographic characteristics of both samples are presented in **Table 2.1**.

**Table 2.1** Participant socio-demographics

Characteristics	Chinese sample (N = 182)		UK sample (N = 96)		
	Group	n (%)	Group	n (%)	
Gender	Boys	84 (46.2)	Boys	38 (39.6)	
	Girls	98 (53.8)	Girls	58 (60.4)	
Age group	15	44 (24.2)	16	22 (22.9)	
	16	85 (46.7)	17	47 (49.0)	
	17	39 (21.4)	18	26 (27.1)	
	18	14 (7.7)	19	1 (1.0)	
School year	First year	57 (31.3)	Year 12	49 (51.0)	
	Second year	95 (52.2)	Year 13	47 (49.0)	
	Third year	30 (16.5)			
Ethnic group	Han Chinese	164 (90.1)	White British	47 (49)	
	Ethnic minorities		18 (9.9)	Asian	21 (21.9)
				Africans	9 (9.4)
				Mixed groups	4 (4.2)
				Other/did not specify	15 (15.6)
Highest level of education (mother or equivalent guardian) <sup>a</sup>	High school graduate	57 (31.3)	High school graduate	21 (21.9)	
	Associate or bachelor's degree	112 (61.5)	Associate or bachelor's degree	45 (46.9)	
	Master's degree or PhD	5 (2.7)	Master's degree or PhD	11 (11.5)	
Employment (mother or equivalent guardian) <sup>b</sup>	Full-time	122 (67.0)	Full-time	40 (41.7)	
	Part-time	9 (5.0)	Part-time	19 (19.8)	
	Neither of these	34 (18.7)	Neither of these	25 (26.0)	
Highest level of education (father or equivalent guardian) <sup>c</sup>	High school graduate	48 (26.4)	High school graduate	21 (21.9)	
	Associate or bachelor's degree	109 (59.9)	Associate or bachelor's degree	37 (48.6)	
	Master's degree or PhD	15 (8.2)	Master's degree or PhD	19 (19.8)	
Employment (father or equivalent guardian) <sup>d</sup>	Full-time	150 (82.4)	Full-time	57 (59.4)	
	Part-time	6 (3.3)	Part-time	9 (9.4)	
	Neither of these	11 (6.0)	Neither of these	11 (11.5)	

a: n=8 (4.5%) Chinese and n=19 (19.8%) UK adolescents chose 'I don't know' option or skipped this question; b: n=17 (9.3%) Chinese and n=12 (12.5%) UK adolescents chose 'I don't know' / 'not applicable' option or skipped this question;

c: n=10 (5.5%) Chinese and n=19 (19.8%) UK adolescents chose 'I don't know' option or skipped this question;

d: n=15 (8.2%) Chinese and n=19 (19.8%) UK adolescents chose 'I don't know' / 'not applicable' option or skipped this question.



## Measures

The survey questionnaire used in this study was firstly developed in English, and then translated into Chinese following back-translation procedures (Chapman & Carter, 1979).

### The TPB variables

A questionnaire was designed to measure attitudes, subjective norms and perceived behavioural control regarding healthy and unhealthy snacking respectively, using the format described by Conner and Norman (2015).

*Attitudes.* Attitudes towards healthy snacking and unhealthy snacking were measured respectively using 7-point semantic differential scales. Two items were used to measure affective attitude, and two items were used to measure instrumental attitude. Internal reliability of the Chinese sample was  $\alpha = 0.87$ , and for the UK sample was  $\alpha = .92$ .

*Subjective norms.* Injunctive norm (i.e., norms of what others approve of) and descriptive norm (i.e., norms of what others actually do) were measured separately by two items on a 7-point scale.

*Perceived behavioural control.* The capacity aspect and autonomy aspect of perceived behavioural control were measured using two items on a 7-point scale.

*Habit strength.* Habit strength of healthy and unhealthy snacking were assessed respectively using the 12-item self-reported habit index (SRHI) developed by Verplanken and Orbell (2003) and adapted to healthy/unhealthy snacking. Coefficient  $\alpha$  in the Chinese sample was .96 for healthy snacking and .96 for unhealthy snacking; in the UK sample was .94 for healthy snacking and .92 for unhealthy snacking.

### Eating styles

*Emotional eating, external eating and restrained eating* were assessed using the Dutch Eating Behaviour Questionnaire (DEBQ) (Van Strien et al., 1986). The DEBQ has been found to have good construct validity and internal reliability. Internal reliability of the Chinese sample was: emotional eating (.93), external eating (.89), restrained eating (.86); and of the UK sample was: emotional eating (.93), external eating (.93), restrained eating (.79).

*Mindful eating* was assessed using the Mindful Eating Questionnaire (MEQ) (Framson et al.,

2009). The MEQ summary scores showed poor internal reliability in both samples of the present study (Chinese sample:  $\alpha = .53$ ; UK sample:  $\alpha = .58$ ). The internal reliability coefficients for subscales of the MEQ in the Chinese sample were: *awareness* (.72), *disinhibition* (.78), *distraction* (.34), *emotional response* (.68), *external cues* (.63); and in the UK sample were: *awareness* (.72), *disinhibition* (.66), *distraction* (.33), *emotional response* (.71), *external cues* (.64). Due to the poor internal reliability of the summary scores in both samples, we further explored the item-total correlations. In the Chinese sample, the summary score of the MEQ was significantly correlated with scores on all subscales except for *external cues* ( $r = .12, p = .117$ ). In UK sample, the summary score of the MEQ was significantly correlated with scores on all subscales, however the correlation coefficient with external cues was small ( $r = .26, p = .012$ ). Strong positive correlations between *external cues* of the MEQ and *external eating* of the DEBQ (Chinese sample:  $r = .67, p < .001$ ; UK sample:  $r = .54, p < .001$ ) may indicate that participants misinterpreted some items of this subscale (also see Chapter 5). Therefore, the *external cues* subscale of the MEQ was excluded for further analyses. After excluding *external cues* subscale, the MEQ summary score internal consistency was acceptable (Framson et al., 2009) in the Chinese sample ( $\alpha = .63$ ) and the UK sample ( $\alpha = .62$ ).

**Perceived stress** was assessed using the 10-item Perceived Stress Scale (PSS; Cohen & Williamson, 1988). This scale asks respondents to evaluate to what extent they have felt stressed during the last month (e.g., “In the last month, how often have you felt nervous or stressed”), on a five-point Likert scale ranging from “never” to “very often”. High scores indicate high level of stress. The scale has shown good construct validity and test-retest reliability (Cohen & Williamson, 1988), and has been used successfully in adolescents (Nguyen-Rodriguez, Chou, Unger, & Spruijt-Metz, 2008). Internal reliability of the Chinese sample was  $\alpha = 0.85$ , and for the UK sample was  $\alpha = .81$ .

**Snacking** was assessed using a modified Beverage and Snack Questionnaire (BSQ; Neuhouser, Lilley, Lund, & Johnson, 2009). The questionnaire contained questions regarding the frequency of snacks (8 items, including salty snacks and sweet snacks), beverage (9 items, including fruit drinks, sport drinks, fizzy drinks, and energy drinks), fruit (1 item) and vegetable (1 item)

consumption during the last week. The same response scale was used for each item: never or less than 1 per week, 1 per week, 2-4 per week, 5-6 per week, 1 per day, 2-3 per day, more than 4 per day. Responses for foods/beverages in each item were coded continuously according to middle value for each response category as (per week): 0, 1, 3, 5.5, 7, 17.5, 28. Unhealthy snack consumption was represented using the sum of self-report frequency of five out of eight snack items, with low-fat/non-fat snacks excluded. Unhealthy beverage consumption was represented using the sum of five out of nine beverage items, with 100% fruit juice, flavoured water and sugar-free fizzy drinks being excluded.

### **Data analysis**

Statistical analysis was conducted using SPSS 21.0. Exploratory analyses were conducted to examine gender and cultural differences in eating styles and TPB variables and snacking frequency using Multivariate analysis of variance (MANOVA). To test hypothesis 1a, Pearson correlations were calculated to examine the associations between BMI, snacking frequencies and eating styles. The relations of snacking frequency with perceived stress, TPB variables and habit strength were also explored using Pearson correlations. The predictive effects of eating styles, perceived stress, TPB variables and habit strength on snacking frequency (hypothesis 1b and 2a) and the moderating effects of gender (hypothesis 1c and 2b) and culture (hypothesis 1d and 2c) were examined using hierarchical multiple regression analysis.

## **2.3 Results**

### **Gender and cultural differences in eating styles, perceived stress, TPB variables and snacking frequency**

Four  $2$  (Chinese, UK)  $\times$   $2$  (boys, girls) between-subjects MANOVAs were conducted to explore the effects of gender and cultural differences on eating styles (i.e., restrained eating, emotional eating, external eating, mindful eating), TPB variables (i.e., attitudes, norms, PBC, habit strength) related to healthy snacking, TPB variables related to unhealthy snacking, and snacking frequency

(i.e., frequency of unhealthy snack food consumption, frequency of unhealthy beverage consumption, frequency of fruit consumption, frequency of vegetable consumption). As highly skewed distribution was observed on the consumption of unhealthy snack foods, unhealthy beverages, fruit and vegetables using the Shapiro-Wilk test ( $p < .001$ ), logarithmic transformation was applied to this group of dependent variables (Benoit, 2011).

For eating styles, total  $N$  of 278 was reduced to 274 with the deletion of four cases missing scores on mindful eating. Results showed that the combined DVs were significantly affected by culture,  $F(4, 267) = 6.26, p < .001, \eta_p^2 = .086$ , gender,  $F(4, 267) = 9.84, p < .001, \eta_p^2 = .128$ , and the interaction between culture and gender,  $F(4, 267) = 3.25, p = .013, \eta_p^2 = .046$ . As shown in **Table 2.2**, compared to UK adolescents ( $n = 94$ ), Chinese adolescents ( $n = 180$ ) scored significantly higher on restrained eating,  $F(1, 270) = 6.97, p = .009, \eta_p^2 = .025$ , and lower on external eating,  $F(1, 270) = 8.58, p = .004, \eta_p^2 = .031$ . Compared to boys ( $n = 119$ ), girls ( $n = 155$ ) showed significantly higher restrained eating,  $F(1, 270) = 11.70, p = .001, \eta_p^2 = .042$ , emotional eating,  $F(1, 270) = 26.74, p < .001, \eta_p^2 = .090$ , and lower external eating,  $F(1, 270) = 13.92, p < .001, \eta_p^2 = .049$ . Significant interactions were observed on mindful eating,  $F(1, 270) = 8.921, p = .003, \eta_p^2 = .032$ , with Chinese boys reporting lower mindful eating than Chinese girls, and UK boys reporting higher mindful eating than UK girls (Appendix 1, Figure 1).

For TPB variables related to healthy snacking, total  $N$  of 278 was reduced to 275 with the deletion of three cases missing scores on attitudes. Results showed that the combined DVs were not significantly affected by culture,  $F(4, 268) = 1.08, p = .369, \eta_p^2 = .016$ , or gender,  $F(4, 268) = 1.03, p = .001, \eta_p^2 = .390$ . There was a significant effect of the interaction between culture and gender,  $F(4, 268) = 3.07, p = .017, \eta_p^2 = .044$ . As shown in **Table 2.2**, significant interactions of culture and gender were observed on attitudes,  $F(1, 271) = 6.83, p = .009, \eta_p^2 = .025$ , with Chinese girls showing more positive attitudes while UK girls showing less positive attitudes towards healthy snacking than their counterparts (Appendix 1, Figure 2). Significant interactions were also observed on norms,  $F(1, 271) = 5.42, p = .021, \eta_p^2 = .020$ , with Chinese girls perceiving stronger norms than Chinese boys, and UK boys perceiving stronger norms than UK girls in relation to healthy snacking (Appendix 1, Figure 3).

For TPB variables related to unhealthy snacking, total  $N$  of 278 was reduced to 277 with the deletion of one case missing a score on attitudes. Results showed that the combined DVs were

significantly affected by culture,  $F(4, 270) = 5.40, p < .001, \eta_p^2 = .074$ , but not gender,  $F(4, 270) = 1.22, p = .302, \eta_p^2 = .018$ , or the interaction between culture and gender,  $F(4, 270) = 1.30, p = .271, \eta_p^2 = .019$ . As shown in **Table 2.2**, compared to UK adolescents ( $n = 94$ ), Chinese adolescents ( $n = 181$ ) showed significantly less positive attitudes,  $F(1, 273) = 14.93, p < .001, \eta_p^2 = .052$ , less strong subjective norms,  $F(1, 273) = 7.36, p = .007, \eta_p^2 = .026$ , and lower levels of habit strength  $F(1, 273) = 8.114, p = .005, \eta_p^2 = .029$  regarding unhealthy snacking.

For snacking frequencies, total  $N$  of 278 was reduced to 276 with the deletion of one case missing a score on frequency of unhealthy snack and beverage intake and one on fruit intake. Results showed that the combined DVs were significantly affected by culture,  $F(4, 269) = 5.92, p < .001, \eta_p^2 = .081$ , and gender,  $F(4, 269) = 6.30, p < .001, \eta_p^2 = .086$ , but not the interaction between culture and gender,  $F(4, 269) = 1.83, p = .123, \eta_p^2 = .027$ . As shown in **Table 2.2**, compared to UK adolescents ( $n = 94$ ), Chinese adolescents ( $n = 182$ ) reported significantly lower consumption frequency of unhealthy snack foods,  $F(1, 273) = 18.27, p < .001, \eta_p^2 = .063$ . In addition, boys reported significantly higher consumption frequency of unhealthy beverages than girls,  $F(1, 273) = 4.05, p = .045, \eta_p^2 = .015$ . Significant interactions were also observed on the consumption of unhealthy beverages,  $F(1, 271) = 6.98, p = .009, \eta_p^2 = .025$ , with Chinese boys reporting a higher frequency, and Chinese girls reporting a lower frequency of unhealthy beverage consumption compared to their UK counterparts (Appendix 1, Figure 4).

In addition, a 2 (Chinese, UK)  $\times$  2 (boys, girls) between-subjects ANOVA was conducted to examine the effects of gender and cultural differences on perceived stress. As shown in **Table 2.2**, there was a significant main effect of gender,  $F(1, 274) = 42.38, p < .001, \eta_p^2 = .134$ , with girls reporting higher perceived stress than boys. There was also a significant interaction effect,  $F(1, 274) = 8.61, p = .004, \eta_p^2 = .030$ , with UK girls reporting a higher level, and UK boys reporting a lower level of perceived stress than their Chinese counterparts (Appendix 1, Figure 5). The main effect of culture was not significant,  $F(1, 274) = 2.50, p = .115, \eta_p^2 = .009$ .

**Table 2.2** Descriptive statistics and multivariate analysis of variance examining gender and cultural differences in eating styles, TPB variables, snacking frequency and perceived stress

Variables	Gender	M ± SD			F, p, $\eta_p^2$		
		Chinese	UK	Culture	Gender	Culture × Gender	
<b>Eating styles</b>							
Restrained eating (1-5)	boys	2.27 (.74)	1.90 (.74)	$F = 6.70$	$F = 11.70$	$F = .50$	
	girls	2.57 (.80)	2.36 (1.0)	$p = .009^{**}$ $\eta_p^2 = .025$	$p = .001^{**}$ $\eta_p^2 = .042$	$p = .478$ $\eta_p^2 = .002$	
Emotional eating (1-5)	boys	1.88 (.81)	1.65 (.67)	$F = 1.09$	$F = 26.74$	$F = .91$	
	girls	2.36 (1.0)	2.35 (.82)	$p = .298$ $\eta_p^2 = .004$	$p < .001^{***}$ $\eta_p^2 = .090$	$p = .34$ $\eta_p^2 = .003$	
External eating (1-5)	boys	3.02 (.80)	3.43 (.77)	$F = 8.58$	$F = 13.92$	$F = .35$	
	girls	2.79 (.52)	3.09 (.68)	$p = .004^{**}$ $\eta_p^2 = .031$	$p < .001^{***}$ $\eta_p^2 = .049$	$p = .56$ $\eta_p^2 = .001$	
Mindful eating (1-4)	boys	2.82 (.32)	2.90 (.26)	$F = 1.08$	$F = 1.03$	$F = .892$	
	girls	2.91 (.33)	2.74 (.35)	$p = .299$ $\eta_p^2 = .004$	$p = .311$ $\eta_p^2 = .004$	$p = .003^{**}$ $\eta_p^2 = .032$	
<b>TPB – healthy snacking (1-7)</b>							
Attitudes	boys	5.11 (1.37)	5.41 (1.13)	$F = .53$	$F = 2.43$	$F = 6.83$	
	girls	5.77 (1.37)	5.25 (1.21)	$p = .47$ $\eta_p^2 = .002$	$p = .12$ $\eta_p^2 = .009$	$p = .009^{**}$ $\eta_p^2 = .025$	
SN	boys	4.54 (1.62)	5.00 (1.36)	$F = .00$	$F = .02$	$F = 5.42$	
	girls	5.01 (1.52)	4.57 (1.41)	$p = .96$ $\eta_p^2 = .00$	$p = .90$ $\eta_p^2 = .00$	$p = .021^*$ $\eta_p^2 = .020$	
PBC	boys	3.99 (1.07)	3.88 (.90)	$F = .50$	$F = 1.39$	$F = 2.45$	
	girls	3.94 (.86)	4.23 (1.11)	$p = .48$ $\eta_p^2 = .002$	$p = .24$ $\eta_p^2 = .005$	$p = .12$ $\eta_p^2 = .009$	
Habit strength	boys	3.73 (1.67)	3.60 (1.41)	$F = 3.57$	$F = .29$	$F = 1.53$	
	girls	4.06 (1.37)	3.47 (1.34)	$p = .06^a$ $\eta_p^2 = .013$	$p = .59$ $\eta_p^2 = .001$	$p = .22$ $\eta_p^2 = .006$	
<b>TPB – unhealthy snacking (1-7)</b>							
Attitudes	boys	3.65 (1.43)	4.50 (.78)	$F = 25.79$	$F = 1.80$	$F = 1.41$	
	girls	4.07 (1.42)	4.53 (1.23)	$p < .001^{***}$ $\eta_p^2 = .052$	$p = .18$ $\eta_p^2 = .007$	$p = .24$ $\eta_p^2 = .005$	
SN	boys	3.30 (1.66)	3.99 (1.27)	$F = 13.76$	$F = .03$	$F = 1.48$	
	girls	3.48 (1.36)	3.74 (.87)	$p = .007^{**}$ $\eta_p^2 = .026$	$p = .86$ $\eta_p^2 = .00$	$p = .22$ $\eta_p^2 = .005$	
PBC	boys	4.22 (1.33)	4.21 (.98)	$F = .13$	$F = 3.05$	$F = .14$	
	girls	3.90 (1.23)	4.00 (1.03)	$p = .093$ $\eta_p^2 = .00$	$p = .082^a$ $\eta_p^2 = .011$	$p = .71$ $\eta_p^2 = .00$	
Habit strength	boys	3.07 (1.63)	3.52 (1.35)	$F = 19.41$	$F = 2.83$	$F = 31$	

	girls	3.29 (1.57)	3.97 (1.50)	$p = .005^{**}$ $\eta_p^2 = .029$	$p = .094^a$ $\eta_p^2 = .010$	$p = .58$ $\eta_p^2 = .001$
<b>Eating frequency</b>						
<b>(times/week)</b>						
Unhealthy snack food	boys	12.45 (18.36)	15.79 (17.38)	$F = 18.27$	$F = 2.31$	$F = .24$
	girls	10.67 (10.77)	20.12 (22.09)	$p < .001^{***}$ $\eta_p^2 = .063$	$p = .13$ $\eta_p^2 = .008$	$p = .62$ $\eta_p^2 = .001$
Unhealthy beverage	boys	14.62 (20.08)	17.04 (28.26)	$F = 1.68$	$F = 14.37$	$F = 6.98$
	girls	5.49 (9.36)	12.12 (19.11)	$p = .20$ $\eta_p^2 = .006$	$p < .001^{***}$ $\eta_p^2 = .050$	$p = .009^{**}$ $\eta_p^2 = .025$
Fruit	boys	10.28 (12.29)	7.99 (9.25)	$F = 2.16$	$F = 1.80$	$F = .02$
	girls	10.39 (10.87)	10.42 (12.06)	$p = .14$ $\eta_p^2 = .008$	$p = .181$ $\eta_p^2 = .007$	$p = .96$ $\eta_p^2 = .00$
Vegetable	boys	8.72 (13.03)	6.71 (7.32)	$F = 1.51$	$F = 1.56$	$F = .020$
	girls	9.87 (13.24)	9.87 (11.21)	$p = .28$ $\eta_p^2 = .004$	$p = .21$ $\eta_p^2 = .006$	$p = .89$ $\eta_p^2 = .00$
<b>Perceived Stress</b>						
(0-40)	boys	19.27 (7.04)	15.42 (5.75)	$F = 2.50$	$F = 42.38$	$F = 8.61$
	girls	22.33 (6.04)	23.48 (6.58)	$p = .115$ $\eta_p^2 = .009$	$p < .001^{***}$ $\eta_p^2 = .134$	$p = .004^{**}$ $\eta_p^2 = .030$

SN: Subjective norms; PBC: perceived behavioural control; \* =  $p < .05$ ; \*\* =  $p < .01$ ; \*\*\* =  $p < .001$ ; a =  $p < .10$ .

#### *Correlations between eating styles, perceived stress, snacking frequency and BMI*

To test hypothesis 1a, the bivariate correlations between eating styles, perceived stress and snacking frequency were calculated, as displayed in **Table 2.3**. Mindful eating was negatively correlated with emotional eating ( $r = -.34$ ;  $p < .001$ ) and external eating ( $r = -.35$ ;  $p < .001$ ), but not with restraint eating. Higher perceived stress was significantly correlated with lower mindful eating ( $r = -.24$ ;  $p < .001$ ), and higher levels of all unhealthy eating styles. Higher frequency of unhealthy snack consumption was significantly correlated with lower level of mindful eating ( $r = -.29$ ;  $p < .001$ ), and higher levels of emotional eating ( $r = .21$ ;  $p < .001$ ) and external eating ( $r = .25$ ;  $p < .001$ ). Higher frequency of unhealthy beverage consumption was significantly correlated with lower level of mindful eating ( $r = -.28$ ;  $p < .001$ ), and higher level of external eating ( $r = .17$ ;  $p < .01$ ). Higher frequencies of fruit and vegetable consumption, however, were only significantly correlated with higher level of restrained eating. Correlations between perceived stress and snacking frequency were not significant.

**Table 2.3** Bivariate correlations between eating styles, perceived stress and snacking frequencies (N = 274)

	Min	Res	Emo	Ext	PS	Snc	Bev	Fru
Mindful eating								
Restrained eating	-.035							
Emotional eating	-.339***	.265***						
External eating	-.348***	-.013	.452***					
Perceived stress	-.244***	.189**	.280***	.178**				
Unhealthy snacks	-.292***	-.105	.209***	.249***	.064			
Unhealthy beverages	-.279***	-.056	.092	.171**	-.045	.548***		
Fruit	.004	.280***	.018	-.016	-.002	.065	.002	
Vegetable	.022	.206**	.039	.050	.065	.116	.158**	.586***

Min: mindful eating; Res: restrained eating; Emo: emotional eating; Ext: external eating; PS: perceived stress; Snc: frequency of unhealthy snack consumption; Bev: frequency of unhealthy beverage consumption; Fru: frequency of fruit consumption.

\* =  $p < .05$ ; \*\* =  $p < .01$ ; \*\*\* =  $p < .001$ .

As 22.7% (n = 63) of participants did not report their weight and/or height, the correlations between eating styles, snacking frequency and BMI were calculated separately. As shown in **Table 2.4**, no significant correlation was found between BMI and eating styles or snacking frequency. This correlation was further examined for each sample. For Chinese adolescents (Table 2.4), the BMI was positively correlated with restrained eating ( $r = .25, p = .001$ ), and negatively correlated with external eating ( $r = .21, p = .007$ ). There was also a negative correlation between the BMI and emotional eating that approached significance ( $r = -.14, p = .08$ ). In addition, the BMI was positively correlated with consumption frequency of fruit ( $r = .20, p = .013$ ) and vegetables ( $r = .16, p = .043$ ). For the UK adolescents (Table 2.4), the BMI was positively correlated with emotional eating ( $r = .35, p = .009$ ), but not with other eating styles or snacking frequencies.

**Table 2.4** Bivariate correlations between eating styles, snacking frequencies and BMI among the whole sample (N = 215), Chinese sample (n = 160) and UK sample (n = 55)

	Unhealthy snacks	Unhealthy beverages	fruit	vegetables	Restraint eating	Emotional eating	External eating	Mindful eating
BMI	-.03	.01	.01	-.01	.09	.02	-.08	-.03
BMI (Chinese)	-.04	.05	.20*	.16*	.25**	-.14 <sup>a</sup>	-.21**	-.02
BMI (UK)	-.08	.18	-.06	.08	.15	.35**	.05	-.20

\* =  $p < .05$ ; \*\* =  $p < .01$ ; \*\*\* =  $p < .001$ ; a =  $p < .10$ .



*Correlations between TPB variables and snacking frequency*

The bivariate correlations between TPB variables related to healthy snacking and consumption frequency of fruit and vegetables are displayed in **Table 2.5**. The frequency of fruit consumption was positively correlated with attitudes towards healthy snacking ( $r = .17, p = .006$ ) and habit strength ( $r = .21, p < .001$ ). The frequency of vegetable consumption was positively correlated with habit strength ( $r = .14, p = .019$ ), but not other TPB variables.

**Table 2.5** Bivariate correlations between TPB variables related to healthy snacking and frequency of fruit and vegetable consumption (N = 274)

	Attitudes (h)	Norms (h)	PBC (h)	Habit (h)	Fruit	Vegetable
Attitudes (h)						
SN (h)	.347***					
PBC (h)	.078	.078				
Habit (h)	.470***	.391***	-.095			
Fruit	.165**	-.042	.009	.209***		
Vegetable	.088	-.016	-.114	.141*	.585***	-

Attitudes (h): attitudes towards healthy snacking; SN (h): subjective norms of healthy snacking; PBC (h): perceived behavioural control of healthy snacking; Habits (h): habits strength of healthy snacking.

**Table 2.6** Bivariate correlations between TPB variables related to unhealthy snacking and frequencies of unhealthy snack food and beverage consumption (N = 275)

	Attitudes (uh)	Norms (uh)	PBC (uh)	Habit (uh)	Unhealthy snacks	Unhealthy beverages
Attitudes (uh)						
SN (uh)	.184**					
PBC (uh)	-.137*	-.086				
Habit (uh)	.534***	.159**	-.381***			
Unhealthy snacks	.165**	.201**	-.133*	.298***		
Unhealthy beverages	.061	.200**	-.125*	.179**	.548***	-

Attitudes (un): attitudes towards unhealthy snacking; SN (un): subjective norms of unhealthy snacking; PBC (un): perceived behavioural control of unhealthy snacking; Habits (un): habit strength of unhealthy snacking.

The bivariate correlations between TPB variables related to unhealthy snacking and consumption frequency of fruit and vegetables are displayed in **Table 2.6**. The frequency of unhealthy snack food consumption was positively correlated with attitudes ( $r = .17, p = .006$ ), norms ( $r = .20, p = .001$ ) and habit strength ( $r = .29, p < .001$ ), and negatively correlated with

perceived behavioural control ( $r = -.13, p = .027$ ). The frequency of unhealthy beverage consumption was positively correlated with norms ( $r = .20, p = .001$ ) and habit strength ( $r = .18, p = .003$ ), and negatively correlated with perceived behavioural control ( $r = .13, p = .038$ ). The correlation between unhealthy beverage consumption and attitudes was not significant.

### **Predictive effects of eating styles, perceived stress and TPB variables on snacking frequency**

To test hypothesis 1b and 2a, four hierarchical regression analyses were conducted to examine the predicted effects of eating styles, perceived stress and TPB variables on consumption frequency of unhealthy snacks, unhealthy beverages, fruit and vegetables, respectively. In each regression, gender and culture were entered as covariates at step 1. Eating styles and perceived stress were entered at step 2, as this group of variables were shown as more stable and thus considered as more proximal predictors for snack consumptions. The TPB variables were entered at the final step. Log transformations were applied to the dependent variables to reduce skewness and eliminate outliers (Benoit, 2011).

The results of the hierarchical regression analysis with consumption frequency of unhealthy snacks as a dependent variable are reported in **Table 2.7**. Eating styles and perceived stress accounted for 13.2% of the variance in snack consumption after controlling for gender and culture. External eating ( $\beta = .21; p = .002$ ) and mindful eating ( $\beta = -.19; p = .003$ ) were shown to significantly predict unhealthy snack consumption. The TPB variables accounted for an additional 6.3% of the variance in unhealthy snack consumption, over and above the variance accounted for by eating styles and perceived stress. In the final model, subjective norms ( $\beta = .18; p = .001$ ), external eating ( $\beta = .18; p = .008$ ) and habit strength ( $\beta = .19; p = .010$ ) emerged as significant predictors of unhealthy snack consumption. The predictive effect of mindful eating reduced to marginal significance ( $\beta = -.12; p = .063$ ).

**Table 2.7** Hierarchical regression analyses examining the predictive effects of eating styles, perceived stress, and the TPB variables on consumption frequency of unhealthy snacks (log-transformed) (N = 271)

Variable	$\beta$	$t$	$R^2$	$\Delta R^2$	$F$ change	$p$
<b>Step 1</b>			.078	.078	11.41	<.001***
Culture	.261	4.433				<.001***
Gender	.084	1.421				.157
<b>Step 2</b>			.210	.132	8.788	<.001***
Culture	.271	4.666				<.001***
Gender	.040	.645				.519
Restrained eating	-.074	-1.242				.215
Emotional eating	.073	1.066				.287
External eating	.210	3.097				.002**
Mindful eating	-.190	-3.010				.003**
Perceived stress	-.041	-.663				.508
<b>Step 3</b>			.274	.063	5.651	<.001***
Culture	.221	3.799				<.001***
Gender	.036	.594				.553
Restrained eating	-.056	-.960				.338
Emotional eating	.058	.878				.381
External eating	.182	2.695				.008**
Mindful eating	-.122	-1.866				.063 <sup>a</sup>
Perceived stress	-.066	-1.103				.271
Attitudes (un)	-.027	-.401				.688
SN (un)	.184	3.373				.001**
PBC (un)	.000	-.001				.999
Habit (un)	.194	2.579				.010*

Attitudes (un): attitudes towards unhealthy snacking; SN (un): subjective norms of unhealthy snacking; PBC (un): perceived behavioural control of unhealthy snacking; Habits (un): habit strength of unhealthy snacking.

\* =  $p < .05$ ; \*\* =  $p < .01$ ; \*\*\* =  $p < .001$ ; a =  $p < .10$ .

The results of the hierarchical regression analysis with consumption frequency of unhealthy beverages as a dependent variable are demonstrated in **Table 2.8**. Eating styles and perceived stress accounted for 10.1% of the variance in beverage consumption after controlling for gender and culture. Mindful eating was shown as a significant predictor of unhealthy beverage consumption ( $\beta = -.24$ ;  $p < .001$ ). External eating also showed a marginally significant predictive effect ( $\beta = .13$ ;  $p = .072$ ). The TPB variables accounted for an additional 3.9% of the variance in beverage consumption, over and above the variance accounted for by eating styles and perceived stress. In the final model, the strongest predictor of beverage consumption was mindful eating ( $\beta$

= -.19;  $p = .006$ ), followed by PBC ( $\beta = -.133$ ;  $p = .030$ ).

**Table 2.8** Hierarchical regression analyses examining the predictive effects of eating styles, perceived stress, and the TPB variables on consumption frequency of unhealthy beverages (log-transformed) (N = 270)

Variable	$\beta$	$t$	$R^2$	$\Delta R^2$	$F$ change	$p$
<b>Step 1</b>			.081	.081	11.870	<.001***
Culture	.092	1.599				.120
Gender	-.278	-4.725				<.001***
<b>Step 2</b>			.182	.101	6.506	<.001***
Culture	.090	1.519				.130
Gender	-.298	-4.716				<.001***
Restrained eating	.022	.356				.722
Emotional eating	.042	.612				.541
External eating	.125	1.805				.072 <sup>a</sup>
Mindful eating	-.243	-3.782				<.001***
Perceived stress	-.077	-1.233				.219
<b>Step 3</b>			.221	.039	3.209	.014*
Culture	.078	1.289				.199
Gender	-.307	-4.927				<.001***
Restrained eating	.033	.545				.586
Emotional eating	.048	.696				.487
External eating	.098	1.395				.164
Mindful eating	-.188	-2.787				.006**
Perceived stress	-.099	-1.615				.107
Attitudes (un)	-.067	-.958				.339
SN (un)	.130	1.818				.070 <sup>a</sup>
PBC (un)	-.133	-2.177				.030*
Habit (un)	.095	1.217				.225

Attitudes (un): attitudes towards unhealthy snacking; SN (un): subjective norms of unhealthy snacking; PBC (un): perceived behavioural control of unhealthy snacking; Habits (un): habit strength of unhealthy snacking.

\* =  $p < .05$ ; \*\* =  $p < .01$ ; \*\*\* =  $p < .001$ ; a =  $p < .10$ .

The results of the hierarchical regression analysis with consumption frequency of fruit as a dependent variable are reported in **Table 2.9**. Eating styles and perceived stress accounted for 7.8% of the variance in fruit consumption after controlling for gender and culture. Restrained eating was shown as a significant predictor of fruit consumption ( $\beta = .285$ ;  $p < .001$ ). The TPB variables accounted for an additional 4.2% of the variance in fruit consumption, over and above the variance accounted for by eating styles and perceived stress. In the final model, the strongest predictor of fruit consumption was restrained eating ( $\beta = .24$ ;  $p < .001$ ), followed by habit strength

( $\beta = .18$ ;  $p = .013$ ).

**Table 2.9** Hierarchical regression analyses examining the predictive effects of eating styles, perceived stress, and the TPB variables on consumption frequency of fruit (log-transformed) (N = 269)

Variable	$\beta$	$t$	$R^2$	$\Delta R^2$	$F$ change	$p$
<b>Step 1</b>			.013	.013	1.79	<.001***
Culture	-.080	-1.309				.192
Gender	.089	1.464				.144
<b>Step 2</b>			.091	.078	4.485	.001**
Culture	-.034	-.541				.589
Gender	.046	.685				.494
Restrained eating	.285	4.441				<.001***
Emotional eating	.003	.044				.955
External eating	.028	.385				.701
Mindful eating	.068	.997				.320
Perceived stress	-.065	-.992				.322
<b>Step 3</b>			.134	.042	3.143	.015*
Culture	-.023	-.370				.712
Gender	.029	.439				.661
Restrained eating	.244	3.778				<.001***
Emotional eating	.013	.180				.857
External eating	-.001	-.015				.988
Mindful eating	.023	.337				.736
Perceived stress	-.048	-.725				.469
Attitudes (h)	.087	1.231				.219
SN (h)	-.039	-.584				.560
PBC (h)	.044	.732				.465
Habit (h)	.176	2.503				.013*

Attitudes (h): attitudes towards healthy snacking; SN (h): subjective norms of healthy snacking; PBC (h): perceived behavioural control of healthy snacking; Habits (h): habits strength of healthy snacking.

\* =  $p < .05$ ; \*\* =  $p < .01$ ; \*\*\* =  $p < .001$ .

The results of the hierarchical regression analysis with consumption frequency of vegetables as a dependent variable are shown in **Table 2.10**. Eating styles and perceived stress accounted for 6.3% of the variance in vegetable consumption after controlling for gender and culture. Restrained eating was shown as a significant predictor of fruit consumption ( $\beta = .25$ ;  $p < .001$ ). The TPB variables accounted for an additional 2.0% of the variance in vegetable consumption, which was not significant. Restrained eating was the only significant predictor for vegetable consumption in the final model ( $\beta = .23$ ;  $p < .001$ ). Habit strength also showed a predictive effect on vegetable

consumption which approached significance ( $\beta = .12; p = .096$ ).

**Table 2.10** Hierarchical regression analyses examining the predictive effects of eating styles, perceived stress, and the TPB variables on consumption frequency of vegetables (log-transformed) (N = 269)

Variable	$\beta$	$t$	$R^2$	$\Delta R^2$	$F$ change	$p$
<b>Step 1</b>			.012	.012	1.62	.200
Culture	.060	.978				.329
Gender	.087	1.431				.154
<b>Step 2</b>			.075	.063	3.540	.004**
Culture	.120	1.906				.058 <sup>a</sup>
Gender	.006	.093				.926
Restrained eating	.250	3.863				<.001***
Emotional eating	-.031	-.415				.678
External eating	.091	1.235				.218
Mindful eating	.085	1.242				.215
Perceived stress	.053	.806				.421
<b>Step 3</b>			.095	.020	1.442	.221
Culture	.132	2.092				.037*
Gender	.002	.028				.978
Restrained eating	.230	3.496				.001**
Emotional eating	-.017	-.233				.816
External eating	.072	.956				.340
Mindful eating	.071	1.013				.312
Perceived stress	.057	.842				.401
Attitudes (h)	.035	.482				.630
SN (h)	-.049	-.729				.467
PBC (h)	-.055	-.898				.370
Habit (h)	.120	1.669				.096 <sup>a</sup>

Attitudes (h): attitudes towards healthy snacking; SN (h): subjective norms of healthy snacking; PBC (h): perceived behavioural control of healthy snacking; Habits (h): habits strength of healthy snacking.

\* =  $p < .05$ ; \*\* =  $p < .01$ ; \*\*\* =  $p < .001$ ; a =  $p < .10$ .

### *Gender and culture of the effects of eating styles on snacking frequency*

To test hypothesis 1c, gender differences in the predictive effects of eating styles on snacking frequency was examined by a series of hierarchical regression analyses. For each regression, culture and gender were entered at step 1, followed by eating styles at step 2. To test the gender  $\times$  eating styles interaction, the relevant multiplicative terms (gender  $\times$  restrained eating, gender  $\times$  emotional eating, gender  $\times$  external eating, gender  $\times$  mindful eating) were entered at the final step.

The log-transformed consumption frequency of unhealthy snacks, beverages, fruit and vegetables were entered as the dependent variable, respectively. The gender  $\times$  eating styles interaction did not emerge as a significant predictor of unhealthy snack consumption,  $\Delta R^2 = .013$ ,  $F_{change} = 1.09$ ,  $p = .361$ , unhealthy beverage consumption,  $\Delta R^2 = .011$ ,  $F_{change} = .85$ ,  $p = .495$ , fruit consumption,  $\Delta R^2 = .008$ ,  $F_{change} = 0.60$ ,  $p = .662$ , or vegetable consumption,  $\Delta R^2 = .008$ ,  $F_{change} = .58$ ,  $p = .675$ , suggesting that there was no gender difference in the relationship between eating styles and snacking frequencies.

To test hypothesis 1d, cultural differences in the predictive effects of eating styles on snacking frequency were examined by four hierarchical regression analyses. For each regression, culture and gender were entered at step 1, followed by eating styles at step 2. To test the culture  $\times$  eating styles interaction, the relevant multiplicative terms (culture  $\times$  restrained eating, culture  $\times$  emotional eating, culture  $\times$  external eating, culture  $\times$  mindful eating) were entered at the final step. The log-transformed consumption frequency of unhealthy snacks, beverages, fruit and vegetables were entered as the dependent variable, respectively. The culture  $\times$  eating styles interaction did not emerge as a significant predictor in unhealthy snack consumption,  $\Delta R^2 = .004$ ,  $F_{change} = .30$ ,  $p = .880$ , unhealthy beverage consumption,  $\Delta R^2 = .003$ ,  $F_{change} = .25$ ,  $p = .907$ , fruit consumption,  $\Delta R^2 = .008$ ,  $F_{change} = .60$ ,  $p = .664$ , or vegetable consumption,  $\Delta R^2 = .015$ ,  $F_{change} = 1.08$ ,  $p = .369$ , suggesting that there was no cultural differences in the relationship between eating styles and snacking frequency.

### **Gender and culture of the effects of TPB variables on snacking frequency**

To test hypothesis 2b, gender differences in the effects of TPB variables on snacking frequency was examined by three hierarchical regression analyses. For each regression, culture and gender were entered at step 1, followed by the related TPB variables at step 2. To test the gender  $\times$  TPB variables interaction, the relevant multiplicative terms (gender  $\times$  attitudes, gender  $\times$  norms, gender  $\times$  PBC, gender  $\times$  habit strength) were entered at the final step. The log-transformed consumption frequency of unhealthy snacks, beverages, fruit and vegetables were entered as the depended variable, respectively. The gender  $\times$  TPB variables interaction did not emerge as a significant predictor in unhealthy snack consumption,  $\Delta R^2 = .005$ ,  $F_{change} = .40$ ,  $p = .805$ , unhealthy beverage

consumption,  $\Delta R^2 = .004$ ,  $F_{change} = .28$ ,  $p = .890$ , fruit consumption,  $\Delta R^2 = .025$ ,  $F_{change} = 1.79$ ,  $p = .132$ , or vegetable consumption,  $\Delta R^2 = .010$ ,  $F_{change} = .71$ ,  $p = .585$ , but showed a significant effect in unhealthy beverage consumption,  $\Delta R^2 = .038$ ,  $F_{change} = 3.14$ ,  $p = .015$ , suggesting gender differences in the relationship between TPB variables and consumption frequency of unhealthy beverages.

Separate multiple regression analyses were further conducted for boys and girls. As shown in **Table 2.11**, for the whole sample, after controlling for gender and culture, the consumption frequency of unhealthy beverages was mostly predicted by habit strength ( $\beta = .24$ ,  $p = .002$ ) and the gender  $\times$  habit interaction ( $\beta = .19$ ,  $p = .008$ ), followed by norms ( $\beta = .14$ ,  $p = .018$ ) and PBC ( $\beta = -.12$ ,  $p = .049$ ). The gender  $\times$  norms interaction also showed a predictive effect that approached significance ( $\beta = .11$ ,  $p = .063$ ). Separate multiple regressions showed that for boys, the TPB variables accounted for an additional 6.5% of the variance in unhealthy beverage consumption after controlling for culture ( $F_{change} = 2.01$ ,  $p = .097$ ). PBC emerged as a significant predictor ( $\beta = -.24$ ;  $p = .013$ ). For girls, the unhealthy beverage consumption was significantly predicted by habit strength ( $\beta = .39$ ;  $p < .001$ ) and norms ( $\beta = .21$ ;  $p = .006$ ). The TPB variables accounted for an additional 17.2% of the variance in unhealthy beverage consumption after controlling for culture ( $F_{change} = 8.25$ ,  $p < .001$ ).



**Table 2.11** The moderating effect of gender on the relationship between TPB variables and consumption frequency of unhealthy beverages (log-transformed)

Variables	$\beta$	$t$	$p$
<b>All participants (N = 275)</b>			
<i>Step 1</i>			
Culture	-.282	1.725	.086 <sup>a</sup>
Gender	.100	-4.847	<.001 <sup>***</sup>
<i>Step 2</i>			
Culture	.071	1.235	.218
Gender	-.312	-5.536	<.001
Attitudes (un)	-.070	-1.018	.309
SN (un)	.111	1.946	.053 <sup>a</sup>
PBC (un)	-.154	-2.531	.012 <sup>*</sup>
Habit (un)	.188	2.611	.010 <sup>*</sup>
<i>Step 3</i>			
Culture	.057	.987	.324
Gender	-.308	-5.536	<.001 <sup>***</sup>
Attitudes (un)	-.092	-1.336	.183
SN (un)	.140	2.380	.018 <sup>*</sup>
PBC (un)	-.124	-1.978	.049 <sup>*</sup>
Habit (un)	.238	3.202	.002 <sup>**</sup>
Gender $\times$ attitudes (un)	-.056	-.829	.408
Gender $\times$ norms (un)	.110	1.869	.063 <sup>a</sup>
Gender $\times$ PBC (un)	.088	1.426	.155
Gender $\times$ habit (un)	.191	2.662	.008 <sup>**</sup>
<b>Boys (n = 121)</b>			
Culture	-.093	-.981	.329
Attitudes (un)	.013	.125	.901
SN (un)	.042	.438	.662
PBC (un)	-.239	-2.517	.013 <sup>*</sup>
Habit (un)	.019	.181	.857
$R^2 = .071$			
$\Delta R^2 = .065$			
$F_{change} = 2.014^a$			
<b>Girls (n = 154)</b>			
Culture	.169	2.254	.026 <sup>*</sup>
Attitudes (un)	-.150	-1.586	.115
SN (un)	.205	2.799	.006 <sup>**</sup>
PBC (un)	-.068	-.784	.434
Habit (un)	.392	3.606	<.001 <sup>***</sup>
$R^2 = .229$			
$\Delta R^2 = .172$			
$F_{change} = 8.245^{***}$			

\* =  $p < .05$ ; \*\* =  $p < .01$ ; \*\*\* =  $p < .001$ ; a =  $p < .10$ .

To test hypothesis 2c, cultural differences in the predictive effects of TPB variables on snacking frequency were examined by four hierarchical regression analyses. For each regression, gender and culture were entered at step 1, followed by the related TPB variables at step 2. To test the culture  $\times$  TPB variables interaction, the relevant multiplicative terms (culture  $\times$  attitudes, culture  $\times$  norms, culture  $\times$  PBC, culture  $\times$  habit strength) were entered at the final step. The log-transformed consumption frequency of unhealthy snacks, beverages, fruit and vegetables were entered as the depended variable, respectively. The culture  $\times$  TPB variables interaction emerged as a significant predictor in unhealthy snack consumption,  $\Delta R^2 = .043$ ,  $F_{change} = 3.59$ ,  $p = .007$ , unhealthy beverage consumption, fruit consumption,  $\Delta R^2 = .104$ ,  $F_{change} = 8.25$ ,  $p < .001$ , and vegetable consumption,  $\Delta R^2 = .044$ ,  $F_{change} = 3.13$ ,  $p = .015$ , suggesting culture moderates the relationship between TPB variables and consumption frequency of unhealthy snacks, unhealthy beverages, fruit and vegetables. Separate multiple regression analyses were further conducted for Chinese and UK adolescents.

As shown in **Table 2.12**, for the whole sample, after controlling for gender and culture, the consumption frequency of unhealthy snacks was mostly predicted by habit strength ( $\beta = .29$ ,  $p < .001$ ) and norms ( $\beta = .16$ ,  $p = .007$ ), followed by the culture  $\times$  habit interaction ( $\beta = .17$ ,  $p = .012$ ). The culture  $\times$  PBC ( $\beta = .12$ ,  $p = .055$ ) and culture  $\times$  norms ( $\beta = -.10$ ,  $p = .090$ ) interactions also showed predictive effects that approached significance. Separate multiple regressions showed that for Chinese adolescents, the unhealthy snack consumption was uniquely predicted by subjective norms ( $\beta = .26$ ,  $p < .001$ ). Habit strength showed a marginally significant effect ( $\beta = .16$ ,  $p = .086$ ). The TPB variables accounted for an additional 13.7% of the variance in unhealthy snack consumption after controlling for gender ( $F_{change} = 6.97$ ,  $p < .001$ ). For UK adolescents, the unhealthy snack consumption was uniquely predicted by habit strength ( $\beta = .58$ ,  $p < .001$ ). PBC also showed a marginally significant effect ( $\beta = .18$ ,  $p = .077$ ). The TPB variables accounted for an additional 29.8% of the variance in unhealthy snack consumption after controlling for gender ( $F_{change} = 9.65$ ,  $p < .001$ ).

**Table 2.12** The moderating effect of culture on the relationship between TPB variables and consumption frequency of unhealthy snacks (log-transformed)

Variables	$\beta$	$t$	$p$
<b>All participants (N = 275)</b>			
<i>Step 1</i>			
Gender	.091	1.564	.119
Culture	.254	4.350	<.001***
<i>Step 2</i>			
Gender	.058	1.057	.291
Culture	.182	3.223	.001**
Attitudes (un)	.001	0.19	.985
SN (un)	.191	3.422	.001***
PBC (un)	-.037	-.624	.533
Habit (un)	.276	3.924	<.001***
<i>Step 3</i>			
Gender	.045	.816	.415
Culture	.167	2.901	.004**
Attitudes (un)	.028	.417	.677
SN (un)	.159	2.703	.007**
PBC (un)	.000	-.006	.995
Habit (un)	.291	4.154	<.001***
Culture $\times$ attitudes (un)	.021	.329	.743
Culture $\times$ norms (un)	-.099	-1.704	.090 <sup>a</sup>
Culture $\times$ PBC (un)	.118	1.926	.055 <sup>a</sup>
Culture $\times$ habit (un)	.171	2.518	.012*
<b>Chinese adolescents (n = 181)</b>			
Gender	.032	.448	.655
Attitudes (un)	.014	.154	.878
SN (un)	.255	3.552	<.001***
PBC (un)	-.098	-1.283	.201
Habit (un)	.160	1.729	.086 <sup>a</sup>
$R^2 = .142$			
$\Delta R^2 = .137$			
$F_{change} = 6.967^{***}$			
<b>UK adolescents (n = 94)</b>			
Gender	.080	.897	.372
Attitudes (un)	.058	.601	.549
SN (un)	.006	.073	.942
PBC (un)	.178	1.788	.077 <sup>a</sup>
Habit (un)	.578	5.363	<.001***
$R^2 = .320$			
$\Delta R^2 = .298$			
$F_{change} = 9.649^{***}$			

\* =  $p < .05$ ; \*\* =  $p < .01$ ; \*\*\* =  $p < .001$ ; a =  $p < .10$ .

**Table 2.13** The moderating effect of culture on the relationship between TPB variables and consumption frequency of unhealthy beverages (log-transformed)

Variables	$\beta$	$t$	$p$
<b>All participants (N = 275)</b>			
<i>Step 1</i>			
Culture	-.282	1.725	.086 <sup>a</sup>
Gender	.100	-4.847	<.001 <sup>***</sup>
<i>Step 2</i>			
Culture	.071	1.235	.218
Gender	-.312	-5.536	<.001
Attitudes (un)	-.070	-1.018	.309
SN (un)	.111	1.946	.053 <sup>a</sup>
PBC (un)	-.154	-2.531	.012 <sup>*</sup>
Habit (un)	.188	2.611	.010 <sup>*</sup>
<i>Step 3</i>			
Culture	.067	1.147	<.001 <sup>***</sup>
Gender	-.335	-6.004	.253
Attitudes (un)	-.064	-.932	.352
SN (un)	.092	1.540	.125
PBC (un)	-.117	-1.880	.061 <sup>a</sup>
Habit (un)	.119	2.795	.006 <sup>**</sup>
Culture × attitudes (un)	-.114	-1.746	.082 <sup>a</sup>
Culture × norms (un)	-.058	-.984	.326
Culture × PBC (un)	.136	2.166	.031 <sup>*</sup>
Culture × habit (un)	.249	3.605	<.001 <sup>***</sup>
<b>Chinese (n = 181)</b>			
Gender	-.453	-6.902	<.001 <sup>***</sup>
Attitudes (un)	.048	.598	.550
SN (un)	.160	2.427	.016 <sup>*</sup>
PBC (un)	-.259	-3.688	<.001 <sup>***</sup>
Habit (un)	.003	.035	.972
$R^2 = .275$			
$\Delta R^2 = .113$			
$F_{change} = 6.801^{***}$			
<b>UK (n = 94)</b>			
Gender	-.124	-1.243	.217
Attitudes (un)	-.167	-1.544	.126
SN (un)	.020	.196	.845
PBC (un)	.072	.654	.515
Habit (un)	.454	3.774	<.001 <sup>***</sup>
$R^2 = .154$			
$\Delta R^2 = .149$			
$F_{change} = 3.882^{**}$			

\* =  $p < .05$ ; \*\* =  $p < .01$ ; \*\*\* =  $p < .001$ ; a =  $p < .10$ .

As shown in **Table 2.13**, for unhealthy beverage consumption of the whole sample, after controlling for gender and culture, the culture  $\times$  habit interaction emerged as the strongest predictor ( $\beta = .25, p < .001$ ), followed by habit strength ( $\beta = .12, p = .006$ ) and the culture  $\times$  PBC interaction ( $\beta = .14, p = .031$ ). Separate multiple regressions showed that for Chinese adolescents, the unhealthy beverage consumption was significantly predicted by PBC ( $\beta = .26, p < .001$ ) and subjective norms ( $\beta = .16, p = .016$ ). The TPB variables accounted for an additional 11.3% of the variance in unhealthy snack consumption after controlling for gender ( $F_{change} = 6.80, p < .001$ ). For UK adolescents, the unhealthy snack consumption was uniquely predicted by habit strength ( $\beta = .45, p < .001$ ). The TPB variables accounted for an additional 14.9% of the variance in unhealthy snack consumption after controlling for gender ( $F_{change} = 3.88, p = .006$ ).

As shown in **Table 2.14**, for fruit consumption of the whole sample, after controlling for gender and culture, the culture  $\times$  PBC ( $\beta = .21, p < .001$ ) and culture  $\times$  habit ( $\beta = .27, p < .001$ ) interactions emerged as the strongest predictors, followed by habit strength ( $\beta = .22, p = .001$ ). Separate multiple regressions showed that for Chinese adolescents, fruit consumption was not significantly predicted by TPB variables. For UK adolescents, the TPB variables accounted for an additional 41.4% of the variance in fruit consumption after controlling for gender ( $F_{change} = 15.36, p < .001$ ). Fruit consumption was significantly predicted by habit strength ( $\beta = .53, p < .001$ ) and PBC ( $\beta = .36, p < .001$ ).

As shown in **Table 2.15**, for vegetable consumption of the whole sample, after controlling for gender and culture, the culture  $\times$  habit interaction emerged as the strongest predictor ( $\beta = .21, p = .004$ ), followed by habit strength ( $\beta = .18, p = .015$ ). Separate multiple regressions showed that for Chinese adolescents, the vegetable consumption was not significantly predicted by TPB variables. For UK adolescents, TPB variables accounted for an additional 29.7% of the variance in vegetable consumption after controlling for gender ( $F_{change} = 9.19, p < .001$ ). Habit strength predicted a significant amount of variance ( $\beta = .51, p < .001$ ).

**Table 2.14** The moderating effect of culture on the relationship between TPB variables and consumption frequency of fruit (log-transformed)

Variables	$\beta$	$t$	$p$
<b>All participants (N = 272)</b>			
<i>Step 1</i>			
Gender	.079	1.307	.192
Culture	-.080	-1.318	.189
<i>Step 2</i>			
Gender	.050	.831	.407
Culture	-.054	-.903	.367
Attitudes (h)	.120	1.741	.083 <sup>a</sup>
SN (h)	-.069	-1.051	.294
PBC (h)	.070	1.163	.246
Habit (h)	.194	2.759	.006 <sup>**</sup>
<i>Step 3</i>			
Gender	.052	.891	.374
Culture	-.035	-.621	.535
Attitudes (h)	.099	1.483	.139
SN (h)	-.012	-.187	.852
PBC (h)	.070	1.227	.221
Habit (h)	.221	3.237	.001 <sup>**</sup>
Culture $\times$ attitudes (h)	.048	.710	.478
Culture $\times$ norms (h)	-.048	-.783	.434
Culture $\times$ PBC (h)	.207	3.609	<.001 <sup>***</sup>
Culture $\times$ habit (h)	.273	4.021	<.001 <sup>***</sup>
<b>Chinese adolescents (n = 180)</b>			
Gender	.055	.707	.480
Attitudes (h)	.067	.761	.448
SN (h)	.026	.294	.769
PBC (h)	-.078	-1.028	.305
Habit (h)	.015	.170	.865
$R^2 = .020$			
$\Delta R^2 = .013$			
$F_{change} = .597$			
<b>UK adolescents (n = 92)</b>			
Gender	.046	.549	.584
Attitudes (h)	.147	1.499	.138
SN (h)	-.070	-.821	.414
PBC (h)	.345	4.071	<.001 <sup>***</sup>
Habit (h)	.528	5.387	<.001 <sup>***</sup>
$R^2 = .420$			
$\Delta R^2 = .414$			
$F_{change} = 15.356^{***}$			

\* =  $p < .05$ ; \*\* =  $p < .01$ ; \*\*\* =  $p < .001$ .

**Table 2.15** The moderating effect of culture on the relationship between TPB variables and consumption frequency of vegetables (log-transformed)

Variables	$\beta$	$t$	$p$
<b>All participants (N = 273)</b>			
<i>Step 1</i>			
Gender	.086	1.419	.157
Culture	.068	1.126	.261
<i>Step 2</i>			
Gender	.074	1.214	.226
Culture	.089	1.479	.140
Attitudes (h)	.059	.844	.399
SN (h)	-.082	-1.235	.218
PBC (h)	-.035	-.573	.567
Habit (h)	.154	2.157	.032*
<i>Step 3</i>			
Gender	.091	1.482	.140
Culture	.104	1.747	.082
Attitudes (h)	.039	.551	.582
SN (h)	-.045	-.681	.496
PBC (h)	-.027	-.444	.657
Habit (h)	.177	2.455	.015*
Culture $\times$ attitudes (h)	.020	.286	.775
Culture $\times$ norms (h)	-.012	-.192	.848
Culture $\times$ PBC (h)	.013	.217	.828
Culture $\times$ habit (h)	.209	2.925	.004**
<b>Chinese adolescents (n = 181)</b>			
Gender	.079	1.015	.312
Attitudes (h)	.024	.275	.784
SN (h)	-.035	-.392	.696
PBC (h)	-.033	-.437	.663
Habit (h)	.017	.192	.848
$R^2 = .010$			
$\Delta R^2 = .003$			
$F_{change} = .119$			
<b>UK adolescents (n = 92)</b>			
Gender	.120	1.299	.198
Attitudes (h)	.074	.690	.492
SN (h)	-.066	-.699	.486
PBC (h)	-.013	-.145	.885
Habit (h)	.508	4.739	<.001***
$R^2 = .306$			
$\Delta R^2 = .297$			
$F_{change} = 9.190^{***}$			

\* =  $p < .05$ ; \*\* =  $p < .01$ ; \*\*\* =  $p < .001$ .

## 2.4 Discussion

### **Gender and cultural differences in adolescent snacking and determinants**

In the present study, gender and cultural differences in adolescent snacking and potential influencing factors including eating styles, perceived stress, the TPB variables and habit strength were first explored. Cultural differences were found in snacking frequency, eating styles and TPB variables in relation to unhealthy snacking. Compared to UK adolescents, Chinese adolescents reported lower frequencies of unhealthy snack and beverage consumption. This is consistent with previous studies showing that snacking is less prevalent among the Chinese compared to western populations (Wang et al., 2012; Wang et al., 2018). Chinese adolescents also showed less positive attitudes, lower subjective norms and lower habit strength related to unhealthy snacking than did UK adolescents. Snacking is not a practice in traditional Chinese culture. Only recently has snacking become a part of daily eating routine among the Chinese (Du et al., 2016). Therefore, Chinese adolescents might still perceive snacking, particularly unhealthy snacking as less acceptable and approved, and this behaviour has not become strongly habitual compared to UK adolescents. UK adolescents reported higher levels of external eating than did Chinese adolescents, indicating the influence of the food-abundant environment on adolescent snacking behaviour in the UK. In comparison, Chinese adolescents showed higher levels of restrained eating, which might reflect a high prevalence of weight concern and body dissatisfaction among the Chinese population. This finding is supported by a recent cross-cultural study showing greater body dissatisfaction of female adolescents from Japan than their counterparts from Finland (Maezono et al., 2019). The increased contact with western influences has been suggested as a main cause for the high body dissatisfaction of Asian populations (Pike & Dunne, 2015). Intervention designers need to be considerate when developing weight management interventions for Chinese adolescents, with an effort to promote healthy body image.

Gender differences were also observed in eating styles, with girls reporting higher levels of restrained eating and emotional eating, and lower levels of external eating than did boys. These findings are in line with previous studies suggesting gender differences in unhealthy eating styles (Hou et al., 2013; Braet et al., 2008; Wardle et al., 1992; Snoek et al., 2008; Lu et al., 2016). When



designing interventions targeting adolescent unhealthy eating styles, gender factor should be taken into consideration.

### **Eating styles and BMI**

Correlations between eating styles and BMI were examined. For the Chinese sample, higher BMI was correlated with higher restrained eating, which is consistent with hypothesis 1a. Contrary to the hypothesis, however, BMI was found to be negatively correlated with external eating and emotional eating. This might be a reflection that Chinese adolescents with higher BMI were more likely to restrain their eating behaviour, and therefore controlling their eating in relation to external cues and emotional states. This finding is not totally surprising, considering previous studies in adolescents tend to report consistent positive associations between body weight and restrained eating, but very mixed results regarding emotional eating and external eating (Hou et al., 2013; Snoek et al., 2007; Wardle et al., 1992; Wu et al., 2017). For the UK sample, only emotional eating was shown to be positively correlated with BMI. However, nearly half (42%) UK adolescents failed to report their weight in this study, suggesting many of this sample of adolescents might not be aware of their accurate body weight. Caution is needed when interpreting this finding. Inconsistent with hypothesis 1a, no significant correlations were found between mindful eating and BMI in the two samples.

### **Eating styles and perceived stress in predicting adolescent snacking**

This study examined the association of eating styles and perceived stress with adolescent snacking, with the results partially supporting hypothesis 1a. As predicted, external eating was positively correlated with the consumption frequency of unhealthy snacks and beverages, which is in line with some of the previous studies among adolescents (De Cock et al., 2016; Snoek et al., 2006). Mindful eating was found to be negatively correlated with the consumption of unhealthy snacks and beverages, as well as with emotional eating and external eating, which is in line with evidence regarding the associations of mindful eating with unhealthy eating styles and dietary intake in adults (Beshara et al., 2013; Pidgeon et al., 2013).

We then further examined the influence of eating styles and perceived stress on adolescent

snacking, and compared the predictive power of these potential determinants using hierarchical regression analysis. Results showed that eating styles and perceived stress explained a significant but small amount of variance in consumption frequency of all types of snacks examined, which supported hypothesis 1b. Of the five variables, mindful eating emerged as a significant predictor of both unhealthy snack and beverage consumptions, irrespective of gender and cultural background. External eating showed the strongest predictive effects on frequency of unhealthy snacks, and a marginally significant effect on frequency of unhealthy beverages ( $p = .072$ ). Emotional eating, although correlated with frequency of unhealthy snack consumption, did not show independent predictive effects. In previous research, high level of external eating has been shown to be consistently associated with high consumption of unhealthy, calorie-dense foods among predominantly western adolescents (De Cock et al., 2016; Lluch et al., 2000; Snoek et al., 2006; Wardle et al., 1992). Evidence for the relationship between mindful eating and dietary intake is relatively limited and mainly focuses on adults (Beshara et al., 2013; Pidgeon et al., 2013). The findings of the present study extend the literature on eating styles and snacking by simultaneously examining and comparing predictive effects of unhealthy eating styles and mindful eating on adolescent snacking. Overall, these findings highlight the role of *mindful eating* and *external eating* in adolescent unhealthy snacking. Enhancing adolescents' mindful eating skills and reducing external eating may have a positive impact on their ability to regulate unhealthy snack and beverage consumption. Moreover, the negative correlation between mindful eating and external eating suggested that teaching adolescents to eat more mindfully could be an effective way to reduce external eating itself. Taken together, mindful eating programmes could be particularly promising to bring about reduced unhealthy snacking in adolescents.

Contrary to hypothesis 1b, however, consumptions of fruit and vegetables were positively correlated with restrained eating. Regression analysis showed that among eating styles and perceived stress, restrained eating uniquely and positively predicted the frequency of FV consumption. This might indicate that restrained eaters among the adolescents restricted their dietary intake by eating more typical healthy foods. Previous studies in adults showed that the perceived healthfulness of food encourages more food intake among restrained eaters (Cavanaugh, Kruja, & Forestell, 2014; Provencher, Polivy, & Herman, 2009). Healthy food such as fruit and vegetables could be seen as less likely to lead to weight gain and thus more appropriate to eat

(Provencher et al., 2009). Such normative beliefs about the healthfulness of food could lead to excessive food and calorie intake (Herman & Polivy, 2007). In the present study, restrained eaters did not show lower frequency of unhealthy snack or beverage intake, indicating that although correlating with high FV frequency, restrained eating might not lead to reduced calorie intake or an overall healthier snacking pattern.

Adolescents who perceived high stress reported high levels of unhealthy eating styles and low levels of mindful eating, indicating an association between stress and eating styles in the expected direction. To our surprise, however, perceived stress was not associated with frequency of unhealthy snack or beverages consumption. Positive correlations between perceived stress and frequency of FV consumption were found, although these associations were not significant in the regression model. These findings are contrary to a systematic review showing that stress was positively associated with unhealthy eating behaviours, and negatively associated with healthy eating among adolescents (Hill et al., 2018). One possible explanation for the inconsistency is the different measures of stress used in the studies. In the present study, we used a 10-item Perceived Stress Scale (PSS; Cohen & Williamson, 1988) as a measure of perceived stress. Despite being frequently used in stress research and showing good psychometric properties across various groups (Eun-Hyun Lee, 2012), the PPS provided a very brief and general assessment of perceived stress. In contrast, of the studies reviewed by Hill and colleagues (2018), most employed more comprehensive and sophisticated measures of stress (De Vriendt et al., 2012; Jeong & Kim, 2007; Kim et al., 2013; Son et al., 2014), which might be more sensitive and appropriate for exploring the stress-snacking association.

### **TPB variables and habit strength in predicting adolescent snacking**

This study also examined the role of an extended TPB in predicting adolescent snacking. In line with hypothesis 2a, results of hierarchical regressions showed that the extended TPB accounted for a significant but very small amount of variance in frequency of unhealthy snack (6.3%), beverage (3.9%) and fruit intake (4.2%), over and above eating styles and perceived stress. The small amount of variance accounted by the TPB variables in comparison to previous studies (Riebl et al., 2015) might indicate that there is an overlap in the prediction of eating styles and

the TPB variables in adolescent snacking. It should be noted, however, that the present study did not measure *intentions* of the TPB due to its research purpose. Therefore, it did not examine the predictive power of the full TPB. For unhealthy snacking, all the TPB constructs and habit strength were shown to be significantly correlated with frequency of unhealthy snacks and beverages in the expected direction, except for *attitudes* with unhealthy beverage consumption. However, only subjective norms and habits emerged as significant predictors for frequency of unhealthy snacks, and PBC for unhealthy beverages. The correlations between the TPB constructs and healthy snacking was less consistent with theoretical hypothesis. The TPB constructs were not significantly correlated with frequency of FV intake, except for *attitudes* with fruit consumption. Habit strength was found to be positively correlated with frequency of FV intake, and significantly predict the frequency of fruit intake.

### **Cultural differences in the extended TPB in explaining adolescent snacking**

In addition, we hypothesised that cultural differences would be observed based on a collectivism-individualism framework, with subjective norms exerting a stronger influence on snacking of Chinese adolescents, while attitudes exerting a stronger influence of UK adolescents. The results partially supported hypothesis 2c. Cultural differences were found in the predictive effects of the extended TPB on frequency of all types of snacks examined. For unhealthy snacking, subjective norms were shown to predict frequency of both unhealthy snack and beverage consumption among Chinese adolescents, but not their UK counterparts. This result reflected a high level of conformity of Chinese adolescents regarding unhealthy snacking, and extended the emerging evidence showing stronger influence of subjective norms on health-related behaviour in collectivistic compared to individualistic cultures (Shukri et al., 2015).

Particularly, *subjective norms* were the only significant predictor among the TPB variables for frequency of unhealthy snacks in Chinese adolescents, suggesting an important role of subjective norms in Chinese adolescent unhealthy snack intake. Previous studies suggested that eating norms may act as a behavioural guide which impact individuals' decision making about eating (Robinson, Blissett, & Higgs, 2013). Individuals might follow eating norms as a way to manage their public image, enhance affiliation with a social group and being liked (Higgs, 2015).

For adolescents, peer and descriptive norms appeared to be more powerful than parent and injunctive norms in influencing eating behaviour (Baker, Little, & Brownell, 2003; Lally, Bartle, & Wardle, 2011). Adolescents use food choices to show conformity with peer norms (Stead et al., 2011). The influences of peers on food choices could be particularly strong for Chinese adolescents due to the tradition of communal eating in China (Veeck et al., 2014). Studies on subjective norms and their influence on snacking have mainly focused on populations from western cultures (Higgs, 2015; Higgs & Thomas, 2016), while little is known about the norms-snacking relationship in Chinese adolescents. The present study provided evidence suggesting that Chinese adolescents might adjust their unhealthy snack and beverage intake in accordance to their perceived opinion and behaviour of significant others. A next step would be to gain understanding of why Chinese adolescents follow norms regarding unhealthy snacking, what might influence their subjective norms, and potential moderators on this norms-snacking relationship. Effective intervention strategies targeting subjective norms or the norm-snacking relationship of Chinese adolescents are also worth investigating. In addition to subjective norms, habit strength also showed a tendency of predicting unhealthy snack consumption among Chinese adolescents ( $p = .086$ ). Frequency of unhealthy beverage consumption was primarily predicted by PBC. Interventions incorporating components related to these constructs may also show positive outcomes in reducing Chinese adolescent unhealthy snacking.

Contrary to hypothesis 2c, however, attitudes did not show significant influence on unhealthy snacking among UK adolescents. Among the four factors, *habit strength* emerged as a consistent predictor of frequency of unhealthy snack and beverage consumption in UK adolescents. Frequency of unhealthy snack consumption was predicted by habit strength and PBC, while unhealthy beverage consumption was uniquely predicted by habit strength. The similar pattern was also found in UK adolescent FV intake, with fruit intake being strongly predicted by habit strength and PBC, while vegetable intake uniquely predicted by habit strength. Attitudes and subjective norms, which are hypothesised to influence health behaviour through intentions within the TPB (Ajzen, 1991), did not exhibit significant associations to snack intake. These results suggested that for UK adolescents, both healthy and unhealthy snacking could be largely habitual rather than intentional.

The importance of habit strength in eating and snacking has been well documented among

adults (Conner, Perugini, O’Gorman, Ayres, & Prestwich, 2007; Verhoeven et al., 2012), however fewer studies have investigated the habitual nature of snacking in adolescents. Findings of the present study provided support for recent studies indicating habit strength as a more important predictor than intentions of FV intake (Albani et al., 2018) and unhealthy snack intake (De Vet et al., 2015) of adolescents from European countries. When the behaviour has been repeatedly performed and become habitual, the power of deliberate intentions in guiding behaviour is attenuated (van’t Riet, Sijtsema, Dagevos, & De Bruijn, 2011). Once habits are formed, the performance of subsequent behaviours might be less determined by reasoned decision-making process depending on information and cognitive beliefs, but automatically triggered by situational cues (Adriaanse et al., 2009; Neal, Wood, Labrecque, & Lally, 2012; Tak et al., 2011). Therefore, attitudes in relation to habitual snacking, although hypothesised to exert stronger influence on UK adolescent snack intake based on the cultural value of individualism, did not emerge as a significant predictor of the behaviour. These findings suggested that for UK adolescents, habit change interventions could be more effective in improving snacking than interventions targeting motivations and intentions. As habitual behaviour can be triggered by situational cues, interventions may promote habit change by altering the situational cues or the link between cues and behavioural response (Adriaanse et al., 2009), and improving cue-driven self-regulation (De Vet et al., 2015). In addition to habit strength, PBC also showed a tendency to predict unhealthy snack consumption among UK adolescents ( $p = .077$ ). Frequency of fruit consumption was strongly predicted by PBC. Interventions targeting snacking of UK adolescents might also benefit by incorporating components that improve PBC.

Another observation regarding cultural differences was that the extended TPB appeared to explain smaller proportions of variance in snacking frequency in Chinese adolescents than in UK adolescents, except for frequency of unhealthy beverages. Particularly, an unexpected finding is that, for Chinese adolescents, frequency of FV intake was not significantly predicted by the extended TPB. This is in sharp contrast to the UK sample, of which the extended TPB explained larger proportions of variance in frequency of fruit (41.4%;  $p < .001$ ) and vegetable (29.7%;  $p < .001$ ) intake than in unhealthy snack and beverage intake. As research on determinants of Chinese adolescent FV intake is very limited, the reason for this result is unclear. One potential explanation is the measure of the TPB variables. In the present study, the TPB variables in relation

to general healthy snacking rather than specific eating behaviour (i.e., eating fruit and vegetables) were measured. In Chinese, the word ‘snacking’ usually refers to eating typical snack foods, which do not include fruit and vegetables. Although fruit and vegetables were presented as examples of healthy snacks in the questionnaire, Chinese adolescents’ cognitive beliefs about healthy snacking might be less relevant to FV intake. Future studies utilising the TPB in Chinese adolescent FV intake should assess TPB variables in relation to specific eating behaviours. Meanwhile, further investigations are needed to explore other potential determinants of Chinese adolescent FV intake.

### **Gender differences in the extended TPB in explaining adolescent snacking**

In addition to cultural differences, gender differences were also examined in the extended TPB in predicting snacking frequency. Based on the literature review, it was expected that social norms would exert a stronger influence on snacking among girls, while attitudes would exert a stronger influence on snacking among boys (hypothesis 2b). Results showed gender differences in the predictive effect of the extended TPB on frequency of unhealthy beverages, but not other types of snacks examined. The extended TPB explained a larger amount of variance in frequency of unhealthy beverages in girls (17.2%;  $p < .001$ ) than in boys (6.5%;  $p = .097$ ). Subjective norms emerged as a significant predictor in girls but not in boys. This finding supported our hypothesis and extended previous studies suggesting that compared to males, females’ intention to engage in unhealthy eating is influenced by eating norms to a greater extent (Branscum & Sharma, 2014; Grogan et al., 1997). Although evidence on other types of social influences has indicated that women are more likely to follow social norms than are men (Bond & Smith, 1996; Eagly & Carli, 1981), investigations on the role of gender in social eating influences are limited, with most studies having only involved women (Higgs, 2015). According to the self-construal theory (Cross & Madson, 1997), women are considered to construct and maintain an interdependent self-construal, which may lead to high conformity to social norms. In comparison, men tend to construct an independent self-construal, and thus are more likely to behave in accordance with their cognitions about behaviour and oneself. This might also explain the finding that PBC significantly predicted frequency of unhealthy beverages only in boys but not in girls.

Contrary to hypothesis 2b, however, attitudes did not emerge as a predictor of unhealthy beverage intake among boys. In addition, habit strength showed as a predictor only in girls but not in boys. As relatively little research has investigated the role of gender in utilising the TPB in predicting adolescent beverage intake, further studies are needed to replicate and expand these findings which might shed light on gender-specific intervention strategies targeting adolescent unhealthy beverage consumption.

## **Evaluation**

A few limitations of the present study should be noted. First, the cross-sectional design limits the possibility of identifying causal relationships. Although we developed research hypotheses and interpreted the results based on theoretical and empirical evidence, no firm conclusions can be drawn on whether the hypothesised determinants induce snack intake or vice versa. The multiple statistical comparisons could also increase the probability of type I error and lead to false-positive results. Caution is needed when interpreting the study findings. Second, the self-report measure of all variables, particularly snacking frequency, could be an important limitation. Participants were asked to report the frequency (i.e., *how many times*) that they consumed fruit, vegetables, and a series of snack foods and beverages in the previous week. Portion size for each eating occasion was not identified, and therefore the eating frequency could not provide accurate information of actual food or calorie intake. Future studies should assess snack intake using more objective and robust measures such as SenseCam technology (Kamar, Evans, & Hugh-Jones, 2016). Third, the generalisation of study findings was limited by the homogeneous study samples and the small size of the UK sample. Further work is needed to determine whether the findings are specific to these samples, or can be generalised to other groups of adolescents. Finally, due to the research purpose, *intentions* of the TPB was not measured. Therefore, although this study extends the application of the TPB in predicting adolescent snacking by examining and comparing predictive effects of each constructs, it did not provide information about the predictive power of the full TPB.

Despite these limitations, this study adds to the very limited knowledge of determinants on snacking of adolescents in mainland China. To our knowledge, this is the first study examining



the role of mindful eating, and the application of the TPB with an added component in explaining snack intake of Chinese adolescents. In addition, using a cross-cultural approach, this study advanced understanding of adolescent snacking and potential determinants by taking into account the cultural context. This is the first study comparing the application of the TPB in explaining adolescent snacking within an individualistic-collectivistic framework.

## **2.5 Conclusion**

This study highlights the role of mindful eating and external eating in adolescent unhealthy snacking regardless of gender and cultural background. In addition, it identified cultural differences in the predictive effects of TPB components on adolescent snacking. Subjective norms significantly predicted frequency of unhealthy snack and beverage consumption in Chinese but not UK adolescents. For UK adolescents, habit strength showed as a consistent predictor of consumption frequency of all types of snacks examined. This finding proposed that the TPB model could be expanded to include habit strength to increase its explanation of adolescent snacking, particularly when used among UK adolescents. It also demonstrates the importance of taking into account the cultural context in the application of the TPB, as the relative contribution of TPB components to explain behaviour could vary across cultures. Gender differences were also found when applying the TPB to predict unhealthy beverage intake, with girls were more likely to be influenced by subjective norms and boys by perceived behavioural control. Overall, the findings of this study provide a unique contribution to understanding Chinese adolescent snacking, and extend previous applications of the TPB in predicting adolescent snacking. Practical implications are discussed, with culture- and gender-specific intervention strategies being recommended.

## **Chapter 3. Intervention preparation: a focus group study**

### **3.1 Introduction**

When developing behaviour change interventions, participatory approaches are recommended (van Gemert-Pijnen et al., 2011; Yardley et al., 2016), which involve end users in intervention development (Eyles et al., 2016). This is thought to better tailor the intervention to users' needs and preferences, and therefore improve its feasibility and effectiveness. Qualitative methods (such as focus groups) and quantitative methods (such as surveys) can each be used to engage users (Yardley et al., 2016). This chapter describes a focus-group study aiming to generate a better understanding of Chinese adolescent snacking, as well as their needs and preferences in relation to snacking interventions. As preparation for intervention development, the findings of this study will help us understand key features of a feasible snacking intervention for Chinese adolescents.

#### **Snack choices among Chinese adolescents**

Ouyang et al. (2016) reported the most frequently consumed snacks of Chinese children and adolescents using the data of CHNS collected in 2011. For adolescents aged 11 to 17 years in urban areas of China, the top five snacks were fruit products, dairy products, beverages, fast foods, and snack foods and pastries. Four types of snacking food patterns were identified, with 82.6% of the adolescents showing a healthy snacking food pattern that mainly consisted of fruit products and dairy products. However, around 15% of the adolescents mainly snacked on beverages and fast foods which could lead to excessive calorie intake.

Two studies investigated snack food choices among Chinese adolescents aged 12 to 13 years (Chan, Tse, Tam, & Huang, 2016) and 16 to 20 years (Veeck, Yu, Yu, Veeck, & Gentry, 2014) using focus groups. Both studies found taste was a key determinant of choice. In addition, older adolescents reported that food safety, nutrition, price, body image, convenience and sharing with peers as influential (Veeck et al., 2014). Younger adolescents appeared to be less concerned about the healthiness of their snack as they thought unhealthy foods were not only more tasty, but also more fun and trendy (Chan et al., 2016). Although older adolescents cited nutrition as being an

important factor to consider (Veeck et al., 2014), young adolescents tended to choose unhealthy foods. It is possible that Chinese adolescents become more health conscious as they get older.

To date, only a few studies have provided detailed information on Chinese adolescents' views and practices around snacking (Chan, Tse, Tam, & Huang, 2016; Veeck et al., 2014; Ouyang et al., 2016), and there is no information on their attitudes towards, and needs, in regard to a snacking intervention. To develop a snacking intervention for Chinese adolescents, it is essential to understand the context and drivers for their snacking behaviour, and what would make a feasible intervention for them.

### **3.2 Current study**

The present study constituted a form of user engagement and aimed to gain a better understanding of Chinese adolescents' snacking behaviour and attitudes towards a snacking intervention.

Focus groups were used as they are effective ways to explore lifestyle behaviours including dietary habits and the complexity surrounding food choice (Rabiee, 2004). Specifically, the following research questions were addressed:

1. Why do Chinese adolescents snack and what do they eat as snacks?
2. How do Chinese adolescents perceive healthy and unhealthy snacking, and what would influence their snack choice?
3. What are the motives and barriers for Chinese adolescents to snack more healthily?
4. What are Chinese adolescents' attitudes towards, and preferences for, a snacking intervention?

### **3.3 Methods**

#### **Ethics**

The study was approved by the University of Leeds Research Ethics Committee (Faculty of Medicine and Health). Reference number: 17-0169; date of approval: 07/06/2017. Prior to securing signed informed consent, participants were informed of the study aims and protocols including audio recordings and transcriptions. It was also explained that they could withdraw

anytime during the discussion without giving any reasons. Data was anonymised at the point of transcription.

## **Participants and Recruitment**

Psychology teachers (known to QZ) from three public boarding high schools in Beijing assisted recruitment in their schools. Teachers were emailed a school and participant information letter. Permission from all head teachers was obtained. However, as the third-year students (18 to 19 years) were intensively preparing for the National College Entrance Examination (NCEE), schools did not support recruitment of the third-year students. We therefore aimed to recruit four single-sex groups of the first and the second-year students (16 to 18 years), with six participants for each group (Rabiee, 2004). We planned to group the adolescents by school year rather than age, considering students in the same school years had very similar daily routines, which could influence their dietary behaviours. Students were invited to take part in the focus group on school premises, and were told that the purpose of this was to explore their snacking and help develop guidelines for a health intervention. People could take part if they:

- (1) were Chinese adolescents aged 16 to 18 years;
- (2) were self-identified snackers;
- (3) did not have a self-reported or diagnosed eating disorder;
- (4) were willing and able to take part in a focus group and talk about snacking with their school peers.

Four single-sex groups, comprising a total of 24 participants, with six adolescents per group, were recruited (see in Table 3.1). Most participants were acquainted with one another in the same group.

**Table 3.1** Participants' characters for each group

Group No.	Participants	No. of participants	Age	Recruitment school
Group 1	First-year boys	6	16 – 17	School A
Group 2	First-year girls	6	16 – 17	School B
Group 3	Second-year boys	6	17 – 18	School C
Group 4	Second-year girls	6	17 – 18	School C

### Focus Group Schedule

A series of questions were designed in line with the study objectives as outlined in Box 3.1.

### Box 3.1 Focus Group Questions

**Question 1. What do Chinese adolescents snack on and why do they snack?**

- a. Tell me about your usual/favourite snacks. On what occasions do you usually have them?
- b. Think about the last time you snacked – what did you have? When, where and why did you have it?
- c. What are other reasons for you to snack?

**Question 2. How do Chinese adolescents identify healthy and unhealthy snacks, and what would influence their snack choice?**

- a. Do you care about healthfulness when choosing snacks? What do you consider?
- b. What do you think are typical healthy/unhealthy snacks? Could you give me some examples?
- c. When and where do you usually have these kinds of snacks?
- d. What do you like and dislike about these snacks?
- e. What would make you choose or not choose these snacks?

**Question 3. What are the motives and barriers for Chinese adolescents to snack more healthily?**

- a. Have you ever tried or would you like to snack more healthily? For what reasons? What did you do?
- b. What made or would make it difficult for you to snack more healthily?

**Question 4. What are Chinese adolescents' attitudes towards and preferences of a healthy snacking intervention?**

- a. We are designing a healthy snacking programme for Chinese adolescents. What would influence your decision on whether or not to take part?
- b. If you decide to take part in a programme like this, what would you expect to achieve from it?
- c. How long would you like it be? How much time would you like to spend on it?
- d. What platform would you prefer (e.g., face-to-face, emails, SMS, website, WeChat)?
- e. What kind of content and support would be important to you?

## **Procedure**

The focus-group discussions were conducted in May 2017. Discussions took from 45 to 70 minutes and were audio-recorded. Participants were also asked to write down the healthy and unhealthy snacks they usually ate during the discussions. Each participant received CNY 30 (approx. £3.40) for participation, which was paid in cash.

## **Data Preparation and Analysis**

Focus group discussions were transcribed in Chinese in full. Content analysis driven by the study aims was conducted on the Chinese transcripts. Progressing through analysis line-by-line, each section of text that had a distinct meaning was coded as either relevant to one or more of the driving questions (Box 3.1) or as “not relevant”. Descriptive labels were then assigned to relevant text (e.g. ‘peer group sharing of snacks’, ‘wanting and intervention to be informative’). The next stage involved grouping similar content together into categories and assigning a higher-order label that described how the data ‘answered’ the driving analytic question (e.g. ‘Emotional reasons for snacking’). Illustrative extracts for each category were selected and translated into English. Food and beverages cited during the discussions were categorised according to the Beverage and Snack Questionnaire (BSQ; Neuhouser, Lilley, Lund, & Johnson, 2009) that we used in the survey study.

## **3.4 Results**

It is important to interpret Chinese adolescent snacking behaviour and influencing factors within the context of their education-centric daily schedule. Most public high school students are required to arrive in class before 7.30 a.m. when a morning self-study session starts. Many commuting students have to leave home before 6 a.m. The school days usually end at 5 or 6 p.m., with optional evening self-study sessions that end after 9 p.m. Even though students can choose not to attend the evening sessions in school, they still have to spend hours completing homework at home. For resident (boarding) students, school hours could be longer. In the present study, students were recruited from boarding schools and most of them were resident students. The second year students had a more intense daily schedule compare to the first-years. As they

mentioned in the focus group discussions, they were required to arrive in class before 7.10 a.m., and the evening sessions which were compulsory for resident students ended at 9.30 p.m. When attempting to understand Chinese adolescent dietary behaviours and eating patterns, this schedule should be taken into consideration.

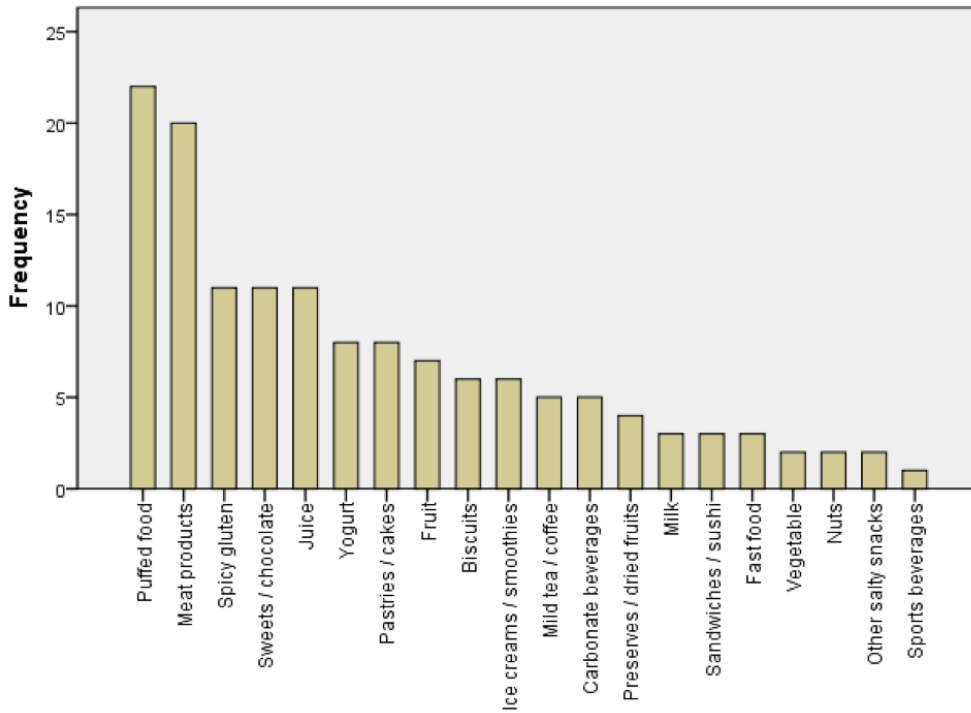
### **Question 1 Part A: What do adolescents snack on?**

Snacking was described as an essential and natural part of their daily life, and all participants reported snacking every day. The majority snacked frequently, and at least one in each group reported that they “*snack all the time*” (e.g., 3; 808)<sup>1</sup>. Snacking occurred in classrooms, dormitories, at home, and at parties. Although all participants reported that snacking was not allowed during class, many reported eating less noticeable snacks such as sweets or smoothies when the class teacher was not paying attention, or the teacher was “a nice one” (1; 31).

Participants reported a range of food and beverages, summarised in **Figure 3.1**. In addition to categories included in the BSQ, three new categories were added to classify the data: meat products, spicy gluten, and sandwiches/sushi. The most commonly reported beverage was juice (n = 11). The most frequently cited snack was puffed food (n = 22), especially crisps (n = 14). Meat products (n = 20), particularly spicy meat snacks such as spicy duck neck, spicy crayfish and chicken feet with pickled peppers, were also common snacks. Many adolescents showed a particular appetite for spicy Chinese snacks, including spicy meat snacks and spicy gluten (n = 11).

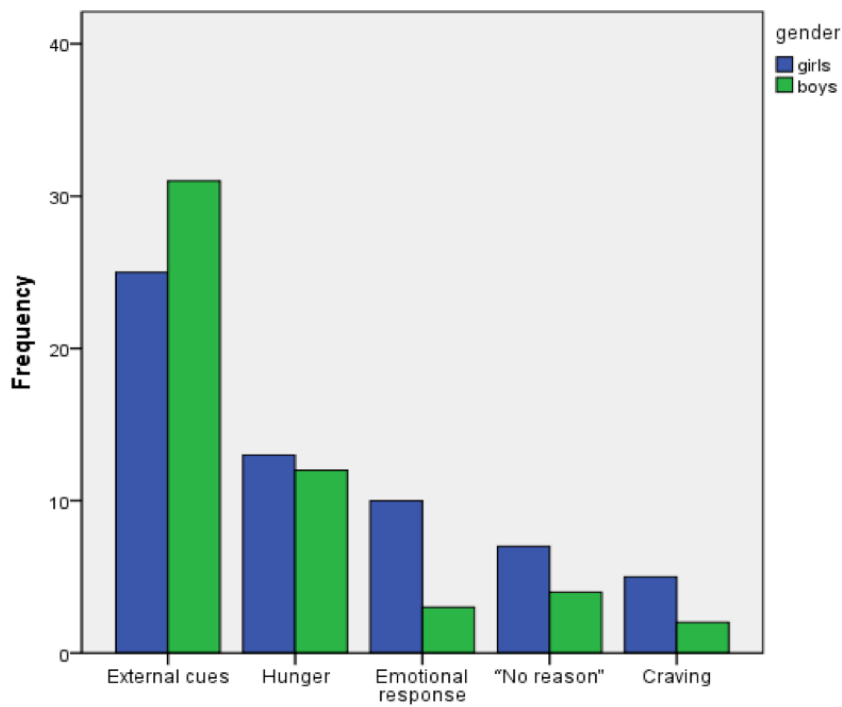
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<sup>1</sup> First digit = focus group number; second digit(s) line number



**Figure 3.1.** Frequency of snacks and beverages mentioned during focus-group interviews

**Question 1 Part B: Why do adolescents snack?**



**Figure 3.2** Motivations to snack by gender of participants



Five main reasons for snacking were reported: external cues, hunger, emotional reasons, “no reasons” and cravings, as summarised in **Figure 3.2**.

*Reason 1: External cues*

A variety of external factors were reported as influencing snacking, including availability (n = 24), screen time (n = 13), seeing others eating (n = 7), doing homework (n = 4), and hanging out with friends (n = 3).

The most frequently reported external cue was *availability*. On many occasions, adolescents said they snacked simply because food or beverages were available. Interestingly, all the four groups described a “sharing culture” when snacking, whereby it was natural for them to share the food they have with friends, classmates and roommates, which greatly contributed to the availability of snacks. Snacking because of *sharing* was cited across four groups (n = 14);

*P6: “The last time I snacked was at English class this morning, as my desk mate gave me a sweet. So I just ate it.”*

*M: “So you share your snacks with classmates?”*

*P6: “You don’t have to. They will find that you are eating, and the next moment, all your food is gone.”*

*P5: “Like the blood in the sea can always attract sharks.”*

*(1; 53-60)*

Adolescents also reported frequent snack consumption during *screen time* (i.e., watching TV, sitting at computers, playing video games and using mobile phones) as well as when *doing homework*. For most adolescents, these sedentary behaviours took up most of their after-class time.

*Reason 2: Hunger*

The second most commonly reported motivation to snack was hunger, often due to missed meals. Five participants reported they skipped breakfast due to the school schedule, e.g., “*Last time I snacked was this morning during a break. I got hungry as I didn’t have time for breakfast. Had to get to classroom very early in the morning.*” (4, 1029-1030). Two girls skipped dinner when they

did not like the meals prepared by parents or the school and four participants skipped dinner due to body image concerns, e.g., *“I didn’t have dinner last night as I’m trying to lose weight. Then I got hungry later so I had some snacks.”* (2, 316)

#### *Reason 3: Emotional reasons*

Adolescents reported two emotional reasons for snacking: feeling bored/have nothing to do (n = 10) and being upset (n = 4). As shown in Figure 2, girls reported emotional reasons more frequently than boys. Snacking when feeling bored was also associated with screen time:

*P6: “When I have nothing to do and feel bored, I go to snack.”*

*P2: “Yeah. Usually when I feel bored I play on my mobile phone, and snack at the same time.”* (1, 38-39)

Stress was not a reported trigger for snacking, although a few reported a loss of appetite during stressful times. In general, snacking was not reported as a common strategy to cope with stress.

*M: “Do you have a desire to eat when feeling stressed?”*

*P (2): “No. When I feel stressed out, which is normally during the exam weeks, I don’t have time at all to snack.”*

*M: “So will you eat less than usual?”*

*P (2): “I don’t think it’s affected by stress.”* (2; 462-466)

#### *Reason 4: “No reasons”*

Some adolescents talked about snacking for no specific reasons but “just felt like eating” or “snacked no matter when and where”. This indicated that adolescents were sometimes unaware of the triggers for snacking, and that their snacking behaviour could be habitual; for example:

*“It has nothing to do with hunger I think. I snack when I’m not hungry. Why? I don’t know. I just feel like eating, and I snack all the time.”* (4; 1047-1048)

*“I ate a duck leg after lunch. There was no reason for that, and it was not because I was hungry or whatever. I just wanted to have it. I felt satisfied after eating it.”* (4; 1041-1042)

#### *Reason 5: Cravings*

Cravings were mainly associated with the consumption of spicy snacks and sweet snacks:

*P1: "I also like spicy snacks such as duck tongues and duck necks."*

*P2: "Oh yes, we all love it!"*

*P3: "They are very spicy...but you just cannot resist them."*

*M: "Why do you like spicy snacks?"*

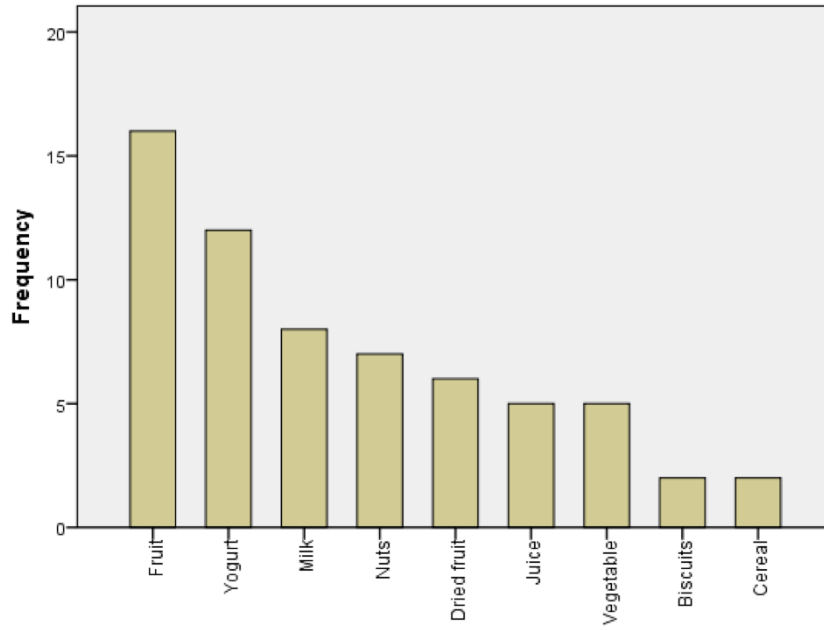
*P1: "Because they are spicy. They satisfy my cravings."*

*P2: "My mouth is watering. The spicier, the better!" (2; 596-602)*

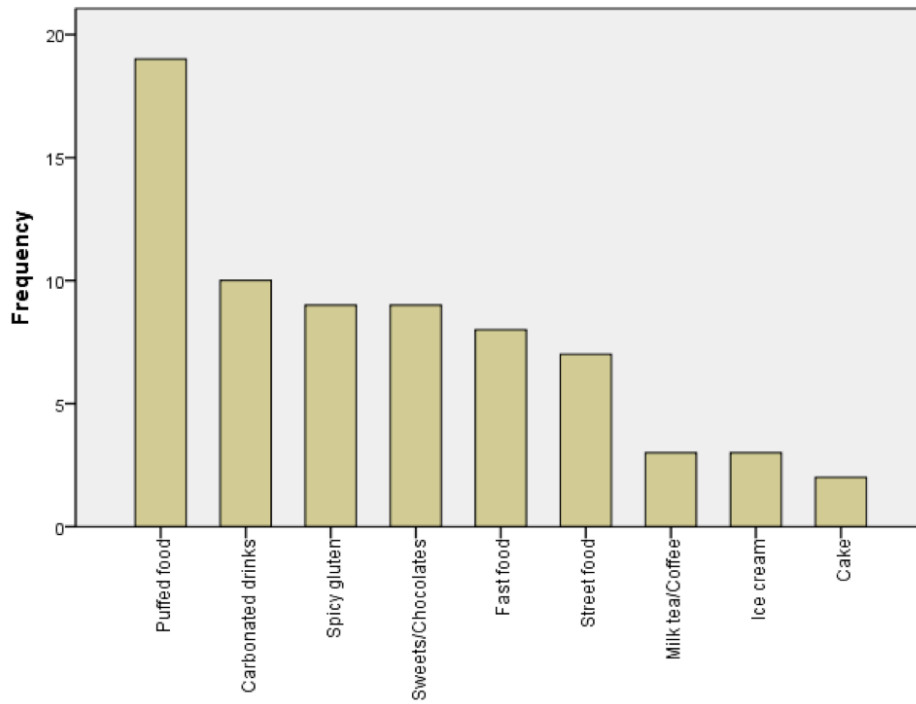
Besides the motivations cited above, two girls reported that they ate snacks to reward themselves after completing a difficult task. Boys claimed that they did not use snacks for self-reward, as they rarely restrained their snacking behaviour and had enjoyed the snacks they liked on normal days.

#### **Question 2 Part A: How do adolescents identify healthy and unhealthy snacks?**

During the focus group, participants were asked to list three to five examples of typical healthy and unhealthy snacks that they frequently consumed, and to explain why they perceived them as healthy or unhealthy. Food and beverages perceived as healthy and unhealthy snacks, and their frequency of consumption, are summarised in **Figure 3.3** and **Figure 3.4**, respectively.

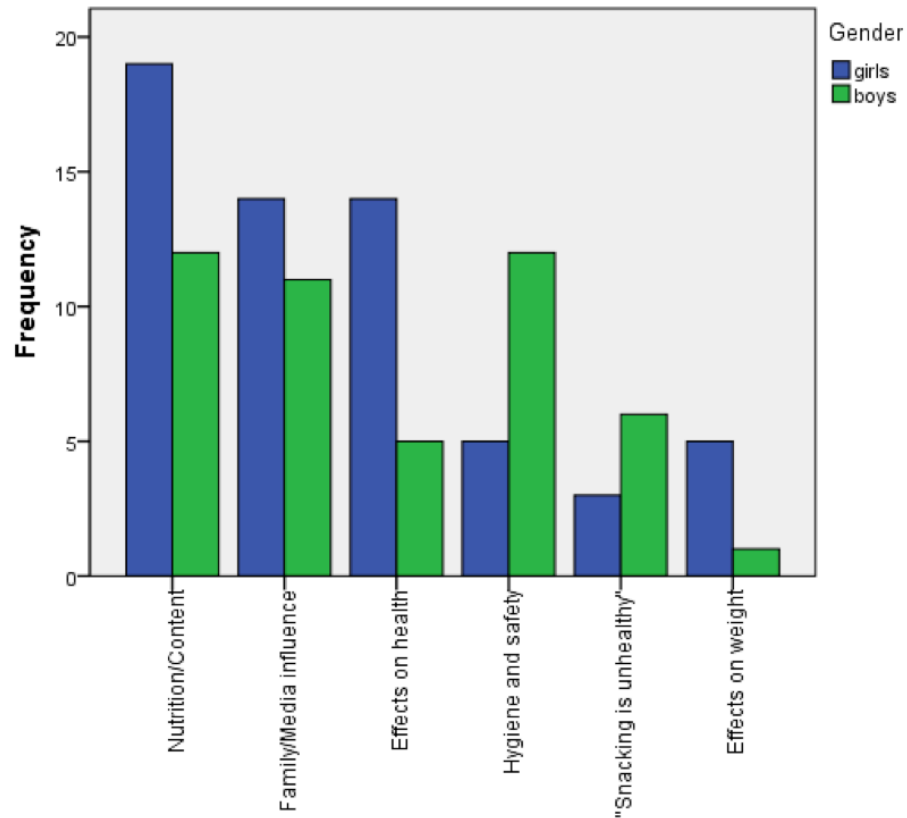


**Figure 3.3** Frequently consumed snacks perceived as *healthy* by participants



**Figure 3.4** Frequently consumed snacks perceived as *unhealthy* by participants

The major reasons for judging a snack as healthy/ unhealthy are summarised in **Figure 3.5**. Overall, girls reported more concerns about food healthfulness than boys.



**Figure 3.5** Basis for identifying healthy and unhealthy snacks by gender of participants

#### *Nutritional values and contents*

The nutritional value and content of food and drinks, specifically, high content of fat, sugar and salt, was the major criteria for judging snacks as unhealthy: *"I think puffed foods are unhealthy, as they contain a lot of fats."* (4; 1075). Unnatural food processing with chemical contents and additives also characterised unhealthy snacks: *"I like chicken feet with pickled peppers, but I think it's totally unhealthy. I heard it was processed using chemical stuff."* (2; 606-607). One cited nutrition was vitamins. Homemade food and drinks were also perceived as healthier than commercial snacks, as they were often prepared in a more natural way, with less sugar, oil and salt: *"Sometimes my parents make juice for me, with fresh fruits and milk. They don't add anything else, just milk and, say, bananas. I think that's quite healthy. Juices you buy from stores are too sweet. They added too many sugars."* (2; 354-355); *"I tried to eat more healthily sometimes..."*

*For example, last night when I went to 7-Eleven to buy food, I took a bottle of juice. As it's natural, and high in vitamin C.” (1; 68-73)*

Most participants only had a general and ambiguous perception of the nutrition and contents of snacks they usually consumed, based to a large degree on information from their parents and media. The appearance and taste of food also provided clues. For instance, food which looked greasy was perceived as high in fat. Only one first-year girl mentioned she got nutritional information by reading food labels.

#### *Family/media influence*

Adolescents reported that their perception of healthy and unhealthy snacks was greatly influenced by their parents' comments on foods and drinks. Parents' opinions also affected other criteria for identifying healthy and unhealthy snacks, such as adolescents' views about the nutritional values of snacks and their impact on health and body weight. Some adolescents also talked about how they relied on information from the media to judge the healthfulness of snacks. However, media influence was reported to be more frequently exercised through adolescents' parents rather than directly on them. TV and self-media on WeChat were described as two main resources of health information for their parents, for example: *“My parents don't let me have carbonated drinks. They said carbonated drinks were bad. They're spermicidal, and bad for teeth and bones. Anyway, whatever the experts said, my mum said it to me. The experts on TV. You know Yangshengtang (a popular Chinese TV programme introducing health knowledge and advice)? She always watches it.” (3; 961-967)*

#### *Effects on physical health and body weight*

Participants also judged the healthfulness of snacks by considering how they affected their body in the immediate and longer-term, including gastrointestinal and cardiovascular health, for example: *“Greasy food is not healthy, as you could feel physically ill after you have it.” (3; 863); “I've heard that food that is high in fat and salt is bad for your health. It can lead to arteriosclerosis when you get older.” (1; 177-178)*

Most adolescents showed a view of how snacks might influence physical health based on knowledge and information they learned from their parents, media or other sources, as presented above. A few adolescents talked about it based on their own experience, e.g., *“I think sweets are not so healthy, as they make me cough.”* (2; 350). Food and drinks beneficial for weight loss were perceived as healthier snacks. Girls talked about snacks’ effects on physical health and body weight more frequently than boys: *“Carbonated drinks are unhealthy, as they make you fat.”* (2; 328)

#### *Food hygiene and safety*

For boys, food hygiene and safety was one of the most important criteria by which they judged food / drink healthiness. Boys mentioned this more than girls. Adolescents expressed the belief that snacks that were homemade, provided by the school refectory or sold in regular stores were safe, while those from small retailers and street vendors were likely to be less safe: *“I only buy unhealthy snacks when I have no other choices. You know, those street foods. They’re unhygienic, usually quite dirty* (1; 115). However, the access to ‘safe’ snacks was reported as good: *“I do consider healthfulness of snacks, but most of the time there’re safe foods to buy, so I’m not concerned too much.”* (1; 111). Products of major food brands were also reported as healthier because they were perceived as safer: *“Spicy gluten was very unhealthy. But now it becomes qualified products with a good brand, and is sold in 7-Eleven. It’s even exported abroad. I think it’s much healthier now.”* (1; 62-63)

#### *“Snacking is unhealthy”*

Many adolescents expressed that snacking *per se* was unhealthy. When asked to list the healthy and unhealthy snacks they frequently ate, they struggled to decide which snacks were actually healthy. When one asked, *“are there any healthy snacks”* (e.g., 4; 1113), other members echoed this uncertainty. Although listing examples of typical healthy snacks, some adolescents perceived them as not really healthy: *“Oatmeal biscuits might be healthy. Well, I don’t think you can call it healthy. It’s just slightly better than others. Basically there are no healthy snacks, and one should avoid snacking to be healthy.”* (2; 325). Another group discussed:

*P (1): “But I think all snacks are unhealthy.”*

*M: "Didn't you mention that yogurt is a healthy choice?"*

*P (1): "Well, I was just saying that it is relatively healthy compared to many other snacks.*

*But overall it's best not to snack at all." (4; 1121-1123)*

Another consideration brought up by girls was quantity; one girl argued that chocolate could be healthy if one ate a sensible amount. The boys did not raise this point.

In summary, the nutritional values and contents of snacks, as well as information from parents and media, were reported to influence their perception of snacks' healthfulness for both boys and girls. Girls showed e more concern about the effects of snacks on physical health and body weight, while boys talked more about food hygiene and safety.

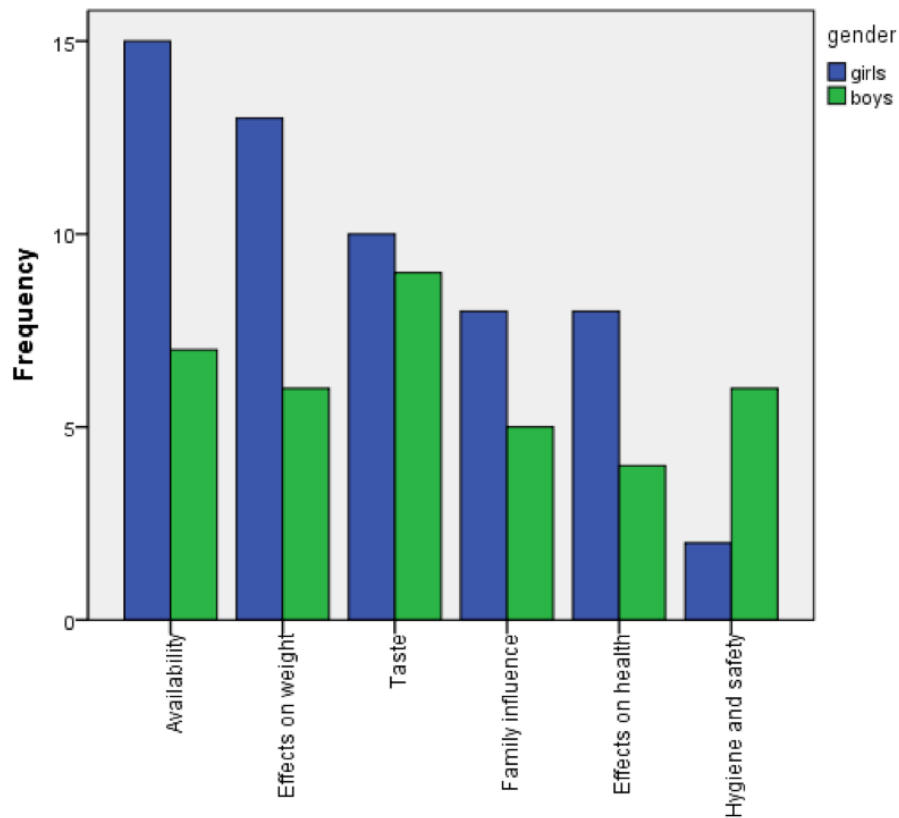
### **Question 2 Part B: How do adolescents choose what to eat as a snack?**

**Figure 3.6** shows the categories generated for this question. On average, girls described more influencing factors ( $n = 4.7$ ) than boys ( $n = 3.2$ ). The most frequently reported influencing factor was *availability* among girls, and *taste* among boys.

#### *Availability*

Participants' choice for snacking was most often influenced by availability of food and drinks. The adolescents tended to choose the food at hand or that was easy to access, whether at home or in stores: "*I ate a pack of crisps last night at home, as I was hungry, and that crisps was the only food I had.*" (3; 889); "*We rarely have carbonated drinks, as they're not sold in campus.*" (4; 1150). Some participants reported that they usually brought snacks to school from home: "*I eat whatever I have bought. So I often eat these snacks mainly because they're what I can get from the store next to our campus.*" (2; 335)





**Figure 3.6** Influencing factors for snack choice by gender of participants

#### *Effects on body weight*

Many participants, particularly girls, intentionally chose low-fat, low-sugar snacks for the purpose of weight control. For some, losing weight appeared to be the strongest or only motivation to eat healthily: *“Usually I don’t care too much about whether the snacks I eat are healthy or not, except when I try to lose weight.”* (4; 1162); *“I rarely eat those greasy foods, for the sake of my weight.”* (4; 1084). Overall, boys showed less concern about weight when choosing snacks. Although only a few adolescents reported to distinguish healthy and unhealthy snacks by their effects on body weight (Figure 3.5), more adolescents took this factor into consideration when choosing what to eat (Figure 3.6). Some perceived weight control as separate to healthfulness: *“When I choose snacks, I don’t care about the health aspect so much. But I do care about low fat, as I don’t want to gain weight.”* (2; 327); P1: *“I do intentionally snack less when I try to lose weight. But it’s more about body shape than being healthy.”*; P2: *“Yes. We are young. We don’t worry about getting sick.”* (1; 203-204)

### *Taste*

The taste of food and drinks was another driver of snack choice. For boys, taste was the most frequently reported influencing factor, whereas it was the third most reported influential factor for girls. Some adolescents described unhealthy snacks as tastier than healthy ones. Although they perceived that the taste of unhealthy snacks was artificial, they found them tempting and hard to resist. Knowledge of additives or parents' advice did not put them off: *"I think unhealthy snacks are tastier. As they add a lot of additive to them, which gives them a better taste."* (2;389-390); *"When I eat preserved plums, I think about what my mum told me and I feel like I shouldn't eat them, as I know it's not good. But I eat them after all, as they really taste good."* (2, 641-644). Immediate enjoyment is often more important than health impacts: *"I don't think about how healthy the snack is. I just listen to my tongue."* (1; 67). However, overall, the adolescents were not negative about the taste of healthy food and drinks. Although a few mentioned they did not like vegetables, most reported very positive attitudes towards the taste of healthy snacks, such as fruit, juice and yogurt.

### *Family influence, effects on health, and hygiene and safety*

Many participants took their parents' advice into consideration when they chose snacks, although they also stated that they often failed to follow that advice. Some talked about how their family eating habits since childhood affected their current eating behaviour. For effects of snacks on physical health, participants were more concerned about the immediate effects on their body, rather than long-term health consequences, e.g., *"Greasy foods makes me feel sick, especially the spicy ones. My stomach is upset when I eat too much of those. Also, last time when I ate a lot of spicy glutens, it caused bad face acne. I had to avoid any greasy and spicy food in the following week."* (4; 1092-1093). Compared to girls, boys talked about food hygiene and safety more frequently regarding food choice, which was in line with their perception of healthy and unhealthy snacks. Three participants stated that cost was as driver in snack choice.

### **Question 3 What are the adolescents' motivations and barriers to snacking more healthily?**

#### *Intention and motivation*

Adolescents reported low to medium intentions to practice healthier snacking, with more girls (n = 6) than boys (n = 3) reporting good intentions. For most, weight loss was the main or only reason that they ever tried or would try to eat more healthily. Compared to boys, girls more frequently described body image concerns due to cultural ideals, e.g.: *"I'm trying to eat more healthily as I want to lose some weight. I mean, it's the season for skirts and shorts, and I have to respect others' eyes."* (2; 485). One girl intended to eat healthily as her family "encouraged" her to control her weight: *"I tried to eat more healthily when the summer began. My dad kept saying that I was fat, so did my whole families. One day I wore shorts, and both my dad and my grandma said 'look at her legs, they are so big!'"* (2; 500-501). Also, only girls expressed a feeling of guilt after overeating: *"I feel guilty when I eat too much, as I gain weight by that."* (4; 1105)

Besides making healthier snacking choices, adolescents talked about other strategies they tried to reduce calorie intake, such as avoiding snacking and skipping dinners. Some common Chinese guidelines related to healthy eating such as "have a nourishing breakfast, an adequate lunch and a light dinner" were also cited within the context of weight control. However, many of them found these dieting plans and dietary guidelines hard to stick to: *I'm trying to eat more healthily, mainly because I don't want to gain weight...I try to eat less, and not eat between meals, but most of the time I couldn't really control myself" (1; 248-252); "I've been trying to lose weight for a while. I try to go running every day, avoid snacking, and watch how much I eat for meals. Try to have nourishing breakfast, adequate lunch and light dinner every day. But these are really hard to stick to."* (2; 505-507).

#### *Perceived barriers*

Among those who ever made attempts to eat more healthily, self-control failure was the most frequently reported perceived barrier, particularly when temptations existed, e.g., *"I just couldn't*

*control myself, as there were too many temptations around. My roommates bought snacks every day. There is a cupboard in our dorm, which is full of snacks.” (2; 511).* Another reported barrier was low self-efficacy. A girl described she intended to lose weight by improving healthy eating but failed to do so as *“I knew I wouldn’t be able to lose weight anyway” (2; 523).*

#### **Question 4 What are the adolescents’ attitudes, expectations and preferences regarding a healthy snacking programme?**

Participants expressed their opinions about a healthy eating programme by discussing around Question 4 (see Box 3.1). Participants were asked to discuss in principle an intervention for Chinese adolescents to help them improve their snacking. Attitudes towards and expectations from such a programme, and preferred delivery platform, duration and characteristics, were sought.

##### *Acceptance and motivations*

Most participants showed an open and positive attitude towards a healthy snacking programme. However, as they did not have strong intentions to perform healthy eating behaviour, these adolescents had considerable demands of an intervention and wanted to be engaged at a high level. They primarily wished the programme to be “interesting” and “fun”: P4: *“I want to see those pictures. I mean, it should be fun to watch.”*; P5: *“Yes, it needs to be interesting. I’d like to take part if it’s interesting. But if it’s not, no matter health or whatever else it’s about, I will not want to do it.” (2; 709-710).* Meanwhile, many had fixed priorities and showed interested in a healthy snacking programme only when it was in order to achieve weight loss: *“If it’s just about health, I don’t think I’ll go. But if it’s about weight loss, I’ll definitely consider it.” (2; 677)*

##### *Expectations*

When asked what they expected to learn or achieve from a healthy snacking programme, a most commonly reported aim was weight loss. Besides, however, many showed interested in scientific knowledge and information about food, even beyond weight control. Specifically, they wanted to know the contents of common snacks, and why exactly they are healthy or unhealthy: *“I’d like to*

*know what those foods are made of.” (2; 708); “Sometimes I want to know what snacks are healthy and what are unhealthy. For example, when I eat crisps, I think to myself, ‘this might be unhealthy’, but I don’t know whether it is really unhealthy and why.” (2; 706-707). Some wanted to learn about the effects of food on their body, and how eating behaviour is related to their psychological states: “I’d like to know more about the snacks we eat, more detailed information about them, for example, what they contained and how well human body can absorb them.” (1; 259); “I would like to know how it is bad for my health, for instance, is it really bad for my brain?” (2; 708); “I’d like to know how snacking is related with my psychological state.” (3; 970). Overall, these adolescents showed a need of scientific and rational explanations on *why*, rather than simple guidelines on *what* snacks are healthy or unhealthy. Other expectations were to learn strategies and skills to resist temptation, to break unhealthy eating habits and to lose weight. They showed a belief that there is specialist knowledge that people need to learn to manage themselves better, or that they feel ill equipped to break habits themselves: “Are there any techniques can help me break the habit that I want to eat whenever I see snacks?” (1; 258)*

#### *Preference: platform*

Participants reported a preference for an Internet-based programme compared to a face-to-face programme, on the basis that the former can be accessed with fewer time or place limitations. WeChat – a very popular social networking mobile application in China – was proposed as a preferred platform for contacts and notifications. When asked about other possible platforms including websites, SMS and emails, the adolescents reported that they rarely used email or SMS in daily life, but used WeChat to communicate with their friends, parents and teachers. As to the platform for content delivery, although websites were generally acceptable, some participants mentioned that courses delivered on WeChat would be more convenient for them. Recruitment through WeChat was also reported as the most acceptable. However, participants described how they tended to ignore or distrust advertising messages posted on WeChat, and were more likely to consider a healthy eating programme if it were introduced by their school or people they know well.

#### *Preference: duration*

When asked about how much time they would like to spend on such a programme, the second years were willing to spend less time (1 hour per week) than the first years (2-3 hours per week). Participants in all four groups suggested that it should be a long-term programme with multiple short sessions, rather than a single long session. Overall, their view was that each session should take no longer than 20 minutes, and the whole programme should last no longer than one month.

#### *Preference: intervention characteristics and components*

All four groups of adolescents emphasised that a healthy eating programme would need to be interesting and fun to facilitate adherence and engagement. Three groups showed a clear preference for pictures and videos over text, as pictures and videos were reported as more interesting to watch: *“I’d just skip it when I see text.”* (2; 714); *“There have to be pictures with text. Videos are the best.”* (3; 987). In contrast, one group (first year boys) showed preference for text, as they did not have Wi-Fi access at school and dorms, and browsing pictures and videos online would use a lot of their mobile data. The importance of some intervention components was also discussed. Overall, participants stated that they would like a programme to be flexible, self-paced and self-tailored: *“I hope it to be very flexible. It doesn’t need to be interactive. You can send us the content, then I can choose to watch what I’m interested in.”* (1; 270). Participants were asked whether other components, including goal setting, personal contacts and parents’ involvement, would be important to them. However, given that most of the participants had very little experience in any kind of psychology programmes or events as they reported, it appeared difficult for them to envisage a healthy eating programme with details, let alone talk about the specific features of it.

### **3.5 Discussion**

The purpose of this exploratory focus-group study was to gain a more comprehensive understanding of Chinese adolescent snacking, as well as their preferences regarding a healthy snacking intervention programme. This study was conducted primarily to help us design a snacking programme for Chinese adolescents and this discussion therefore considers the findings in terms of their relevance to this.

Participants reported a wide range of food and drinks that they frequently consumed between meals. Similar to findings of previous studies (Du et al., 2016; Wang et al., 2012) and the survey study (study 1) in Chapter 2, snacking was popular among Chinese adolescents. In the survey study, we used a Beverage and Snack Questionnaire (BSQ; Neuhouser et al., 2009) to assess adolescents' snacking frequency. The BSQ, originally developed in a western culture, contains questions regarding the consumption of snacking food, beverages, milk, fruit and vegetables during the previous week. The snacking food section consists of eight items including salty snacks and sweet snacks. In the present study, we found that in addition to these typical salty and sweet snacks, meat products and spicy gluten were also major parts of Chinese adolescent daily snacking. Following puffed food products, meat products and spicy gluten ranked the second and third most frequently cited snacks. The original BSQ failed to capture these consumptions. When administered to Chinese adolescents, the BSQ and other standard measurements of snack consumption could be usefully modified to include these culture-specific food groups.

Participants reported that they frequently snacked in response to external and situational cues. The presence and availability of snacks, as well as sedentary lifestyles, were reported as major triggers for snacking. Previous studies have shown a correlation between eating in response to external cues and consumption of unhealthy snacks and sweet drinks among adolescents (De Cock et al., 2016; Grenard et al., 2013; Snoek et al., 2006). In our survey study (Chapter 2), we found that the Chinese adolescents' score on external eating of the DEBQ was positively associated with their consumption of unhealthy snacks and beverages. Other main reported motivations for snacking in the present study included emotional reasons and cravings, which is also supported by previous findings. As reviewed in Chapter 2, emotional eating is associated with higher frequency of adolescent snacking, especially unhealthy snacking (Snoek et al., 2006; Nguyen-Michel et al., 2007; De Cock et al., 2016; Lu et al., 2016). Although there is lack of studies on adolescents, food cravings in adults are associated with more snacking and less compliance with dietary restrictions (Pelchat, 2009). It is therefore possible that interventions targeting external eating, emotional eating and food cravings could reduce Chinese adolescents' snacking frequency as well as consumption of unhealthy snacks.

Notably, in line with Veeck et al. (2014), the present study's findings described a sharing culture, showing how adolescents can affect each other's snacking behaviour and food choices.

Studies in western cultures have shown that adolescents are under an increasing peer influence on food purchasing as they are becoming independent of their parents (Bevelander, Anschutz, & Engels, 2011). Adolescent snack and soft drink consumption was also influenced by the consumption of peer groups, particularly when availability of snacks and beverages in school was high (Wouters et al., 2010). Spending a long time every day for five to six days a week at school with schoolmates, Chinese adolescents might experience an even stronger peer influence on their daily health behaviours. Thus, school-based educational programmes for all students could be effective in improving adolescents' food choice. Alternatively, interventions that teach adolescents to eat in response to hunger, rather than peer influence, might be useful.

Hunger was cited as another main reason why adolescents snacked. Many Chinese high school students have to finish breakfast before 7 a.m. or even earlier, while lunch is usually between 12 noon and 1 p.m., and dinner after 6 p.m – thus, gaps between meals are long. However, in the present study, adolescents reported a belief that eating less between meals or avoiding snacking at all were basic principles of healthy eating. This is a reflection of general beliefs of healthy eating in Chinese culture. In Chinese culture, timing of eating is usually considered as an important aspect of healthy eating, with regular meals emphasised (Chan, Prendergast, Grønhøj, & Bech-Larsen, 2011). Eating between meals is often seen as unhealthy. A cross-cultural study found this a unique perspective on healthy eating among the Chinese (Banna, Gilliland, Keefe, & Zheng, 2016). Influenced by this norm, adolescents tended to ignore the real needs of their body, and simply perceive snacking as an unhealthy diet practice. To improve adolescent snacking behaviour, it appears important to enhance their awareness of the potential health benefits of snacking, and to help them make healthier snacking choices accordingly, rather than simply telling them to reduce or stop snacking which may lead to extreme hunger (and possible over eating when food is accessed) in a normal school day.

Although viewing snacking in general as “second best” to meals and lacking in health benefits, adolescents talked about their attempts to identify “relatively healthy” and unhealthy snacks. Adolescents oriented to the nutritional values of snacks, and their effects on physical health, as ways to judge healthfulness. Mostly, adolescents learned health information from their parents and media. These findings are consistent with previous studies of Chinese adolescents (Chan et al., 2016; Veeck et al., 2014). However, although Veeck et al. (2014) suggested that



nutrition education might not be effective because information deficit did not exist among Chinese adolescents aged 15 to 20 ( $n = 16$ ), we found a lack of reasonably accurate and systematic knowledge of nutrition and health among the adolescents in our sample. It appears that most participants only had a general and ambiguous understanding of nutrition and contents of the snacks they usually consumed. Only one girl reported using food labels to access nutrition information, and none of the four groups mentioned any dietary guidelines. The reported infrequent use of food labels and dietary guidelines was consistent with findings of previous studies among Chinese youths and adults (Chan et al., 2016; Liu, Hoefkens, & Verbeke, 2015). It might lead to a misperception of healthy and unhealthy snacks when judging based on ambiguous information. For instance, in our focus group discussions, dried fruit was cited as a typical healthy snack because it was made of fruit, despite the fact that most of packaged dried fruit snacks on market are very high in sugar. Adolescents also tended to perceive juice as healthy, without noticing that many juice products they cited were actually sugar-sweetened beverages.

Adolescents accessed health knowledge mainly from their parents and media, and many parents relied heavily on the media to learn relevant information. However, the quality of health information on many Chinese media, particularly self-media, is rather concerning. In China, self-media refers to independently operated social media accounts on popular platforms such as WeChat and Weibo, usually run by individual users (Dai, 2011). Self-media is currently one of the main information resources for the public in China, including health information. However, health information on self-media could be highly inaccurate and misleading (Zhang, Wen, Liang, & Lei, 2017). In this present study, some adolescents reported being uncertain and confused about the health information they got from their parents and from the media, but were unaware of sources of reliable guidelines. To improve adolescents' as well as the parents' knowledge of healthy diet, authorities should increase the visibility and knowledge source of scientific information and dietary guidelines using multiple media. In addition, nutrition education interventions targeting adolescents and parents are still needed.

However, it should be noted that nutrition education interventions alone could be essential but not sufficient to effectively improve adolescent healthy snacking. As with previous studies among adolescents in China and other cultures (Bech-Larsen, Boutrup Jensen, & Pedersen, 2010; Chan et al., 2016; Stead, McDermott, MacKintosh, & Adamson, 2011; Stevenson, Doherty,

Barnett, Muldoon, & Trew, 2007; Veeck et al., 2014), we found that the healthfulness of snacks was not a primary consideration in food choice. Overall, their snack choices were most influenced by the availability of food and drinks. In this regard, environmental interventions are potentially effective to promote adolescent healthy snacking. Regulations and interventions on school as well as home food environment have been widely proposed as effective measures to improve schoolchildren's eating behaviour (Loth et al., 2016; Welker, Lott, & Story, 2016). Although difficult to implement, government regulations on school environment have shown initial and positive outcomes in some areas of China. Since 2013 in Beijing, carbonated drinks have not been allowed to be sold in schools. In our focus groups, participants frequently reported they tended to choose juice over carbonated drinks, partly because carbonated drinks were not available on campus. These findings emphasise the well-established influence of environment on adolescent dietary behaviour, and potential effectiveness of environmental interventions to improve adolescent snacking.

Body weight was another frequently reported consideration when choosing snacks, particularly for girls. Particularly, many adolescents viewed body weight as separate to healthfulness, and were driven to control weight by body image concerns. In the present study, girls showed higher body image concerns due to cultural ideals and pressure from parents, and reported a higher intention to perform healthy eating for the purpose of weight control. This is in line with studies showing higher levels of body dissatisfaction among adolescent girls than boys in western cultures (e.g., Griffiths et al., 2017). Encouragement of weight control as well as negative weight talk from family members was found to increase body image concerns of adolescents (Neumark-Sztainer et al., 2010; Schaefer & Salafia, 2014). In the present study, girls described a feeling of guilt after overeating, also related to body weight. Adolescence is a critical period for body image development, and negative body image could lead to dysfunctional eating and exercise behaviours (Voelker, Reel, & Greenleaf, 2015). Intervention designers need to be considerable when developing weight management interventions for adolescents, with an effort to promote healthy body image.

In addition to availability and body weight, another driver that came before healthfulness was taste. Adolescents reported choosing unhealthy snacks which are tasty and bring immediate enjoyment, despite negative impacts on health. This is in line with previous focus group studies

suggesting that taste was one of the most important considerations for Chinese adolescents' food choices (Chan et al., 2016; Veeck et al., 2014). However, although some adolescents in the present study described unhealthy snacks as sometimes tastier than healthy snacks, overall they did not express negative attitudes towards the taste of healthy snacks. Several previous studies have shown that young adolescents aged 12 to 15 years held a relatively negative attitude towards healthy eating and healthy snacks. They tended to find healthy food tasteless and boring, while unhealthy food was described as exciting and interesting (Bech-Larsen et al., 2010; Chan et al., 2016; Krølner et al., 2011; Stevenson et al., 2007). Some young adolescents described healthy eating and persons who eat healthily as “unpopular”, “non-trendy”, and “geeky” (Stead et al., 2011). In the present study, in contrast, participants showed an overall positive attitude towards healthy snacking. Also, contrary to younger Chinese adolescents who reported to perceive healthy snacks as more expensive than unhealthy snacks (Chan et al., 2016), participants in current study did not report such views. This might be explained by the difference in age group. Older adolescents could have more disposable money on snacks, and be more mature and health conscious than younger ones. In this regard, older adolescents could be better targets of behaviour change interventions for healthy snacking.

Adolescents showed an open attitude towards a healthy eating programme, although their intention to practice healthier eating behaviour was relatively low, and many reported weight control as a clear priority for them to take part in such a programme. For healthy eating interventions targeting adolescents who have no intention to lose weight, enhancing their motivation could be a major challenge. Interestingly, some adolescents showed curiosity about scientific knowledge of food and healthy eating. Rather than passively following eating guidance that simply telling them what to or not to do, they expressed a need to understand the rationale behind the guidance before they would be persuaded to change their behaviour. Healthy eating interventions targeting Chinese adolescents should provide such information and knowledge. Adolescents also expressed a feeling of being ill equipped to manage their eating behaviour and break habits by themselves. For those who intended to improve healthy eating, low self-control and self-efficacy were perceived as major barriers. This is in line with evidence from previous studies among adolescents in western cultures (Fitzgerald et al., 2013; Honkanen, Olsen, Verplanken, & Tuu, 2012). Interventions should teach skills to improve adolescents' self-

management, and therefore increase their self-efficacy. Participants expected an intervention to be highly engaging. How to make the intervention “interesting and fun” to adolescents would be another challenge in its development.

### **Study Evaluation**

There are a number of limitations to this study. The sample was small and limited to Beijing. As Beijing is among the most developed and prosperous cities in China, one should be cautious when generalising the findings to lower socioeconomic areas. Also, participants were interested in snacking, and therefore may not be representative of other Chinese adolescents. In addition, participants’ responses during focus group discussions could be influenced by other members and a desire to please the facilitator. This study also has a number of strengths. Participants actively contributed to the discussion and these remained focused on the key analytic questions. Analysis was detailed and systematic and the findings provided valuable information to guide the development of a healthy snacking intervention for Chinese adolescents.

### **3.6 Conclusion**

To conclude, the current study found that snacking was reported as an essential and natural part of an adolescent’s daily life. What a snacking intervention for Chinese adolescents can target is eating behaviours in response to external cues, emotional states, and food craving. The adolescents showed positive and open attitudes towards healthy snacking and a snacking programme, although their intention to eat more healthily was relatively low. They reported being open to an intervention that was engaging, informative, easily accessible and which both improved their dietary knowledge and was weight focused. Interventions should deliver nutrition knowledge and behavioural regulation skills that improve adolescents’ self-control on eating, and aiming at improving adolescents’ motivation to be engaged in healthy snacking practices, as well as self-efficacy of doing so.

## **Chapter 4. Revision and validation of a Chinese version of the Mindful Eating Questionnaire – Part 1. A think aloud study**

### **4.1 Introduction**

As reviewed in Chapter 2, mindfulness-based interventions (MBIs) tailored towards eating practices (E-MBIs) have shown effectiveness in reducing obesity-related eating behaviours and potential in promoting weight loss (e.g., Carrière et al., 2018; Dunn et al., 2018; Katterman et al., 2014; Olson & Emery, 2015; Ruffault et al., 2017; Warren et al., 2017). Becoming a more mindful eater is the proposed mediator of these outcomes. The findings of our survey study (Chapter 2) highlighted the importance of mindful eating in adolescent unhealthy snacking. Drawing on evidence from the literature review and previous studies of this research, we decided to develop a snacking intervention using a mindful eating approach.

Having valid and reliable measures of mindful eating is important to our understanding of the relationships between ways of eating and health and weight status, as well as for testing E-MBI outcomes and mediators. Three measures of mindful eating exist - the Mindful Eating Scale (Hulbert-Williams, Nicholls, Joy, & Hulbert-Williams, 2014), the Mindful Eating Behaviour Scale (Winkens et al., 2018), and the Mindful Eating Questionnaire (MEQ, Framson et al., 2009). The MEQ is the most commonly used measure. However, it has only been validated in the United States and Italy, and almost exclusively with white, adult populations, and a number of problems have been reported with it. In our survey study (Chapter 2), the MEQ showed poor internal reliability in both UK and Chinese adolescent samples. To generate a more robust and culturally appropriate measure of mindful eating that can be used in the subsequent feasibility test of intervention, two studies were conducted. This chapter outlines a think-aloud study examining the suitability of the MEQ for the Chinese population.

#### *The Mindful Eating Questionnaire*

The MEQ purports to measure the extent to which a person's eating behaviour is mindful. Via 28 items, the MEQ examines five constructs: (i) *disinhibition*, describing one's inability to stop

eating when full; (ii) *awareness*, describing the extent to which an individual notices the characteristics of the food they are eating, and the effects of the food on their internal state; (iii) *awareness related to external cues*, indicating one's awareness of external triggers for eating; (iv) *emotional response*, referring to eating in response to negative emotions; and (v) *distraction*, describing a lack of focus on eating experience while eating. Each construct is assessed as a subscale of three to eight items, scored from one (never/rarely) to four (usually/always), and both subscale and an overall score is generated.

The MEQ was originally validated in a sample of 303 adults (mean age = 42.0 years, SD = 14.4) in the United States, and good internal consistency reliability was demonstrated for each subscale (*disinhibition*, 0.83; *awareness*, 0.74; *external cues*, 0.70; *emotional response*, 0.71; *distraction*, 0.64) and the MEQ summary score (0.64). Significant negative associations between BMI and the summary MEQ score and all subscales were also reported. However, the original validation sample was likely to have been unrepresentative of a general population, given that a high percentage were recruited from yoga studios (where mindfulness was emphasised), fitness facilities and weight loss programmes (Framson et al., 2009).

The MEQ has been employed in intervention studies to explore potential mechanisms of change (Brazeau et al., 2014; Mason et al., 2016), and in cross-sectional studies to investigate its relationship with weight (Anderson, Reilly, Schaumberg, Dmochowski, & Anderson, 2016; Goodwin, Lucio, Vega-López, & Bruening, 2017; Moor, Scott, & McIntosh, 2013), food intake (Anderson et al., 2016; Beshara, Hutchinson, & Wilson, 2013), eating behaviours (Anderson et al., 2016; Martin, Prichard, Hutchinson, & Wilson, 2013), physical activity (Martin et al., 2013; Moor et al., 2013) and well-being (Khan & Zadeh, 2014). Overall, the MEQ total score showed acceptable or good internal consistency reliability in these studies, with Cronbach's  $\alpha$  ranging from 0.61 to 0.83. In all of these studies, the original English version of the MEQ was used with adult samples, except for one study with 57 young people (Goodwin et al., 2017).

However, of the only two studies that reported internal consistency reliability of the MEQ subscales (Beshara et al., 2013; Moor et al., 2013), both reported poor reliability of *distraction* ( $\alpha = .43$ ,  $n = 171$  and  $\alpha = .55$ ,  $n = 100$ ), and one reported poor reliability of *external cues* ( $\alpha = .56$ ,  $n = 100$ ). Similarly, Apolzan et al. (2016) examined the psychometric properties of the original English version of the MEQ in a sample of 40 pregnant women from the USA. This study reported

good test-retest reliability ( $r = .85$ ) of the MEQ summary score, but poor internal consistency reliability of both the MEQ summary score ( $\alpha = .56$ ) and the *external cues* subscale ( $\alpha = .31$ ). As to convergent validity, although the MEQ total score was significantly correlated with the Mindful Attention Awareness Scale (MAAS; Carlson & Brown, 2005) and the Eating Inventory (EI; Stunkard & Messick, 1985), two awareness-related subscales of the MEQ, *awareness* and *external cues*, showed no significant correlation with the MAAS or the EI's subscales. Using cognitive interviews, Apolzan et al. (2016) reported that most participants showed confusion or misinterpretations of the *external cues* subscale, and revisions were recommended. Collectively, these findings suggest that more detailed investigation of the MEQ is warranted.

In addition, the validity of the MEQ has not been tested beyond US populations except for one study in Italy (Clementi, Casu, & Gremigni, 2017). In the Italian version of the MEQ, eight items of the original MEQ were excluded, as 15 professionals working in the area of mindful eating rated them as poorly representative of the construct in an Italian context. Thus, the meaning of the MEQ items for different cultural groups needs to be examined. Finally, the preponderance of studies on the MEQ are with adults and we know little of its psychometric properties for younger people, nor whether the items are meaningful to them.

### *The present study*

The present study examined how a sample of Chinese adults and a sample of young Chinese people engaged with a Chinese version of the MEQ. We used think aloud interviews, a method established as useful in exploring scale interpretation and improvement (Apolzan et al., 2016; French, Cooke, Mclean, Williams, & Sutton, 2007; Van Oort, Schröder, & French, 2011). Think-aloud interview data provide valuable information for evaluating sources of response error in survey questionnaires, based on which further improvements can be made (French et al., 2007; Van Oort et al., 2011). We generated a translated Chinese version of the MEQ and examined how Chinese adults and adolescents read, interpreted and responded to each item in order to assess the suitability of the MEQ to the eating practices of Chinese adults and youth, and if/where improvements to item clarity and / or relevance were needed for these groups.

## 4.2 Methods

This study was approved by the University of Leeds Research Ethics Committee (Faculty of Medicine and Health; reference: 17-0169; date: 07, June 2017).

### *Participants*

Recruitment calls were posted on WeChat, a popular Chinese social networking application, inviting adolescents aged 16 to 18 years and adults aged 21 to 50 years to participate in a WeChat interview. Inclusion criteria for both samples were: Chinese nationality and fluent in Chinese; absence of self-report or diagnosed eating disorders; and able to take part in a video interview via WeChat. Seven adults (sample 1) and ten adolescents (sample 2) completed the interview. Participants in sample 1 were four females and three males aged from 21 to 35 years ( $M = 27.4$ ;  $SD = 4.28$ ), all well-educated with an average of 18.1 years of schooling. Participants in sample 2 were ten Chinese high school students (six females and four males) aged between 16 and 18 years ( $M = 16.9$ ,  $SD = 0.74$ ). No participants declared being experienced in mindfulness or meditation practice.

### *Materials*

The original version of the MEQ (Framson et al., 2009) was translated into simplified Chinese by a native Chinese-speaking PhD student in Psychology. Two additional psychologists who were fluent in both Chinese and English, and with research experience in mindfulness, then back translated it independently. Discussions on inconsistencies were held before all three translators reached an agreement to produce a Chinese version of the original MEQ for use in the present study.

### *Think aloud interviews*

Think aloud interviews have been used extensively to evaluate the problems people may have when completing validated measures (Willis, 2004). Four major processes have been proposed to explain how people complete questionnaires or measures: comprehension of the question,



retrieval from memory of relevant information, decision making and response generation (Tourangeau, Rips, & Rasinski, 2000). In think aloud interviews, participants are asked to verbalise their thoughts as they work through each measure item, from reading it to arriving at an answer. Participants are not asked to explain their thoughts or give any other commentary. This method supports the identification of problems associated with measure completion (Tourangeau et al., 2000).

### *Procedure*

Following consent, each participant completed a video interview via WeChat. Both written and verbal instructions for the think-aloud task were adopted from French et al. (2007). Participants first practiced thinking aloud in relation to the following practice question: “Do you eat more than usual when you feel stressed”. Participants were then asked to complete the MEQ, sent to them via email or WeChat, and to then think aloud; the interviewer was off-camera to minimise influence. The interviewer did not ask questions or interrupt participants once they started talking, but only encouraged them to keep going when they fell silent for more than 10 seconds. The interviews were audio-recorded with consent. Participants received CNY 30 for taking part.

### *Analysis*

Interviews were transcribed in full. Analysis involved assigning at least one of five categories (described in Table 4.1) to each MEQ item, a method adopted from previous think aloud studies on measure completion (French et al., 2007; Van Oort et al., 2011). Two researchers, both Chinese-native speakers, independently coded transcripts. The agreement between the two raters was good (Cohen's  $k = .87$ ; Altman, 1990). A third researcher, an English-native speaker, analysed the transcripts translated into English and examined the coding of the first two coders. Only minor clarifications were sought with regard to justifying coding. Full coding consensus was then achieved.

**Table 4.1** Coding categories for analysis of think-aloud interviews

	<b>Category</b>	<b>Description</b>
<b>1</b>	<b>No problem</b>	No significant problems identified.
<b>2</b>	<b>No sufficient thinking aloud</b>	Participants did not report sufficient information for coding purposes on any of the four cognitive processes (Tourangeau et al., 2000).
<b>3</b>	<b>Reread/stumbled</b>	Participants re-read a question or stumbled whilst reading it. Although re-reading a question did not necessarily mean that participants had problems in understanding the question, more than one participant re-reading a question could indicate this question requires efforts to understand.
<b>4</b>	<b>Problems understanding</b>	Participants demonstrated problems in understanding or answering the question, including querying the meaning of the question, claiming they needed more information before they could answer it, or stated they were uncertain about whether they had understood or answered the question properly.
<b>5</b>	<b>Misinterpretation</b>	Participants appeared to answer a different question from the one that was asked, or gave reasoning that appeared inconsistent with, or irrelevant to, the answer given.

### 4.3 Results

#### *Sample 1: Adults*

For the adult sample, seven participants answered 28 items of the MEQ, which generated 196 (7 × 28) text segments for coding. Of these, 193 were assigned into one of the five categories and three were assigned into two categories (e.g., *re-read* and *misinterpreted* a question). Of the 196 segments, 36 were assigned to category 2 (failed to provide sufficient information) and were discounted from the analysis. The coding of the remaining 160 segments identified a total of 43 problems related to 17 items of the MEQ. The frequency and type of problems identified by adult participants for each construct of the MEQ is shown in **Table 4.2**. Examples illustrating the two main types of problems (i.e., *problems understanding* and *misinterpretation*) related to each item are shown in **Table 4.3**.

**Table 4.2** Frequency and type of problems with the MEQ reported by Chinese adults (n = 7)

<b>Construct (number of items)</b>	<b>N problematic items on subscale</b>	<b>N of problems overall</b>	<b>Reread/ stumbled</b>	<b>Problems understanding</b>	<b>Misinter- pretation</b>
Awareness (7)	4	9	—	3	6
Distraction (3)	2	2	—	1	1
Disinhibition (8)	4	5	—	1	4
Emotional response (4)	1	1	—	1	—
External cues (6)	6	26	2	4	20
<b>Total (28)</b>	<b>17</b>	<b>43</b>	<b>2</b>	<b>10</b>	<b>31</b>

**Table 4.3** Examples of *problems understanding* and *misinterpretation* reported by Chinese adults (n = 7)

<i>MEQ Subscale</i>	<i>MEQ Item</i>	<b>Problems understanding or answering the question</b>	<b>Misinterpretation</b>
<b>Awareness</b>	10. I notice when there are subtle flavours in the foods I eat.	One respondent was uncertain about the meaning of “subtle flavours”: <i>“I’m not sure about the so-called subtle flavours. I’m wondering what subtle flavours are – does it mean good flavours, or flavours different than usual?”</i> (PP3)	None
	12. When eating a pleasant meal, I notice if it makes me feel relaxed.	None	Two respondents interpreted this question as how often eating a pleasant meal made them feel relaxed, rather than ‘noticing’, e.g. <i>“Yes, I choose a four for this one. Pleasant meals do make me feel relaxed”</i> (PP3)
	16: I appreciate the way my food looks on my plate.	None	Three respondents focused on whether the food looked good and was worth being appreciated other than their intention/actions to appreciate the appearance of food, e.g. <i>“Let me think about it, think about whether there was food that looked beautiful. Sometimes I can, sometimes it looks disgusting, and I don’t appreciated it.”</i> (PP4)
	26. I notice when the food I eat affects my emotional state.	Two respondents were confused about which part of the question they should answer, e.g. <i>“Does this question ask whether I notice it, or whether food affects my emotional state? If it asks whether I notice it, then I often notice it; however, my emotional state is rarely affected by food. But since I notice it, I choose 3.”</i> (PP4)	One respondent interpreted this question as how often their emotional state was affected by food, rather than ‘noticing’: <i>“Well, rarely. Daily events like eating rarely affect my emotional state.”</i> (PP2)
<b>Distraction</b>	1. I eat so quickly that I don’t taste what I’m eating.	None	One respondent gave reasoning inconsistent with the question that was asked: <i>“Eat so quickly that I don’t taste...Rarely. Sometimes I eat very quickly and don’t taste at working lunch,</i>

			<i>but there's nothing worth tasting in working lunch anyway. So I'll choose 'never/rarely'.</i> (PP7)
	6. My thoughts tend to wander when I'm eating.	One respondent was unsure whether <i>reading or watching TV while eating</i> was "thought wandering": "Let me see... I always eat alone; sometimes I read or watch TV when eating. Does that count as 'thought wandering'? I suppose so. I choose 'often'." (PP3)	None
<b>Disinhibition</b>	5. When a restaurant food portion is too large, I stop eating when I'm full.	None	One respondent answered to how often the situation described actually happened, rather than his behaviour in this situation: "The answer is 1, never or rarely. Because I have a big appetite, and by far it never happened to me that the food portion is larger than I need when eating at restaurant, so I always eat it up. It is my habit, and also I don't want to waste any food. Food is never easy to get." (PP6)
	9. If it doesn't cost much more, I get the larger size food or drink regardless of how hungry I feel.	None	One respondent ignored the condition described in this question and decided it depended on how hungry she was: "I always order the small size, because I... I choose 2 (sometimes), as I buy larger size when I'm hungry, and buy small ones when I'm not. Yes, sometimes." (PP3)
	18. If there's good food at a party, I'll continue eating even after I'm full.	None	Two respondents interpreted the behaviour described as rude, and gave reasoning and answers accordingly, e.g. "Rarely. I care about my image at public events like parties, or you can say I'm more likely to control myself in front of others. Usually I tend to indulge myself when I'm alone." (PP1)
	25. When I'm at a restaurant, I can tell when	One respondent asked about whether it counts when she can tell the portion is too large only after she finished the meal:	None

	the portion I've been served is too large for me.	<i>"I can only tell after having the meal, if there's leftover then it's too large, if no leftover then it's just right, and if I still feel hungry then it's too small. Does that count...? Yes, I suppose."</i> (PP4)	
<b>Emotional Response</b>	13. I snack without noticing I'm eating.	One respondent was confused about the meaning of this question: <i>"What does this mean? Sometimes, for most of the time I notice it."</i> (PP5)	None
<b>External Cues</b>	3. At a party where there is a lot of good food, I notice when it makes me want to eat more food than I should.	One respondent reported problem in understanding this question: <i>"Hum... Rarely notice it. (Read the question again) What does it mean? I don't quite understand it, but I don't think I notice it. I choose 1."</i> (PP5) One respondent reported problem in answering this question because the external cue in question never triggered her eating behaviour: <i>"At parties I usually eat less, just as when at buffets, because I feel satisfied just seeing so many foods. So it never makes me want to eat more than I should, and this situation doesn't exist, so which one should I choose? If it ever happens, I think I'll notice it. Just a guess."</i> (PP4)	One respondent talked about how often being at a party actually made him want to eat more than he should, rather than his awareness of such external eating behaviour: <i>"This one, yes, usually it's at family reunions on holidays or new year. I did eat more on these occasions. I choose 3, often."</i> (PP2)
	4. I recognise when food advertisements make me want to eat. ("Not applicable" option: Food ads never make me want to	None	Five respondents talked solely about how often food ads made them want to eat, rather than their recognition of such situations, e.g. <i>"Eh... I don't think just watching food ads can make me have an appetite to eat. Usually it's something internal, a feeling of my body that makes me want to eat. This kind of external cues</i>

	eat.)		<i>rarely (make me want to eat). So I think it's 'rarely'.</i> ” (PP2)
	8. I notice when just going into a movie theatre makes me want to eat candy or popcorn. (“Not applicable” option: I never eat candy or popcorn)	None	Four respondents talked about how often just going into a movie theatre made them want to eat, rather than their awareness of the behaviour, e.g. <i>“Rarely. I rarely eat sweets or popcorn at movie theatres. I don't like popcorn or sweets; don't like these kinds of food. Except when the smell is very good and I'm too hungry, I might choose to have some. Otherwise, rarely.”</i> (PP3)
	14. When I eat a big meal, I notice if it makes me feel heavy or sluggish.	One respondent reported difficulty in understanding this questions: <i>“I don't quite understand this question: does it mean physical feelings of heavy or sluggish because of eating too much, or that eating too much results in some kind of psychological burden, which leads to psychological feelings of heavy or sluggish? ... It's just I'm not sure which kind of heavy feeling it means, but I think I do notice it, no matter it's physical or psychological.”</i> (PP1)	Three respondents talked about how often eating a big meal made them feel heavy or sluggish, e.g. <i>“Yes, I always feel very heavy. I think eating is something you need to exert energy to do.”</i> (PP4)  One respondent answered about how often he actually ate a big meal: <i>“Well, my answer is 2 (sometimes), as I don't always eat a lot.”</i> (PP6)
	23. I recognise when I'm eating and not hungry. (“Not applicable” option: I don't eat when I'm not hungry.)	One respondent was confused about which part of the question she was supposed to answer to: <i>“Sometimes, sometimes I recognise it... Does this mean I often recognise this thing, or... One thing I'm not sure about this question is that, when I choose 'sometimes' or 'often', does it mean I often recognise this thing, or I often eat when not hungry. I'm not sure which part this word is supposed to describe. For me, when I'm eating and not hungry, I always recognise it; however, I don't often eat when not hungry. So I choose 'sometimes'.”</i> (PP1)	One respondent talked about how often she ate when not hungry, rather than her recognition of such behaviour: <i>“Yes, it happens when I feel bored. But I don't eat things that can make me feel full.”</i> (PP4)

<p><b>External Cues</b></p>	<p>24. I notice when I'm eating from a dish of candy just because it's there.</p>	<p>None</p>	<p>Four respondents talked about how often they ate just because foods were there, rather than their awareness of such behaviours, e.g. <i>"Yes, very much so. I eat as long as there are snacks, so I choose 4. That's why I don't buy snacks anymore, or keep them away from me."</i> (PP3)</p>
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### **Sample 2: Adolescents**

In the adolescent sample, 10 participants answered 28 items of the MEQ, generating 280 (10 × 28) codable segments. Of these, 274 segments were assigned into one of the five categories (described in Table 4.1), and 6 segments identified two problems and therefore were assigned into two categories (e.g., *re-read* and *misinterpreted* a question). Seventy-eight segments were coded as *no sufficient thinking aloud* and were discounted from further analysis. The remaining 202 segments represented a total of 68 problems relating to 16 items of the MEQ. The frequency and type of problematic segments of adolescent participants for each construct of the MEQ is shown in Table 4.4. Examples illustrating two main types of problems (i.e., *problems understanding* and *misinterpretation*) related to each item are shown in Table 4.5.

**Table 4.4** Frequency and type of problems with the MEQ reported by Chinese adolescents (n = 10)

Construct (number of items)	N		Reread/ stumbled	Problems	
	problematic items on subscale	N of problems overall		understan- ding	Misinter- pretation
Awareness (7)	5	18	—	3	15
Distraction (3)	2	3	1	—	2
Disinhibition (8)	3	6	1	1	4
Emotional response (4)	—	—	—	—	—
External cues (6)	6	40	4	4	33
<b>Total (28)</b>	<b>16</b>	<b>68</b>	<b>6</b>	<b>8</b>	<b>54</b>

Taken together, 19 items of the MEQ yielded a total of 111 problems in the two samples, of which 14 items yielded problems in both samples. The number of total problems and misinterpretations related to each item is shown in Table 4.6. The remaining 9 questions of the MEQ yielded no problems in the two samples.

**Table 4.5** Examples of *problems understanding* and *misinterpretation* reported by Chinese adolescents (n = 10)

<i>MEQ Subscale</i>	<i>MEQ Item</i>	<b>Problems understanding or answering the question</b>	<b>Misinterpretation</b>
<b>Awareness</b>	10. I notice when there are subtle flavours in the foods I eat.	Three respondents showed to be confused over the exact meaning of “subtle flavours”, or reported their answer would depend on the type of subtle flavours in question, e.g. <i>“I think it rarely happens. Subtle flavours... I’m not sure if I understand this word correctly, as I don’t see it a lot. I’ll choose ‘sometimes’. There are only several kinds of meals from home to school refectory, and I never taste any subtle flavours in them even though I’ve already got bored of them.”</i> (PP4)	Three respondents identified “subtle flavours” as “strange tastes” or “tastes different than usual”, e.g. <i>“Yes. If it’s something I’ve had before, it’s obvious when it tastes different than usual. I choose ‘often’.”</i> (PP1)
	12. When eating a pleasant meal, I notice if it makes me feel relaxed.	None	Two respondents answered about how often eating a pleasant meal made him feel relaxed, or how often they thought eating a pleasant meal was supposed to make people relaxed, e.g. <i>“I rarely notice this kind of situation. I don’t really think about whether I feel relaxed when having meals. People should be relaxed when eating, because eating with families or friends... I might feel nervous eating with my boss when I grow up, but now eating with families or peers is supposed to be relaxing.”</i> (PP4)
	16. I appreciate the way my food looks on my plate.	None	Two respondents talked about how often food looked good and was worth being appreciated, e.g. <i>“Well, sometimes. I appreciate it when it looks good.”</i> (PP5)
	20. I notice when foods and	None	One respondent defined “too sweet” as “too sweet for others”:

	drinks are too sweet.		<p><i>“Too sweet... I like strong flavours, so I may not be able to notice it when it’s too sweet for other people.” (PP5);</i></p> <p>One defined it as “sweeter than usual”: <i>“Sometimes. If it’s something I often eat or drink, I notice it when it’s sweeter than usual.” (PP6)</i></p>
	26. I notice when the food I eat affects my emotional state.	None	Six respondents answered about how often their emotional state was affected by the food they ate, e.g. <i>“Often so, when the food I eat is not good, or not to my taste, or too spicy or too salty or too bland. It did quite often affect my emotional state.” (PP4)</i>
<b>Distraction</b>	6. My thoughts tend to wander when I’m eating.	None	Two respondents reported their thought never wandered when eating as they focused on other activities rather than eating, e.g. <i>“When at school this doesn’t happen as I’m always in a hurry. I need to go to the self-study session at noon. When at home, I watch videos when eating, so my thought don’t wander. Therefore it’s a ‘never’.” (PP1)</i>
<b>Disinhibition</b>	5. When a restaurant food portion is too large, I stop eating when I’m full.	One respondent was confused about whether it was school restaurants or restaurants outside in question: <i>“Restaurant food... Does this mean restaurants at school, or restaurants outside? If it means restaurants at school – I can’t waste food at school restaurants. I have to eat it up, or I’ll be penalised. When eating out with my friends, well, if I continue eating after feeling full, I’ll grow fat. So yes I stop eating when I’m full. But I don’t eat out a lot, so usually it’s at school restaurants.” (PP9)</i>	None
	7. When I’m eating one of	None	One respondent did not notice that the question was negative

	my favourite foods, I don't recognise when I've had enough.		when choosing his answer: <i>"No, never. I cannot recognise it."</i> (PP2)
	18. If there's good food at a party, I'll continue eating even after I'm full.	None	Two adolescents interpreted the behaviour described in this question as rude and chose their answer accordingly, e.g. <i>"Rarely. There are schoolmates around, I need to watch my behaviour."</i> (PP5)  One adolescent appeared to answer about how often the condition in question actually happened, rather than his own behaviour: <i>"This rarely happens. Because it seems that there've never been food that particularly good at the parties I went to."</i> (PP1)
<b>External Cues</b>	3. At a party where there is a lot of good food, I notice when it makes me want to eat more food than I should.	Three respondents reported problems in understanding this question, e.g. <i>"I notice when... What does this mean? I'm not sure. But my understanding is that it's asking if I can notice when I want to eat more than I should and restrain it, so it's a 'often'."</i> (PP1)	Four respondents talked about how often being at a party actually made them want to eat more than he should, rather than their awareness of such external eating behaviour, e.g. <i>"Often, because there are good foods that I don't eat everyday."</i> (PP2)  Two respondents talked about how often they noticed the food at parties that made them want to eat more, e.g. <i>"Make me want to eat more than I should... Of course I notice it, I always notice the food that I like."</i> (PP10)
	4. I recognise when food advertisements make me want to eat. ("Not	None	Five respondents talked solely about how often food ads made them want to eat, rather than their recognition of such situations, e.g. <i>"I rarely want to eat when seeing food ads. I don't watch</i>

	applicable” option: Food ads never make me want to eat.)		<i>food ads at all. I choose 1 (never/rarely).” (PP10)</i>
	8. I notice when just going into a movie theatre makes me want to eat candy or popcorn. (“Not applicable” option: I never eat candy or popcorn)	None	Five respondents talked about how often just going into a movie theatre made them want to eat, rather than their awareness of the behaviour, e.g. <i>“Generally I don’t like eating popcorn at movie theatres. One reason is that I think the sound of eating is embarrassing. Also I don’t know why I have to eat popcorn when watching a movie. I choose 1 (never/rarely).” (PP1)</i>
	14. When I eat a big meal, I notice if it makes me feel heavy or sluggish.	One participant reported difficulty in understanding the question: <i>“I don’t notice it. Eating a big meal makes my stomach bursting, especially when standing up. That’s what could happen after eating a big meal. But does this mean after eating or while eating? I’m not sure. If it means after eating, I might feel heavy or sleepy, because I always feel sleepy after having a meal, and I don’t know why.” (PP4)</i>	Five respondents talked about how often eating a big meal made them feel heavy or sluggish, e.g. <i>“...I think I feel very happy when I eat a big meal, and I eat a lot of the food I like, so of course I don’t feel heavy or sluggish. Definitely not. I choose 1 (never/rarely).” (PP10)</i>
	23. I recognise when I’m eating and not hungry. (“Not applicable” option: I don’t eat when I’m not hungry.)	None	Five respondents talked about how often they ate when not hungry, rather than their recognition of such behaviour, e.g. <i>“I eat only when I’m hungry, so it’s a ‘never’.” (PP9)</i>
	24. I notice when I’m eating from a dish of candy just because it’s there.	None	Seven respondents talked about how often they ate just because foods were there, rather than their awareness of such behaviours, e.g. <i>“Never. I eat snacks mainly because they taste good and draw my attention, not because they are there.” (PP7)</i>

**Table 4.6** Misinterpretations and total number of problems in both samples

Questionnaire items	Sample 1		Sample 2		Both samples	
	Misinter-pretation (N)	Total problems (N)	Misinter-pretation (N)	Total problems (N)	Misinter-pretation (N)	Total problems (N)
<b><i>Awareness</i></b>						
10. I notice when there are subtle flavours in the foods that I eat.	—	1	3	6	3	7
12. When eating a pleasant meal, I notice if it makes me feel relaxed.	2	2	2	2	4	4
16. I appreciate the way my food looks on my plate.	3	3	2	2	5	5
20. I notice when foods and drinks are too sweet.	—	—	2	2	2	2
26. I notice when the food I eat affects my emotional state.	1	3	6	6	7	9
<b><i>Distraction</i></b>						
1. I eat so quickly that I don't taste what I'm eating.	1	1	—	1	1	2
6. My thoughts tend to wander when I'm eating.	—	1	2	2	2	3
<b><i>Disinhibition</i></b>						
5. When a restaurant food portion is too large, I stop eating when I'm full.	1	1	—	1	1	2
7. When I'm eating one of my favourite foods, I don't recognise when I've had enough.	—	—	1	2	1	2
9. If it doesn't cost much more, I get the larger size food or drink regardless of how hungry I feel.	1	1	—	—	1	1
18. If there's good food at a party, I'll continue eating even after I'm full.	2	2	3	3	5	5
25. When I'm at a restaurant, I can tell when the portion I've been served is too large for me.	—	1	—	—	—	1

**Table 4.6.** Misinterpretations and total number of problems in both samples (continued)

Questionnaire items	Sample 1		Sample 2		Both samples	
	Misinter- pretation (N)	Total problems (N)	Misinter- pretation (N)	Total problems (N)	Misinter- pretation (N)	Total problems (N)
<i>Emotional response</i>	—	1	—	—	—	1
13. I snack without noticing I'm eating.						
<i>External cues</i>						
3. At a party where there is a lot of good food, I notice when it makes me want to eat more food than I should.	2	6	6	13	8	19
4. I recognise when food advertisements make me want to eat. ("Not applicable" option: Food ads never make me want to eat.)	5	5	5	5	10	10
8. I notice when just going into a movie theatre makes me want to eat candy or popcorn. ("Not applicable" option: I never eat candy or popcorn.)	4	4	4	4	8	8
14. When I eat a big meal, I notice if it makes me feel heavy or sluggish.	4	5	5	6	9	11
23. I recognise when I'm eating and not hungry. ("Not applicable" option: I don't eat when I'm not hungry.)	1	2	5	5	6	7
24. I notice when I'm eating from a dish of candy just because it's there.	4	4	7	7	11	11
<i>Total</i>	<i>31</i>	<i>43</i>	<i>53</i>	<i>67</i>	<i>84</i>	<i>110</i>

#### 4.4 Discussion

We examined how Chinese adults and adolescents read, interpreted and responded to each item on the MEQ to identify any problematic items. From the total of 28 MEQ items, 19 were identified as problematic. Many were problematic for both the adult and adolescent Chinese participants (of the 19 items that generated problems, 15 items yielded problems in both samples), although adolescent participants reported slightly more problems on average. The majority of the problems were item misinterpretation ( $N = 89$ ), raising questions about the meaningfulness of participants responses. We focus here on items that demonstrated at least three total problems in both samples before offering suggestions for item improvements. Taking the results of both samples together, all items for *external cues* and more than half of the items for *awareness* yielded three or more problems.

The *external cues* subscale yielded most problems ( $N = 66$ ), including 52 misinterpretations and 8 explicitly reported difficulties in understanding or answering the items. It appears that most of the problems (51 misinterpretations and at least one identified difficulty in answering the question) were caused by item structure on this subscale. All six items are designed to evaluate respondents' awareness and noticing of their externally driven eating behaviour rather than the behaviour itself (e.g., 'I notice when just going into a movie theatre makes me want to eat candy or popcorn'). However, most of our adult and adolescent participants responded to the items by considering whether the behaviour ever occurred, rather than on their ability to notice it when it happened. This interpretation does not reflect mindful eating. Notably, many participants selected the 'not applicable' option on the *external cues* subscale (e.g., 'I never eat candy or popcorn'), and many of the think aloud segments were therefore coded as 'no significant problem identified'. This may have concealed further difficulties with the noticing aspects of the items. Our findings are in line with those of Apolzan et al. (2016) who found that a US sample only talked about the behaviour in *external cues* questions, or reported their confusion over the questions.

Four items on the *awareness* subscale structured as 'I notice when + a situation' (i.e., item 10, 12, 20, 26) also revealed similar problems. For example, of the nine problems identified with



item 26 ('I notice when the food I eat affects my emotional state'), seven problems were related to 'noticing'. Participants often responded by considering if food had ever affected their emotion state, rather than their level of noticing the effect of food on them in the moment. It also appeared difficult to respond in the negative to 'noticing' items, e.g. how is it meaningful to answer 'never' to the item 'I notice when foods and drinks are too sweet' (item 20). Additionally, other items in the measure ask about actual behaviour, requiring respondents to shift focus across 'noticing' and 'behaving' questions. Most participants answered the MEQ items by referring to their own behaviour rather than the act of noticing.

A further challenge in the MEQ was the focus on intention to notice, which posed different problems to those around noticing vs. behaving noted above. In line with Grossman (2008) concerns, our respondents interpreted many items on noticing as questioning their passive and/or per chance awareness rather than their conscious intention to notice moment-by-moment experience, on purpose. For example, in response to the item 'I notice when there are subtle flavours in the foods that I eat' (item 10), several participants spoke about their taste sensitivity (e.g., "*I always notice it, as my sense of taste is very sharp*"; Participant 2, sample 1). Such responses appear appropriate to the question, but they do not reflect intention to notice, which is the mindful construct the MEQ is attempting to assess. Overlooking intentionality was also evident in two items in *awareness* subscale. Item 16 ('I appreciate the way my food looks on my plate') generated five misinterpretations as the act of 'appreciating' was interpreted as a passive consequence that mostly depended on the characteristics of the food rather than an intentional act. In contrast, item 21 ('Before I eat I take a moment to appreciate the colours and smells of my food') asks about intentional appreciation. In response, participants spoke about their tendency to intentionally attend to the food they eat.

Our findings point to the challenges of completing the MEQ when respondents are unfamiliar with mindfulness, and specifically with mindful (intentional) noticing. We therefore propose that comprehension and validity of the measure could be improved by greater emphasis on a person's *intention to notice* eating behaviours and their consequences. This change would better align the MEQ with dominant conceptualisations of mindfulness as intentionally paying attention to

present-moment experience (with certain attitudes) (e.g., Bishop et al., 2010; Kabat-Zinn, 1982; Shapiro, Carlson, Astin, & Freedman, 2006). Many generic mindfulness scale assess intention to notice (Bergomi et al., 2013). For example, the Five Facet Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006), asks ‘When I’m walking, I *deliberately notice* the sensations of my body moving’ (item 1), or ‘I *pay attention to* how my emotions affect my thoughts and behaviour’ (item 36).

Based on these findings, we suggest that the problematic awareness-related items of the MEQ, i.e., items for *awareness* and *external cues* subscales with identified problems (see Table 4.6), could be rephrased to ask about intentional noticing to either internal experiences (for the awareness subscale) or external cues. We present suggested revisions to items in **Table 4.7**, most of which incorporate the phrase ‘deliberately notice’ in order to distinguish between the act or event, and the purposeful noticing of it.

In addition to those already discussed, three further items were problematic for different reasons. First is item 6 of the distraction subscale (‘My thoughts tend to wander when I’m eating’). One adult participant asked about whether doing other activities while eating should be seen as “thoughts wandering”, and two adolescents decided doing activities was not mind-wandering, since their attention was focused on the activities. Mind-wandering has a particular conceptualisation in mindfulness practice, and thus the operationalising of this item on the MEQ may only be intelligible to mindfulness meditators. Second, item 18 (i.e., ‘If there’s good food at a party, I’ll continue eating even after I’m full’) on the *disinhibition* subscale was also problematic. Two adults and two adolescents interpreted this behaviour as rude and reported they would not do it as a matter of courtesy. However, the item is attempting to assess the extent to which people are mindful of their hunger and satiety. Considering there are only three questions for the *distraction* subscale, misconceptions of one item could greatly affect the validity and consistency reliability of the subscale. Finally, the phrase ‘subtle flavours’ (item 10 of *awareness* subscale; ‘I notice when there are subtle flavours in the foods that I eat’) generated misunderstanding (see Tables 4.3 and 4.5). This might have been caused by the translation from English into Chinese, as in Chinese ‘subtle flavours’ can be confused with ‘subtle tastes’. More adolescents reported

difficulties in understanding ‘subtle flavours’ than adults. Compared to adults, many adolescents have a relatively monotonous diet. When applying the questionnaire to adolescents, the relevance of items to their daily life should be taken into consideration.

### *Evaluation*

There are some limitations to the present study. First, due to the nature of the think aloud method, the findings reflect naturally occurring problems for our chosen samples which may not be replicated in other samples, or may be not comprehensive of all problems. Studies are needed to validate our translated Chinese version of the MEQ as well as our suggestions for item revision. Second, our sample sizes were small, although they were similar to previous think-aloud studies exploring engagement with measures (French et al., 2007; Van Oort et al., 2011). The adult sample was not representative of the Chinese population, being younger and better educated. Validation efforts for the Chinese version of the MEQ should include a more diverse sample. Finally, this study employed a Chinese version of the MEQ, and one should be cautious in generalising the findings to the original English version of the measure.

## **4.5 Conclusions**

We identified an extensive range of problems encountered by participants attempting to complete a Chinese version of the MEQ, particularly the items related to mindful awareness and noticing. When answering these items, both adult and adolescent participants tended to ignore the focus on noticing in the moment and instead focused solely on whether the eating behaviour ever occurred, which is not necessarily indicative of mindful eating. We suggest that the MEQ items assessing mindfulness awareness could be rephrased to emphasise intentional noticing. In addition, our findings indicate that measures of mindful eating need to be intelligible and meaningful to people not familiar with mindfulness and /or not currently eating mindfully. Researchers and practitioners immersed in mindfulness should be cautious when developing mindfulness assessments for general populations. Further studies are needed to identify the problems participants may encounter when completing the original English version of the MEQ and to test

the potential improvements to it.

**Table 4.7** Examples of suggested rephrasing of awareness-related questions in the MEQ

Original content	Suggested rephrasing
<i><b>Awareness</b></i>	
10. I notice when there are subtle flavours in the foods that I eat.	I deliberately notice the subtle flavours in the foods that I eat.
12. When eating a pleasant meal, I notice if it makes me feel relaxed.	When eating a pleasant meal, I deliberately notice how it affects my bodily sensations.
16. I appreciate the way my food looks on my plate.	Before I eat, I take a moment to appreciate the way my food looks on my plate.
21. I notice when the food I eat affects my emotional state.	When I'm eating, I deliberately notice how the food I eat affects my emotional state.
<i><b>External cues</b></i>	
3. At a party where there is a lot of good food, I notice when it makes me want to eat more food than I should.	When there is a lot of good food around, I pay attention to how it might affect my desire to eat.
4. I recognise when food advertisements make me want to eat.	When watching food advertisements, I deliberately notice how it affects my desire to eat.
8. I notice when just going into a movie theatre makes me want to eat candy or popcorn.	When going into a movie theatre, I deliberately notice whether it makes me want to eat sweets or popcorn.
14. When I eat a big meal, I notice if it makes me feel heavy or sluggish.	When I eat a big meal, I deliberately notice how it might affect my bodily sensations.
23. I recognise when I'm eating and not hungry.	I recognise when I'm eating even though I'm not hungry.
24. I notice when I'm eating from a dish of candy just because it's there.	I deliberately notice whether I'm eating snacks just because they're there.

## **Chapter 5. Revision and validation of a Chinese version of the Mindful Eating**

### **Questionnaire – Part 2. A validation study**

#### **5.1 Introduction**

In the think-aloud study (Chapter 4), we identified a wide range of problems encountered by both adults and adolescents attempting to complete a Chinese version of the MEQ (C-MEQ), and made recommendations for potential improvements. Based on the problems identified, we suggested that the MEQ items assessing mindfulness awareness should present a clearer focus on intentional noticing. Specifically, we recommended rephrasing 10 MEQ items (Chapter 4, Table 4.7). This chapter reports on a subsequent study to validate our revised C-MEQ (C-MEQ-R) in a sample of Chinese undergraduates. The two study aims were: (1) to test the psychometric properties of the C-MEQ-R; and (2) to investigate whether the revision of the questionnaire improved its reliability and validity.

#### **5.2 Methods**

##### **Participants and Recruitment**

Participants were recruited from an art university in Jinan, a city of East China. A head teacher of the university gave permission for recruitment and administration of the study. An e-copy of the survey with an informed consent form was sent to the head teacher, who helped to print, distribute and collect the survey questionnaires. Students of the university were invited to take part. Inclusion criteria were: Chinese nationality and fluent in Chinese; aged over 18 years; willing to participate in a survey study which should take no more than 15 minutes. Participation was anonymous. This study was approved by the University of Leeds School of Psychology Research Ethics Committee (PSC-358; date: 26, June 2018).

We received 520 questionnaires, of which 47 did not provide demographic information, and 43 showed unsatisfactory quality (defined as more than 25% of the questions not completed or straight-lining/patterned responses). The final sample consisted of 430 Chinese university students aged 18 to 35 years ( $M = 19.55$  years,  $SD = 2.11$ ), of which 73.5% were female ( $n = 316$ ).

The mean self-reported BMI of the sample was 20.14kg/m<sup>2</sup> (ranging from 14.52 to 32.65 kg/m<sup>2</sup>; *SD* = 2.63). One third (*n* = 143) of the participants reported to be on a weight loss diet.

### **Design and measures**

Participants filled out a cross-sectional paper-based survey that included questions regarding eating-related demographics (e.g., age, gender, weight, height) and the following measures.

***Chinese version of the Mindful Eating Behaviour (C-MEQ) and revised items*** To achieve our first study aim, we administered the original 28-item C-MEQ. This was followed by our 10 revised items. The preparation of the C-MEQ and rephrased items were described in Chapter 4.

***Dutch Eating Behaviour Questionnaire*** Emotional eating and external eating were assessed using a validated Chinese version of the DEBQ (Wu, Cai & Luo, 2017). Cronbach's  $\alpha$  of the DEBQ in the present sample was: *emotional eating* (.92); *external eating* (.74).

***Five Facet Mindfulness Questionnaire (FFMQ)*** Mindfulness was assessed using the FFMQ (Baer et al., 2006). The FFMQ is one of the most extensively validated measures of mindfulness (Sauer et al., 2013), which captures five factors of mindfulness (i.e., observing, describing, act with awareness, non-judging of inner experience, and non-reactivity to inner experience). The questionnaire consists of 39 statements with the response to each item from 1 (never or very rarely true) to 5 (very often or always true). A validated Chinese version of the FFMQ (Deng et al., 2011) was used in the current study. In Deng et al. (2011)'s study, the Ch-FFMQ showed acceptable internal reliability for all subscales except for *non-reactivity* (Cronbach's  $\alpha$  = .45) among a sample of Chinese undergraduates. In the present sample, the FFMQ showed similar Cronbach's  $\alpha$ : *observing* (.72); *describing* (.64); *act with awareness* (.78); *non-judging* (.71); *non-reactivity* (.48).

### **Statistical Analysis**

Statistical analysis was conducted using SPSS 22.0. Missing data for all items were less than 5% (ranging from 0 to 2.3%) and were replaced using column means. Conventional psychometric analyses were conducted to examine the validity and reliability of the C-MEQ and the C-MEQ-

R. First, principal component analyses (PCA) with varimax rotation (see below) were conducted to investigate the factor structure of the questionnaires. Second, the internal reliability of the subsequent factors of both questionnaires was examined using Cronbach's alpha. Based on the results of reliability analysis, the C-MEQ-R was then refined, and PCA and reliability analysis were run again with the refined version of the C-MEQ-R. Last, respondents' scores on the final version of the C-MEQ-R were correlated with the FFMQ and the DEBQ to assess convergent validity. As mindful eating is an application of mindfulness principles to eating, we proposed that there should be a moderate correlation between the C-MEQ-R and the FFMQ. Theoretically, mindful eating should be negatively associated with emotional eating and external eating. We thus expected negative correlations between the C-MEQ-R and emotional eating and external eating of the DEBQ. We also examined the relation between respondents' BMI and scores on the C-MEQ-R. To compare the convergent validity of the C-MEQ and the C-MEQ-R, correlations between the C-MEQ and other measures were also calculated.

### 5.3 Results

#### *Step 1: Factor analysis with the C-MEQ and the C-MEQ-R*

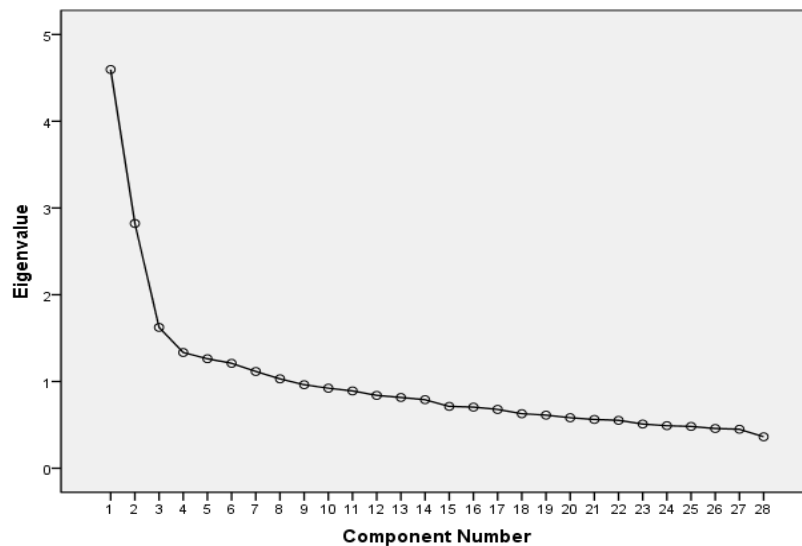
Principal components analysis (PCA) was performed to investigate the factor structure of the C-MEQ and the C-MEQ-R. As the original MEQ was developed based on five hypothesised domains of mindful eating (Framson et al., 2009), a five-component solution was selected for both the C-MEQ and the C-MEQ-R. In order to select an appropriate rotation method, an oblique rotation was run with five factors, and for both questionnaires, the correlations between all factors were below .32. Following Tabachnick and Fidell (2014, p699)'s recommendation, an orthogonal rotation (varimax) was chosen. Items with factor loadings above .40 was used as a cut-off in the interpretation of which items were included in each factor (Tabachnick & Fidell, 2014, p702).

The 28-item C-MEQ had a Kaiser-Meyer-Olkin measure of sampling adequacy of .78 and a significant Bartlett's test of sphericity (2048.10,  $p < .001$ ), indicating that it was appropriate to use factor analysis on this set of data. Loadings of variables on factors, eigenvalues and percentage variance explained by each factor are shown in **Table 5.1**. With a cutoff of .40, four of 28 items did not load on any factor. The five factors accounted for 39.9% of the variance.



Factor 1 was a combination of items on *external cues* and *emotional response* subscales of the original MEQ. It should be noted, however, that items on *external cues* and *emotional response* were correlated with this factor in exact opposite direction. Factor 2 was clearly associated with *disinhibition*, and factor 3 with *awareness* subscale. Factor 4 was a mixture of items on *distraction*, *disinhibition*, and *external cues*, and factor 5 mainly covered items on *awareness*.

The 28-item C-MEQ-R had a Kaiser-Meyer-Olkin measure of sampling adequacy of .82 and a significant Bartlett's test of sphericity (2213.85;  $p < .001$ ), indicating that factor analysis is appropriate for these data. Results of the PCA with the C-MEQ-R are shown in Table 5.2. Two items did not load above .4 on any factor. The five factors accounted for 41.56% of the variance. Factor 1 combined items on *external cues* and *awareness* subscales of the original MEQ, which were associated with individuals' intentional noticing of food-related experiences. Factor 2 was mainly associated with *disinhibition*, with two additional items on *distraction*. Factor 3 consisted of items on *awareness*, *disinhibition*, and *external cues*, with all items except for one describing one's intentional awareness of food properties. Factor 4 included two items on *emotional response*. Factor 5 included two items on *disinhibition* and one on *distraction*, which appears difficult to define. The scree plot for the PCA of the C-MEQ-R is shown in Figure 5.1



**Figure 5.1** Scree plot for the PCA of the C-MEQ-R<sup>2</sup>

<sup>2</sup> The interpretation of the plot is ambiguous indicating that a 3 or 4 factor solution might be appropriate. Based on the plot and the theorised underlying structure of the questionnaire, a 4-factor solution was subsequently adopted.

**Table 5.1** Principal component analysis with a varimax rotation of the C-MEQ (28 items; five factors): factor loadings

Item	Subscale of the original MEQ	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
24. I notice when I'm eating from a dish of sweets just because it's there.	External cues	<b>-.63</b>	.04	.02	-.13	.06
19. When I'm sad, I eat to feel better.	Emotional response	<b>.57</b>	.21	-.11	-.23	-.20
17. When I'm feeling stressed at school, I'll go find something to eat.	Emotional response	<b>.56</b>	.27	-.19	-.11	-.24
27. I have trouble not eating ice cream, cookies, or crisps if they're around the house.	Emotional response	<b>.55</b>	.15	.01	.06	-.17
23. I recognise when I'm eating and not hungry.	External cues	<b>-.54</b>	.08	.13	-.15	.01
13. I snack without noticing that I'm eating.	Emotional response	<b>.51</b>	.14	-.19	.17	.27
8. I notice when just going into a movie theatre makes me want to eat sweets or popcorn.	External cues	<b>-.49</b>	.06	.03	-.05	-.08
4. I recognise when food advertisements make me want to eat.	External cues	<b>-.45</b>	-.04	-.11	-.25	.23
15. I stop eating when I'm full even when eating something I love.	Disinhibition	-.04	<b>.72</b>	.18	.02	.07
5. When a restaurant portion is too large, I stop eating when I'm full.	Disinhibition	.07	<b>.59</b>	.10	-.24	.18
11. If there're leftovers that I like, I take a second helping even though I'm full.	Disinhibition	.21	<b>.58</b>	-.28	.30	-.12
18. If there's good food at a party, I'll continue eating even after I'm full.	Disinhibition	.30	<b>.52</b>	-.15	.22	.10
25. <i>When I'm at a restaurant, I can tell when the portion I've been served is too large for me.</i>	Disinhibition	-.02	.39	.35	-.11	.09
21. Before I eat I take a moment to appreciate the colours and smells of my food.	Awareness	-.13	.02	<b>.73</b>	-.04	.15
22. I taste every bite of food that I eat.	Awareness	-.10	.02	<b>.68</b>	.11	.01
16. I appreciate the way my food looks on my plate.	Awareness	-.05	.02	<b>.54</b>	-.18	.36
1. I eat so quickly that I don't taste what I'm eating.	Distraction	-.02	.10	.16	<b>.58</b>	.09
7. When I'm eating one of my favourite foods, I don't recognise when I've had enough.	Disinhibition	-.07	.35	-.12	<b>.52</b>	-.10

2. When I eat at "all you can eat" buffets, I tend to overeat.	Disinhibition	.28	.23	-.00	<b>.50</b>	.05
28. I think about things I need to do while I'm eating.	Distraction	-.02	-.03	-.35	<b>.44</b>	-.08
14. When I eat a big meal, I notice if it makes me feel heavy or sluggish.	External cues	-.17	.13	-.03	<b>-.41</b>	.04
3. <i>At a party where there is a lot of good food, I notice when it makes me want to eat more food than I should.</i>	External cues	-.05	.05	.05	-.39	.25
9. <i>If it doesn't cost much more, I get the larger size food or drink regardless of how hungry I feel.</i>	Disinhibition	.30	.22	-.19	.34	.12
12. When eating a pleasant meal, I notice if it makes me feel relaxed.	Awareness	-.19	.26	.09	.04	<b>.69</b>
10. I notice when there are subtle flavours in the foods that I eat.	Awareness	-.13	.03	.17	-.14	<b>.53</b>
6. My thoughts tend to wander while I'm eating.	Distraction	.25	.07	-.33	.23	<b>.48</b>
20. I notice when foods and drinks are too sweet.	Awareness	.12	-.15	.17	-.12	<b>.45</b>
26. <i>I notice when the food I eat affects my emotional state.</i>	Awareness	-.14	.24	.27	.07	.37
<b><i>Eigenvalue</i></b>		<b>4.23</b>	<b>2.79</b>	<b>1.59</b>	<b>1.35</b>	<b>1.22</b>
<b><i>Percentage variance explained</i></b>		<b>15.10</b>	<b>9.97</b>	<b>5.68</b>	<b>4.81</b>	<b>4.36</b>
<b><i>Cumulative percentage variance explained</i></b>				<b>39.91</b>		

Note: Loadings < .4 were suppressed.

**Table 5.2** Principal component analysis with a varimax rotation of the initial version of the C-MEQ-R (28 items, 5 factors): factor loadings

Item	Subscale of the original MEQ	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
R4. When watching food advertisements, I deliberately notice how it affects my desire to eat.	External cues	<b>.63</b>	-.14	.10	-.06	-.10
R12. When eating a pleasant meal, I deliberately notice how it affects my bodily sensations.	Awareness	<b>.62</b>	.02	.18	-.21	-.03
R26. When I'm eating, I deliberately notice how the food I eat affects my emotional state.	Awareness	<b>.56</b>	-.04	.15	-.32	-.02
R14. When I eat a big meal, I deliberately notice how it might affect my bodily sensations.	External cues	<b>.54</b>	.00	.33	-.02	-.18
R3. When there is a lot of good food around, I pay attention to how it might affect my desire to eat.	External cues	<b>.52</b>	.04	.22	-.19	.02
R8. When going into a movie theatre, I deliberately notice whether it makes me want to eat sweets or popcorn.	External cues	<b>.51</b>	-.34	-.07	.06	.06
R24. I deliberately notice whether I'm eating snacks just because they're there.	External cues	<b>.51</b>	-.05	-.04	-.14	.25
1. I eat so quickly that I don't taste what I'm eating.	Distraction	.07	<b>.56</b>	.12	-.16	-.03
9. If it doesn't cost much more, I get the larger size food or drink regardless of how hungry I feel.	Disinhibition	-.13	<b>.54</b>	.05	.19	.01
7. When I'm eating one of my favourite foods, I don't recognise when I've had enough.	Disinhibition	-.01	<b>.54</b>	-.08	.14	.16
2. When I eat at "all you can eat" buffets, I tend to overeat.	Disinhibition	-.25	<b>.52</b>	.00	.01	.20
11. If there're leftovers that I like, I take a second helping even though I'm full.	Disinhibition	.02	<b>.51</b>	-.19	.28	.29
28. I think about things I need to do while I'm eating.	Distraction	-.01	<b>.48</b>	-.30	-.08	-.16
18. If there's good food at a party, I'll continue eating even after I'm full.	Disinhibition	-.16	<b>.42</b>	.03	.19	.18
13. I snack without noticing that I'm eating.	Emotional response	-.30	.39	.20	.39	-.14
R23. I recognise when I'm eating even though I'm not hungry.	External cues	.16	.10	<b>.55</b>	.13	-.05
20. I notice when foods and drinks are too sweet.	Awareness	-.15	.02	<b>.55</b>	.08	.07
R10. I deliberately notice the subtle flavours in the foods that I eat.	Awareness	.24	-.02	<b>.54</b>	-.07	-.04
R16. Before I eat, I take a moment to appreciate the way my food looks on my plate.	Awareness	.20	-.07	<b>.54</b>	-.29	.14

21. Before I eat I take a moment to appreciate the colours and smells of my food.	Awareness	.09	-.18	<b>.51</b>	-.26	.24
22. I taste every bite of food that I eat.	Awareness	.15	.04	<b>.46</b>	-.20	.12
25. When I'm at a restaurant, I can tell when the portion I've been served is too large for me.	Disinhibition	.19	-.03	<b>.45</b>	.21	.20
19. When I'm sad, I eat to feel better.	Emotional response	-.18	-.08	.02	<b>.72</b>	.05
17. When I'm feeling stressed at school, I'll go find something to eat.	Emotional response	-.15	.10	-.05	<b>.67</b>	.06
27. I have trouble not eating ice cream, cookies, or crisps if they're around the house.	Emotional response	-.21	.19	.03	.37	.13
15. I stop eating when I'm full even when eating something I love.	Disinhibition	.08	.16	.20	.12	<b>.70</b>
5. When a restaurant portion is too large, I stop eating when I'm full.	Disinhibition	-.05	.17	.27	.11	<b>.53</b>
6. My thoughts tend to wander while I'm eating.	Distraction	.09	.39	.06	.29	<b>-.51</b>
<b>Eigenvalue</b>		<b>4.60</b>	<b>2.82</b>	<b>1.62</b>	<b>1.33</b>	<b>1.26</b>
<b>Percentage variance explained</b>		<b>16.42</b>	<b>10.08</b>	<b>5.80</b>	<b>4.76</b>	<b>4.51</b>
<b>Cumulative percentage variance explained</b>				<b>41.56</b>		

Note: Loadings < .4 were suppressed. R: revised item

*Step 2: Reliability analysis of the C-MEQ and the C-MEQ-R*

Reliability analysis with both questionnaires was carried out based on the factors yielded in step 1. Considering there were only three to eight items on each factor, Cronbach's alpha above .6 was considered as acceptable. According to Field (2005), items with an item-total correlation below .25 should be considered for elimination. As shown in **Table 5.3**, only two factors showed acceptable internal consistency. The other three factors showed low internal consistency. Particularly, factor 1 showed negative internal consistency coefficient ( $\alpha = -.16$ ), and all items on this factor had small item-total correlation. The internal consistency of the whole questionnaire was poor (Cronbach's  $\alpha = .44$ ).

Compared to the C-MEQ, the C-MEQ-R showed better internal consistency (Cronbach's  $\alpha = .59$ ). As shown in **Table 5.4**, Cronbach's  $\alpha$  for all factors of the C-MEQ-R are acceptable, except for factor 5 which had a very poor internal consistency coefficient ( $\alpha = .16$ ). Unlike the other four factors demonstrating a relatively clear domain, factor 5 consisted of only three items, with two items on *disinhibition* and one on *distraction* subscale of the original MEQ, which did not appear to assess the same structure. One interesting finding revealed by the results of reliability analysis with the C-MEQ-R was that all items on *distraction* subscale of the original MEQ (i.e., item 1, 6, and 28) had low item-total correlation ( $r < .25$ ), which should be considered for elimination. In step 1, the PCA was performed with a five-factor solution due to the theoretical structure of the original MEQ. However, if all items on *distraction* subscale were removed, then a four-factor solution should be selected instead. Therefore, in the next step, we performed factor analysis and reliability analysis again with the C-MEQ-R after removing the three items on *distraction* subscale of the original MEQ.

**Table 5.3** Cronbach's alpha coefficients for the factors of the C-MEQ and item-total correlations

Factors and items	Cronbach's $\alpha$	Item-total correlation <sup>a</sup>
<b>Factor 1</b>	<b>-.16</b>	<b>.26</b>
4. I recognise when food advertisements make me want to eat.		-.09
8. I notice when just going into a movie theatre makes me want to eat sweets or popcorn.		-.14
13. I snack without noticing that I'm eating.		-.02
17. When I'm feeling stressed at school, I'll go find something to eat.		.03
19. When I'm sad, I eat to feel better.		.12
23. I recognise when I'm eating and not hungry.		-.05
24. I notice when I'm eating from a dish of sweets just because it's there.		-.15
27. I have trouble not eating ice cream, cookies, or crisps if they're around the house.		-.08
<b>Factor 2</b>	<b>.64</b>	<b>.61</b>
18. If there's good food at a party, I'll continue eating even after I'm full.		.48
15. I stop eating when I'm full even when eating something I love.		.42
11. If there're leftovers that I like, I take a second helping even though I'm full.		.41
5. When a restaurant portion is too large, I stop eating when I'm full.		.36
<b>Factor 3</b>	<b>.61</b>	<b>.58</b>
21. Before I eat I take a moment to appreciate the colours and smells of my food.		.47
16. I appreciate the way my food looks on my plate.		.41
22. I taste every bite of food that I eat.		.37
<b>Factor 4</b>	<b>.21</b>	<b>.40</b>
2. When I eat at "all you can eat" buffets, I tend to overeat.		.21
7. When I'm eating one of my favourite foods, I don't recognise when I've had enough.		.19
1. I eat so quickly that I don't taste what I'm eating.		.19
28. I think about things I need to do while I'm eating.		.15
14. When I eat a big meal, I notice if it makes me feel heavy or sluggish.		-.20
<b>Factor 5</b>	<b>.38</b>	<b>.61</b>
12. When eating a pleasant meal, I notice if it makes me feel relaxed.		.31
10. I notice when there are subtle flavours in the foods that I eat.		.23
20. I notice when foods and drinks are too sweet.		.21
6. My thoughts tend to wander while I'm eating.		.07

<sup>a</sup> Individual item scores are correlated with the score of the factor that contains that item; factor scores are correlated with summary score.

**Table 5.4** Cronbach's alpha coefficients for the factors of the C-ME-R (initial version) and item-total correlations

Factor and items	Cronbach's $\alpha$	Item-total correlation
<b>Factor 1</b>	<b>.71</b>	<b>.14</b>
R26. When I'm eating, I deliberately notice how the food I eat affects my emotional state.		.49
R12. When eating a pleasant meal, I deliberately notice how it affects my bodily sensations.		.48
R4. When watching food advertisements, I deliberately notice how it affects my desire to eat.		.45
R3. When there is a lot of good food around, I pay attention to how it might affect my desire to eat.		.43
R14. When I eat a big meal, I deliberately notice how it might affect my bodily sensations.		.43
R24. I deliberately notice whether I'm eating snacks just because they're there.		.34
R8. When going into a movie theatre, I deliberately notice whether it makes me want to eat sweets or popcorn.		.31
<b>Factor 2</b>	<b>.66</b>	<b>.42</b>
11. If there're leftovers that I like, I take a second helping even though I'm full.		.50
18. If there's good food at a party, I'll continue eating even after I'm full.		.43
7. When I'm eating one of my favourite foods, I don't recognise when I've had enough.		.41
2. When I eat at "all you can eat" buffets, I tend to overeat.		.38
9. If it doesn't cost much more, I get the larger size food or drink regardless of how hungry I feel.		.36
*1. <i>I eat so quickly that I don't taste what I'm eating.</i>		.24
*28. <i>I think about things I need to do while I'm eating.</i>		.21
<b>Factor 3</b>	<b>.65</b>	<b>.59</b>
R16. Before I eat, I take a moment to appreciate the way my food looks on my plate.		.47
21. Before I eat I take a moment to appreciate the colours and smells of my food.		.44
R10. I deliberately notice the subtle flavours in the foods that I eat.		.40
22. I taste every bite of food that I eat.		.37
R23. I recognise when I'm eating even though I'm not hungry.		.31
25. When I'm at a restaurant, I can tell when the portion I've been served is too large for me.		.29
20. I notice when foods and drinks are too sweet.		.25
<b>Factor 4</b>	<b>.64</b>	<b>.68</b>
17. When I'm feeling stressed at school, I'll go find something to eat.		.47
19. When I'm sad, I eat to feel better.		.47



<b>Factor 5</b>	<b>.16</b>	<b>.49</b>
5. When a restaurant portion is too large, I stop eating when I'm full.		.23
15. I stop eating when I'm full even when eating something I love.		.16
*6. <i>My thoughts tend to wander while I'm eating.</i>		-.10

<sup>a</sup> Individual item scores are correlated with the score of the factor that contains that item; factor scores are correlated with summary score.

### *Step 3: Factor analysis and reliability analysis with a refined version of the C-MEQ-R*

A PCA with varimax rotation was performed with a refined version of the C-MEQ-R (25 items) using a four-factor solution. As shown in **Table 5.5**, one item did not load above .4 on any factor. The remaining items neatly loaded on four factors, accounting for 39.3% of the variance. Factor 1 included seven items which were clearly associated with *intentional awareness* of how food or food-related stimuli affect one's physical and emotional states. Factor 2 included seven items on *disinhibition* subscale of the original MEQ. Factor 3 consisted of seven items describing intentional attending to the sensory properties of food while eating, which can be seen as a reflection of *attentive eating*. Factor 4 consisted of three items on *emotional response* subscale of the original MEQ. Therefore, four domains labeled as *intentional awareness*, *disinhibition*, *attentive eating* and *emotional response* were identified.

The internal reliability of the four domains was then examined using Cronbach's alpha. *Intentional awareness*, *disinhibition* and *attentive eating* showed acceptable internal consistency, with Cronbachs' alpha ranging from .65 to .71. The *emotional response* subscale showed relatively low internal consistency ( $\alpha = .58$ ). The index 'alpha if item deleted' indicated that item 13 should be removed, which increased the Cronbach's alpha of *emotional response* subscale to .64. As shown in **Table 5.6**, the final C-MEQ-R consisted of 23 items and four subscales: *intentional awareness* (7 items), *disinhibition* (7 items), *attentive eating* (7 items), and *emotional response* (2 items). Cronbach's alpha for this 23-item scale was .62. Correlations between subscales and summary score of the C-MEQ-R ranged from .23 to .62. Descriptive statistics of and intercorrelation between subscales are shown in **Table 5.7**.

**Table 5.5** Principal component analysis with a varimax rotation of a refined version of the C-MEQ-R (25 items, 4 factors): factor loadings

Item	Subscale of the original MEQ	Factor 1	Factor 2	Factor 3	Factor 4
R14. When I eat a big meal, I deliberately notice how it might affect my bodily sensations.	External cues	<b>.64</b>	-.11	.19	.10
R4. When watching food advertisements, I deliberately notice how it affects my desire to eat.	External cues	<b>.63</b>	-.20	.07	-.03
R12. When eating a pleasant meal, I deliberately notice how it affects my bodily sensations.	Awareness	<b>.58</b>	-.03	.20	-.27
R24. I deliberately notice whether I'm eating snacks just because they're there.	External cues	<b>.55</b>	.05	.00	-.14
R3. When there is a lot of good food around, I pay attention to how it might affect my desire to eat.	External cues	<b>.54</b>	.01	.20	-.17
R26. When I'm eating, I deliberately notice how the food I eat affects my emotional state.	Awareness	<b>.53</b>	-.07	.19	-.36
R8. When going into a movie theatre, I deliberately notice whether it makes me want to eat sweets or popcorn.	External cues	<b>.41</b>	-.24	-.00	-.07
11. If there're leftovers that I like, I take a second helping even though I'm full.	Disinhibition	-.01	<b>.71</b>	-.15	.18
18. If there's good food at a party, I'll continue eating even after I'm full.	Disinhibition	-.22	<b>.65</b>	.08	.19
7. When I'm eating one of my favourite foods, I don't recognise when I've had enough.	Disinhibition	.02	<b>.57</b>	-.11	.06
2. When I eat at "all you can eat" buffets, I tend to overeat.	Disinhibition	-.23	<b>.56</b>	-.01	-.05
9. If it doesn't cost much more, I get the larger size food or drink regardless of how hungry I feel.	Disinhibition	-.03	<b>.51</b>	-.10	.21
15. I stop eating when I'm full even when eating something I love.	Disinhibition	.04	<b>.49</b>	.29	.03
5. When a restaurant portion is too large, I stop eating when I'm full.	Disinhibition	-.03	<b>.46</b>	.25	.04
21. Before I eat I take a moment to appreciate the colours and smells of my food.	Awareness	.06	-.12	<b>.66</b>	-.26
R16. Before I eat, I take a moment to appreciate the way my food looks on my plate.	Awareness	.17	-.09	<b>.64</b>	-.18
R10. I deliberately notice the subtle flavours in the foods that I eat.	Awareness	.19	-.05	<b>.56</b>	-.05
22. I taste every bite of food that I eat.	Awareness	.18	-.03	<b>.52</b>	-.16
20. I notice when foods and drinks are too sweet.	Awareness	-.10	.07	<b>.51</b>	.18
25. When I'm at a restaurant, I can tell when the portion I've been served is too large for me.	Disinhibition	.25	.03	<b>.43</b>	.34
R23. I recognise when I'm eating even though I'm not hungry.	External cues	.29	.08	<b>.40</b>	.27

17. When I'm feeling stressed at school, I'll go find something to eat.	Emotional response	-.12	.18	-.13	<b>.68</b>
19. When I'm sad, I eat to feel better.	Emotional response	-.22	.04	-.02	<b>.67</b>
13. I snack without noticing that I'm eating.	Emotional response	-.19	.34	.00	<b>.44</b>
27. I have trouble not eating ice cream, biscuits, or crisps if they're around the house.	Emotional response	-.15	.27	-.02	.39
<b><i>Eigenvalue</i></b>		<b>4.49</b>	<b>2.74</b>	<b>1.35</b>	<b>1.25</b>
<b><i>Percentage variance explained</i></b>		<b>17.98</b>	<b>10.97</b>	<b>5.38</b>	<b>5.01</b>
<b><i>Cumulative percentage variance explained</i></b>			<b>39.34</b>		

Note: Loadings < .4 were suppressed. R: revised item

**Table 5.6** Cronbach's alpha coefficients for the factors of the C-MEQ-R (final version) and item-total correlations

Factor and items	Cronbach h's $\alpha$	Item-total correlation <sup>a</sup>
<b>Factor 1: Intentional awareness</b>	<b>.71</b>	<b>.23</b>
R26. When I'm eating, I deliberately notice how the food I eat affects my emotional state.		.49
R12. When eating a pleasant meal, I deliberately notice how it affects my bodily sensations.		.48
R4. When watching food advertisements, I deliberately notice how it affects my desire to eat.		.45
R3. When there is a lot of good food around, I pay attention to how it might affect my desire to eat.		.43
R14. When I eat a big meal, I deliberately notice how it might affect my bodily sensations.		.43
R24. I deliberately notice whether I'm eating snacks just because they're there.		.34
R8. When going into a movie theatre, I deliberately notice whether it makes me want to eat sweets or popcorn.		.31
<b>Factor 2: Disinhibition</b>	<b>.68</b>	<b>.57</b>
18. If there's good food at a party, I'll continue eating even after I'm full.		.54
11. If there're leftovers that I like, I take a second helping even though I'm full.		.52
15. I stop eating when I'm full even when eating something I love.		.35
2. When I eat at "all you can eat" buffets, I tend to overeat.		.35
7. When I'm eating one of my favourite foods, I don't recognise when I've had enough.		.35
9. If it doesn't cost much more, I get the larger size food or drink regardless of how hungry I feel.		.33
5. When a restaurant portion is too large, I stop eating when I'm full.		.32
<b>Factor 3: Attentive eating</b>	<b>.65</b>	<b>.50</b>
R16. Before I eat, I take a moment to appreciate the way my food looks on my plate.		.47
21. Before I eat I take a moment to appreciate the colours and smells of my food.		.44
R10. I deliberately notice the subtle flavours in the foods that I eat.		.40
22. I taste every bite of food that I eat.		.37
R23. I recognise when I'm eating even though I'm not hungry.		.31
25. When I'm at a restaurant, I can tell when the portion I've been served is too large for me.		.29
20. I notice when foods and drinks are too sweet.		.25
<b>Factor 4: Emotional response</b>	<b>.64</b>	<b>.62</b>
17. When I'm feeling stressed at school, I'll go find something to eat.		.47
19. When I'm sad, I eat to feel better.		.45

<sup>a</sup> Individual item scores are correlated with the score of the factor that contains that item; factor scores are correlated with summary score.

**Table 5.7** C-MEQ-R domains: descriptive statistics and intercorrelations

Domain	Range	Mean	SD	IA	DIS	AE	ER
Intentional Awareness	1 – 4	2.28	.51	-			
Disinhibition	1 – 4	2.74	.56	-.25***	-		
Attentive Eating	1.14 – 4	2.40	.51	.39***	.05	-	
Emotional Response	1 – 4	2.71	.84	-.34***	.29***	-.14**	-
<i>Summary score</i>	1.61 – 3.43	2.53	.30	.23***	.57***	.50***	.62***

\*\*  $p < .01$ ; \*\*\*  $p < .001$ . IA: intentional awareness; DIS: disinhibition; AE: attentive eating; ER: emotional response.

*Step 4: Correlations of the C-MEQ and the C-MEQ-R with other variables*

As shown in **Table 5.8**, the C-MEQ-R was positively correlated with the FFMQ ( $r = .32; p < .001$ ). All subscales except for *emotional response* showed a positive correlation with the FFMQ. The C-MEQ-R was negatively correlated with *emotional eating* ( $r = -.34; p < .001$ ) and *external eating* ( $r = -.22; p < .001$ ) on the DEBQ as expected, although interestingly, some subscales showed positive correlations with these unhealthy eating styles. There was also a significantly negative correlation between the C-MEQ-R and BMI ( $r = -.10, p < .05$ ).

**Table 5.8** Pearson correlation coefficients showing the relations between the scores on the C-MEQ-R, the C-MEQ and other measures (n = 430)

	C-MEQ-R					C-MEQ
	Intentional Awareness	Disinhibition	Attentive Eating	Emotional Response	Summary score	
<b>FFMQ</b>	.23***	.18***	.32***	.02	.32***	.26***
Observing	.39***	-.06	.57***	-.19***	.25***	.19***
Describing	.26***	.08	.27***	.02	.27***	.13**
Actaware	-.17***	.27***	-.07	.14**	.12*	.25***
Non-judging	-.23***	.11*	-.37***	.11*	-.13**	-.11*
Non-reactivity	.29***	-.06	.32***	-.07	.18***	.05
<b>DEBQ</b>						
Emotional eating	.37***	-.29***	.04	-.55***	-.34***	-.37***
External eating	.29***	-.36***	.20***	-.38***	-.22***	-.23***
<b>BMI</b>	-.10*	-.06	-.10*	.01	-.10*	-.07

\*  $p < .05$ ; \*\*  $p < .01$  \*\*\*  $p < .001$ ; *Actaware*: acting with awareness

Correlations between the C-MEQ and other measures are also shown in **Table 5.8**. The scores on the C-MEQ were calculated using the original scoring method of the MEQ (Framson et al.,

2009). Similar to the C-MEQ-R, the C-MEQ also showed a positive correlation with the FFMQ ( $r = .26; p < .001$ ), and was negatively correlated with *emotional eating* ( $r = -.37; p < .001$ ) and *external eating* ( $r = -.23; p < .001$ ) on the DEBQ. However, compared to the C-MEQ, there was a stronger correlation between the C-MEQ-R and the FFMQ. The correlation between the C-MEQ and BMI was not significant.

## 5.4 Discussion

The main purpose of this study was to examine the psychometric properties of a revised Chinese version of the MEQ (C-MEQ-R). The final C-MEQ-R consists of 23 items that make up four domains: intentional awareness, disinhibition, attentive eating, and emotional response.

The original MEQ contains five domains: awareness, disinhibition, external cues, emotional response, and distraction. Results of PCA and consistency reliability analysis of the C-MEQ-R suggested that the three items on *distraction* should be considered for elimination. These items loaded on two factors with other items on *disinhibition*, which made these factors difficult to define (Table 5.2). Also, these items showed low item-total correlations in the reliability analysis (Table 5.4). Previous studies have reported poor reliability of *distraction* ( $\alpha < .60$ ) (Beshara et al., 2013; Moor et al., 2013). In our survey study with adolescents (Chapter 2), *distraction* of the MEQ showed poor internal reliability in both the Chinese ( $\alpha = .34$ ) and the UK ( $\alpha = .33$ ) sample. These findings and evidence suggested that these items were not measuring the same construct with each other, or any other items of the questionnaire, and therefore dropped.

Of the four domains of the final C-MEQ-R, *disinhibition* and *emotional response* were very similar to the original MEQ. *Emotional response* consisted of two of the four items on emotional response subscale of the original MEQ. Item 27 ('*I have trouble not eating ice cream, biscuits, or crisps if they're around the house*') was dropped due to low factor loading. Item 13 ('*I snack without noticing that I am eating*') was removed based on the result of reliability analysis. As reported by Framson et al. (2009), these items were originally developed to assess other hypothesised domains, but unexpectedly loaded on the *emotional response* factor. They suggested that the clustering of these items might reflect a unique characteristic of the study sample. Results of the present study indicated that these items should be excluded from the *emotional response*

domain.

*Disinhibition* of the C-MEQ-R contains seven of the eight items on disinhibition subscale of the original MEQ. The only difference was item 25 ('*When I'm at a restaurant, I can tell when the portion I've been served is too large for me*'). This item loaded on another factor clearly associated with individuals' intentional attending to the properties of food consumed, which was labeled as *attentive eating*. Attentive eating has been suggested as a key mindful eating strategy (Warren et al., 2017). It appears reasonable that item 25 loaded on this factor, as it too describes awareness of food properties (i.e., portion size).

Interestingly, seven of the 10 revised items loaded on the same factor. These items were originally designed to evaluate respondents' awareness of how food or food-related stimuli affect their physical and emotional sensations. However, from the think-aloud study, we found that participants tended to respond by considering whether the situation ever occurred, rather than on their notice of it when it happened. Based on these findings, we rephrased these items with a specific emphasis on intentional noticing. Therefore, this factor was labeled as *intentional awareness*.

The C-MEQ-R and its subscales demonstrated acceptable internal consistency reliability. The Cronbach's  $\alpha$  for the C-MEQ-R summary score was .62, which was similar to the internal consistency coefficient of the MEQ reported by the authors ( $\alpha = .64$ ) (Framson et al., 2009). All subscales were significantly and positively correlated with the C-MEQ-R summary score. In addition, the C-MEQ-R summary score were significantly correlated with the FFMQ as well as *emotional eating* and *external eating* of the DEBQ in expected direction, which indicated good preliminary convergent validity.

However, there were some unexpected findings regarding associations between the C-MEQ-R subscales and theoretically related measures. For example, scores on *intentional awareness* were positively correlated with *emotional eating* and *external eating* of the DEBQ. A longitudinal study with a sample of 300 young adult women found that higher scores on *observing* (i.e., tendency to notice internal and external stimuli) of the FFMQ predicted higher emotional and external eating across six months (Sala & Levinson, 2017). One potential explanation suggested by the authors was that the increased awareness of emotional and external cues might lead to eating in response to such cues. In the context of mindful eating, it was expected that increased

awareness of triggers for eating and eating-related experiences could interrupt the automatic processes of emotional eating and external eating, and therefore enabling intentional behavioural regulation on these eating behaviours (Warren et al., 2017). However, as most of our participants were young adults who probably had little experience in mindfulness or mindful eating, noticing eating-related internal or external stimuli does not necessarily mean they would have intentions or skills to regulate their behaviours accordingly. In the present study, *intentional awareness* of the C-MEQ-R was positively correlated with *observing*, *describing* and *non-reactivity*, but negatively correlated with *act with awareness* and *non-judging* of the FFMQ. This suggested that in our sample, those who tended to notice or attend to eating-related experiences were less accepting of their inner experience, and more likely to act on automatic pilot. Therefore, their awareness of external and internal eating triggers could lead to increased but not decreased eating behaviours.

Similarly, scores on *attentive eating* was positively correlated with *external eating*. In mindfulness-based approaches for healthy eating and weight control, participants are guided to pay close attention to sensory properties of food, through which their eating pleasure and memory for food consumed could be enhanced (Arch et al., 2016; Robinson, Blissett, & Higgs, 2013). However, for individuals who had no experience in mindfulness, tendency to attending to food properties could partially reflect their interest in food. Participants who scored higher on *attentive eating* could be more interested in food or more attentive to external food cues, and therefore reported higher levels of external eating. In addition, *attentive eating* was also shown to be negatively correlated with *non-judging* on the FFMQ. In the present study, domains of the C-MEQ-R showed a different pattern of associations with mindfulness facets assessed using the FFMQ, although most C-MEQ-R domains and its summary score were significantly correlated with the total score of the FFMQ in the expected direction. Further research is needed to investigate the associations between the different domains of mindful eating and mindfulness facets, as well as other eating styles. Particularly, two C-MEQ-R domains, *intentional noticing* and *attentive eating*, were negatively correlated with *non-judging* of the FFMQ. One important critique of the MEQ was that it failed to measure the acceptance component of mindful eating (Hulbert-Williams et al., 2014). The present study found that attention to and awareness of eating experiences measured by the C-MEQ-R was not necessarily accompanied by acceptance of these



experiences. This should be taken into consideration when interpreting the scores on the C-MEQ-R, and more studies are needed to further improve this measure of mindful eating.

To investigate whether the revision of the questionnaire items improved its reliability and validity, we also examined the factor structure and reliability of the C-MEQ containing 28 original items. When performing a PCA with the 28-item C-MEQ using a five-factor solution, however, the factors revealed appeared problematic (Table 5.1). Most items on *external cues* and *emotional response* loaded on the same factor, but were correlated with this factor in the opposite direction, which led to a very low internal reliability of this factor (Table 5.3). As discussed above, items on *external cues* were designed to assess individuals' intentional awareness of external triggers for eating (e.g., 'I recognise when food advertisements make me want to eat.'). However, as revealed in the think-aloud study, respondents tended to rate these items as the extent to which these behaviours actually happened. Therefore, original items on *external cues* were measuring external eating more than respondents' awareness of it. Items on emotional response were designed to assess respondents' emotional eating (e.g., 'when I'm sad, I eat to feel better'), and then reversed scored to represent tendency of mindful eating. Generally, there was a positive correlation between emotional eating and external eating (e.g., in the present sample, the correlation between *emotional eating* and *external eating* of the DEBQ was  $r = .41$ ). This might explain why the original items on *external cues* and *emotional response* loaded on the same factor, and were negatively correlated with each other. Of the other four factors, two factors showed very low internal consistency reliability, and were difficult to define.

As the domains of the C-MEQ yielded by PCA appeared problematic, we calculated summary scores of the C-MEQ using the original scoring method (Framson et al., 2009), and examined its correlations with measures of mindfulness, unhealthy eating styles as well as BMI. The C-MEQ was significantly correlated with the FFMQ and *emotional eating* and *external eating* of the DEBQ in the expected direction. Compared to the C-MEQ, there was a stronger medium-sized correlation between the C-MEQ-R and the FFMQ. The BMI was also significantly negatively correlated with the C-MEQ-R, but not with the C-MEQ. Overall, the C-MEQ-R showed better factor structure validity, internal reliability and convergent validity compared to the C-MEQ. The C-MEQ-R is also shorter than the C-MEQ, which could reduce response burden and be more time efficient.

### *Evaluation*

There are some limitations to this study. First, the sample of this study consisted mostly of undergraduates and females, which limits the generalisability of the findings. Further studies are needed to establish the psychometric properties of the C-MEQ-R in various populations. Second, although we assumed that most of our participants had limited experiences in mindfulness or meditation, we did not measure it. As mindfulness experiences could influence one's interpretations of related measures, future studies should carefully measure and categorise this characteristic of participants, or compare the psychometric properties of the questionnaire between meditators and non-meditators. Third, this study did not examine test-retest reliability of the C-MEQ-R. Another limitation is that as the same to the MEQ, the C-MEQ-R did not include items assessing mindfulness acceptance. We revised the MEQ based on the findings of our think-aloud study, and therefore adding items and domains to the questionnaire was beyond the scope of this study. Further efforts regarding this issue are suggested. There are also some strengths. The sample size was adequate for analysis conducted with the data (Tabachnick & Fidell, 2014; p666). To our knowledge, this was the first attempt to validate a Chinese version of a mindful eating assessment.

### **5.5 Conclusion**

We characterised the psychometric properties of the C-MEQ-R. Overall, the C-MEQ-R showed good structure factor validity, convergent validity and acceptable internal reliability among a sample of Chinese undergraduates. Compared to the C-MEQ, the C-MEQ-R showed better validity and reliability with fewer items. Further studies are needed to examine its test-retest reliability, and investigate its psychometric properties among more general populations.

## **Chapter 6. Promoting weight loss by improving snacking: development of an online mindful snacking intervention for overweight Chinese adolescents**

### **6.1 Chapter overview**

This chapter describes the development of an online mindful snacking intervention for overweight Chinese adolescents. The study draws on understandings of digital interventions, mindfulness-based interventions and planning strategies in promoting health behaviour and weight loss, as well as the findings of our survey and focus group study. The intervention was designed and developed using the Behavioural Change Wheel (BCW) and the COM-B model, followed by user consultation and subsequent refinement. From this process, we developed an online weight loss programme targeting unhealthy snacking incorporating nutrition education, mindful eating strategies and planning. The development process and the intervention are outlined in this chapter.

### **6.2 Digital interventions for health behaviour change and weight loss**

With Internet availability and smartphone ownership rapidly growing, digital platforms have been increasingly used to deliver interventions for weight loss and related behaviour change. Digital interventions have shown certain advantages compared to traditional face-to-face interventions including reach, privacy, flexibility and standardised (Ritterband et al., 2003; Wantland, Portillo, Holzemer, Slaughter, & McGhee, 2004).

Various digital platforms have been utilised to promote a wide range of health-related behaviours. A systematic review (Webb, Joseph, Yardley, & Michie, 2010) of 85 studies involving 43,236 participants showed that overall, digital behaviour change interventions (DBCIs) had a statistically small but significant effect on targeted behaviour, such as PA, dietary behaviour and smoking abstinence. DBCIs have also been employed and evaluated within the context of weight loss. For example, Lyzwinski (2014) reviewed 12 behavioural weight loss interventions using mobile phones and devices for overweight/obese adults in the USA and Europe. The review showed effectiveness of mobile interventions for promoting weight loss as well as improving

dietary behaviours and PA levels. Both reviews (Lyzwinski, 2014; Webb et al., 2010) recommended the utilisation of behavioural change theories in developing DBCIs, such as social cognitive theory (Bandura, 1989), the theory of reasoned action/planned behaviour (Ajzen, 1991) and implementation intentions (Gollwitzer, 1999). Behaviour change techniques (BCTs) also appear important to intervention outcomes. Commonly used BCTs include self-monitoring, goal setting, provision of general health information, barrier identification and feedback. Promoting encouragement, prompting practice and providing social support are also frequently used in mobile weight loss interventions (Lyzwinski, 2014). In addition, Webb et al. (2010) suggested that personal contact, especially access to an advisor for advice, might help to promote behaviour change. In recent years, DBCIs have also been increasingly implemented in developing countries, particularly in Asia. Although research in developing countries is still in its infancy, there is preliminary evidence supporting the feasibility and effectiveness of DBCIs in improving healthy diets and PA (Müller, Alley, Schoeppe, & Vandelanotte, 2016).

### **DBCIs for adolescent weight loss**

Evidence for the effectiveness of DBCIs for adolescent weight loss is insufficient and mixed. Chen and Wilkosz (2014) reviewed 10 RCTs and four clinical trials examining the effectiveness of digital interventions for weight loss/maintenance in adolescents aged 12 to 18 years. Six of the 11 interventions targeting overweight/obese adolescents, including four Internet-based interventions and two active video-games, appeared effective in reducing BMI or percentage body fat in the short term (i.e., less than 12 months of follow-up) (e.g., Christison & Khan, 2012; Doyle et al., 2008; Madison et al., 2011). All of these effective interventions aimed to promote weight loss by improving dietary behaviours and/or PA using strategies such as nutrition education, CBT techniques and providing opportunities for PA. The limited evidence suggests that digital interventions between 10 and 16 weeks with weekly intervention components have the best potential to reduce adolescent overweight/obesity.

In a more recent study, Rose and colleagues (2017) reviewed a wider range of digital interventions (n = 26) aiming to improve healthy eating and PA levels in adolescents aged 10 to

19 years. Most interventions were delivered online, but other platforms included text messages, games, apps, email, and social media. This review showed that DBCIs can be effective in improving adolescent diet and PA behaviours, and suggested that the effective interventions usually included education on the importance of healthy diet and/or PA, setting specific goals, providing a means of progress monitoring, and parent involvement (e.g., Lubans, Morgan, & Tudor-Locke, 2009; Smith et al., 2014). Other recommended features of DBCIs for improving adolescent healthy eating included personal contact and individually tailored feedback (An, Hayman, Park, Dusaj, & Ayres, 2009; Hamel & Robbins, 2013). As most of the reviewed interventions were delivered via websites (Hamel & Robbins, 2013; Rose et al., 2017), it cannot be concluded which platforms are superior for DBCIs for adolescents. Rose et al. (2017) suggested that smartphone-based interventions could be low-cost and widely accessible to adolescents, but more research on their feasibility and effectiveness is still needed.

There is no conclusive evidence for whether the usage of behaviour change theories can improve the effectiveness of DBCIs for healthy eating and weight loss in adolescents. For example, Hamel and Robbins (2013) found that although DBCIs based on behaviour change theories such as social cognitive theory and TPB were effective in improving healthy eating in adolescents, some non-theoretical-based interventions also showed positive dietary outcomes and related physical changes (e.g., Casazza & Ciccazzo, 2007; Doyle et al., 2008). Therefore, although previous reviews (Lyzwinski, 2014; Webb et al., 2010) of general DBCIs recommended use of theories to inform the interventions, it is unclear whether the application of theory serves as an active component, or which theories are optimal for digital weight control or/and healthy eating interventions for adolescents.

Overall, there is preliminary evidence for the short-term but not long-term (12m+) effectiveness of DBCIs in promoting adolescent weight loss and related behaviours. Health education, goal-setting, self-monitoring, personal contact and parent involvement appear to be effective intervention components. Further evidence is needed to identify optimal behaviour change theories to underpin DBCIs for adolescent weight loss.

### **6.3 Mindfulness, mindfulness-based interventions and mindfulness in weight loss**

This section describes the potential of mindfulness-based interventions (MBIs) to improve eating behaviour and promote weight loss. Following an explanation of mindfulness within modern psychology, the section focuses on the potential effects and mechanisms of MBIs in promoting weight loss, including via digital platforms.

### **Mindfulness: concepts and core components**

Although there are various definitions of the term ‘mindfulness’, a frequently cited definition is by Kabat-Zinn (2003) as ‘awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience moment by moment’.

This definition proposes several core components of mindfulness. It posits that mindfulness is fundamentally a quality of awareness, with an emphasis on the central role of attention. In addition, it describes an intentional regulation of attention towards present moment experience, with an attitude of acceptance. Since the original definition, researchers have tried to further conceptualise the core constructs or processes involved in mindfulness and different models have been proposed (e.g., Brown & Ryan, 2003; Langer & Moldoveanu, 2000). However, Bishop and Shapiro offer well accepted proposals as to the core constructs. Bishop et al. (2004) proposed two core components of mindfulness: attention regulation and a stance of acceptance. Shapiro et al. (2006) put forward a similar three-component model of mindfulness including key features of *attention* and *attitude*, alongside another component *intention*, which refers to the particular purpose of practicing mindfulness.

### **State and dispositional mindfulness**

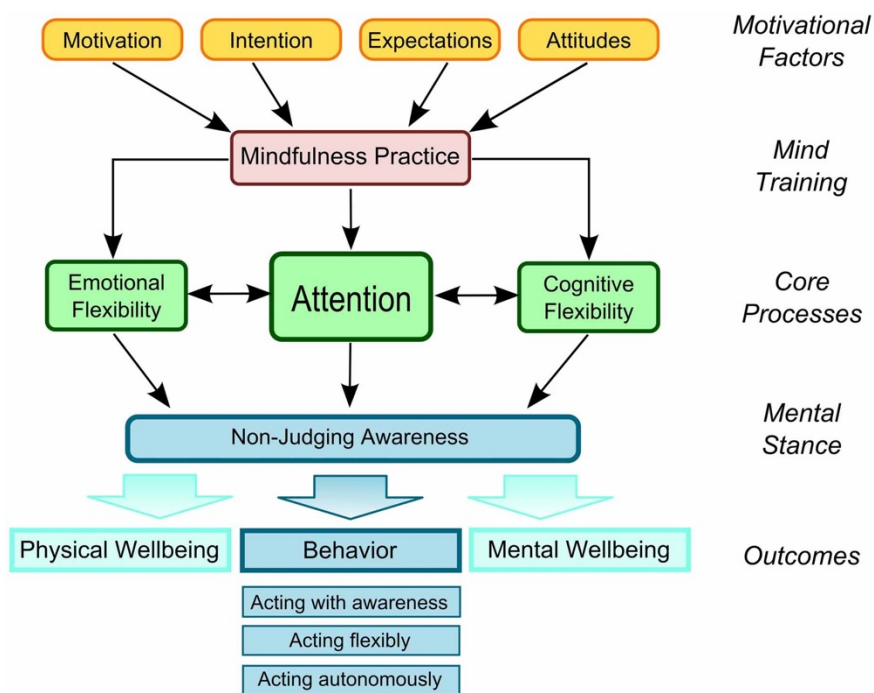
Mindfulness has been conceptualised as both a state of being present (in a non-judgmental way), and a dispositional trait (referring to the tendency of individuals to be mindful in everyday life). State mindfulness is context dependent and variable within persons over time, and it can be induced by short meditation practice. Dispositional mindfulness, in comparison, is relatively stable and varies between individuals, and it can be further cultivated through repeated meditation

practice (Brown & Ryan, 2003; Kiken et al., 2015). High levels of both state and dispositional mindfulness have been found to be associated with good well-being and emotional regulation, in adults (e.g., Bao, Xue & Kong, 2015; Branstrom et al., 2011; Friese & Hofmann, 2016) and adolescents (e.g., Bluth & Blanton, 2014; Pepping, Duvenage, Cronin, & Lyons, 2016). Preliminary evidence has shown a relationship between high dispositional mindfulness and low impulsivity (Lattimore, Fisher & Malinowski, 2011; Peters, Erisman, Upton et al, 2011; Murphy & MacKillop, 2012; Reid, Bramen, Anderson, & Cohen, 2014) and disinhibition (Lattimore et al., 2011), as well as fewer impulsive behaviours including gambling and substance use (Bowen & Enkema, 2014; Lakey, Campbell, Brown, & Goodie, 2007; Murphy & MacKillop, 2012) among adults. A study with a large sample of adolescents (n = 1051; mean age = 15.6 years) showed a negative association between a high score on dispositional mindfulness and the likelihood of lifetime alcohol/drug use (Robinson, Ladd, & Anderson, 2014). Recent research has also explored the role of mindfulness in eating behaviour, showing negative associations between dispositional mindfulness and emotional eating and external eating (Pidgeon et al., 2013; Ouwens et al., 2015), and both dispositional and state mindfulness with impulsive eating and calorie consumption (Jordan et al., 2014) among adults.

### **Mindfulness-based interventions (MBIs): mechanisms of action**

As suggested by Grossman and Van Dam (2011), mindfulness in Buddhist texts primarily referred to a practice of meditation that involves distinct phases ranging from observing bodily sensations to expanding attention to emotions, thoughts and values. This meditation practice initially was adopted in the West as an essential technique in clinical treatments targeting physiological and mental distress. These treatments are typically referred to as mindfulness-based interventions (MBIs; Baer, 2003; Kabat-Zinn, 2003). Two standardised mindfulness programmes - Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1982) (originally introduced as a practice for pain management), and Mindfulness-Based Cognitive Therapy (MBCT; Segal, Williams, & Teasdale, 2013) (to prevent depressive relapses), are the most extensively employed and evaluated standardised MBIs (Gu, Strauss, Bond & Cavanagh, 2015). Both interventions are

eight-week group-based programmes in which participants are trained to cultivate mindfulness through a series of formal and informal meditation practice. By practicing mindfulness, participants build attention and awareness of whatever is present in the moment, without the need to avoid or alter any sensations, emotions or thoughts (Kabat-Zinn, 2003). Qualities such as gratitude and self-compassion are also promoted via mindfulness practice (Shapiro, Schwartz, & Santerre, 2002). By cultivating these qualities, more adaptive cognitive coping and emotion regulation strategies appear to develop to replace previous maladaptive tendencies such as avoidance, rumination and emotional distortion or suppression. As a result, participants report experiencing alleviated emotional distress and greater well-being and life satisfaction (Baer, 2003; Gu et al., 2015). Malinowski (2013) proposed the Liverpool Mindfulness Model integrating the dynamics of mindfulness, which structures the process of mindfulness into five main tiers from individuals' motivation to engage in mindfulness practice to its beneficial outcomes, with an emphasis on the central role of mindfulness attention (Figure 6.1).



**Figure 6.1** The Liverpool Mindfulness Model (Malinowski, 2013)

In the UK, MBIs have been recommended by the National Institute for Clinical Excellence (NICE) as a treatment for preventing depressive relapse (NICE, 2009), and are being used within



the National Health Service (NHS) particularly for stress management (Marx, Strauss, & Williamson, 2015). Meanwhile, researchers and practitioners are exploring the utility of MBIs in a wider range of conditions and disorders such as sleep disorders and cancer survivors (Dimidjian & Segal, 2015). Particularly, MBIs have shown promise as a treatment for addiction (Garland & Howard, 2018; Maglione et al., 2017; Sancho et al., 2018; Spears et al., 2017). Sancho et al. (2018) systematically reviewed 54 studies (4,916 participants) examining the efficacy of MBIs in an array of addictions from tobacco smoking and alcohol addiction to gambling disorder. The review found that MBIs, especially those combined with other active treatments, are effective in reducing psychological dependence, craving, and other addiction-related symptoms, through improving mood state and emotion regulation among adults. Other proposed mechanisms of MBIs for addictions include decreased automaticity, attention bias, reward sensitivity and increased self-efficacy for emotion regulation (Garland et al., 2016; Spears et al., 2017). Awareness and acceptance appear to be essential intervention components for the positive outcomes (Sancho et al., 2018; Witkiewitz, Bowen, Douglas, & Hsu, 2013).

### **MBIs for weight management and related eating behaviours**

As reviewed in Chapter 2, there is growing evidence for the effectiveness of MBIs and E-MBIs in improving weight management related eating behaviours, including binge eating, emotional eating, external eating, reactivity to food cravings, and unhealthy food intakes/choice (e.g., Carrière et al., 2018; Dibb-smith et al., 2019). Evidence for their effectiveness on weight loss is mixed, while interventions primarily focused on weight loss in overweight/obese populations and included mindful eating as a core component showed promising outcomes (Carrière et al., 2018; Dunn et al., 2018; Katterman et al., 2014; Olson & Emery, 2015; Ruffault et al., 2017; Warren et al., 2017).

MBIs for weight loss and related eating behaviours varied in intervention components and duration. Carrière et al. (2018) reviewed 18 MBIs and found moderate effects of MBIs on pre-to-post weight loss. Mean weight loss was 6.8lbs (3.3% of initial body weight) at post-intervention and 7.5lbs (3.5% of initial body weight) at follow-up (M = 16.5 weeks). Warren and colleagues

(2017) reviewed 16 MBIs for weight related eating behaviours and identified key mindful eating strategies delivered by MBIs as follows: (1) specific mindful eating exercise, e.g., ‘mindful raisin’; (2) attentive eating, i.e., mindfully paying attention to eating experience and sensory properties of food; (3) eating slowly; (4) meditations focused on bodily sensations of hunger and satiety; (5) meditations to notice eating triggers such as emotional triggers; (6) meditations to manage cravings. Interventions for overweight/obese populations were longer and more intensive than those for normal-weight populations. Of the eight interventions that were associated with post-intervention reduced body weight, the intervention duration varied from 6 to 24 weeks.

Mechanisms of MBIs for weight management and healthy eating have been proposed. Tapper (2017) reviewed 19 studies that examined the independent effects of mindfulness strategies on weight management and related eating behaviours. Based on the evidence, she proposed three potential mechanisms of MBIs in regard to weight management: present moment awareness, acceptance, and decentering.

#### *Present moment awareness*

Mindful eating strategies such as attentive eating and eating slowly encourage individuals to focus on present moment experience, and therefore promote awareness of food sensory properties as well as bodily sensations while eating. The importance of these are borne out in studies. For example, Robinson et al. (2013) reviewed 24 experimental studies examining the effects of attentive/non-attentive eating on food intakes. The review showed that reducing attention via distraction (e.g., watching television or listening to a radio play) during eating increased immediate as well as later food intake, and reducing awareness of food consumed (e.g., eating in dark restaurant area or removing used plates from table) increased immediate intake with a large size of effect. Alternatively, attentive eating may enhance memory for food consumed, which can influence one’s decisions about future food intake and lead to decreased later intake (Higgs & Donohoe, 2011; Robinson et al., 2013). However, the effect of mindful eating on food-related memory was not found in some other studies (Robinson, Kersbergen, & Higgs, 2014; Seguias & Tapper, 2018), and thus further research is needed.

Attending to food sensory properties could also reduce calorie intake by enhancing eating pleasure. Cornil and Chandon (2016) suggested that sensory pleasure could be a substitute for food portion. They found children who imagined the sensory properties of palatable foods subsequently chose smaller portions of these foods compared to control groups, which may occur because they better realised that sensory pleasure would peak with smaller portions and then decline due to sensory-specific satiation (Olsen, Ritz, Hartvig, & Moller, 2011). A series of experimental studies found that brief mindfulness instructions that directed participants' attention towards the sensory experience of eating enhanced the eating enjoyment of undergraduate students. The greater eating enjoyment led to lower calorie intake among of mindfulness condition relative to control conditions (Arch et al., 2016). These findings demonstrated the positive impact of mindfully attending to food sensory properties on behavioural outcomes.

In addition, mindful eating strategies direct individuals' attention to bodily sensations such as hunger and satiety, and the awareness brought by this attention seems to enable them to better regulate eating in response to these physiological cues (Monroe, 2015). Participants in E-MBIs are also guided to notice different eating triggers, such as environmental cues and emotional reasons (Warren et al., 2017). Both eating in response to environmental cues (i.e., *external eating*) and emotional reasons (i.e., *emotional eating*) involve relatively automatic process (Cohen & Farley, 2008; Mantzios & Wilson, 2015; Tapper, 2017), while environmental and emotional cues are reliable triggers for craving, which therefore could also lead to automatic and uncontrolled eating (May, Andrade, Kavanagh, & Hetherington, 2012). As a result, overweight individuals frequently eat in the absence of physical hunger and consume excessive calories. Increasing awareness of these eating triggers, physiological sensations and habitual eating patterns may interrupt the automatic, unconscious intake, and improve intentional behavioural regulation. Warren et al. (2017) suggested that increased awareness of internal physical, emotional and external cues are potential mechanisms of MBIs for promoting eating behaviours based on findings of fMRI studies. For example, significant signal decreases in midline cortical structures related with interception were observed during body scan practice, indicating an increased awareness of internal states (Ives-Deliperi, Solms, & Meintjes, 2011). Another study found

increased functional connectivity in auditory and visual networks after an 8-week MBSR, suggesting an increased awareness of sensory experience (Kilpatrick et al., 2012). These findings provide preliminary support for the effects of general mindfulness trainings in improving awareness, though further research is needed with a focus on E-MBIs or mindful eating strategies.

### *Acceptance*

Acceptance strategies commonly serve as a core component of MBIs, although they are also core in CBT, acceptance and commitment therapy (ACT) and dialectical behaviour therapy (DBT). Acceptance strategies promote behaviour change by encouraging individuals to accept thoughts, feelings and bodily sensations rather than avoiding or trying to change them (Lindsay & Creswell, 2017). Within the context of behavioural weight loss, acceptance strategies improve one's ability to tolerate unpleasant feelings such as physical discomfort and decreased pleasure, which are commonly experienced during attempts to maintain or lose weight (Forman, Butryn, Stephanie & Bradley, 2015). Unhealthy eating behaviours such as emotional eating, external eating and binge eating frequently involve experiential avoidance. It is suggested that emotional eating could occur as an attempt to alleviate or distract attention from negative feelings (Tice & Bratslavsky, 2000). For individuals who are trying to lose weight, failure to resist external cues for eating could lead to negative experience, while attempting to avoid this experience in turn contributes to overeating (Tapper et al., 2009). Binge eating can also be seen as a result of trying to escape from aversive self-perceptions and the accompanying unpleasant emotions, as proposed by Heatherton and Baumeister's (1991) escape model. Experiential acceptance stands in contrast to experiential avoidance, and therefore is a promising strategy for decreasing these behaviours.

One proposed mechanism of acceptance components of MBIs in improving eating behaviours is that they decrease self-control failure by increasing the availability of self-regulatory resources and the priority level of long-term self-control goals. Trying to suppress 'unwanted' feelings such as food cravings could exhaust self-regulatory resources, which leaves little strength to regulate behaviours and resist the food (Tapper, 2017). Alternatively, a person may give up long-term goals when they focus on immediate emotion regulation. For example, if

one is attempting to lose weight but feels upset due to craving high-calorie foods, he/she could regulate emotions by having the foods but ignore the long-term weight loss goals (Tice & Bratslavsky, 2000). Both situations can lead to self-control failure; in contrast, accepting the trigger emotion may be beneficial to self-control goals.

It should be noted, however, that acceptance strategies are usually employed along with intervention components enhancing attention regulation and awareness in E-MBIs as well as acceptance-based interventions for weight loss. Tapper (2017) found only one out of four studies which specifically examined the effects of acceptance strategies reported a significant reduction in subsequent calorie intake when acceptance was combined with increased awareness of bodily sensations (Marchiori & Papies, 2014). Thus, although there is evidence supporting the effectiveness of behavioural weight loss interventions adopting acceptance components in both adults (Forman, Butryn, Hoffman, & Herbert, 2009; Niemeier et al., 2012; Tapper et al., 2009) and adolescents (Tronieri, Wadden, Leonard, & Berkowitz, 2019), it is unclear whether acceptance strategies alone can bring about change.

### *Decentering*

Decentering, also termed as ‘re-perceiving’ (Shapiro et al., 2006) or ‘cognitive defusion’ (Hayes, Strosahl, & Wilson, 1999), refers to the ability to observe thoughts and feelings as temporary events that are not necessarily true representations of the self and reality, or requiring any particular behavioural reactivity (Sauer & Baer, 2010). As described by Bernstein et al. (2019)’ metacognitive process model of decentering, decentering is initiated by meta-awareness of subjective experience, and then entails disidentification from internal experience as well as reduced reactivity to thought content. Decentering skills are originally taught in traditional cognitive therapies to help clients cultivate a decentered perspective on their thoughts (Teasdale et al., 2002). In the MBIs, participants are usually encouraged to build a decentered relationship with not only their thoughts, but also their bodily sensations and emotions. For example, one frequently used decentering practice in the MBIs for addiction and cravings is ‘urge surfing’ (Marlatt, 1994). This practice teaches individuals to observe their bodily sensations, thoughts and

feelings related to cravings, seeing the urge as an ocean wave and surf on it, allowing it to naturally rise and fall without having to respond to it. ‘Urge surfing’ and other decentering techniques have been found effective in preventing relapse of substance misuse among adults (Bowen & Marlatt, 2009; de Dios et al., 2012) as well as adolescents (Harris, Stewart, & Stanton, 2017).

Similarly, decentering has been suggested as an essential component of E-MBIs for improving healthy eating and reducing food cravings (Keesman, Aarts, Hafner, & Papies, 2017; Tapper, 2018). Evidence from laboratory studies showed that brief training on a decentering skill can effectively reduce experienced food cravings (Keesman, Aarts, Hafner, & Papies, 2019; Lacaille et al., 2014; Moffitt, Brinkworth, Noakes, & Mohr, 2012; Papies, Pronk, Keesman, & Barsalou, 2015) and unhealthy food consumption (Papies et al., 2015). Moreover, other studies have shown the effects of decentering in reducing chocolate consumption over 5-7 days outside the laboratory (Moffitt et al., 2012; Jenkins & Tapper, 2014). Some studies found decentering skills to be more effective in reducing chocolate cravings or consumptions than other mindfulness strategies such as awareness and acceptance (Lacaille et al., 2014; Jenkins & Tapper, 2014). These findings provided support for the key role of decentering in E-MBIs for reducing food cravings and improving healthy eating.

One proposed mechanism of decentering in decreasing craving-driven behaviours is that it changes the representation of food-related cues, and thus reduces bodily reactivity to it (Keesman et al., 2017; Papies et al., 2015; Tapper & Ahmed, 2018). The grounded cognition theory of desire suggested that encountering food-related cues activates simulations of consuming the food based on previous experiences (Barsalou, 2008), which can in turn trigger the activity in related brain areas and produce reward predictions (Chen, Papies, & Barsalou, 2016). Decentering enables individuals to disengage from such ‘simulations’ and bodily reactivity is reduced (Keesman et al., 2019; Westbrook et al., 2013). A recent experimental study showed that participants using decentering salivated less when exposing to attractive food, although they reported to imagine eating the food at similar levels to the control group (Keesman et al., 2019).

In addition, decentering may improve eating behaviours by enhancing self-regulation. Decentering from feelings and thoughts triggering habitual eating behaviours may enable

individuals to exert self-control and make more conscious choices. This might further increase the maintenance of long-term health and/or weight loss goals (Tapper & Ahmed, 2018). In a study with 90 university students, compared to participants in a relaxation group, those who were instructed to adopt a decentering perspective when viewing a picture of chocolates produced significantly more words related to health and weight loss in the subsequent word completion task (Tapper & Ahmed, 2018).

In summary, E-MBIs with a primary focus on weight loss in overweight/obese populations showed promising outcomes. Present moment awareness, acceptance, and decentering have been proposed as main mechanisms of MBIs promoting weight management and related eating behaviours. These techniques are usually used in combination and tend to facilitate each other (Tapper, 2017).

### **E-MBIs for weight loss in adolescents**

Despite the accumulating evidence showing effects of E-MBIs on weight loss among overweight/obese adults, quite a few studies have tested E-MBIs for adolescents. In a pilot study, Barnes and Kristeller (2016) examined the feasibility and effectiveness of a school-based E-MBI (Mindfulness-Based Eating Awareness Training for adolescents; MB-EAT-A) in a sample of predominantly African-American overweight/obese adolescents with a mean age of 16.2 years ( $SD = 1.2$ ). The MB-EAT-A included 12 sessions (45m each). Results supported the feasibility of the MB-EAT-A. At 6-month post-intervention, the MB-EAT-A group ( $n = 18$ ) lost an average of 0.3lbs, demonstrating no significant difference compared to the health education control group ( $n = 22$ ). The MB-EAT-A was associated with improved habits (low-calorie foods and increasing aerobic exercise), but was associated with decreases in binge eating in comparison with health education control group. Another study feasibility tested a 6-week after-school E-MBI in a sample of obese Latino girls aged 14 to 17 years (Daly et al., 2016). The mindful eating group ( $n = 14$ ;  $BMI = 37.7 \pm 7.6 \text{ kg/m}^2$ ) showed a significantly greater decrease in BMI ( $M = 1.1 \text{ kg/m}^2$ ) compared to a usual care control group ( $n = 23$ ;  $BMI = 34.3 \pm 6.2 \text{ kg/m}^2$ ) at post-intervention, which continued to decline at the four-week follow-up ( $M = 1.4 \text{ kg/m}^2$ ). However, the mindful

eating group did not show significant changes in mindfulness awareness assessed using the Mindful Attention Awareness Scale (MAAS; Brown et al., 2011). A high attrition rate (43%) of the mindful eating group was also reported, which might attenuate its feasibility in the studied group.

In summary, studies of E-MBIs for weight loss among adolescents is very limited, with the results mixed regarding the feasibility and effectiveness of the programmes. As E-MBIs have shown promising effects in overweight/obese adults, there is merit in developing and testing E-MBIs for adolescent weight loss.

### **Delivering E-MBIs using digital platforms**

In recent years, the delivery of MBIs has been expanded from traditional face-to-face group programmes to using multiple digital platforms. Systematic reviews have shown evidence supporting the feasibility and effectiveness of online MBIs in improving mental health mainly among adults (Spijkerman, Pots, & Bohlmeijer, 2016), and alleviating symptom burden of individuals with chronic physical conditions (Toivonen, Zernicke, & Carlson, 2017).

Only a few studies have evaluated E-MBIs delivered using digital platforms. Mason et al. (2018) tested a self-paced 28-day smartphone-delivered E-MBI targeting craving-related eating behaviours among overweight/obese adults from the United States. Of 104 participants enrolling in the intervention, 78 (75%) completed the 28-day course within seven months, indicating the delivery of the E-MBI via smartphone is feasible. They also found significant reductions in trait cravings and craving-related eating from pre- to 1-month post-intervention, and a positive correlation between reductions in trait craving and weight loss. In another study (Dibb-Smith et al., 2019), a brief E-MBI targeting unwanted snacking habits was delivered via email in a PowerPoint-style PDF file to a sample of 158 Australian adults. However, this study reported unexpected findings including increased habit strength of snacking and decreased self-compassion at follow-up, and a relatively high attrition rate (50%) over two weeks. In addition, Lyzwinski et al. (2019) reviewed 22 mindful eating apps on iTunes and reported an overall poor quality. They found most of these apps failed to cover essential components of mindful eating but



simply provided tools such as mindful eating diaries or hunger rating scales. The authors proposed that mindful eating apps should provide more information on the benefits of mindful eating, general nutrition knowledge, various eating triggers as well as guidance for basic mindful eating practice and meditation. It was also recommended to include more entertaining features and integrate BCTs to improve engagement and usefulness.

Overall, evidence for the feasibility of digital platforms in delivering E-MBIs is very limited. E-MBIs should cover knowledge of mindful eating and guidance for mindful eating practices, and secure the consistent engagement of users.

#### **6.4 Planning interventions in health-related behaviour change**

One important intervention technique that is widely used to promote enactment of the intended health behaviour is planning. As a parsimonious and potentially effective technique to bridge the *intention-behaviour gap* with low response burden, planning approaches have drawn much attention in multiple health-related behavioural domains. Planning approaches are based on stage models of behaviour change, such as the model of action phases (Gollwitzer, 1993) and the Health Action Process Approach (Schwarzer & Luszczynska, 2008). Compared to continuum behaviour models such as the TPB, stage theories describe behaviour change as an ordered set of stages and include a motivational stage that ends with an intention to enact a behaviour, and a volitional stage that ends with the enactment of behaviour (Schwarzer, Lippke, & Luszczynska, 2011). Planning techniques help individuals who are at the volitional stage to successfully perform the intentional behaviour. Implementation intentions, action planning and coping planning are the most frequently applied planning techniques adopted to promote behaviour change (Hagger & Luszczynska, 2014; Kwasnicka, Preseu, White, & Sniehotta, 2013; Sniehotta, 2009).

##### **Implementation intentions**

Implementation intentions are a technique using “if-then” plans to help motivated individuals engage in health behaviour change. This approach is based on Gollwitzer (1993)’s model of action

phases. According to this model, the performance of a behaviour involves two phases: the motivational phase in which individuals form an intention to engage in a particular behaviour, and the volitional phase which is concerned with the processes of translation from intention to action. Implementation intentions, working in the volitional phase, require individuals who have already formed an intention to perform the behaviour, to specify a critical trigger or cue and to pair it with a goal-directed response. By linking the motivational and situational cues of unhealthy behaviour (“if”) with an appropriate response (“then”), the new desired behaviour are, in principle, activated more easily and consistently. Furthermore, as the link between cues and new desired response is formed more recently than the habitual pattern, it is possible that implementation intentions could not only initiate the preferred response but also overrule the habitual response (Adriaanse, de Ridder, & de Wit, 2009; Adriaanse, Gollwitzer, De Ridder, De Wit, & Kroese, 2011).

The “if-then” technique has been employed in an attempt to reduce unhealthy snacking. Adriaanse et al. (2009) argued that unhealthy snacking is a complex type of behaviour which does not seem to be directly linked to specific situational stimuli such as times or places, but occurs for a variety of reasons. For this type of behaviour, identifying why people perform the behaviour (motivational cues) could be more important than just understanding where and when (situational cues) they usually do so. In a pilot study using food diaries (Adriaanse et al., 2009), a sample of 39 university students aged 17 to 25 years (all female, mean BMI =  $21.3 \pm 2.2$ ) identified a list of situational (including place, activity, and company) and motivational cues for their unhealthy snacking. The most frequently reported motivational cues were appetite, enjoyment, feeling bored, and to be social. The researchers then examined and compared the efficacy of implementation intentions specifying situational cues and motivational cues in reducing unhealthy snacking. In this study, participants (N = 118, all female, aged 18 to 25 years, BMI ranging from 18.1 to 29.2) were randomly assigned to two experimental conditions or the control condition. Participants in experimental conditions were provided with an “if-part” statement using one of two situational cues (“being alone” or “at home”), or using one of two motivational cues (“to be social” or “feeling bored”). They were then asked to choose a healthy snack they liked and to complete the

statement (e.g., If I am alone and I feel like having a snack, then I will take...). The 7-day food diary showed that only participants in the motivational cue condition reported significantly healthier snack consumption than did participants in the control condition. Implementation intentions specifying motivational cues appeared more effective in promoting healthy snacking than those specifying situational cues. However, in this study, neither type of implementation intentions reduced unhealthy snacking; this may have been because the cues were assigned to participants, therefore dismissing the personal cues across individuals.

Thus, in the subsequent study, participants were provided with a list of six situational cues (at home, at school, on a visit, alone, with friends, with family) or six motivational cues (to be social, feeling bored, enjoyment, politeness, distraction, because other people are eating) for unhealthy snacking. Participants chose the cue most related to unhealthy snacking for them. The 7-day food diary post-intervention showed that, compared to the control condition, only participants in the motivational cue condition reported significantly more healthy snacking and less unhealthy snacking compared to pre-intervention. These findings supported the efficacy of individually tailored implementation intentions specifying motivational cues in reducing unhealthy snacking. As suggested by the authors, it could further benefit the efficacy of the implementation intentions to allow participants to identify and use their own set of motivational cues.

Similarly, O'Connor, Armitage, and Ferguson (2015) reported evidence supporting the efficacy of an individually tailored "if-then" approach of implementation intentions in reducing adults' stress-related snacking. In this study, a sample of 219 participants (aged 18 to 60 years, mean age = 22.96 years; mean BMI = 22.85) were instructed to describe up to five stressful situations that elicit negative emotions and trigger unhealthy snacking ("if"), and to choose a healthy snack alternative they could eat ("then"). The stressful situations and the alternative healthy snacks were written down in two columns. Only participants (n = 107) in the experimental condition were then asked to link each stressful situation and healthy snack choice, and to visualise themselves enacting each of the plans. The following 7-day online diary showed that daily stressors were significantly associated with unhealthy snacking but only for participants in

the control (“*if-then*”) condition and not for those in the experimental (“*if-then linking*”) condition. These findings indicated that simply identifying situational cues and appropriate responses may be not sufficient for healthy behaviour change. Forming an association between specific cues and responses appears to be essential for the success of implementation intentions for healthy behaviour change.

However, given that there are a variety of triggers for unhealthy snacking, although stress-unhealthy snacking was reduced by the implementation intentions specifying stressful situational cues, no overall main effect of condition on healthy or unhealthy snacking was found. Participants in the experimental condition with higher levels of motivation to eat more healthily reported a greater healthy snack consumption than those with low levels of motivation, suggesting the importance of establishing strong intentions in applying implementation intentions to promote healthy snacking.

A more comprehensive approach to implementation intentions is to provide structured lists covering the majority of critical cues and possible behavioural responses, such as Armitage (2008)’s volitional help sheet to promote smoking cessation. This volitional help sheet provided 20 situations derived from a long form of temptations to smoke scale (Velicer, DiClemente, Rossi, & Prochaska, 1990) and translated into “if” statement (e.g., “If I am tempted to smoke at a bar or pub having a drink”), along with 20 appropriate responses adapted from the 20-item processes of change scale (Prochaska, Velicer, DiClemente, & Fava, 1988) and translated into “then” statements (e.g., “Then I will think about something else”). Both the temptation scale and processes of change scale were developed based on the transtheoretical model (Prochaska & DiClemente, 1982). Armitage (2008) compared smoking cessation at 1-month follow-up for participants across four conditions: participants in *if-then list* and *if-then link* conditions were provided with the volitional help sheet and asked to choose as many critical situations and appropriate behavioural responses as they wanted, while only the latter group was instructed to link situations with responses; participants in the active control condition were asked to make a plan to quit smoking in the next month without any further instruction; and participants in the passive control condition only completed assessments. Compared to any other condition, the *if-*

*then link* condition was more effective in quitting smoking, decreasing cigarette use and nicotine dependent.

The structured volitional help sheet has also been used to effectively promote physical activity in adults with low socioeconomic status (Armitage & Arden, 2010), reduce alcohol consumption in young students and a general population (Arden & Armitage, 2012; Armitage & Arden, 2012), and promote additional weight loss in an overweight sample engaged in a weight loss programme (Armitage, Norman, Noor, Alganem, & Arden, 2014). An advantage of the structured volitional help sheet is that it provides a relatively comprehensive list of specific cues and appropriate responses by experts based on theories and/or evidence. At the same time, it allows participants to choose the most personally relevant cues and feasible reactions. In this way, the content and quality of both “if” and “then” conditions of plans could be better guaranteed compared to the conditions created by participants themselves, but still participants can formulate their own plans by choosing and linking cues and reactions. This ownership of self-formulated plans might increase the commitment to these plans and promote participants’ motivation to implement them (Snichotta, 2009).

### **Action planning**

Action planning is another technique to translate intentions into actions by specifying when, where and how to perform a behaviour (Gollwitzer, 1999). Action planning shares similar characteristics to implementation intentions, such as the focus on making a link between cues and behavioural responses, and the two terms have been used interchangeably in the literature. However, there are also some differences in the underpinning theories, concepts and operations of these two approaches to planning. Action planning appears in numerous models such as the Health Action Process Approach (HAPA; Schwarzer & Luszczynska, 2008) and the I-Change Model (de Vries, Mesters, Van de Steeg, & Honing, 2005). Compared to implementation intentions, which tend to target a single cue-to-action response, the action planning approach focuses on a broader perspective and is more frequently applied in field research as a way to obtain more complex sets of behavioural responses and less-specific behaviour change, such as

an increase in physical activity. In addition, the action planning approach is generally combined with other components such as coping planning and self-evaluation of the plan formulation and enactments (Hagger & Luszczynska, 2014).

There has been growing evidence supporting the effectiveness of implementation intentions and action planning in improving health-related behaviours such as healthy eating (Adriaanse et al., 2009; Adriaanse et al., 2011; Armitage, 2004; O'Connor et al., 2015) and physical activity (e.g., Conner, Sandberg, & Norman, 2010). As suggested by previous studies, an important mechanism through which implementation intentions operate is that, by forming and strengthening the link between cues and actions, the intended behaviour can eventually be enacted automatically and unconsciously when cues are encountered (Strack & Deutsch, 2004; Webb & Sheeran, 2008). For action planning, however, specifying a more complex cues and a sequence of actions as well as enacting the plans could entail more deliberate, effortful process of self-evaluation and self-regulation (Hagger & Luszczynska, 2014; Luszczynska, Tryburcy, & Schwarzer, 2006).

Habit strength has been suggested as an important moderating factor in planning-based behaviour change interventions. Implementation intentions are often seen as a potential way to break unhealthy habits, as the link between critical cues and the new desired response is formed more recently than the habitual pattern, and therefore could be more accessible (Adriaanse et al., 2009; Adriaanse et al., 2011). However, the effectiveness of planning interventions in breaking habitual patterns may be moderated by habit strength. Evidence shows that the effect of implementation intentions on behavioural engagement is stronger for those with weaker habits compared to those with stronger habits. Habits are automatic responses to specific cues, which are usually a result of frequent performance in similar situations over a considerable length of time (Verplanken & Orbell, 2003). Adriaanse et al. (2011) conducted a series of experimental studies to examine the underlying processes of implementation intentions breaking habitual unhealthy snacking using a primed lexical decision task. Results showed that, after the counter-habitual implementation intentions were formulated, the cognitive advantage of the habitual means was no longer shown on encountering critical cues, particularly in cases where participants

were allowed to choose their personal critical cues and habitual snacks. However, the mental link of new responses and critical cues was not stronger than the habitual mean either, suggesting that the old habit was not immediately replaced by a new behaviour. Developing a new habit may need repeated performance of the new response in the critical situations.

### **Coping planning**

In contrast to implementation intentions and action planning, coping planning is more complex, and focuses on behaviour maintenance and distraction inhibition by specifying how to deal with anticipated barriers to behaviour change. The “if” component in coping plans specifies the possible barriers to performing target behaviours, such as situations and emotional or cognitive states. The “then” component specifies the coping response to the barriers. (Kwasnicka et al., 2013; Sniehotta, 2009).

Kwasnicka et al. (2013) reviewed 11 RCT studies using coping planning alone or as a part of a health-related behaviour change intervention for non-vulnerable adults. The target behaviour included physical activity (e.g., Arbour-Nicitopoulos, Ginis, & Latimer, 2009), smoking cessation (e.g., Armitage, 2008), alcohol consumption (e.g., Armitage & Arden, 2012), and mammography uptake (Rutter, Steadman, & Quine, 2006). The review suggested that forming action plans along with coping plans is more efficacious in promoting behaviour change than forming only action planning. Coping plans appear to be more efficacious in behaviour change when plans were formed with supervision, assistance and feedback, or when the plans are pre-specified. For example, five interventions using a volitional help sheet were all effective in behaviour change. Change in self-efficacy is one possible factor moderating the effectiveness of coping planning on behaviour change, although the authors suggested that more evidence is still needed.

It should be noticed that in previous literature, there appears to be no clear distinction in the operationalisation and definitions of the three planning approaches discussed above. For example, Kwasnicka et al. (2013)’ review of coping planning interventions included Armitage (2008)’s study using a volitional help sheet to promote smoking cessation, although the study was one of implementation intentions in the original paper (Armitage, 2008). This is probably because some

of the items in this volitional help sheet could be seen as ways to manage barriers (e.g., “If I am tempted to smoke when I realise that quitting smoking is an extremely difficult task for me, then I will...”). Although there is seeming overlap between implementation intentions, action planning and coping planning, the three approaches together provide a more comprehensive perspective of how planning techniques could be used in promoting health behaviour.

### **Intervention design issues using planning techniques**

Based on the literature review and expert opinions, two papers (Hagger & Luszczynska, 2014; Hagger et al., 2016) demonstrated the current state of planning intervention research in health psychology and made suggestions for future research and practice based on evidence. In respect to the format and content of planning interventions in health contexts, five main research findings have been reported. First, that compared to “global” plans that require participants to write down plans in a free-response format, the “if-then” format is more effective in improving health behaviour (Chapman, Armitage, & Norman, 2009) and thus should be adopted. Second, that personally relevant and steadily accessible cues linked to the target behaviour should be identified based on pilot data and contained in the planning intervention. Evidence showed that provided the cues are personally relevant, the source of plans (user-defined vs. researcher-defined) makes no difference (Armitage, 2009). However, to guarantee the quality of plans, examples of salient cues and guidance and feedback from researchers on plan formation are recommended. Third, additional coping plans to deal with potential barriers should be included with implementation intentions and action plans, particularly for interventions aiming at complicated behaviour change involving temptation, impulsivity or strong habits. Fourth, adding “booster” planning sessions that allow participants to repeat the original plans or form more suitable plans showed greater effectiveness than a single planning intervention (Chapman & Armitage, 2010; Conner & Higgins, 2010). Fifth, interventions targeting populations with weak intentions and strong habits should consider including techniques to promote motivation and self-efficacy alongside planning components (Milne, Orbell, & Sheeran, 2002).

In addition, recommendations related to the design and report of studies examining the



effectiveness of planning interventions were also put forward in these papers, including measures of mediators and moderators, clear and comprehensive report of intervention protocols, relevant control groups, and long-term follow-up measures, etc. Particularly, intervention fidelity, i.e., the extent to which the interventions are implemented in accordance with the instructions or protocol, should be considered as an important aspect of planning intervention. Some studies reported low adherence (i.e., do form plans as instructed) of participants to planning interventions. For example, a brief online planning intervention aiming at increasing physical activity among university students reported low adherence to the intervention protocol ranging from 58.8% to 76.7% (Skår, Sniehotta, Molloy, Prestwich, & Araujo-Soares, 2011). The authors of this study suggested the low adherence as a major reason that no changes in self-reported physical activity or other measures were found after the intervention. Low adherence was also reported in planning interventions using a pen-and-paper questionnaire (e.g., Michie, Dormandy, & Marteau, 2004; Rutter et al., 2006). Intervention designers should therefore seek ways to maximize adherence to planning intervention particularly when it is delivered online, considering that adherence is a consistently big challenge of online-based interventions as well (Webb, Joseph, Yardley, & Michie, 2010). The contents and quality of plans formed by participants can also impact the effectiveness of planning intervention, and could be evaluated using self-reported questionnaire or a content analysis of the scripts of plans that participants create during the intervention (Hagger et al., 2012).

In summary, there is evidence showing the effectiveness of planning approaches in bridging the intention-behaviour gap. Personally relevant plans using the “if-then” format appear particularly effective in promoting health behaviours. Low intervention adherence and poor quality of plans formed by participants are barriers to positive outcomes of planning interventions. Future studies should provide details of adherence and plan quality along with any psychological and behavioural outcomes.

The literature review above provides theoretical and empirical basis of building blocks of health behaviour and weight loss interventions. Mindful eating skills that improve awareness, acceptance and decentering, and the ‘if-then’ approach of implementation intentions were then

employed as main components of our intervention, with recommendations from literatures carefully considered.

## 6.5 Designing a weight loss intervention using the BCW

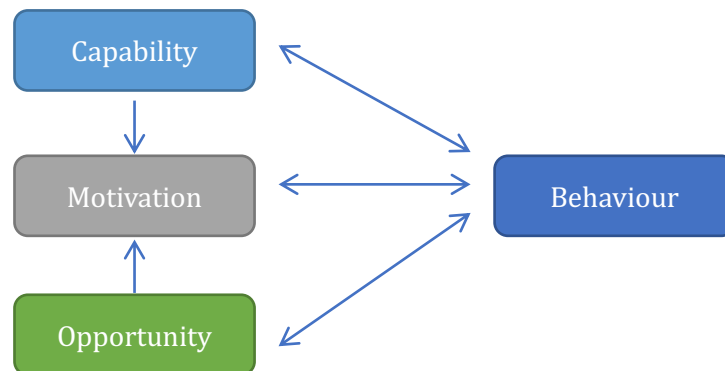
This section describes the design and development of a digital E-MBI for overweight/obese Chinese adolescents using the Behaviour Change Wheel (BCW). Target behaviours, intervention functions, behavioural change techniques and mode of delivery were specified following the process of intervention development recommended by the BCW. Intervention components including nutrition knowledge, mindful eating principles and practices, as well as implementation intentions were incorporated with identified intervention functions. The content of each intervention session is then outlined.

### The Behaviour Change Wheel and Theoretical Domains Framework

The Behaviour Change Wheel (BCW) (Michie, Atkins, & West, 2014; Michie, van Strlen, & West, 2011) is a framework that integrates multiple theories and models of behaviour change, designed to enable systematic development of behaviour change interventions. A core feature of the BCW is the COM-B model, which is based on 19 existing behaviour change frameworks and used to guide understanding of the behaviour in question. As shown in **Figure 6.2**, the COM-B model proposes that in order to perform a *behaviour* (B), individuals need to have: (1) physical and psychological *capability* (C), e.g. physical strength, knowledge and skills; (2) physical and social *opportunity* (O), e.g. social support or sufficient time to conduct the behaviour; (3) reflective and automatic *motivation* (M), i.e., to be highly motivated (intentionally or automatically) to perform the behaviour. Behaviour change interventions can promote desired behaviours or prevent undesired behaviours by altering these determinants. In addition, according to the COM-B model, enacting the behaviour can in turn alter related capability, opportunity and motivation. Opportunity and capability can also influence motivation.

Capability, opportunity and motivation of the COM-B model can further be sub-divided into

domains within the Theoretical Domains Framework (TDF) (Michie et al., 2014). The TDF is an integrative framework that identifies core theoretical constructs of behaviour change. The original TDF identified 128 constructs, which were grouped as 12 domains such as knowledge, skills, behavioural regulation, etc. These domains cover a great range of potential barriers to behaviour change, and therefore provide a wide selection of potential intervention components (French et al., 2012).



**Figure 6.2** The COM-B model

The BCW framework then supports the selection of intervention functions, policy categories and behaviour change techniques (BCTs) (Michie et al., 2014). Intervention functions refer to broad categories of means by which an intervention can change behaviour. BCTs are the effective ingredients within an intervention designed to change behaviour. The BCW classifies nine intervention functions (i.e., education, persuasion, incentivisation, coercion, training, restriction, environmental restructuring, modeling, enablement), seven policy categories (i.e., communication/marketing, guidelines, fiscal measures, regulation, legislation, environmental/social planning, service provision) and 93 BCTs (BCT Taxonomy v1) (Michie et al., 2013).

### **Designing a weight loss intervention using the BCW**

According to the BCW handbook for designing interventions (Michie et al., 2014), designing a behaviour change intervention using the BCW framework involves three main stages and eight

steps, as shown in **Table 6.1**. The following describes the process of developing a mindfulness-based weight loss intervention for overweight/obese Chinese adolescents using the BCW approach.

**Table 6.1** The BCW intervention design process

BCW stages	BCW steps
1. Understand the behaviour	1. Define the problem in behavioural items 2. Select the target behaviour 3. Specify the target behaviour 4. Identify what needs to change
2. Identify intervention options	5. Identify intervention functions 6. Identifying policy categories
3. Identify content and implementation options	7. Identifying behavioural change techniques 8. Determine the mode of delivery

*Stage 1: Understand the behaviour*

**Step 1 & 2 - Define the problem in behavioural terms and select the target behaviour**

Step one and two of the BCW involve defining and specifying target behaviours and population. The present project aimed to promote weight loss in overweight Chinese adolescents aged 16 to 18 years. The literature review (see Chapter 1) showed that high calorie intake due to the changes of dietary patterns, and low energy expenditures result from low PA levels and sedentary lifestyles, are suggested as major contributors to adolescent overweight and obesity in China. Dietary behaviour, PA and sedentary behaviour are common behaviour targets of weight loss interventions for adolescents (e.g., Chen & Wilkosz, 2014; Feng et al., 2017). A school-based PA programme entailing 10min PA every weekday has been adopted in many high schools across China (Wang & Zhai, 2013). However, there is a lack of research on evidence- and theory-based interventions targeting the dietary behaviours of overweight Chinese adolescents that can be translated into practice. In addition, considering the intense and education centric daily schedule of Chinese adolescents in high school, it would be difficult to change their sedentary lifestyle or increase PA level. Therefore, we decided to focus on improving the dietary behaviour of overweight adolescents.

Specifically, we chose snacking as the target behaviour. From the literature review and study 1 and 2 of our project, we identified two specific snacking behaviours that may contribute to adolescent overweight. First, unhealthy food choice for snacking is suggested to be associated with overweight in the literature (e.g., Li et al., 2010; O'Connor et al., 2015). Second, our focus group study found that Chinese adolescents frequently consumed snacks in response to environmental or emotional cues rather than physical hunger (see Chapter 3). The intervention aimed to target these behaviours, among overweight adolescents who frequently snacked.

The BCW suggests selecting target behaviours by considering the following criteria:

(1) Impact of behaviour change on desired outcome. For those who frequently snacked on high-calorie foods and in the absence of hunger, improving these behaviours could lead to significant reduction in calorie intake, and thus weight loss.

(2) Likelihood of changing behaviour. Compared to some other candidate behaviours such as meal consumption, snacking could be a more feasible target, as adolescents have more autonomous choice for snacking. Changing habitual behaviours could be difficult. However, in our focus group study we found Chinese adolescents held an overall positive attitude towards healthy snacking, and were motivated to perform healthy snacking behaviour when it comes to weight management. Therefore, we suggested that for overweight adolescents who attempted to lose weight, it could be promising to improve their snacking.

(3) Spillover effect, i.e., how likely it is that changing the behaviour will influence other related behaviours. Many intervention components targeting snacking are also likely to improve participants' other dietary behaviours. For example, nutrition knowledge and self-regulation skills regarding snacking can also be applied to regulate food consumption during meals.

(4) Ease of measurement. Snack consumption is measurable.

In summary, in the first two steps of the BCW intervention design, we identified our target population as overweight Chinese adolescents aged 16 to 18 years who frequently snacked, and target behaviours as healthier snack choice and decreased snacking in the absence of hunger.

### Step 3 - Specify the target behaviour

The next step was to specify the behaviour in appropriate detail and in its context, as shown in **Table 6.2**. This helps to identify barriers and potentials to behaviour change in next steps.

**Table 6.2** Specifying the target behaviour and content

<b>Target behaviour</b>	<b>Healthier snack choice and decreased snacking in absence of hunger</b>
<i>Who</i> needs to perform the behaviour?	overweight Chinese adolescents who frequently snack
<i>What</i> do they need to do differently?	Making healthier food choice for snacking; Snacking in response to hunger rather than other reasons
<i>When</i> do they need to do it?	Whenever they snack (eating occasions between meals)
<i>Where</i> do they need to do it?	Wherever they snack

### Step 4 – Identify what needs to change

After identifying and specifying the target behaviours, the next step is to identify what needs to change using the COM-B model, which can also be combined with the TDF. Based on the findings of our focus group study (see Chapter 3), we identified potential barriers to achieving the target behaviours. Then we mapped the identified barriers to the COM-B model and the TDF. Based on the barrier analysis, the intervention should work on adolescents' psychological capability, reflective motivation and physical opportunity related to target behaviours. Seven relevant TDF domains (i.e., knowledge; skills; memory, attention and decision processes; beliefs about capabilities; behavioural regulation; beliefs about consequences; environmental context and resources) were identified. The identified barriers, COM-B components and TDF domains are demonstrated in **Table 6.3**.

#### *Stage 2: Identify intervention options*

### Step 5 – Identify intervention functions

Based on the behavioural analysis in previous steps, two intervention functions – *education* and

*training* – were identified. **Table 6.3** illustrates how the intervention functions relate to corresponding COM-B and TDF components. The intervention delivered content directly relevant to each identified TDF domains except for *belief about capabilities*, as we assumed that the improvement in psychological capability would naturally lead to increased self-efficacy.

### **Step 6 – Identify policy categories**

This step was not undertaken in detail, as the present study was not primarily concerned with changing policy.

### *Stage 3 – Identify content and implementation options*

### **Step 7 – Identify behavioural change techniques (BCTs)**

BCTs linked to relevant intervention functions, TDF domains and barriers to behaviour change were identified using the Behaviour Change Technique Taxonomy (BCTTv1) (Michie, Richardson, Johnston et al., 2013). Four BCTs linked to *education* (i.e., instruction on how to perform the behaviour; information about antecedents; action planning; information about health consequences) and nine BCTs related to *training* (i.e., instruction on how to perform the behaviour; model/demonstration of the behaviour; behavioural practice/rehearsal; behaviour substitution; habit formation; generalisation of target behaviour; action planning; restructuring the physical environment; avoidance/reducing exposure to cues for the behaviour) were selected, as shown in **Table 6.3**.

It should be noted that some BCTs such as goal setting and self-monitoring, although recommended by previous research on the DBCIs, were not adopted in the present intervention. These BCTs might not be completely compatible with the principles of mindfulness. For example, the mindfulness-based approach to weight management encourages individuals to regulate food intake primarily based on internal signals, rather than relying on external goals to monitor their weight (Rossy, 2016).

**Table 6.3** Mapping behavioural analysis onto the BCW

COM-B	TDF	Barriers to performing target behaviours	Intervention Function	BCTs	Intervention Content
Psychological capability	Knowledge	<p>A lack of nutrition knowledge;</p> <p>A lack of knowledge about the role of hunger/fullness in healthy eating;</p> <p>A lack of knowledge about overweight-related eating patterns</p>	Education	<p>4.1 Instruction on how to perform the behaviour</p> <p>4.2 Information about antecedents</p>	<p>Nutrition education and instruction on reading food labels</p> <p><i>(Making healthier choice for snacking)</i></p> <p>Knowledge about hunger and fullness <i>(Six kinds of hunger)</i></p> <p>Knowledge about common triggers for snacking <i>(Emotional eating and external eating; Food cravings)</i></p>
	Skills	A lack of skills on regulating snacking and breaking unhealthy eating habits	Training	<p>4.1 Instruction on how to perform the behaviour</p> <p>6.1 Model/demonstration of the behaviour</p> <p>8.1 Behavioural practice/rehearsal</p> <p>8.2 Behaviour substitution</p> <p>8.3 Habit formation</p>	<p>Mindful eating practice <i>(Listening to your stomach practice; Exploring the six kinds of hunger; One bite at a time practice; Urge surfing)</i></p>
	Memory, attention and decision processes	<p>Snacking was greatly affected by external cues, emotional reasons and cravings other than physical needs;</p> <p>Low awareness/ignorance of bodily</p>			



		sensations Low awareness of snacking patterns		8.6 Generalisation of target behaviour	Participants were encouraged to also applying mindful eating practice to meal consumption
Reflective motivation	Behavioural regulation	Difficulties in implementing intentions for healthy snacking	Education Training	1.4 Action planning	Making action plans using “if-then” technique ( <i>Planning</i> )
	Beliefs about consequences	A lack of knowledge about the effects of unhealthy snacking on body weight	Education	5.1 Information about health consequences	Knowledge about how unhealthy snacking may contribute to overweight
	Beliefs about capabilities	Low self-efficacy on healthy eating/weight management	-	-	-
Physical opportunity	Environmental context and resources	Availability of unhealthy snacks at home or in school led to unhealthy snack consumption	Training	12.1 Restructuring the physical environment 12.3 Avoidance/reducing exposure to cues for the behaviour	Guidance on purchasing healthy snacks and keeping unhealthy snacks out of sight

## **Step 8 – Determine the mode of delivery**

The BCW guides the selection of delivery mode by using a taxonomy of modes of delivery (p177, Michie et al., 2014). The present study aimed to develop a distance intervention that targets individual behaviour change. In our focus group study, adolescents proposed WeChat as a preferred platform for intervention delivery. WeChat is a Chinese mobile app serving a wide range of functions including instant messaging, sharing videos and photos, and social networking. With over one billion monthly active users, it became one of the largest mobile apps by 2018.

The BCW recommends use of APEASE criteria (i.e., the affordability, practicability, effectiveness and cost-effectiveness, acceptability, side-effects/safety, and equity) when selecting mode of delivery. WeChat service is free to use, and thus delivery via WeChat itself would not cost either the providers or the recipients. Due to its wide range of functions, text, photos and videos can all be easily shared between WeChat users, which makes the delivery of intervention content possible. WeChat also allows users to post text, images, and share articles and videos to their timeline. Privacy and confidentiality of participants can be well maintained on WeChat, as users can decide whether their post can be viewed by particular groups of people. According to the participants of our focus group study, WeChat is commonly used by high school students in Beijing, and well accepted as a platform for healthy eating programmes. Therefore, despite the lack of direct evidence for its effectiveness, we chose WeChat as the platform of intervention delivery.

In addition, our focus group study found that adolescents expected the intervention to be highly engaging, and showed a preference for videos. Therefore, we chose to deliver intervention content by short videos.

## **Specifying the intervention content**

After identifying intervention functions and BCTs following the process introduced above, specific intervention content and strategies were addressed in detail. Two main strategies were employed for the two target behaviours: *nutrition education* to promote adolescents' healthy food choice for snacking, and *mindful eating skills* to reduce snacking in the absence of hunger. In

addition, it has been suggested that MBIs for adolescents should be carefully modified, and take adolescents' lifestyle and developmental characteristics, such as less working memory and attentional capacities, into consideration (Tan, 2016). The present intervention innovatively incorporated mindful eating skills with an "if-then" approach for *planning* (Hagger & Luszczynska, 2014), attempting to promote the accessibility of mindful eating skills in real life situations for adolescents, and therefore their motivation to perform the behaviours.

**Table 6.3** shows examples of intervention content for each intervention function. The *education* function involves delivering knowledge about nutrition and healthy food choice, hunger and fullness, as well as common unhealthy eating patterns resulting in food consumption in the absence of hunger (i.e., emotional eating, external eating, eating in response to food cravings). Basic mindful eating principles and practice are also introduced, such as attentive eating, eating slowly, acceptance of one's desire to eat and making conscious behavioural choice. The *training* function involves four mindful eating practices (i.e., listening to your stomach practice, exploring the six kinds of hunger practice, one bite at a time practice, urge surfing). For the instruction / guidance wording of several of the standard mindful eating exercises, we drew upon descriptions in the Mindful Eating – Conscious Living (ME-CL) course (Bays & Wilkins; <http://www.me-cl.com>). This was to ensure the guidance we used was relatively standard for the field, and expert endorsed.

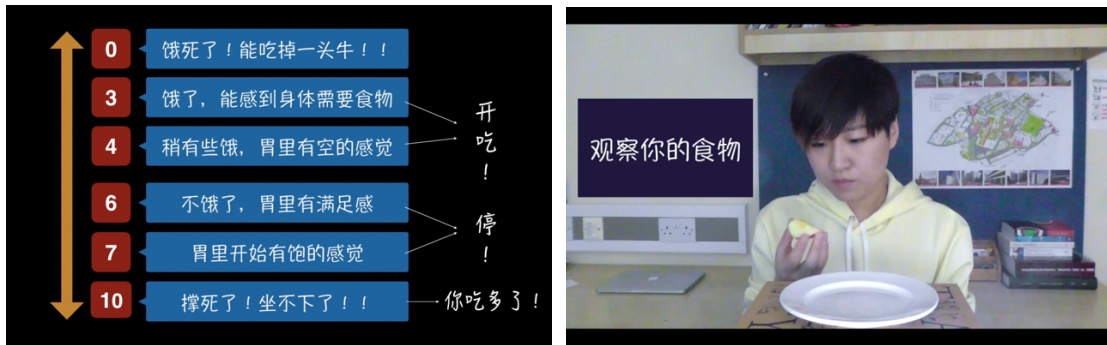
In addition, the intention was that some (randomly allocated) participants would be trained to form action plans using the if-then technique. The 'if' conditions described specific situations of mindless snacking, or common cues for snacking in the absence of hunger. We identified six domains of 'if' conditions: three (i.e., distraction, disinhibition, acceptance) representing mindful/mindless snacking based on measures of mindful eating including the Mindful Eating Questionnaire (MEQ; Framson et al., 2009) and the Mindful Eating Scale (MES; Hulbert-Williams et al., 2014); and three (i.e., emotional eating, external eating, food craving) covering common triggers for snacking reported by adolescents during focus group discussions (see Chapter 3). A total of 16 'if' conditions covering the six domains were translated from related measures (e.g., MEQ, DEBQ) as well as focus group discussions. Then 14 solutions ('then'

conditions), with each targeting at least one of the ‘if’ conditions, were identified. Most of the solutions were based on mindful eating skills. All of the solutions were explained in detail during the course. The list of ‘if’ and ‘then’ conditions are shown in Table 7.6 and 7.7 (Chapter 7).

### Creating intervention videos

Ten short videos (3 – 10 mins) were created covering the intervention content. Video scripts (see Appendix 10) were firstly written and refined, and video templates were designed. Then essential video clips were recorded and necessary materials including photos, images and movie clips were prepared. Lastly, the videos were edited and animated using iMovie. In this stage, efforts were made to increase the accessibility and attractiveness of intervention videos to Chinese adolescents. Pictures and animations of topics familiar to Chinese adolescents were broadly used in the videos. Examples of video screenshots are shown as follows:





Screenshots of intervention videos

### Outline of intervention sessions

Based on the adolescents' preference regarding the duration and intensity of the intervention (see Chapter 3), content was planned to be delivered weekly and consecutively for three weeks, taking no longer than 30min per week. The descriptions for each session are shown in **Table 6.4**.

**Table 6.4** Outline of intervention sessions

	<b>Topic</b>	<b>Description of content</b>	<b>Theoretical/evidence underpinning and considerations</b>
Week 1	Introduction	<p><b>Video 1: Welcome and a brief introduction of the programme (3')</b></p> <p>This video briefly introduces the programme, including its purpose, duration, and what participants need to do during the course. The importance of completing pre- and post-intervention assessments is also emphasised.</p>	<p>Considering the general high attrition rate of online interventions and adolescents' expectations for a highly engaging intervention, this video was made primarily to interest adolescents and get them involved in the programme.</p>
	Nutrition education	<p><b>Video 2: Making wiser choices for snacking. (7'55'')</b></p> <p><i>Learning Point 1.</i> Does snacking make you fat? - The relationship between snacking and overweight based on scientific evidence.</p> <p>This section provides information and scientific findings of the relationship between snacking and overweight, showing that unhealthy snacking habits will contribute to overweight, while snacking when hungry and on healthy food does not necessarily make people fat.</p> <p><i>Learning Point 2.</i> How to choose healthy snacks? - Learn how to make healthy choice for snacking by reading food labels.</p> <p>This section teaches how to read food labels, and gives examples by showing and reading the labels on several beverages and snacks that Chinese adolescents frequently eat. Then the recommendations on how many sugars, fats and calories one should consume per day are provided.</p>	<p>High snacking frequency has been found in both healthy and unhealthy dietary behaviours and lifestyle patterns. Studies found that snacking is associated with increased intakes of healthy foods and physical activity, improved dietary quality, and suggested to help appetite control thus preventing overeating at meals. However, adolescents tend to choose high-calorie snacks, which could contribute greatly to adolescent overweight/obesity.</p> <p>Findings of our previous studies with Chinese adolescents:</p> <ol style="list-style-type: none"> <li>1. Results of the survey study showed a high prevalence of snack and beverage consumption among Chinese adolescents. Therefore, this video focuses on beverages as well as snacks.</li> <li>2. The focus group study found that although most of the adolescents loved snacking, they perceived snacking as unhealthy behaviour. On one hand, they snack frequently in daily life; on the other hand, avoiding snacking was one of the most often reported strategies they used to reduce calorie intake as an attempt to lose weight. Some</li> </ol>

			<p>extreme cases were also mentioned (e.g., fainted in school after long-term dieting). In addition, many of them showed confused about how to choose healthy snacks, and expected to learn such knowledge from a healthy snacking programme.</p>
Hunger and fullness		<p><b>Video 3: The six kinds of hunger (9')</b></p> <p><i>Learning point:</i> To learn about the six kinds of hunger: eyes hunger, nose hunger, mouth hunger, stomach hunger, mind hunger, and heart hunger, with the emphasis on mouth hunger and stomach hunger.</p> <p>This video briefly introduces a basic concept of mindful eating (Bays, 2016)*. <i>The six kinds of hunger</i> is an interesting and accessible way to put different eating triggers together (e.g., emotional eating as <i>heart hunger</i>). By learning the six kinds of hunger, participants are expected to be more aware of various triggers for them to snack other than physical (<i>stomach</i>) hunger. The learners are encouraged to pay attention to their physical sensations before and when snacking, and let the stomach decide when to stop eating. Other basic mindful eating skills such as taking a pause before eating and slowing down are also recommended.</p> <p>*In the ME-CL course, another form of hunger (i.e., <i>cellular hunger</i>) was also introduced together with these six kinds of hunger (Bays, 2016). Cellular hunger is relatively subtle and could be less accessible to adolescents. Thus, this video does not cover cellular hunger.</p>	<p>The commonality of problematic eating behaviours related to overweight/obesity (e.g., binge eating, emotional eating, external eating) is that they are eating in the absence of hunger, which results in excessive calorie intake and weight gain. One of the most important aspects of mindful eating is being aware of physical hunger and being able to distinguish it from emotional or external cues that can trigger an eating episode. This video provides the basic knowledge of “hunger” from the perspective of mindful eating.</p> <p>Particular considerations:</p> <p>Previous studies reported that one of the most important factors influencing adolescents’ choices for snacking is the taste of the food. In our focus group study, taste was also identified as among the most important determinants for food choice. In addition, one of the most frequently reported reasons for snacking was “greedy mouth” (贪嘴 or 嘴馋, a word in Chinese that people usually use to refer to a desire to eat, similar with <i>appetite</i> or <i>cravings</i>, but very focuses on “mouth”). Thus this video particularly emphasizes the mouth hunger and the stomach hunger, aiming to help participants better distinguish the needs of their mouth and the needs of their stomach/body.</p> <p>As there is another video talking about external eating and emotional</p>

			eating in details, and to keep it short, this video does not cover too much information of the related eyes hunger, nose hunger and heart hunger.
	Hunger and fullness	<p><b>Video 4: Listening to your stomach exercise (4')</b></p> <p><i>Learning point:</i> To improve the awareness of the physical sensations of hunger and fullness through a mindful eating exercise.</p> <p>The video instructs the learners to do a very brief mindful eating exercise. By paying attention to the feelings in the stomach through a very brief meditation, and rating their current level of hunger/fullness on a scale, this exercise can help participants be more aware of their hunger and fullness. Participants are encouraged to do this brief exercise at least once a day in the following week.</p> <p>This practice is adapted from the ME-CL course (class one, exercise 2: <i>brief listening to stomach exercise</i>).</p>	<p>Awareness is a core component of mindfulness, and awareness of hunger/fullness a core component of mindful eating. Besides teaching the basic principles and concepts, mindfulness-based approaches emphasize the importance of meditation-based exercise to improve one's awareness. This brief and simple exercise was the first meditation-based practice of this intervention.</p> <p>Particular consideration:</p> <p>In the ME-CL course, a stomach metre (like a fuel gauge of our body) is used as a tool to evaluate the level of hunger at the moment. However, considering our participants are adolescents and do not have experience in driving (in China only the over 18s can drive), they might not be familiar with this image. So in this video a 10-point scale (adapted from Lynn Rossey's <i>The Mindfulness-based Eating Solution</i>, Chapter 3) was used instead.</p>
Week 2	Emotional and external cues	<p><b>Video 5: Emotional eating and external eating (9'16'')</b></p> <p><i>Learning point:</i> To learn two common triggers for snacking in the absence of hunger – emotional states and external cues.</p> <p>This video talks about how emotional states and external food-related cues can induce one's desire to eat, why this could contribute to overweight, and how to reduce emotional eating and external eating using mindful eating skills.</p>	<p>Kaplan and Kaplan (1957) proposed the Psychosomatic Theory which considers excessive eating as a reaction to emotional arousal, i.e., <i>emotional eating</i>. External Theory of obesity proposed by Schachter and Rodin (1974) focuses on eating in response to external stimuli, such as the smell and taste of food or time of day, regardless of the internal state of hunger or satiety, i.e., <i>external eating</i>. Plenty of evidence showed that emotional eating and external eating are commonly reported obesity-related eating behaviours and positively correlated with unhealthy eating/snacking. Mindfulness-</p>



		<p>This video aims to help participants improve their awareness of emotional cues and external cues for snacking, and teach them to use basic mindful eating skills to reduce these unhealthy eating behaviour, such as taking a moment before eating to find out what they are really hungry for (<i>awareness</i>) and to choose what and how much to eat rather than to eat automatically (<i>de-automatisation</i>). An attitude of acceptance of the bodily feelings is also encouraged.</p>	<p>based interventions for healthy eating/weight loss showed to be effective in reducing emotional eating and external eating assessed by the DEBQ (e.g., Alberts et al., 2012).</p> <p>Findings of our previous studies:  Study 1 (survey study): emotional eating and external eating were positively related to unhealthy snacking;  Study 2 (focus group study): external cues and emotional reasons were among the most frequently reported triggers for snacking.</p>
	<p>Mindful awareness of physical sensations</p>	<p><b>Video 6: Exploring the six kinds of hunger (9')</b></p> <p><i>Learning point:</i> To pay fully attention to and be aware of the eating experience and physical sensations through a mindful eating exercise.</p> <p>This video invites participants to do a basic mindful eating meditation – to eat a piece of snack in a mindful way. In this exercise, participants are instructed to eat a snack they like, with focusing their attention on the physical sensations. Participants are led to explore and evaluate their eyes hunger, nose hunger, mouth hunger, stomach hunger, mind hunger, and heart hunger.</p>	<p>This video introduces a meditation-based mindful eating exercise. Although there are researchers developing novel approaches for cultivating mindfulness without meditation (e.g., Mantzios &amp; Wilson, 2014), many researchers and practitioners insist that meditation-based exercise is an essential part of the MBIs. The aim of this exercise is to improve participants' awareness of their physical sensations of hunger, so they can better distinguish the physical hunger from other triggers for eating. In addition, by slowing down and paying attention to the eating experience in this exercise, one can learn how to better savor the snack that they like.</p> <p>Particular considerations:  This exercise is closely related to the video 3 <i>The six kinds of Hunger</i>. However, compared to the <i>Listening to your stomach exercise</i>, this exercise is longer and a little more complicated. Considering our participants are teenagers most of whom do not have experience in meditation, the first exercise should be simple and straightforward. In addition, although this is</p>

			a good exercise for improving awareness of physical sensations, the <i>Listening to your stomach exercise</i> is more practical in daily life. Therefore, the <i>listening to you stomach</i> rather than this practice was set as the first mindful eating practice of the intervention.
	Pausing and slowing down	<p><b>Video 7: One bite at a time exercise (5')</b></p> <p><i>Learning point:</i> To take pause before eating and between bites, and to slow down when eating.</p> <p>This video invites participants to do another brief mindful eating exercise. By doing this exercise, participants learn how to pause and take a moment to explore the food they are going to eat, and how to slow down eating by putting the food/utensil between bites.</p> <p>This exercise is adapted from the ME-CL course (Class two, exercise 2: <i>pausing</i>).</p>	Snacking behaviours can be highly habitual. Although we encourage our participants to pay attention to their physical sensations and needs, to be aware of the real triggers for their desire to snack, and to eat only when physically hungry and stop when full, they may find themselves start snacking automatically before they can register with their body, or have eaten too much before realising the signals of satiety. Pausing and slowing down gives them time and opportunities to explore their bodily sensations, allowing them to make conscious choices before and during snacking, and to fully taste and enjoy the snacks. Eating slowly has been found to reduce food consumption and energy intake in previous studies (e.g., Andrade, Greene, & Melanson, 2008; Ferriday et al., 2015).
Week 3	Food cravings	<p><b>Video 8: Food cravings (9'17")</b></p> <p><i>Learning point 1:</i> What is food craving?</p> <p>This section introduces food cravings and the difference between food cravings and hunger.</p> <p><i>Learning point 2:</i> Why do you crave certain foods?</p> <p>This section talks about the three kinds of the most commonly experienced food cravings – sugar craving, fat craving, and salt (and spicy food) craving. Information on why these cravings exist and how</p>	<p>Food cravings refer to an intense desire to eat specific foods, which is different from physiological hunger. Thus, food cravings are highly likely to trigger eating behaviour in the absence of physical hunger, which can lead to excessive calorie intake. Craving-related eating has shown to be correlated with high calorie snacking (e.g., Choa, Grilo, White, &amp; Sinha, 2014; Gilhooly et al., 2007) and the BMI (e.g., Franken &amp; Muris, 2005). MBIs have shown promise in targeting reductions in craving (e.g., Mason et al., 2016; Tapper, 2018).</p> <p>Particular considerations:</p>

		<p>they might cause problems is provided. The effect of emotional states and dieting on food cravings is also discussed. Since emotional eating has been covered in a previous video, this video does not focus on the emotional aspects of food cravings.</p> <p><i>Learning point 3: How to deal with food cravings?</i></p> <p>This section introduces the basic ideas behind urge surfing – cravings and urge to eat are like the ocean waves, which will recede and disappear in time. Trying to get rid of the urge or control it only makes it stronger. Participants are encouraged to observe it with curiosity and acceptance, rather than struggling or fighting it.</p>	<p>In the focus group study, food craving was reported as a common trigger for snacking. Particularly, spicy food cravings were most frequently reported in the discussions, more than sweet cravings and fat cravings. Therefore, this video covers the cravings for spicy food as well as other commonly studies food cravings.</p>
	Food cravings	<p><b>Video 9: Urge surfing (6')</b></p> <p><i>Learning point: A mindfulness-based behavioural technique for dealing with food craving.</i></p> <p>This video shows instructs participants to do the <i>urge surfing</i> exercise. Urge surfing was described as ‘riding the wave’ of urges or cravings, in other words, being aware of them and ‘surfing’ them rather than ‘sinking’ or giving in to them.</p>	<p>Urge surfing or craving surfing is a mindfulness and cognitive-behavioural technique that teaches participants to “ride” and tolerate eating-related cravings and distress. Previous studies showed that healthy eating/weight loss interventions employing the “urge surfing” technique significantly reduced chocolate consumption (Jenkins &amp; Tapper, 2014) and improved weight loss (Forman et al., 2013).</p>
	Planning	<p><b>Video 10: Planning (8'20")</b></p> <p><i>Learning point: This video guides participants to form specific action plans using the if-then technique. They are instructed to select three situational or motivational cues (‘if’ conditions) that most suitable for them from the list provided, and then choose one solution (‘then’</i></p>	<p>The aim of this video is to promote the accessibility of mindful eating skills in real life situations for adolescents, and therefore their motivation to perform the behaviours using the ‘if-then’ technique of planning. Previous studies have found that making links between situational cues and specific solutions as well as visualizing the enactment of plans can improve the</p>

		conditions) for each cue to form a total of three complete plans. They are encouraged to write down the complete plans, and then visualise themselves acting out each plan in real life. Also, they are encouraged to keep a record of their plans on mobile phone so they can review the plans anytime.	effectiveness of planning intervention (e.g., O'Connor, Armitage, & Ferguson, 2015). In addition, this video provides self-trailered components as participants are instructed to form personal plans.
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## **6.6 User consultation interview**

Once the intervention videos had been recorded, a user consultation interview study was conducted for three main aims: (1) to check whether the content of intervention videos was clear and understandable to Chinese adolescents; (2) to test whether it was technically feasible to deliver the intervention content via WeChat; and (3) to probe their general attitudes towards these videos. The videos were then refined based on participants' opinions and suggestions.

### *Recruitment and ethics*

Recruitment calls were posted on WeChat, inviting adolescents aged 16 to 18 years to participate in a WeChat interview. Inclusion criteria were: Chinese nationality and fluent in Chinese and be able to take part in a video interview via WeChat. Considering the length of the videos, each participant was asked to view no more than four videos. Therefore, we aimed to recruit at least five participants, so that each video could be evaluated by two adolescents.

Participation was anonymous. Participants' information and responses were recorded using a participation code developed by them. It was explained that they could withdraw anytime during the intervention. Consent for audio recording of the interviews was obtained. This study was approved by the University of Leeds Research Ethics Committee (Faculty of Medicine and Health), as part of a feasibility study. Reference number: PSC-325; Date of Approval: 24, April 2018.

### *Participants and Procedure*

Participants provided their evaluation and feedback of each video they had watched by answering the following questions:

1. How do you find this video?
2. Is there any part of it you found hard to understand or unclear?
3. After watching this video, on a scale of 0 (Not understand at all) to 10 (perfectly understand), to what extent do you think you've understood \_\_\_\_\_ (the main

content of the video, e.g., how to choose healthy snacks by reading food labels; what emotional eating is)?

4. How would you suggest us to improve this video?
5. What else would you like to tell us?

All ten videos were uploaded onto Youku (<http://www.youku.com>), a major video website based in China. The videos on Youku were set as password-protected and not accessible to the public. Six girls and one boy aged 16 to 18 years ( $M = 16.7$  years;  $SD = .76$ ) completed the interview.

After giving informed consent via WeChat message, participants received the links to the videos. Each participant was invited to watch 3 to 4 videos, which took around 25 minutes. Considering the tight schedules that Chinese high school students have, participants were asked to freely arrange their time to watch the videos and contact the researcher again for an audio-interview via WeChat when they were ready. Six participants completed the interview on the same day of receiving the links, and one participant completed the interview two days later. The interviews took no longer than 30min and were audio-recorded using a voice recorder. Each video was viewed by at least two adolescents. Three videos (i.e., *six kinds of hunger*, *one bite at a time*, and *planning*) received negative comments from one viewer but overall positive comments from the other viewer, so one more participant was invited to view these three videos and gave feedback.

### *Data analysis*

Interviews were transcribed in Chinese in full and translated into English. Driven by study aims, the interviews were analysed within the following questions: technical problems, evaluation on clarity of video content, general attitudes and comments, and suggestions for improvement.

### *Results*

None of the participants reported any technical problems during the study. Participants' evaluation on content clarity, attitudes and suggestions regarding to each video are presented in **Table 6.5**. Actions taken to refine the videos based on the consultation are also described.

**Table 6.5** Content analysis of user consultation interviews

Video	No. of viewers	Average rating on clarity (0 – 10)	Attitudes and comments	Suggestions	Actions taken
<b>Welcome</b>	2	8.5	<p>Both viewers gave positive comments on the video, finding it “understandable” “interesting” and can induce viewers’ curiosity. For example:</p> <p><i>“Overall this video is quite good, very fascinating, I finished watching this three-minute (video) before I knew it. I was really able to enter a state of thinking and watch this video with myself thinking. Also I notice there’s a question in the video was ‘how is snacking related to psychology’, and I’m very curious about it.” (zcp0012)</i></p>	<p>One viewer found the video was a little bit “fuzzy” and suggested a higher definition would be better.</p>	<p>Among all participants only one viewer reported to find the videos “a little bit fuzzy”, and it did not affect her understanding of the video content. Therefore, we did not make changes to this video.</p>
<b>Making wiser choices for snacking</b>	2	10	<p>The two viewers reported no obstacle to understanding the content of this video. Both viewers found the video interesting to watch. One viewer reported that this video was very helpful for him and motivated him to change his food choice:</p> <p><i>“...but after watching this video, I feel that I really need to make some changes from now on, and I have to change a lot in my diet, to choose what to eat and what not. As to beverages, I think I’ll choose water from now on. Also, I’ve watched some videos talking about how drink a beverage means eating a lot of sugars, but this time it really provides</i></p>	<p>One viewer found a typo in the video, and suggested that we could introduce knowledge about total energy intake in addition to sugar intake and fat intake. The other viewer suggested to use puffed food as examples to show food labels rather than</p>	<p>The typo was corrected. Considering this video is already quite long, we did not add information as suggested. In the focus group interviews with Chinese adolescents, we found that most of them already had the impression that puffed food is not healthy, so dried fruit – which was frequently mentioned as a kind of</p>

			<i>comprehensive analysis using data, and gives a very concrete impression of it. It also introduced the benefits of snacking, which I didn't know before. I thought snacking was just for fun. From now I have reasons to argue with my mum when she disapproves of my snacking."</i> (zcp0012)	using biscuits or dried fruit, and to introduce other risks of drinking beverages in addition to growing fat.	healthy snack – was selected as an example instead.
<b>Six kinds of hunger</b>	3	9.3	<p>All three viewers reported that they understood the content of this video clearly. Two viewers gave positive comments on this video. Particularly, they showed very positive attitudes towards the resources (i.e., music, pictures and movie clips) utilised in this video. For example:</p> <p><i>"I think this video is very good, and all the texts, music and pictures are used very properly."</i> (373qiq)</p> <p>The other viewer, however, thought the video employed too many resources, although it did not affect the clarity of the video content:</p> <p><i>"This video, well, I think it employs too many resources, which gives me a sense of clutter. As those resources are not all in the same style."</i> (Yhn517)</p>	The viewer who found this video a little messy and suggested utilising picture and movie resources in a unified fashion and make them more connected with each other.	As two of three viewers were satisfied with the resources utilised in this video, and most viewers of other videos showed positive attitudes towards the way these videos use pictures and movie clips to give examples, we did not make changes to this video.
<b>Listening to your stomach practice</b>	2	9	Both viewers found this video nicely done and practical, e.g., <i>"The listening to your stomach video is good, and as to its content, I find it very practical for me. I did the practice following the video, and I feel it really works."</i> (Rm13)	One viewer suggested to add a review of the practice by showing a list of the steps of the practice in the end of the video.	A review of practice steps was added as suggested.



			<p>However, one viewer thought the instructor in the video looked a little too serious:</p> <p><i>“... Also maybe make some jokes, don’t talk about it in a very serious way, I think some jokes could lighten the atmosphere. But overall I think it’s very good.” (010801hxx)</i></p>	The other reviewer found it hard to make suggestions for practice videos as learners could have very different experience when doing the practice.	
<b>Emotional eating and external eating</b>	2	9	<p>The two viewers reported no problems in understanding the content of this video. The viewers found this video “OK” or “quite good”. Both viewers thought it introduced emotional eating and external eating very clearly. However, when making suggestions, both viewers mentioned some parts of this video were a little bit boring:</p> <p><i>“For the part of external eating, I find it a little bit...boring I think.” (Rm13)</i></p> <p><i>“...In addition, I think it freeze on some pictures for too long. It’d be better to add more animations. Also the voice could be more passionate, more emotional, otherwise it could make viewers feel sleepy.” (010801hxx)</i></p>	The viewers suggested to add background music and more animations to make the video more fun to watch.	As this is the only video that received relatively negative comments from both viewers, major changes were made to improve it. Actions taken included adding background music and animations, and using more funny pictures so in the new edition it does not stay still on the same picture for too long.
<b>Exploring the six kinds of hunger</b>	2	9.5	<p>One viewer found this video “interesting” and “interactive” (373qiq); the other viewer who rated the “six kinds of hunger” video as a little messy thought this one was “much better” and looked “more comfortable” compared to the previous one (yhn517).</p>	One viewer suggested to add background music to help the viewers more concentrated.	Background music was added as suggested.
<b>One bite at a</b>	3	9.3	All three viewers found this video easy to understand. Two	The viewer who does not	Mindful eating practices invite

<b>time practice</b>			viewers showed overall positive attitudes towards this video. One found it useful and reported to “learned a lot from it” ( <i>zcp0012</i> ). One found it good to have a demonstrator showing how to do the practice ( <i>40656A</i> ). However, the other viewer did not like this video as she thought the demonstrator in the video “ate the snack stiffly, and seemingly did not like the snack at all” ( <i>3248F</i> ).	like this video suggested to improve it by adding fun pictures and animations as in the knowledge/information videos.	participants to pay full attention to their eating-related experience. We expected our participants to actually do the practice while watching the video. Therefore, unlike the information/knowledge videos, funny pictures or movie clips were not utilised as these might distract them from their own experience. However as mentioned above, some adolescents could find the practice videos too “serious” and less enjoyable. As with the other practice videos, background music was added to lighten it up.
<b>Food cravings</b>	2	9.5	The viewers showed very positive attitudes towards this video. They thought this video was useful and nicely done. They particularly liked the movie clips showed in this video, for example: <i>“...The movie clips employed in this video are very good, and proper. I think this video is very good, and one can really understand food cravings.” (010801hxx)</i>	More background music is suggested	Since the viewers showed very satisfied with this video, we did not make changes to it.
<b>Urge surfing</b>	2	8	The viewers found this video understandable and did not report any confusion. They showed relatively neutral attitudes	One viewer suggested to add a review of the	A review of the practice steps was added as suggested.

			<p>towards this video. It looks like they thought this video “just to teach a method” so it is OK as long as it demonstrated the method clearly:</p> <p><i>“This video teaches you how to deal with your food cravings. It’s OK, just to teach a method I think... There’s nothing to change about this video I think, as it’s a demonstration of a method. Nothing needs to change.”</i></p> <p><i>(Rm13)</i></p>	<p>practice by showing a list of practicing steps in the end of the video.</p>	
<b>Planning</b>	3	10	<p>One viewer found this video “very good” and “helpful” (373qiq). The other two viewers, however, found the part of showing the “if” and “then” lists was too long and detailed.</p>	<p>Two viewers suggested it was unnecessary to read the “if” and “then” items out in the video, but can just show them in texts and viewers can pause the video at their own pace.</p>	<p>Although two of three viewers suggested that it would be better not to read each “if” and “then” conditions out, the concern is that some participants would not read the items carefully if the instructor did not read for them. Therefore, we kept this part but speed up the audio file (1.3 times) to shorten it.</p>

## *Discussion*

The intervention videos were reported to be clear and understandable to adolescents. They rated 8 – 10 (out of 10) on the clarity of video content, and did not report any difficulties in understanding video content. We did not find any technical problems during the study. These reviews suggested that the delivery of the intervention using videos and via WeChat is feasible. Adolescents evaluated most of the videos as interesting and engaging. This was encouraging as adolescents could be highly demanding on these features of a health programme. Some adolescents were less positive about the mindful eating practice videos than other videos, which they found to be less interesting and “too serious”. These videos demonstrated mindful eating practices, which were rooted in mindfulness meditation. For adolescents who were not familiar with or had no experience in meditation, these practices could look strange. As participants in the present study only viewed several videos rather than the whole course, they were not fully informed with the rationale of each practice, which could affect their attitudes towards it. Some adolescents also showed intentions to use the knowledge and skills to regulate their eating, although they were not specifically asked about this. For example, one adolescent talked about how they would make healthier snack choice using the knowledge he learned from the video on nutrition education. In conclusion, adolescents evaluated the videos as understandable and mostly interesting. It appeared possible to recruit adolescents to engage in this type of intervention. Adolescents’ suggestions regarding to each video were carefully considered, based on which the videos were refined.

## **6.7 Evaluation and summary**

There are several strengths of the intervention as prepared for this first stage consultation. First, the intervention was designed following guidance of a well-developed framework (i.e., the BCW) and based on evidence from literature as well as empirical findings with Chinese adolescents. A participatory approach to intervention development was adapted. Focus groups and user consultation interviews were conducted in various stages of the intervention development, and the intervention was developed and refined based on the targeted users' needs and preferences. Last, the intervention content was delivered via videos to enhance engagement. A main limitation is the lack of expert consultation and consensus seeking during intervention development.

It was concluded that the intervention was suitable for testing in a feasibility and acceptability study, which is reported in the following chapter.

## **Chapter 7. Feasibility test of an online mindful snacking intervention for overweight Chinese adolescents**

### **7.1 Introduction**

The previous chapter described the development of an online mindful snacking intervention to promote weight loss by overweight Chinese adolescents. This chapter details a feasibility study of the mindful snacking intervention in a group of overweight Chinese adolescents aged 16 to 18 years.

#### **Aims and objectives of the present study**

The present study aimed to test the feasibility, acceptability and effects of an online mindful snacking intervention for overweight adolescents in China. Specifically, our objectives were:

(1) to evaluate the acceptability of an online mindful snacking intervention for overweight Chinese adolescents. Based on recommendations for the design and report of feasibility evaluations of health interventions (Bowen et al., 2009; Hoddinott, 2015; Murray et al., 2016), this study examined feasibility and acceptability as indicated by recruitment and retention rates; extent of measure completion; technological functionality; participants' reported usage and satisfaction with the intervention; and number of reported adverse events (indicators for feasibility and accessibility are set out in the section of analysis plan below). From the focus group study (see Chapter 3), we found that Chinese adolescents are more likely to trust and react to recruitment information of interventions that they heard from school. Therefore, we were also interested to see whether school teachers would support the recruitment of this programme, and how this might influence adolescents' engagement.

(2) to examine the effects of the intervention on adolescents' self-reported weight loss, snacking, eating styles, trait craving and eating self-efficacy. As the intervention targeted eating behaviours related to unhealthy snacking, chosen eating style outcomes were emotional eating, external eating and eating in response to craving. We also explored whether participants' eating

self-efficacy and mindful eating level increased after the intervention (cognizant that this was only a feasibility study).

(3) to examine whether an added intervention component (i.e., planning), would improve any of the intervention's proposed key outcomes. We also collected and analysed the plans participants made during the intervention, and explored their perceived usefulness and barriers to using this approach.

(4) if sufficient data, to investigate the effect of improved mindful eating on main intervention outcomes (i.e., weight loss and change in unhealthy snacking), and explore potential mediating effect of other eating-related behaviours.

In terms of evidence of feasibility and effectiveness, it was hypothesised that:

(1) participants in both groups (i.e., No Planning group, Planning group) will report significant post-intervention reductions in weight, unhealthy snacking and overall snacking, emotional eating, external eating, trait craving, and increases in mindful eating and eating self-efficacy at post-intervention assessment.

(2) the Planning Group will report greater changes in weight, snacking, eating styles, craving and eating self-efficacy than No Planning Group.

(3) changes in mindful eating will significantly predict weight loss and reduction in unhealthy snack consumption.

## **7.2 Methods**

### **Recruitment and ethics**

This study was approved by the University of Leeds Research Ethics Committee (Faculty of Medicine and Health. Reference number: PSC-325; Date of Approval: 24, April 2018).

Psychology teachers (known to QZ) from three Chinese public high schools agreed to assist recruitment in their schools. Teachers were emailed a school and participant information letter, a recruitment poster, and PowerPoint slides explaining the study. The teachers also received a link

to the *Welcome* video of the intervention to view before agreeing to support recruitment.

A WeChat account was created to process recruitment and for intervention delivery. Contact information including the researcher's email address and a Quick Response (QR) code of the WeChat account was shown on information sheet, poster and slides. Students who were interested in the intervention were encouraged to contact the researcher via email, or via our WeChat account by scanning the QR code. Anyone who scanned the QR code got access to the recruitment slides and the *Welcome* video, and could send questions or messages to the WeChat account. Enrollment started in June 2018. Participants were free to consider and choose when to start their participation up until 1<sup>st</sup> December 2018.

### **Inclusion criteria**

Young people were eligible to take part if they met all the criteria below:

- (1) were Chinese adolescents aged 16 to 18 years;
- (2) were BMI  $\geq 24$  kg/m<sup>2</sup>;
- (3) were self-identified snackers;
- (4) self-identified as motivated to lose weight;
- (5) did not have a self-reported or diagnosed eating disorder;
- (6) were willing and able to take part in the intervention via WeChat and complete online surveys before and after the programme.

We chose 24kg/m<sup>2</sup> as the BMI cut-off point for overweight. The Group of China Obesity Task Force (GCOTF; 2004) proposed a BMI reference to define overweight and obesity for Chinese children and adolescents, with 24 kg/m<sup>2</sup> as a cut-off point for overweight for both males and females aged 18 years. The cut-off points for boys and girls aged 16 to 17 years were between 23.5 and 23.8 kg/m<sup>2</sup>. A recent study showed that this GCOTF reference is more suitable than several other commonly used references for screening overweight in Chinese adolescents (Tan, Xin, & Ming, 2018). To make the inclusion criterion more operational and accessible, we used 24kg/m<sup>2</sup> as a BMI cut-off point (rather than sex- and age-specific BMI cut-off points) for



screening eligible participants.

Adolescents who showed interest by contacting us on WeChat but did not meet inclusion criteria were thanked and briefed about why they could not take part. They also received material regarding healthy snacking and balanced diet.

Participation was anonymous. Participants' information and responses were recorded using a participation code developed by them. It was explained that they could withdraw anytime during the intervention, or withdraw their data within one month of completing their participation without having to give any reasons. Participants were assured that the school teachers would not be informed of their participation or withdrawal. Participants were not made aware in advance of the two groups in the study design, but this was explained in a post-intervention debrief sheet. Participants in the No Planning Group received the link to the *planning* video after completing all post-intervention assessments.

### **Planned sample size**

In previous pilot studies that used the randomised controlled trial (RCT) design to evaluate the feasibility and initial effectiveness of MBIs for weight loss, sample sizes ranged from 14 to 30 for each condition (e.g., Kidd, Graor, & Murrock, 2013; Mantzios & Wilson, 2015). In guidance for designing feasibility study (Julious, 2005; Lancaster, Dodd, & Williamson, 2004; Sim & Lewis, 2012), sample sizes between 12 and 25 for each condition have been recommended to estimate a parameter. As attrition rates commonly observed in mobile intervention studies are around 25% (Brindal et al., 2013; Carter et al., 2013; Mason et al., 2018), we aimed to recruit at least 16 participants for each group.

### **Study design and randomisation**

This study employed an RCT design with quantitative data collected at baseline (pre-intervention) and post-intervention. Participants were randomly assigned into one of two groups: No Planning Group or Planning Group. Considering the researcher was involved in participant enrollment and

intervention delivery, simple randomisation (Suresh, 2011) based on computer-generated random numbers was employed as an attempt to minimise researcher bias. As the intervention content of the first two weeks was identical to both groups, each participant was not randomised until just before receiving Week 3 content, in order to minimise bias during the implementation of the intervention.

Pre- and post-intervention self-report assessments were administered via Wenjuanxing (wjx.cn), a commonly used Chinese online survey platform. All participants were invited to take part in a post-intervention 30-minute feedback interview either via an audio interview on WeChat, or by audio recording their responses to a list of questions (see Table 7.2), and sending the recording to us within two weeks. The latter option was provided considering many adolescents had a very tight schedule and found it difficult to set a time in advance for the interview. Participants who were interested in delivering the post-intervention feedback received a separate participant information sheet and were given a week to consider taking part. Separate informed consent was obtained from participants who provided spoken feedback. Each participant received CNY 50 (approx. GBP 5.5) for participation, which was paid via WeChat.

### **Intervention delivery**

The intervention was implemented on WeChat. Intervention content was delivered by 10 short videos, which were uploaded to Youku ([www.youku.com](http://www.youku.com)), a video-sharing website based in China. All the videos were password-protected. Intervention content was delivered weekly and consecutively for three weeks, each no longer than 30min per week. Descriptions of content and duration of each video are shown in Table 6.4 (Chapter 6).

After giving informed consent via WeChat message, adolescents who met the inclusion criteria received a link to baseline assessments. Once complete, they received links to the Week 1 videos along with passwords. Participants received Week 2 and Week 3 videos and passwords on the first day of the second and the third week (i.e., 7 days and 14 days after baseline assessments). Once participants received the links and passwords, they had access to the videos without time limits, although they were encouraged to finish watching all videos for that week in

time for release of the next week’s videos. On the first day of the fourth week (i.e., 21 days after baseline assessment), participants received a WeChat message reminding them they would be invited to complete another online survey after 6 days, and they were expected to finish watching all the videos before that. On the last day of the fourth week (i.e., 27 days after baseline assessment), participants received a link to post-intervention assessments, and were requested to complete the survey within three days. Throughout the intervention, participants were welcome to contact the researcher anytime by sending WeChat messages.

**Table 7.1** Intervention content and assessments received by each intervention group throughout the study

	<b>No Planning Group</b>	<b>Planning Group</b>
<b>Week 1</b>	(Day 1) Baseline assessments  Video 1. Welcome Video 2. Making healthier choices for snacking Video 3. Six kinds of hunger Video 4. Listening to your stomach practice.	(Day 1) Baseline assessments  Video 1. Welcome Video 2. Making healthier choices for snacking Video 3. Six kinds of hunger Video 4. Listening to your stomach practice.
<b>Week 2</b>	(Day 8) Video 5. Emotional eating and external eating Video 6. Exploring your six kinds of hunger Video 7. One bite at a time practice	(Day 8) Video 5. Emotional eating and external eating Video 6. Exploring your six kinds of hunger Video 7. One bite at a time practice
<b>Week 3</b>	(Day 15) Video 8. Food cravings Video 9. Urge surfing practice	(Day 15) Video 8. Food cravings Video 9. Urge surfing practice Video 10. Planning
<b>Week 4</b>	(Day 28) Post-intervention assessments	(Day 28) Post-intervention assessments

The videos and assessments each group received are shown in **Table 7.1**. The only difference between the two groups was in the third week when the Planning Group received one more video, i.e., Video 10: *Planning*. Participants in the Planning Group were requested to send us a screenshot

or photo of the plans they had made by the end of the third week. Those who failed to send us their plans by the end of the third week ( $n = 7$  out of 25) received a reminder on the first day of the fourth week asking them to send their plans as soon as possible.

## **Quantitative measures**

Participants reported their height and body weight, and completed measures of eating styles (i.e., mindful eating, emotional eating, and external eating), food craving, eating self-efficacy, and snacking pre- and post-intervention via Wenjuanxing (wjx.cn). They also rated their pre-intervention motivation to participate and acceptability of the intervention post-intervention.

***Body mass index and weight category*** Body weight (kg) and height (cm) were self-reported by participants. Body mass index (BMI) scores were calculated by dividing each individual's weight in kilograms by the square of their height in metres ( $\text{kg}/\text{m}^2$ ). As described above, we used  $24\text{kg}/\text{m}^2$  as the BMI cut-off point for overweight (GCOTF; 2004).

***Eating styles*** Emotional eating and external eating were assessed using the Dutch Eating Behaviour Questionnaire (DEBQ; Van Strien et al., 1986). In this study a Chinese version of the DEBQ validated in Chinese adolescents (Wu, Cai, & Luo) was used. The Cronbach's alpha reliability coefficients for emotional eating and external eating were .95 and .85, respectively. Mindful eating was assessed via the Mindful Eating Questionnaire (MEQ; Framson et al., 2009). In this study a revised Chinese version of the MEQ was used (C-MEQ-R; see Chapter 5). Internal consistency in the present sample at baseline was  $\alpha = .83$ . The internal reliability coefficients for subscales were: *intentional awareness* (.77), *disinhibition* (.78), *emotional response* (.85), *attentive eating* (.83).

***Food craving*** was measured using the Food Cravings Questionnaire –Trait-reduced reduced (FCQ-T-r; Meule et al., 2014). The 15-item FCQ-T-r asked respondents to evaluate the cognitive, physiological and behavioural aspects of general food craving the experienced (e.g., “Whenever

I have cravings, I find myself making plans to eat”). Responses were scored on a six-point scale ranging from 1 (“never”) to 6 (“always”). High scores indicated high level of food craving. The original version of the FCQ-T-r showed good reliability (Meule et al., 2014). Internal consistency in the present sample at baseline was  $\alpha = .94$ .

***Eating self-efficacy*** was measured using the Weight Efficacy Lifestyle Questionnaire Short Form (WEL-SF; Ames, Heckman, Grothe, & Clark, 2012). This 8-item questionnaire asked respondents to evaluate their self-confidence for controlling eating behaviour in various situations (e.g., “I can resist eating too much when I’m watching TV”) on a scale ranging from 0 (“strongly disagree”) to 10 (“strongly agree”). The WEL-SF yields a global scale of eating self-efficacy, with high scores indicating high level of self-efficacy. Internal consistency in the present study at baseline was  $\alpha = .92$ .

***Snacking*** was assessed using a modified Beverage and Snack Questionnaire (BSQ; Neuhouser et al., 2009) (see Chapter 2). Particularly, based on the findings of the focus group study (see Chapter 3), one new category (i.e., meat products) was added to the snack food section and one was added to the beverage section (i.e., sugar-sweetened milk tea, soya drinks and coffee drinks). In addition, the original item ‘other salty snacks’ was modified to ‘other salty or spicy snacks’, and ‘spicy gluten’ was listed among the examples.

***Motivation to take part (only for pre-intervention assessment)*** Participants reported their motivation to take part in the intervention by answering a question: “why are you participating in this programme?” Participants rated the importance of four motives (i.e., *to lose weight; to stay healthy; to learn new knowledge and skills; I’m interested in psychology programmes*) on a four-point scale (1 = “not at all important”; 4 = “very important”). The overall motivation was demonstrated using the sum of the scores on all four questions.

***Acceptability (only for post-intervention assessment)*** Participants evaluated their acceptability of

the intervention by rating nine statements regarding their experience of the intervention (i.e., “Overall, I am very satisfied with my experience in taking in this programme”). Participants rated the satisfaction, time demands, convenience, enjoyment, usefulness and actual usage of the intervention on a five-point scale (1 = “strongly disagree”; 5 = “strongly agree”). The questionnaire is shown in Appendix 14.

### **Qualitative data**

Qualitative data included written feedback on three post-intervention survey questions on perceived intervention usefulness and suggestions for intervention improvement. The questions are shown in **Table 7.2**. Qualitative data was also generated through follow-up interviews based around questions shown in **Table 7.2**. Questions explored participants’ motivation to take part, expectations and satisfaction, perceived behavioural change and usefulness of intervention components, barriers and suggested improvements.

**Table 7.2** Qualitative measures in post-intervention survey and follow-up interviews

<i>Form</i>	<i>Question</i>	<i>Main Theme</i>
<b>Written</b>	<i>Q1.</i> What do you find was the most useful part of the programme and why?	Usefulness
	<i>Q2.</i> What do you find was the least useful part of the programme and why?	Usefulness
	<i>Q3.</i> How do you think the programme could be improved?	Suggested improvements
<b>Spoken</b>	<i>Q1.</i> What motivated you to participate in this programme? What did you expect to achieve by participating in this programme?	Motivation and expectation
	<i>Q2.</i> To what extent do you think this programme meets your expectation? Which part of your expectations has been fulfilled and which has been not?	Satisfaction
	<i>Q3.</i> Overall, how's your experience in participating in this programme?	Satisfaction
	<i>Q4.</i> Please think about how you snacked at the beginning of the programme and how you snack now. What changes in snacking have you made?	Perceived changes
	<i>Q5.</i> This programme introduced knowledge and skills about healthy snacking and weight control by ten short videos. Now think about what you have learned from the programme. How have you used the knowledge and skills to improve your snacking habit?	Perceived changes and usefulness
	<i>Q6.</i> In the whole programme, which parts do you find most useful to you? What was it about these parts that made them most useful?	Perceived usefulness
	<i>Q7.</i> Which parts were least useful to you? What was it about these parts made them least useful?	Perceived usefulness/barriers
	<i>Q8.</i> What barriers have you encountered in applying the knowledge and skills you've learned from this programme in your daily life? How do you think we can help you overcome the barriers?	Barriers and suggested improvements
	<i>Q9.</i> What was missing in the programme to help you make changes in your snacking and loss weight?	Suggested improvements
	<i>Q10.</i> What barriers have you encountered in completing this programme?	Barriers
	<i>Q11.</i> Is there anything about the programme dissatisfied you? What was about it disappointed you?	Satisfaction
	<i>Q12.</i> What else would you like to share with us?	Suggested improvements
	<i>*Q13.</i> In the end of the programme, we invited you to make three plans. How do you find these plans? Are there any barriers for you to actually implement these plans?	Usefulness of planning

\* Only participants in Planning Group were invited to answer Q13.

## Analysis Plan

### *Feasibility and Acceptability*

**Table 7.3** shows the analysis plan to evaluate the intervention in terms of feasibility, acceptability, and preliminary effectiveness and suggested amendments.

Feasibility was assessed by:

(1) ability to recruit participants. Previous studies found an overall low recruitment rate (7.5 to 48%) to weight management interventions for young adults (Lam, Partridge, & Allman-Farinelli, 2016). The recruitment among overweight/obese children and adolescents could be even more difficult (Daly et al., 2016; Finne et al., 2009; Nguyen et al., 2011). For example, a six-week after school mindful eating intervention targeting obese girls recruited less than 10% of potential eligible participants, although this study reported a short recruitment window (Daly et al., 2016). Considering the possibly lower participant burden (e.g., short duration, flexible and self-paced) of the present intervention, we anticipated a reasonably higher recruitment rate, with **25%** of the reached eligible participants indicating feasibility.

(2) retention rate and measure completion. Due to the nature of this online intervention, retention rate was indicated by participants' response to intervention messages and post-intervention assessments, combined with the views of each intervention video. Participants who stopped replying to intervention messages or failed to complete post-intervention assessments were seen as withdrawn. According to Cochrane Handbook (2011), intervention studies with retention over 80% can be considered as having low attrition, and retention between 60% to 79% as moderate attrition. Most previous published studies of mobile phone delivered weight loss interventions have reported retention rate over 70% (Lyzwinski, 2014). Therefore, we set a retention rate of **70%** as an *a priori* indicating intervention feasibility.

(3) "if-then" plans formed by participants in Planning Group. We expected to receive three "if-then" plans of each participant in Planning Group, which would indicate good adherence of the planning component. The quality of plans was also evaluated.

(4) any technical problems and adverse events observed during the intervention.



**Table 7.3** Feasibility evaluation of the mindful snacking intervention regarding acceptability, effectiveness and amendments – overview.

<i>Intervention evaluation</i>	<i>Source of data</i>	<i>Analysis</i>
<b>Feasibility and Acceptability</b>	Recruitment rate	Quantitative (Descriptive)
	Retention rate/measure completion	Quantitative (Descriptive)
	Video views	Quantitative (Descriptive)
	“If-then” plans formed by participants in planning group	Quantitative (Descriptive) & Content analysis
	Post-intervention ratings	Quantitative (Descriptive)
	Technical problems and adverse events recorded during intervention	
	Qualitative feedback:	
	<i>Motivations and expectations</i>	Content analysis
	<i>Satisfaction/dissatisfaction</i>	Content analysis
	<i>Perceived usefulness</i>	Content analysis
<i>Perceived barriers</i>	Content analysis	
<b>Effectiveness</b>	Pre- and post-intervention self-report weight/BMI	Quantitative (ANOVAs)
	Pre- and post-intervention eating measures	Quantitative (ANOVAs)
	Predictive effect of improved mindful eating on intervention outcomes	Quantitative (Correlation & Regression)
	Qualitative feedback: <i>Perceived changes</i>	Content analysis
<b>Amendments</b>	Qualitative feedback: <i>Satisfaction</i>	Content analysis
	<i>Barriers</i>	Content analysis
	<i>Suggested improvements</i>	Content analysis

Participants’ acceptability of the intervention was assessed by post-intervention ratings and qualitative feedback. The follow-up interviews were transcribed in Chinese in full. Content analysis based on the topic of each question was conducted on the Chinese transcripts.

Quantitative data were analysed using SPSS 22.0. Descriptive statistics (i.e., means and

standard deviations) for all variables pre- and post-intervention for each group were computed. Multivariate analysis of variance and chi-square tests were conducted to examine group differences at baseline.

A series of 2 (time)  $\times$  2 (group) Repeated Measures Analysis of Variance (ANOVA) with time (pre- and post-intervention) as the within-subjects factor and group (No Planning Group and Planning Group) as the between-subjects factor was conducted for weight, BMI, eating styles (i.e., mindful eating, emotional eating, external eating), food craving, eating self-efficacy, and snacking. Significant main effects of time were interpreted as the indicator for intervention effectiveness. Significant interaction effects were interpreted as the difference in effectiveness of intervention conditions. Effect sizes were calculated using partial eta squares ( $\eta_p$ ), with  $\eta_p$  between .06 and .14 indicating a medium effect size, and larger than .14 indicating a large effect size (Bakeman, 2005; Cohen, 1988).

The relationships of weight loss and changes in eating behaviour measures were examined via Pearson correlation analysis. Based on the results of correlation analysis, stepwise linear regression analysis was conducted to explore the predictive power of changes in eating behaviours on weight loss and snacking.

## 7.3 Results

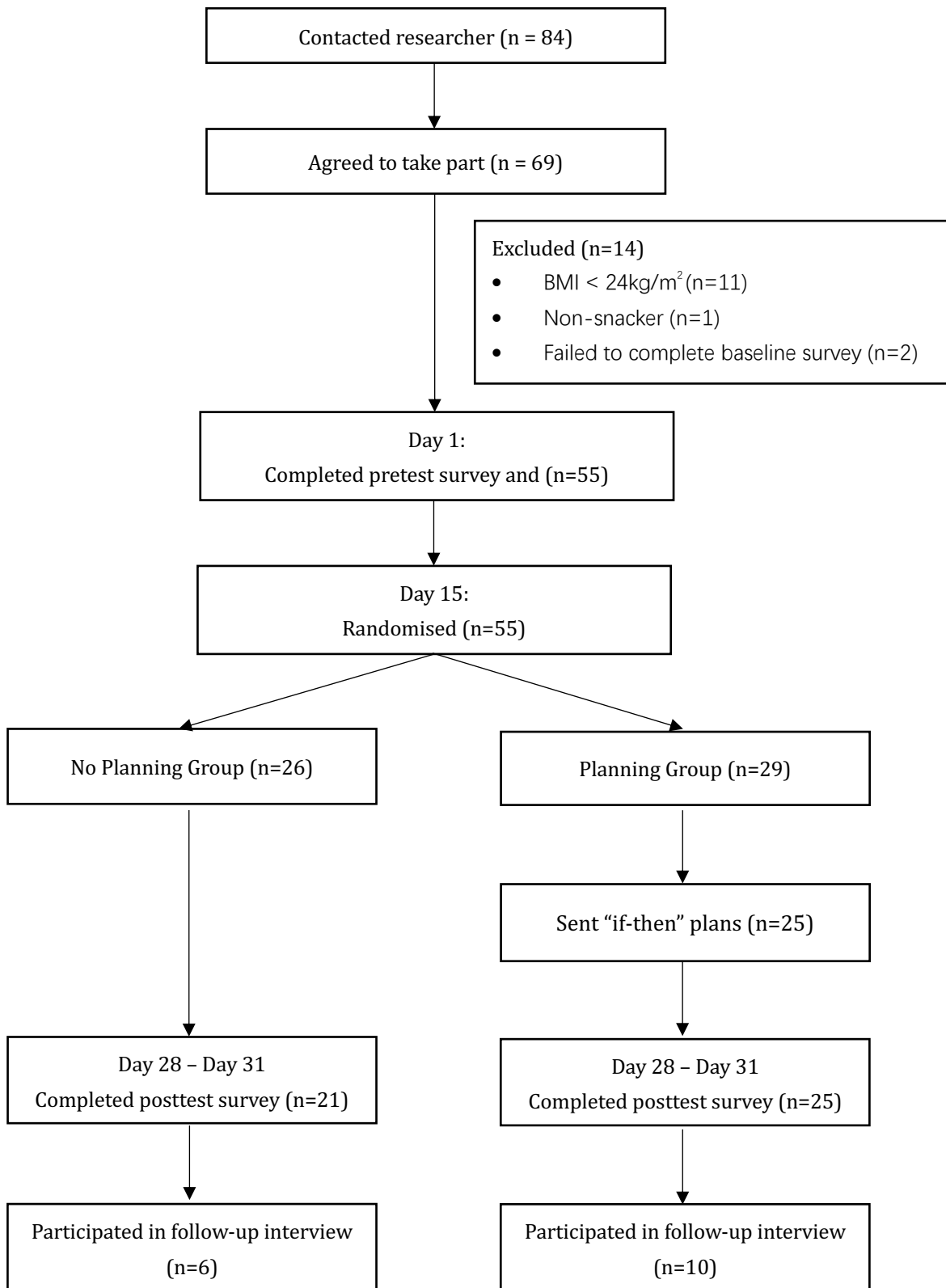
### Acceptability and Feasibility

#### *Recruitment*

Recruitment was conducted in three Chinese high schools. Posters displayed on noticeboards in the campuses of two high schools did not draw any attention or interest of adolescents; no teachers in these schools encouraged the study and no participants were recruited from here. Only the school teacher's recommendation generated interest and successful recruitment in one high school in Beijing; introduced and recommended the study in several first- and second-year research study classes to about 400 students in total in June, September and October 2018.

Participant recruitment and flow through the study and the level of pre- and post-intervention data collected are detailed in **Figure 7.1**. A total of 84 adolescents added our WeChat account to their contacts between July and October 2018. After initial contact, 69 adolescents consented to take part. Twelve of these were excluded for not meeting the inclusion criteria: eleven reported a BMI less than  $24\text{kg}/\text{m}^2$ , and one identified himself as a non-snacker. Two adolescents withdrew before completing the pre-intervention measures. The remaining 55 were randomly allocated into No planning Group ( $n = 26$ ) or Planning Group ( $n = 29$ ).

As adolescents in this study were recruited from the same school with our survey study (Chapter 2), the number of potential eligible participants was estimated based on data of the survey study. In the survey study, 22.5% of participants reported a BMI above  $24\text{kg}/\text{m}^2$ . Among 400 adolescents reached by the school teacher aiding our recruitment, it is estimated that there were approximately 90 adolescents with a BMI above  $24\text{kg}/\text{m}^2$ . Fifty-five enrolled in this study, indicating a recruitment rate of 61.1%. This exceeded the *a priori* criteria for recruitment rate (25%) and our initial goal of recruitment (16 for each group), indicating that recruiting for this intervention is highly feasible.



**Figure 7.1** Participant recruitment and flow through the study

### *Randomisation*

A total of 55 participants completing pre-intervention measures were randomly assigned into two groups. Descriptive statistics of baseline demographic characteristics for participants assigned to each group are shown in **Table 7.4**. MANOVA and chi-square tests showed no group difference in age, gender, school year, weight or BMI at baseline, indicating that the randomisation had been successful.

**Table 7.4** Descriptive statistics and group differences for demographic characteristics at baseline assessments (N = 55)

	M (SD)/%		<i>p</i>
	Group 1: No Planning ( <i>n</i> = 26)	Group 2: Planning ( <i>n</i> = 29)	
Age (yrs)	16.32 (0.49)	16.34 (0.48)	.99
Gender (female)	53.6%	63.1%	.59
School year (first year)	61.5%	55.2%	.79
Weight (kg)	75.38 (10.89)	74.71 (13.12)	.84
BMI (kg/m <sup>2</sup> )	25.65 (2.10)	26.25 (2.79)	.38

### *Retention/measure completion and engagement*

Of 55 participants completing the pre-intervention measures adequately and randomised, nine withdrew from the study without providing specific reasons, with 46 (83.6%) completing post-interventions measures. For No Planning Group, five (four girls and one boy) withdrew with 21 out of 26 (80.7%) completing the intervention and post-intervention measures. For Planning Group, four (all boys) withdrew with 25 out of 29 (86.2%) completing the intervention and post-intervention measures.

The intervention video views are reported as a proxy measure of engagement. The views shown in **Table 7.5** were recorded immediately after all participants completed post-intervention online survey. It should be noted that the video views shown on the video-sharing website shows overall times watched and not the numbers of participants who had watched the video. Also, the

views of the *Planning* video was not limited to the Planning Group (n=29), as participants in No Planning Group got access to the *Planning* video once they completed post-intervention assessments.

**Table 7.5** Views of intervention videos

Video	Views
<i>Video 1.</i> Welcome	72
<i>Video 2.</i> Making healthier choices for snacking	54
<i>Video 3.</i> Six kinds of hunger	52
<i>Video 4.</i> Listening to your stomach practice.	52
<i>Video 5.</i> Emotional eating and external eating	49
<i>Video 6.</i> Exploring your six kinds of hunger	47
<i>Video 7.</i> One bite at a time practice	49
<i>Video 8.</i> Food cravings	51
<i>Video 9.</i> Urge surfing practice	50
<i>Video 10.</i> Planning	38

#### *“If-then” plans*

Plans from all 25 participants in Planning Group were returned, with three plans from each participant and 75 plans in total. Of 25 participants, 18 sent their plans by the end of the third week as requested. The remaining seven participants sent their plans within three days after receiving a reminder message from the researcher. No participants reported any questions or barriers regarding forming plans during the intervention or in follow-up interviews. Overall, the plans participants formed appeared reasonable.

The frequencies of each “if” and “then” conditions used by participants to form plans were presented in **Table 7.6** and **Table 7.7**. All 16 “if” conditions and 14 “then” conditions provided in the *planning* session were used by at least one participant. Several conditions were more frequently employed than others. The most frequently selected “if” conditions were related to emotional eating (“If I feel like having a snack when I’m bored”), external eating (“If I feel like having a snack when I walk past a shop/ bakery / café”) and disinhibition (“If I am snacking on my favourite food and find it hard to stop eating even when I’m full”). The most frequently selected solutions in general were to choose healthy snacks by reading labels (number 4), to

evaluate hunger level and eating only in response to physical hunger (number 1), and to decide ahead of time specifically how much to eat in one sitting (number 10).

**Table 7.6** Frequency of “if” conditions selected by participants in planning

<i>Snacking behaviours</i>	<i>“If” conditions (n=16)</i>	<i>Number of plans (N=75)</i>
<b>Emotional eating</b>	If I am upset/sad/disappointed/frustrated and feel like having a snack	1
	If I am feeling stressed and feel like having a snack	3
	If I feel like having a snack when I am bored	12
	If I feel like having a snack/beverage to reward myself or celebrate	6
<b>External eating</b>	If I feel like having a snack because snacks are there	4
	If I feel like having a snack when I see others snack	4
	If I want to snack because the food looks/smells/tastes very good	4
	If I feel like having a snack when I walk past a shop/ bakery / café	12
<b>Distraction</b>	If I find myself thinking about other things and not enjoying the food when I am snacking	4
	If I find myself snacking too quickly that I don’t taste what I am eating	1
	If I find myself snacking when I am watching TV/reading/doing my homework	6
<b>Disinhibition</b>	If I am snacking on my favourite food and find it hard to stop eating even when I’m full	8
	If I am at a party/buffet/restaurant where is a lot of good food and I feel like eating more than I need	3
	If I find myself snacking all the time	4
<b>Craving</b>	If I find myself crave high-calorie snacks/beverage	2
<b>Acceptance</b>	If I find I criticise myself for feeling like snacking	1

**Table 7.7** Frequency of “then” conditions selected by participants in planning

<i>No.</i>	<i>“Then” conditions</i> ( <i>n=14</i> )	<i>Number of plans</i> ( <i>N = 75</i> )
1	Then I will take a moment to check my hunger level, choose to eat if I feel my stomach needs food, and stop eating when I am no longer feeling hungry.	<b>9</b> (Emotional eating: 4; external eating: 4; disinhibition: 1)
2	Then I will remind myself that it is OK to have difficult feelings, I can just let it go without trying to fix it, and that food is not designed to fix feelings.	1 (Emotional eating: 1)
3	Then I’ll do something else that can relax me instead of snacking.	<b>8</b> (Emotional eating: 8)
4	Then I’ll choose to buy healthy snacks by reading the labels on the package.	<b>12</b> (Emotional eating: 3; external eating: 8; distraction: 1)
5	Then I will pause to reflect on the type of food or flavour that would satisfy me, consciously choose the food I want, and pay attention to how it tastes and how I feel when I eat it.	4 (Emotional eating: 2; external eating: 1; distraction: 1)
6	Then I will neutrally watch any distractions and thoughts, letting them come and go, and will keep coming back to the sensations involved in eating and tasting.	2 (Distraction: 2)
7	Then I will try to slow down, pause and take a breath between bites, and chew my food thoroughly.	<b>6</b> (Disinhibition: 3; distraction: 3)
8	Then I will pay close attention to my body sensations when snacking, observe the signs of satiety and fullness, and stop eating when I feel satisfied.	2 (Disinhibition: 2)
9	Then I will set my intention to either watch TV/reading/studying or stop to have a snack mindfully.	3 (Distraction: 3)
10	Then I will decide ahead of time specifically how much I will eat in one sitting, take the planned amount and no more.	<b>9</b> (External eating: 3; disinhibition: 4; distraction: 1; craving: 1)
11	Then I will notice my thoughts and feelings then let them go, reminding myself I don’t need to criticise myself for my desire to eat.	3 (External eating: 2; acceptance: 1)
12	Then I will keep my snacks out of my sight where I cannot easily reach them.	5 (Disinhibition: 5)
13	Then I’ll observe my bodily sensations without reacting to the craving, reminding myself that the cravings will ebb just like the ocean waves.	5 (External eating: 4; craving: 1)
14	Then I will remind myself it’s natural to crave tasty food, I have right to enjoy the snacks that I like, then take a small amount of snack, relax and enjoy it, and take no more.	2 (Emotional eating: 2)



### *Technical problems and adverse events*

No adverse event was observed or reported during the intervention. The only reported technical problem was that the password for intervention videos was too complicated and needed to be entered every time before watching the video (see **Table 7.14**, Dissatisfaction – technical issue). Overall, the delivery of this intervention via WeChat was technically feasible.

### *Acceptability ratings*

Participants' ratings on acceptability and perceived usefulness of the intervention are shown in **Table 7.8**. Overall, both groups rated high on satisfaction, usefulness and actual usage of the intervention content. Mann-Whitney U test was performed to compare the ratings of the two groups. Compared to the No Planning Group, the Planning Group reported significantly higher perceived knowledge gain ( $Z = -2.33, p = .020$ ). The Planning Group also showed a trend of lower perceived time pressure ( $Z = -1.92, p = .054$ ).

**Table 7.8** Mean scores (SD) of and group difference for participants' ratings on acceptability and usefulness of the intervention (range: 1-5)

Variable	Mean (SD)		Z	p
	Group 1: No Planning (n = 21)	Group 2: Planning (n = 25)		
Satisfied	4.33 (0.66)	4.48 (0.59)	-.74	.458
No pressure	4.24(0.77)	4.64(0.49)	-1.92	<b>.054</b>
Convenient	4.67 (0.58)	4.60(0.50)	-.67	.506
Gained knowledge	4.43(0.60)	4.80(0.41)	-2.33	<b>.020*</b>
Improved skills	4.43(0.60)	4.52(0.51)	-.44	.659
Useful	4.52 (0.68)	4.72(0.46)	-.90	.367
Enjoyable	4.57(0.60)	4.48(0.59)	-.61	.544
Have been using	4.19(0.68)	4.28(0.68)	-.46	.644
Will continue using	4.14(0.73)	4.48(0.51)	-1.59	.113
<i>Average</i>	4.44 (0.52)	4.56(0.38)	1.51	.225

## Intervention effects – quantitative outcomes

### *Participant characteristics*

The final sample included 26 first year and 20 second year high school students aged 16 to 17 years ( $M = 16.35$  years,  $SD = .48$ ), with 60.9% female. The BMI ranged from 24.16 to 32.19  $\text{kg/m}^2$ , with a mean of 25.79  $\text{kg/m}^2$  ( $SD = 2.05$ ).

In the final sample, 10 out of 21 (47.6%) participants for No Planning Group and 18 out of 25 (72.0%) for Planning Group were female. A chi-square test of independence was performed to examine group difference for gender. As a result of participant attrition, the difference in percentage of girls between groups showed a marginal trend toward significance:  $\chi^2(1, N = 46) = 2.85, p = .091$ .

**Table 7.9** Mean scores (SD) of and group difference for eating styles, craving, weight efficacy, and snacking frequency at baseline (N = 46)

	Mean (SD)		F	p
	Group 1: No Planning (n = 21)	Group 2: Planning (n = 25)		
Age (yrs)	16.38 (.50)	16.32 (.48)		
Weight (kg)	77.1 (11.5)	71.8 (9.4)	2.91	.095
BMI ( $\text{kg/m}^2$ )	25.8 (2.5)	25.8 (1.9)	.01	.908
Motivation (4-16)	12.10 (.49)	12.72 (.45)	.89	.351
<b>DEBQ (1-5)</b>				
Emotional eating	2.26 (.85)	3.03 (.93)	8.43	<b>.006**</b>
External eating	3.44 (.62)	3.74 (.85)	1.92	.173
<b>MEQ (1-4)</b>	2.55 (.41)	2.45 (.42)	.79	.434
<b>FCQ-T (15 – 90)</b>	40.43 (13.83)	43.44 (11.98)	.63	.433
<b>WEL (0 – 80)</b>	50.76 (15.97)	43.36 (14.89)	2.64	.111
<b>Snacking</b> (times/week)				
Food	37.40 (25.65)	32.4 (19.3)	.56	.457
Beverage	20.1 (17.3)	23.7 (24.2)	.32	.574

Age, weight, BMI, motivation, eating behaviours, self-efficacy and snacking frequencies of each group at baseline are illustrated in **Table 7.9**. Multivariate analysis of variance was

conducted to examine group differences for baseline measures. No Planning Group showed significantly lower average scores on *emotional eating* ( $F = 8.43, p = .006$ ) of the DEBQ compared to Planning Group. There was no significant difference in other baseline measures between two groups.

*Descriptive statistics of pre- and post-intervention assessments*

Mean scores, standard deviations and ranges of pre- and post- intervention measures and pre- to post-intervention changes for each group are shown in **Table 7.10**. The pre- to post-intervention changes were in the expected directions for all measures.

**Table 7.10** Mean scores (*SD*) of BMI, eating styles, craving, weight efficacy and snacking frequency at pre- and post-intervention assessments by group

Measures	Time point	M ± SD		Time	Group	Time × Group
		Range				
		No Planning Group (n = 21)	Planning Group (n = 25)			
<b>Weight (kg)</b>	T <sub>1</sub>	77.07 ± 11.48 63.0 – 105.0	71.82 ± 9.38 59.0 – 100.0	$F(1, 44) = 23.43,$	$F(1, 44) = 3.22$	$F(1, 44) = .31,$ $p = .582,$
	T <sub>2</sub>	75.64 ± 11.49 61.0 – 103.0	70.03 ± 9.00 57.0 – 97.6	$p < .001^{***},$ $\eta_p^2 = .35$	$p = .080$ $\eta_p^2 = .068$	$\eta_p^2 = .00$
	T <sub>2</sub> – T <sub>1</sub>	-1.42 ± 1.47 -4 – .70	-1.79 ± 2.72 -9.6 – 3.0			
<b>BMI (kg/m<sup>2</sup>)</b>	T <sub>1</sub>	25.83 ± 2.25 24.16 – 32.19	25.76 ± 1.91 24.20 – 30.19	$F(1, 44) = 27.11,$	$F(1, 44) = .13$ $p = .72$	$F(1, 44) = 1.22, p = .275,$
	T <sub>2</sub>	25.31 ± 2.31 23.31 – 32.19	24.96 ± 1.50 23.42 – 29.47	$p < .001^{***};$ $\eta_p^2 = .38$	$\eta_p^2 = .00$	$\eta_p^2 = .027$
	T <sub>2</sub> – T <sub>1</sub>	-.52 ± .46 -1.4 – 0	-.79 ± 1.07 -3.41 – 1.10			
<b>Snacking Food (times/week)</b>	T <sub>1</sub>	37.40 ± 25.65 9.5 – 124.0	32.4 ± 19.3 7.0 – 83.5	$F(1, 44) = 5.61,$	$F(1, 44) = .13$ $p = .91$	$F(1, 44) = 2.44,$
	T <sub>2</sub>	23.57 ± 12.17 0 – 50.0	29.58 ± 17.03 5.0 – 65.5	$p = .022^*,$ $\eta_p^2 = .11$	$\eta_p^2 = .00$	$p = .13,$ $\eta_p^2 = .05$
	T <sub>2</sub> – T <sub>1</sub>	-13.83 ± 23.39 -74.0 – 20.0	-2.84 ± 24.11 -55.0 – 47.0			

Snacking <b>Unhealthy food</b> (times/week)	T <sub>1</sub>	13.60 ± 14.57 0 – 58.0	14.84 ± 12.26 1.0 – 54.5	$F(1, 44) = 10.98,$ $p = .002^{**},$ $\eta_p^2 = .20$	$F(1, 44) = .33$ $p = .57$ $\eta_p^2 = .01$	$F(1, 44) = .00,$ $p = .97,$ $\eta_p^2 = .00$
	T <sub>2</sub>	6.76 ± 4.03 0 – 16	8.18 ± 7.55 0 – 30.0			
	T <sub>2</sub> – T <sub>1</sub>	-6.83 ± 12.95 -48.0 – 6.0	-6.67 ± 14.39 -50.5 – 20.0			
Snacking <b>Beverage</b> (times/week)	T <sub>1</sub>	20.12 ± 17.30 3.0 – 56.5	23.7 ± 24.2 3.0 – 95.0	$F(1, 44) = 8.85,$ $p = .005^{**},$ $\eta_p^2 = .17$	$F(1, 44) = .08$ $p = .78$ $\eta_p^2 = .00$	$F(1, 44) = 0.74,$ $p = .39,$ $\eta_p^2 = .02$
	T <sub>2</sub>	14.17 ± 10.90 0 – 42.0	12.90 ± 8.92 1.0 – 38.0			
	T <sub>2</sub> – T <sub>1</sub>	-5.95 ± 11.65 -34 – 15	-10.80 ± 23.47 -77.5 – 23.5			
Snacking <b>Unhealthy beverage</b> (times/week)	T <sub>1</sub>	9.74 ± 10.50 0 – 39.0	10.00 ± 8.97 0 – 31.0	$F(1, 44) = 16.83,$ $p < .001^{***},$ $\eta_p^2 = .28$	$F(1, 44) = .16$ $p = .69$ $\eta_p^2 = .00$	$F(1, 44) = 0.54,$ $p = .47,$ $\eta_p^2 = .01$
	T <sub>2</sub>	5.24 ± 5.62 0 – 19.0	3.54 ± 3.30 0 – 11.5			
	T <sub>2</sub> – T <sub>1</sub>	-4.50 ± 8.52 -25.5 – 9.5	-6.46 ± 9.43 -30.0 – 4.0			
DEBQ <b>Emotional eating</b> (1-5)	T <sub>1</sub>	2.26 ± .85 1.00 – 4.23	3.03 ± .93 1.15 – 4.92	$F(1, 44) = 10.44,$ $p = .002^{**},$ $\eta_p^2 = .19$	$F(1, 44) = 7.16$ $p = .01^{**}$ $\eta_p^2 = .14$	$F(1, 44) = 1.40,$ $p = .244,$ $\eta_p^2 = .03$
	T <sub>2</sub>	2.00 ± .80 1.00 – 3.62	2.47 ± .96 1.00 – 5.00			
	T <sub>2</sub> – T <sub>1</sub>	-.26 ± .62 -2 – .69	-.56 ± 1.01 -2.77 – 1.23			
DEBQ <b>External eating</b> (1-5)	T <sub>1</sub>	3.44 ± .62 2.57 – 4.57	3.74 ± .85 2.29 – 5.00	$F(1, 44) = 36.19,$ $p < .001^{***},$ $\eta_p^2 = .45$	$F(1, 44) = 1.87$ $p = .18$ $\eta_p^2 = .04$	$F(1, 44) = .26,$ $p = .61,$ $\eta_p^2 = .01$
	T <sub>2</sub>	2.76 ± .64 1.43 – 4.29	2.94 ± .78 1.57 – 4.86			
	T <sub>2</sub> – T <sub>1</sub>	-.68 ± .62 -1.86 – 1.00	-.81 ± .98 -3.0 – .86			
C-MEQ-R <b>Mindful eating</b> Summary score (1-4)	T <sub>1</sub>	2.53 ± .39 1.39 – 3.09	2.43 ± .42 1.54 – 3.54	$F(1, 44) = 29.10,$ $p < .001^{***},$ $\eta_p^2 = .40$	$F(1, 44) = .21$ $p = .65$ $\eta_p^2 = .01$	$F(1, 44) = .72,$ $p = .40,$ $\eta_p^2 = .02$
	T <sub>2</sub>	2.87 ± .40 2.25 – 3.54	2.89 ± .41 2.30 – 3.92			
	T <sub>2</sub> – T <sub>1</sub>	.34 ± .51 -.30 – 2.14	.46 ± .49 -.11 – 2.09			

C-MEQ-R <i>Intentional awareness</i> (1-4)	T <sub>1</sub>	2.24 ± .67 1.00 – 3.57	2.35 ± .60 1.00 – 3.71	<i>F</i> (1,44) = 5.90, <b><i>p</i></b> = .019*, $\eta_p^2 = .12$	<i>F</i> (1, 44) = .64 <i>p</i> = .43 $\eta_p^2 = .01$	<i>F</i> (1,44) = .00, <i>p</i> = .99, $\eta_p^2 = .00$
	T <sub>2</sub>	2.52 ± .58 1.20 – 3.57	2.64 ± .65 1.14 – 3.86			
	T <sub>2</sub> – T <sub>1</sub>	.29 ± .63 -.57 – 1.86	.29 ± .91 -2.36 – 2.43			
C-MEQ-R <i>Disinhibition</i> (1-4)	T <sub>1</sub>	2.46 ± .61 1.14 – 3.43	2.44 ± .70 1.29 – 3.71	<i>F</i> (1, 44) = 15.24, <b><i>p</i></b> < .001***, $\eta_p^2 = .26$	<i>F</i> (1, 44) = .48 <i>p</i> = .49 $\eta_p^2 = .01$	<i>F</i> (1, 44) = 1.15, <i>p</i> = .29, $\eta_p^2 = .03$
	T <sub>2</sub>	2.78 ± .62 1.43 – 3.71	3.01 ± .70 1.57 – 4.00			
	T <sub>2</sub> – T <sub>1</sub>	.32 ± .72 -1.00 – 2.57	.57 ± .81 -1.00 – 2.16			
C-MEQ-R <i>Emotional response</i> (1-4)	T <sub>1</sub>	2.81 ± .83 1.00 – 4.00	2.18 ± 1.01 1.00 – 4.00	<i>F</i> (1, 44) = 20.20, <b><i>p</i></b> < .001***, $\eta_p^2 = .32$	<i>F</i> (1, 44) = 5.32 <b><i>p</i></b> = .026* $\eta_p^2 = .11$	<i>F</i> (1, 44) = .42, <i>p</i> = .52, $\eta_p^2 = .01$
	T <sub>2</sub>	3.33 ± .76 2.00 – 4.00	2.88 ± .92 1.00 – 4.00			
	T <sub>2</sub> – T <sub>1</sub>	.52 ± .95 -1.50 – 2.00	.70 ± .89 -.50 – 3.00			
C-MEQ-R <i>Attentive eating</i> (1-4)	T <sub>1</sub>	2.62 ± .70 1.39 – 3.86	2.73 ± .58 1.86 – 3.71	<i>F</i> (1, 44) = 4.37, <b><i>p</i></b> = .042*, $\eta_p^2 = .09$	<i>F</i> (1, 44) = .81 <i>p</i> = .37 $\eta_p^2 = .02$	<i>F</i> (1, 44) = .11, <i>p</i> = .74, $\eta_p^2 = .00$
	T <sub>2</sub>	2.84 ± .57 1.29 – 3.86	3.02 ± .79 1.57 – 4.00			
	T <sub>2</sub> – T <sub>1</sub>	.21 ± .80 -1.00 – 2.14	.29 ± .83 -2.00 – 1.86			
FCQ-T <b>Food craving</b> (15 – 90)	T <sub>1</sub>	40.43 ± 13.83 17.0 – 79.0	43.44 ± 11.98 18.0 – 65.0	<i>F</i> (1, 44) = 17.06, <b><i>p</i></b> < .001***, $\eta_p^2 = .28$	<i>F</i> (1, 44) = .21 <i>p</i> = .65 $\eta_p^2 = .01$	<i>F</i> (1, 44) = 0.79, <i>p</i> = .38, $\eta_p^2 = .02$
	T <sub>2</sub>	34.33 ± 11.47 15.0 – 61.0	34.00 ± 9.77 20.0 – 52.0			
	T <sub>2</sub> – T <sub>1</sub>	-6.1 ± 14.79 -46.0 – 17.0	-9.44 ± 10.67 -41.0 – 5.0			
WEL <b>Eating self- efficacy</b> (0 – 80)	T <sub>1</sub>	50.76 ± 15.97 17.0 – 72.0	43.36 ± 14.89 14.0 – 72.0	<i>F</i> (1, 44) = 10.54, <b><i>p</i></b> = .002**, $\eta_p^2 = .19$	<i>F</i> (1, 44) = 1.79 <i>p</i> = .18 $\eta_p^2 = .04$	<i>F</i> (1, 44) = 1.55, <i>p</i> = .22, $\eta_p^2 = .03$
	T <sub>2</sub>	55.29 ± 12.00 21.0 – 72.0	53.52 ± 12.31 31.0 – 72.0			
	T <sub>2</sub> – T <sub>1</sub>	4.52 ± 14.55 -37.0 – 34.0	10.16 ± 15.87 -16.0 – 41.0			

*Intervention effects on body weight and BMI*

Two 2 (Time: pre, post) × 2 (Group: No Planning, Planning) ANOVAs with repeated measures

on the time was conducted on body weight and BMI.

*Body weight.* There was a significant main effect of time:  $F(1, 44) = 23.43, p < .001, \eta_p^2 = .347$ , with both groups decreasing in BMI over the time period (see Table 7.10). However, the interaction between time and group was non-significant:  $F(1, 44) = .31, p = .582, \eta_p^2 = .00$ . There was a non-significant main effect of group:  $F(1, 44) = 3.22, p = .080, \eta_p^2 = .068$ .

*BMI.* The result showed a significant main effect of time:  $F(1, 44) = 27.11, p < .001, \eta_p^2 = .38$ , with both groups decreasing in BMI over the time period (see Table 8.10). However, the interaction between time and group was non-significant:  $F(1, 44) = 1.22, p = .275, \eta_p^2 = .027$ . There was a non-significant main effect of group:  $F(1, 44) = .13, p = .72, \eta_p^2 = .00$ .

To further compare the effects of two intervention conditions on body weight and BMI, multivariate analysis of covariance (MANCOVA) was performed to control for gender and motivation. In addition, as significant group differences were observed in baseline emotional eating (see Table 7.9), the baseline emotional eating was also included as a covariate. The time-group interactions were not significant after controlling for these factors.

#### *Intervention effects on snacking*

Four 2 (Time: pre, post)  $\times$  2 (Group: No Planning, Planning) ANOVAs with repeated measures on the time was conducted on total consumption (i.e., frequency) of snack foods, consumption of unhealthy snack foods, total consumption of beverages, and consumption of unhealthy beverages.

*Total snack food consumption.* Result showed a significant main effect of time:  $F(1, 44) = 5.61, p = .022, \eta_p^2 = 0.11$ , with both groups decreasing in total snack food consumption over the time period (see Table 7.10). However, the interaction between time and group was non-significant:  $F(1, 44) = 2.44, p = .13, \eta_p^2 = .05$ . There was a non-significant main effect of group:  $F(1, 44) = .13, p = .91, \eta_p^2 = .00$ .

*Unhealthy snack food consumption.* There was a significant main effect of time:  $F(1, 44) = 10.98, p = .002, \eta_p^2 = .20$ , with both groups decreasing in unhealthy snack food consumption over the time period (see Table 7.10). There was a non-significant interaction between time and group:

$F(1, 44) = .00, p = .97, \eta_p^2 = .00$ . The main effect of group was non-significant:  $F(1, 44) = .33, p = .57, \eta_p^2 = .01$ .

*Total beverage consumption.* Result showed a significant main effect of time:  $F(1, 44) = 8.85, p = .005, \eta_p^2 = 0.17$ , with both groups decreasing in total beverage consumption over the time period (see Table 7.10). However, the interaction between time and group was non-significant:  $F(1, 44) = 0.74, p = .39, \eta_p^2 = .02$ . There was a non-significant main effect of group:  $F(1, 44) = .08, p = .78, \eta_p^2 = .00$ .

*Unhealthy beverage consumption.* Result showed a significant main effect of time:  $F(1, 44) = 16.83, p < .001, \eta_p^2 = 0.28$ , with both groups decreasing in unhealthy beverage consumption over the time period (see Table 7.10). The interaction between time and group was also non-significant:  $F(1, 44) = 0.54, p = .47, \eta_p^2 = .01$ . There was a non-significant main effect of group:  $F(1, 44) = .16, p = .69, \eta_p^2 = .00$ .

#### *Intervention effects for eating styles*

Three 2 (Time: pre, post)  $\times$  2 (Group: No Planning, Planning) ANOVAs with repeated measures on the time was conducted on emotional eating, external eating and mindful eating.

*Emotional eating.* There was a significant main effect of time:  $F(1, 44) = 10.44, p = .002, \eta_p^2 = .19$ , with both groups decreasing in emotional eating over the time period (see Table 7.10). However, the interaction between time and group was non-significant:  $F(1, 44) = 1.40, p = .244, \eta_p^2 = .03$ . There was a significant main effect of group:  $F(1, 44) = 7.16, p = .01, \eta_p^2 = .14$ .

*External eating.* There was a significant main effect of time:  $F(1, 44) = 36.19, p < .001, \eta_p^2 = .45$ , with both groups decreasing in external eating over the time period (see Table 7.10). The interaction between time and group was non-significant:  $F(1, 44) = .26, p = .61, \eta_p^2 = .01$ . There was a non-significant main effect of group:  $F(1, 44) = 1.87, p = .18, \eta_p^2 = .04$ .

*Mindful eating.* Results showed a significant main effect of time:  $F(1, 44) = 29.10, p < .001, \eta_p^2 = .40$ , with both groups increasing in mindful eating over the time period (see Table 7.10). However, the interaction between time and group was non-significant:  $F(1, 44) = .72, p = .40, \eta_p^2 = .02$ . There was a non-significant main effect of group:  $F(1, 44) = .21, p = .65, \eta_p^2 = .01$ .

To further understand the intervention effect on mindful eating, the same ANOVAs were performed on sub-constructs of mindful eating:

*Intentional awareness.* Results showed a significant main effect of time:  $F(1, 44) = 5.90, p = .019, \eta_p^2 = .12$ , with both groups increasing in *disinhibition* of the MEQ over the time period (see Table 7.10). The interaction between time and group was non-significant:  $F(1,44) = .00, p = .99, \eta_p^2 = .00$ . The main effect of group was non-significant:  $F(1,44) = .64, p = .43, \eta_p^2 = .01$ .

*Disinhibition.* Results showed a significant main effect of time:  $F(1, 44) = 15.24, p < .001, \eta_p^2 = .26$ , with both groups increasing in *disinhibition* of the MEQ over the time period (see Table 7.10). However, the interaction between time and group was non-significant:  $F(1, 44) = 1.15, p = .29, \eta_p^2 = .03$ . There was a non-significant main effect of group:  $F(1, 44) = .48, p = .49, \eta_p^2 = .01$ .

*Emotional response.* Results showed a significant main effect of time:  $F(1, 44) = 20.20, p < .001, \eta_p^2 = .32$ , with both groups increasing in *emotional response* of the MEQ over the time period (see Table 7.10). The interaction between time and group was also non-significant:  $F(1, 44) = .42, p = .52, \eta_p^2 = .01$ . There was a significant main effect of group:  $F(1, 44) = 5.32, p = .026, \eta_p^2 = .11$ .

*Attentive eating.* Results showed a significant main effect of time:  $F(1, 44) = 4.37, p = .042, \eta_p^2 = .09$ , with both groups increasing in *external cues* of the MEQ over the time period (see Table 7.10). However, the interaction between time and group was also non-significant:  $F(1, 44) = .11, p = .74, \eta_p^2 = .00$ . There was a non-significant main effect of group:  $F(1, 44) = .81, p = .37, \eta_p^2 = .02$ .

#### *Intervention effects for food craving and eating self-efficacy*

Two 2 (Time: pre, post)  $\times$  2 (Group: No Planning, Planning) ANOVAs with repeated measures on the time were performed on food craving and eating self-efficacy.

*Food craving.* There was a significant main effect of time:  $F(1, 44) = 17.06, p < .001, \eta_p^2 = 0.28$ , with both groups decreasing in food craving over the time period (see Table 7.10). The interaction between time and group was also non-significant:  $F(1, 44) = 0.79, p = .38, \eta_p^2 = .02$ .



There was a non-significant main effect of group:  $F(1, 44) = .21, p = .65, \eta_p^2 = .01$ .

*Eating self-efficacy.* Results showed a significant main effect of time:  $F(1, 44) = 10.54, p = .002, \eta_p^2 = 0.19$ , with both groups increasing in the WLE over the time period (see Table 7.10). The interaction between time and group was also non-significant:  $F(1, 44) = 1.55, p = .22, \eta_p^2 = .03$ . There was a non-significant main effect of group:  $F(1, 44) = 1.79, p = .18, \eta_p^2 = .04$ .

#### *Relationships between changes in eating behaviour measures and weight loss*

As no group difference was observed in intervention effects on weight and eating behaviour measures, Pearson correlation analysis was conducted for the whole sample to explore the relationships between pre- to post-intervention changes in eating behaviour measures and weight loss.

As shown in **Table 7.11**, for the whole sample, the pre- to post-intervention weight change was positively correlated with change in emotional eating ( $r = .42, p = .004$ ), external eating ( $r = .32, p = .031$ ), and food craving ( $r = .35, p = .016$ ), and negatively correlated with change in mindful eating ( $r = -.33, p = .026$ ). Surprisingly, changes in consumption of unhealthy snacks and beverages were not significantly correlated with change in weight. Only change in external eating was positively correlated with both change in unhealthy food consumption ( $r = .45, p = .002$ ) and unhealthy beverage consumption ( $r = .47, p = .001$ ). In addition, change in mindful eating was positively correlated with change in eating self-efficacy ( $r = .44, p = .002$ ), and negatively correlated with the changes in emotional eating ( $r = -.49, p = .001$ ), external eating ( $r = -.38, p = .010$ ), food craving ( $r = -.61, p < .001$ ), and consumption (frequency) of unhealthy snacks ( $r = -.31, p = .037$ ).

**Table 7.11** Pearson correlation coefficients showing the relations between pre- to post-intervention changes in weight and eating behaviour measures

	1	2	3	4	5	6	7	8
1. Weight $T_2 - T_1$	–							
2. Mindful eating $T_2 - T_1$	-.33*	–						
3. Emotional eating $T_2 - T_1$	.42**	-.49**	–					
4. External eating $T_2 - T_1$	.32*	-.38*	.60***	–				
5. Food craving $T_2 - T_1$	.35*	-.61***	.50**	.61***	–			
6. Eating self-efficacy	-.23	.44**	-.52**	-.36*	-.52***	–		
7. Unhealthy food $T_2 - T_1$	.03	-.31*	.26	.45**	.17	-.17	–	
8. Unhealthy beverage $T_2 - T_1$	.07	-.18	.01	.47**	.26	-.05	.50***	–

Note: \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ .  $T_1$ : pre-intervention assessment;  $T_2$ : post-intervention assessment.

### *Testing mediation effects*

Based on the result of the correlation analysis, two hierarchical regressions were performed to explore potential mediating effects of eating-related measures (i.e., emotional eating, external eating, food cravings) on the relationship between improved mindful eating and main intervention outcomes (i.e., weight loss and reduction in consumption of unhealthy snacks). Baron and Kenny (1986) suggested that mediation effects are demonstrated when the following conditions are met: (1) the independent variable (i.e., improved mindful eating) significantly predicts the dependent variable (i.e., weight loss and reduction in unhealthy snack consumption); (2) the independent variable significantly predicts the mediator (i.e., changes in other eating-related measures); (3) the mediator significantly predicts the dependent variable when controlling for the independent variable; (4) full mediation is indicated if the significant association between independent and dependent variables diminish when the mediator is held constant.

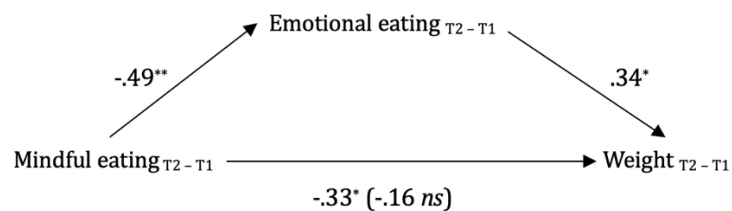
For the relationship between improved mindful eating and weight loss, change in mindful eating was entered as a predictor variable into the regression equation at step 1, in order to test condition 1. Then change in emotional eating, change in external eating and change in trait food craving were entered using a stepwise approach, to detect mediators and test condition 3 and 4 (step 3). The potential mediators were also separately regressed onto weight change to test condition 2 (step 2). For pre- to post-intervention weight change, change in mindful eating ( $\beta =$

-.33,  $p = .026$ ) predicted 11% of the variance,  $F(1, 44) = 5.33$ ,  $p = .026$ , indicating participants with greater improvements in mindful eating reported greater weight loss. When potential mediators entered the equation, only change in emotional eating ( $\beta = .34$ ,  $p = .033$ ) was included in the model, which explained 18% of the variance,  $F(1,44) = 9.56$ ,  $p = .003$ , and the beta weight for change in mindful eating was reduced to non-significance ( $\beta = -.16$ , *ns*), indicating mediation (see **Table 7.12** and **Figure 7.2**).

**Table 7.12** Hierarchical regression analysis testing the mediating effects of change in emotional eating on the relationship between change in mindful eating and weight loss (N = 46)

	R	R <sup>2</sup>	R <sup>2</sup> change	Beta
Step 1:				
Weight <sub>T2-T1</sub> on mindful eating <sub>T2-T1</sub>	.33	.11		-.33*
Step 2:				
Mindful eating <sub>T2-T1</sub> on emotional eating <sub>T2-T1</sub>	.49	.24		-.49**
Step 3:				
Weight <sub>T2-T1</sub> on change in emotional eating	.42	.18		.34*
Weight <sub>T2-T1</sub> e on mindful eating <sub>T2-T1</sub>	.47	.20	.02	-.16

Note: \*  $p < .05$ ; \*\*  $p < .01$ . T<sub>1</sub>: pre-intervention assessment; T<sub>2</sub>: post-intervention assessment.



**Figure 7.2** Mediation analysis of change in mindful eating, change in emotional eating, and weight change

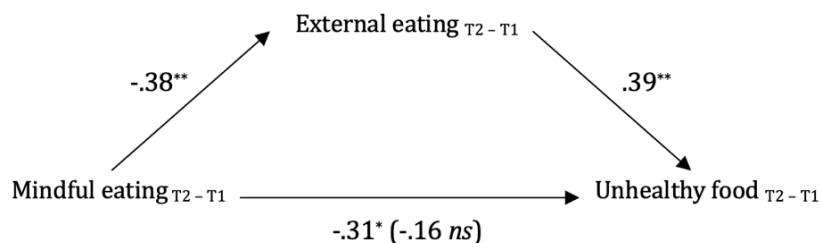
For the relationship between improved mindful eating and reduction in unhealthy snack consumption, change in mindful eating was entered as a predictor variable into the regression equation at step 1, in order to test condition 1. Then change in external eating was entered to test condition 3 and 4 (step 3). Change in external eating was also separately regressed onto weight change to test condition 2 (step 2). For pre- to post-intervention change in unhealthy snack consumption, change in mindful eating ( $\beta = -.31$ ,  $p = .037$ ) predicted 10% of the variance,  $F(1,$

44) = 4.64,  $p = .037$ , indicating participants with greater improvements in mindful eating reported greater reduction in unhealthy snack consumption. When change in external eating ( $\beta = .39$ ,  $p = .011$ ) entered the equation (step 3), it explained 20% of the variance,  $F(1,44) = 11.00$ ,  $p = .002$ . and the beta weight for change in mindful eating was reduced to non-significance ( $\beta = -.16$ , *ns*), indicating mediation (see **Table 7.13** and **Figure 7.3**).

**Table 7.13** Hierarchical regression analysis testing the mediating effects of change in external eating on the relationship between change in mindful eating and reduction in unhealthy snack consumption (N = 46)

	R	R <sup>2</sup>	R <sup>2</sup> change	Beta
Step 1:				
Unhealthy food T <sub>2</sub> - T <sub>1</sub> on mindful eating T <sub>2</sub> - T <sub>1</sub>	.31	.10		-.31*
Step 2:				
Mindful eating T <sub>2</sub> - T <sub>1</sub> on external eating T <sub>2</sub> - T <sub>1</sub>	.38	.14		-.38**
Step 3:				
Unhealthy food T <sub>2</sub> - T <sub>1</sub> on external eating T <sub>2</sub> - T <sub>1</sub>	.45	.20		.39**
Unhealthy food T <sub>2</sub> - T <sub>1</sub> on mindful eating T <sub>2</sub> - T <sub>1</sub>	.47	.22	.02	-.16

Note: \*  $p < .05$ ; \*\*  $p < .01$ . T<sub>1</sub>: pre-intervention assessment; T<sub>2</sub>: post-intervention assessment.



**Figure 7.3** Mediation analysis of change in mindful eating, change in external eating, and change in unhealthy snack consumption

### Qualitative outcomes

Of the 46 participants who completed post-intervention survey, 45 provided written comments, and 16 (10 in Planning Group and six in No Planning Group) participated in follow-up interviews and provided feedback by recording their responses to the questions shown in Table 7.2. A summary of qualitative outcomes is demonstrated in **Table 7.14**.

**Table 7.14** Summary of qualitative outcomes

<i>Categories and responses</i>	<i>N of participants</i>
<b>Motivations and expectations</b>	
Motivation 1: Weight loss	15
Motivation 2: Schoolteachers' recommendation	7
Motivation 3: Curiosity about psychology programmes	2
Expectation 1: To learn knowledge and skills	10
Expectation 2: To lose weight	6
Expectation 3: Gain self-control	4
<b>Satisfaction and dissatisfaction</b>	
Satisfaction: positive experience	16
Satisfaction: expectations fulfilled	13
Dissatisfaction: intervention duration;	1
Dissatisfaction: technical issue;	1
Dissatisfaction: expectations not fulfilled	1
<b>Perceived changes and usefulness of related intervention components</b>	
Change 1: Improved snacking and self-regulation	
Change 2: Mindful snack choice	16
Change 3: Increased awareness of triggers for snacking	16
Change 4: Attentive eating	21
Change 5: Improved perceived control of eating	9
	14
<b>“Least useful” components and perceived barriers to usage</b>	
Barrier 1: Lack of self-control	
Barrier 2: “I can't feel it”	8
Barrier 3: Time and environmental limits	7
	6
<b>Perceived usefulness of planning</b>	
Particularly useful	
Generally useful	2
Not useful	4
	2
<b>Suggestions for amendments</b>	
Use multiple platforms and be more interactive	
Cover more knowledge about healthy snacks	10
Include intervention components on physical activities	8
	7

*Why did adolescents take part and what did they expect? – Motivations and expectations of participants*

In the follow-up interviews, participants were invited to talk about their motivations to take part in this intervention as well as their expectations (Q1; see table 7.2). The most frequently reported motivations and expectations along with indicative extracts are demonstrated in **Table 7.15**.

Overall, weight loss was the most common motivation for adolescents to participate in this intervention. However, many participants primarily expected to learn how to lose weight in a healthy way rather than achieve a goal of actual weight loss through the intervention. In addition to the intention of losing weight, schoolteachers' recommendation of the intervention also greatly influenced adolescents' decision of taking part.

Interestingly, when talking about expectations, many of the participants primarily focused on what they would learn from the intervention, rather than the outcome of weight loss. Ten participants talked about how they expect to learn knowledge and skills about weight loss and/or healthy snacking by taking part of the intervention. They showed a flexible attitude towards the outcome regarding weight loss, and appeared to perceive weight loss as a gradual progress.

*How did participants think about the intervention? – Satisfaction and dissatisfaction*

To evaluate participants' acceptance of and satisfaction about the intervention, we asked them to talk about their overall experience in taking part (Q3), to what extent the intervention fulfilled their expectations (Q2), and what was about the intervention that dissatisfied them (Q11; see Table 7.2). Participants' responses and representative quotes are shown in **Table 7.15**.

Overall, participants reported very positive experience of taking part in the intervention. They were satisfied with the intervention as it was useful, flexible, thoughtful, scientific and comprehensive, and fun. Among the 16 participants who participated in follow-up interview, 12 thought the intervention fulfilled their expectations "very well" or "mostly", one thought it "beyond expectation", and one found it different from what she expected but useful.

Although 14 of the 16 participants reported that there was nothing about the intervention that

dissatisfied them, and two had some complaints. One found the passwords of intervention videos too complicated. One thought some videos could be shorter. In addition, one participant found the intervention did not fulfill her expectation, as the intervention could not help her effectively lose weight

**Table 7.15** Summary of qualitative data across question categories showing number of participants respondents per category and indicative quote: motivation, expectation, satisfaction and dissatisfaction

<i>Category</i>	<i>Responses</i>	<i>Number of participants</i>	<i>Indicative extracts</i>
<b>Motivation</b>	Weight loss	<b>15</b>	<i>Wight loss for health:</i> “My motivation was to lose weight, to become slimmer, and then become healthier” (681yhh) <i>Weight loss for body image:</i> “I think was definitely about my weight. Or you can say I expected a better body shape, but I was fat, so I wanted to lose weight in a reasonable way” (P1551p)
	Teacher recommendation	<b>7</b>	“My motivation to take part in this programme was, well, it was actually recommended by my teacher. As I had a high body weight, I chose this programme to take part.” (03418jxy; Q1)
	Curiosity	<b>2</b>	“I participated in this programme in the first place was because, well, actually I had never participated in research programme like this, and I was curious about this kind of events. Also my teacher from school recommended it, and therefore I decided to give it a go.” (Real666; Q1)
<b>Expectations</b>	Learn knowledge and skills for weight loss	<b>10</b>	“I hoped to learn scientific and effective methods to gradually lose weight.” (0114cr; Q1) “... So I wanted to lose weight in a reasonable way by taking part in this programme. I mean, in a way that wouldn’t make me feel very uncomfortable, and can help me develop habits good for weight loss in daily life. So what I expected was to learn some knowledge that can be applied in my daily routine, which can help me lose weight.” (P1551p; Q1)
	Lose weight	<b>6</b>	“I expected to lose weight without having to stop snacking, through some healthy way.” (Zac123; Q1) “My expectation was to lose weight, so I can get a better grade in PE class.” (233adc; Q1)
	Gain self-control	<b>4</b>	“...As I have a sweet tooth that had made me fat, I’d like to see whether there would be good ways to control myself.” (Ww7326; Q1)
<b>Satisfaction</b>	Positive experience	<b>16</b>	“I think this programme is very comprehensive and detailed, from how to choose snacks as a beginning to a series of practice. And my experience... well, I feel it’s quite scientific. In the programme it gave a lot of examples,



			made me feel it's authentic and believable." (681yhh; Q3) "For me there was nothing at all that was dissatisfying. I think it was a very meaningful event for high school students in Beijing, as the prevalence of obesity among them is high. This kind of programme can really help the students learn the importance and significance of keeping healthy, improve their awareness of health issue, and enhance their motivations to keep healthy." (10987y; Q11)
	Expectations fulfilled	<b>13</b>	"I think this programme, to tell the truth, is already beyond my expectations. It taught how to choose snacks, and how to control my appetite. Before this I mixed desire up with hunger, and eat whenever I feel like eating. There's nothing that I expected but was not fulfilled." (Ww7326; Q2)
<b>Dissatisfaction</b>	Intervention duration	<b>1</b>	"I don't think there was anything about it that dissatisfied me. Well, maybe the length of the videos. I found some parts of the videos were too detailed, and went a little bit too slow. So sometimes I skipped the part that I thought I had already understood. I think the high school students now are very restless, and would find it unnecessary to spend time on things they had already known. That's it. Overall I was very satisfied with the programme." (P1551p; Q11)
	Technical issue	<b>1</b>	"What dissatisfied me was that the passwords were too complicated, and every time I watched a video I had to enter the password again. Maybe there were some easier ways that I didn't find out? I watched the videos via WeChat on my mobile phone, and every time I had to enter a password, and those passwords were quite long, so it was bothersome. I don't think it can really count as dissatisfied experience, but it did bother me when I entered the password." (79ash, Q11)
	Expectations not fulfilled	<b>1</b>	"As to my expectation, I think it might not meet my expectations very much. It only met the part that now I understand what kind of snacks I should or should not eat. But what expectations it failed to fulfill is that, for me who have already had a lot of fat on my body, whether I eat those kinds of snacks or not, it doesn't make big differences for me. My fat is still there." (005zsw; Q2)

*What was changed and how? – Perceived changes and usefulness of related intervention components*

As an essential part of the follow-up interview, participants were invited to talk about perceived changes in their snacking, and how they used what they learned from the intervention to make these changes by answering *Question 4-6* (see Table 7.2). Particularly, *Question 6* mainly involved participants' perceived usefulness of specific intervention components. As participants frequently talked about "the most useful parts" of the intervention along with the major changes they made, answers around this question were combined with those to *Question 4* and *5* when analysing. It should be noted that although feedback around *Question 4, 5, and 6* mainly revealed this theme, all relevant feedback content was included in analysis without limiting to these questions. In addition, written feedback provided during post-intervention survey regarding the question "what parts of the programme do you find most helpful and why" (Q1; see table 8.2) were also incorporated. Participants' main perceived meaningful changes and related intervention components are reported in **Table 7.16**.

**Improved regulation of snacking:** Thirteen of 16 participants in follow-up interviews reported a major change in their snacking, including decreased frequency of purchasing and consuming snacks, decreased consumption of unhealthy snacks, or replacing unhealthy snacks with healthy snacks. More importantly, all 16 participants reported improved self-regulation of snacking. They showed a heightened motivation to regulate their snacking or increased perceived self-control of eating.

**Mindful snack choice:** A total of 16 participants reported an overall more mindful and healthier snack choice as a major change they made by participating in the intervention. Among them, eight perceived *how to choose healthy snacks* as one of the most useful components of the intervention. When purchasing or choosing snacks to eat, they read food labels and chose healthier snacks based on the content of sugar, fat and calories. Specifically, many talked about how they were unaware of the composition of snacks, or potential effects of snacking on health and body weight before the intervention. Through the intervention, their awareness of such effects increased,

and accordingly, they showed a promoted motivation to regulate their snacking, and took the healthfulness of snacks into consideration when making choice.

**Increased awareness of triggers for snacking:** Ten participants reported to have gained a better understanding of their desire to eat, and talked about how they perceived this as a meaningful change during follow-up interviews. They reported an increased awareness of bodily sensations of hunger, as well as other potential triggers for snacking such as emotional states and external cues. These participants showed a good understanding and frequent use of intervention components relevant to physical hunger and desire to eat. They described how they changed from responding to desire automatically and snacking mindlessly before the intervention, to intentionally taking a moment to evaluate their hunger level and observe their desire to eat. By this way, they regulated their snacking and reduced eating occasions in absence of physical hunger. Some linked specific intervention components with their increased awareness of hunger and desire, as well as improved eating control. The most frequently mentioned components were *listening to your stomach practice* (five participants) and *six kinds of hunger* (four participants). Other components including *exploring your six kinds of hunger*, *emotional and external eating*, and *food craving* were also perceived as useful by increasing awareness. In addition, 11 participants reported perceived increased awareness of hunger and other triggers for eating as most useful part of the intervention in written feedback.

**Attentive eating:** Nine adolescents reported increased attentive eating. They described how they intentionally slowed down and chewed thoroughly when snacking. They linked this change in eating habit with *one bite at a time practice*, perceiving this practice as among the most useful intervention components. By doing the practice, they managed to focus on the taste of food as well as their bodily sensations when eating, thereby being satisfied with less amount of food and better controlling how much to eat based on physical needs.

**Increased perceived control of eating:** In addition to many of the reported perceived changes indicating an overall increased self-control of eating, nine participants specifically talked about the improvement in eating self-control as an important change. As shown above, participants reported increased perceived control of eating by practicing mindful eating skills

including evaluating physical hunger before snacking and slowing down while eating. In addition, some gained control on eating using other intervention components such as urge surfing and planning.

In summary, participants perceived increased knowledge about healthy snacking and better understanding of their desire to eat. They showed an improved intentional self-regulation and enhanced perceived self-control of snacking. By practicing mindful eating in daily life and paying attention to their bodily sensations, participants managed to regulate their eating based on physical hunger and reduce excessive food intake.

**Table 7.16** Summary of qualitative data across question categories showing number of participants respondents per category and indicative quote: perceived changes and usefulness of related intervention components

<i>Responses</i>	<i>Number of participants</i>	<i>Related intervention components (N of participants)</i>	<i>Indicative extracts</i>
<b>Improved regulation of snacking</b>	16 (interview)	<i>Overall</i>	<p>“At the beginning of the programme I had a lot of beverages and crisps, and this kind of snacks. Now basically I eat fruit and vegetables everyday, and I eat less unhealthy snacks. When I’m hungry I eat an apple, or a corn, and I don’t eat so many unhealthy snacks anymore. (Real666; Q4)</p> <p>“...By learning and practicing these parts I start to choose those snacks that won’t make me fat, and the frequency I buy snacks greatly decreases, and I stop buying those high-fat, high-sugar snacks.” (Ww7326; Q6)</p>
<b>Mindful snack choice</b>	11 (interview) 5 (written)	<i>How to choose healthy snacks (13)</i>	<p><i>Read food labels and pay attention to ingredients:</i> “I think I changed from knowing nothing and being very ignorant about snacking, to snack in a more scientific way. I don’t eat that much of high-fat snacks anymore. Every time when I buy snacks, or before eating snacks, I read nutrition labels, to see how many sugars and fats, also carbohydrates it contains.” (03418jxy; Q4)</p> <p>“The knowledge on calories in food; helped me be clear of what kind of snacks are high in calories, and how to check snack contents, and then make healthier choices.” (Zcm632; W-Q1)</p> <p><i>Increased awareness of healthfulness of snacks:</i> “Before this programme I thought good foods are those that look, smell and taste good. Now after participating in this programme, I consider more about their health benefits. Of course, I still value the taste of foods, but my requirement for its health-related values has increased greatly now.” (Real666; Q4)</p>

<b>Increased awareness of triggers for snacking</b>	10 (interview) 11 (written)	<i>Six kinds of hunger (6)</i> & <i>Exploring your six kinds of hunger (3)</i>	<p>“I used to buy or eat snacks whenever I wanted to, but now I first try to figure out whether I’m really hungry, or it’s because my mood, or other reasons such as my mouth or eyes or hands that want to get snacks. Before eating I take a moment to observe whether it’s my stomach or other parts of my body that is hungry.” (Zac123; Q4, Q6)</p> <p>“The ‘six kinds of hunger’ and ‘exploring the six kinds of hunger practice’ help me stop snacking or eat less when I’m not hungry.” (681yhh, Q6)</p>
		<i>Listening to your stomach practice (8)</i>	<p>“I think the ‘listening to your stomach’ practice changed my eating habits. I felt like eating whenever I saw food, without necessarily being hungry, and then, without noticing it, I gained weight. But now by doing the ‘listening to your stomach’ practice, I manage to control myself when eating. I listen to my stomach first, so I manage to eat less, and gain less weight.” (0424k; Q5)</p>
		<i>Emotional eating and external eating (2)</i>	<p>“What is sure is, it changed my views of hunger. I come to realise that the desire to snack could be an emotional desire, rather than the real hunger. Before this I mixed desire up with hunger, and ate whenever I felt like eating.” (Ww7326; Q2, Q4)</p>
<b>Attentive eating</b>	8 (interview) 1 (written)	<i>One bite at a time practice (8)</i>	<p>“I think for me the most useful part is actually ‘one bite at a time practice’. This practice helped me understand how to carefully taste the food, to focus on its taste. When I really taste it, I don’t eat a lot, and I can stop eating when I feel full.” (03418jxy ; Q6)</p> <p>“When I eat a large portion of food, I tended to eat very quickly before, but now I eat slowly and can better taste it. By this way I eat less than before, and I don’t eat to feeling too full like I used to.” (005zsw; Q6)</p>
<b>Increased perceived control of eating</b>	9 (interview) 5 (written)	<i>Listening to your stomach practice (3)</i>	<p>“The most helpful part is “listening to your stomach practice”. The listening to your stomach practice helps me eat proper amount of food when I snack, and enables me better control my food intake.” (Jz16ryf; W-Q1)</p>
		<i>One bite at a time practice (3)</i>	<p>“The ‘one bite at a time’ practice is also good, quite easy to understand and do, very practical, and helps me to better control myself when eating.” (0424k; Q6)</p>
		<i>Food cravings (2)</i>	<p>“For me one of the most useful parts is ‘food craving’. What it changed is that my food cravings become</p>

			less intense, and I can control my desire to eat. When I crave food, as I love spicy food, I always ate whenever I saw spicy food. But after the programme, before I eat I think about whether I've eaten too much spicy food recently, and then I can better control myself, to eat less, or eat spicy food only once for a while." (005zsw; Q6)
		<i>Urge surfing (2)</i>	"The most useful skill I learned is definitely the surfing experiment. I bought a snack I like, tried to control my impulsivity to eat it. I put it on table and did the practice following the video. At first time I didn't feel quite different than usual, but then I gradually become able to control myself." (Ww7326; Q6)
		<i>Planning (2)</i>	"I think these plans are very useful, and greatly helped me control my eating." (10987y; Q13).
		<i>Emotional eating and external eating (1)</i>	"The most useful part for me is 'emotional eating and external eating'. This part particularly helps me control myself, because I was more likely to snack in these situations. Now I don't eat much because of emotions. For example, at my friend's birthday party, although there were a lot of good food and drinks, I knew how much I could eat and took food based on my needs. Before this programme I usually ate as much as I wanted, and then took leftovers away." (233adc; Q5)

*What did not work and why? – “Least useful” components and perceived barriers to usage*

By answering the *Question 7, 8 and 10* in follow-up interviews and *Question 2* of written comments (see Table 8.2), participants talked about the least useful intervention components for them, and any barriers they encountered in participating in the intervention or applying what they had learned from the intervention in real life.

In the written comments, four participants skipped this question and 14 reported there were no “least useful” components for them. In follow-up interviews, two participants talked about how they found all the intervention components were useful and important. Other participants talked about the less useful components and related barriers to usage. The main perceived barriers and related intervention components are demonstrated in **Table 7.17**.

**Lack of self-control:** Eight participants reported the lack of self-control or will power as the main barrier they had. They described that although they tried to snack healthily and mindfully using what they had learned from the intervention, they sometimes found it hard to resist temptations and control their eating.

**“I can’t feel it”:** Seven participants found some mindful eating practices less useful as it was difficult for them to observe and be aware of their bodily sensations clearly. Five reported that they could not differentiate the bodily sensations of each kind of hunger from the other when doing the *exploring your six kinds of hunger* practice. Others had difficulties in observing their bodily sensations when doing *urge surfing practice* and *listening to your stomach practice*.

**Time and environmental limits:** Seven participants reported that the main barrier for them was that they did not have enough time or proper environment to practice mindful eating in their daily life, particularly during school days. Some participants talked about time and environmental barriers in relation to specific intervention components, mostly with the components of mindful eating practices. They found some of the practices “least useful” as they did not have opportunities to do it due to time or environmental limits. Interestingly, one adolescent talked about how she perceived the four practices as both the most and the least useful intervention components (*79ash*;



Q6, Q7). On one hand, these practices were novel to her and improved her awareness of bodily sensations and eating control. On the other hand, she found it difficult to allocate time to do the practice:

“The most useful parts, I think, are the four practices. I feel they’re really useful, and it was the first time I learned this kind of practice. By doing the practice I do discover something about my body, I mean, the feelings of my body or my own experience and thoughts, things like that, and then I can control myself.

The least useful parts are actually also the four practices... Well, it’s like half and half. I feel that they did help me make improvements, but... I don’t know how to describe it, but it feels like, as I said earlier, sometimes when there’re too many things needed to do, it’s hard to set aside time to do these practices. It might be because I didn’t give priority to it, this could be one reason. But still I think the practices require efforts, and a lot of attention to do.” (79ash; Q6, Q7)

When taken participants’ feedback regarding the most and the least useful intervention components together, it appears that many of them showed a preference for simple and practical practices that can be quickly done and help regulate eating more directly. Many reported to use *listening to your stomach practice* and *one bite at a time practice* to regulate their snacking, but found the longer practices less useful. For example, some perceived the *urge surfing practice* “the least useful as one could hardly focus for a long period” (1228yn; W-Q2), or “observing food” hard to do (0903mj, W-Q2; 0928lr, W-Q2). Here is a quotation explicitly talking about this preference:

“As to the barriers, I think some methods and practices are too complicated. I hope they can be simpler, so that more practical. Those simple methods are more effective to use to make changes, such as reading food labels, or eating one bite at a time. But if you ask me to, for example, take time to observe it, or smell it, I find that very hard to do.” (P1551p; Q8)

**Table 7.17** Summary of qualitative data across question categories showing number of participants respondents per category and indicative quote: least useful components and perceived barriers to usage

<i>Responses</i>	<i>Number of participants</i>	<i>Related intervention components (N of participants)</i>	<i>Indicative extracts</i>
<b>Lack of self-control</b>	6 (interview) 2 (written)	<i>Overall</i>	<p>“The problem I have when using these methods in daily life is that sometimes it’s really hard to control my desire to eat. I mean no matter how I intentionally control it, I can’t stop thinking about it.” (005zsw; Q8)</p> <p>“How to control myself. It’s different between knowing it and actually doing it.” (gh23; W-Q2)</p> <p>“The barrier is the lack of self-control. When I see my mates eat I still can’t resist eating, and I just want to join them.” (681yhh; Q8)</p>
<b>“I can’t feel it”</b>	5 (interview) 2 (written)	<i>Exploring your six kinds of hunger (5)</i>	<p>“I think the ‘exploring the six kinds of hunger practice’ doesn’t really work for me, as no matter how hard I try to calm down and focus my attention to my bodily feelings, I can’t tell which kind of hunger is which, and I just feel that hunger is hunger. I can’t tell the difference between them. That’s it.” (005zsw; Q7)</p> <p>“The least helpful part is ‘exploring the six kinds of hunger’, as I can’t clearly distinguish the six kinds of hunger of my own.” (1102TY; W-Q2)</p>
		<i>Urge surfing (1)</i>	<p>“As to the least useful part, for me is ‘urge surfing practice’. I think I felt nothing at all during that practice. I feel that I was very calm down throughout the practice, and I didn’t feel like surfing.” (03418jxy; Q7)</p>
		<i>Listening to your stomach practice (1)</i>	<p>“The least useful parts, I can’t think of one. But I rarely use the ‘listening to your stomach practice’. As my feeling is like, it’s either hungry or full, and there’s no such quite a thing in between.” (233adc; Q7)</p>
	6 (interview)	<i>Overall</i>	<p>“When applying what I’ve learned in daily life, I think there’s time issue, as now the new semester has started. When I feel hungry during breaks, I can only eat whatever I have, and gulp it down. But during</p>

<b>Time and environmental limits</b>		<p>holidays or weekends, I think there're no big problems." (27sy; Q8)</p> <p>"When you put the food on table, and say, stare at it, people around you would think you're weird. And when people look at you in that funny way... I'll stop practicing and just eat it right away. So I don't have many opportunities to practice. That's the barrier I've encountered." (Ww7326; Q8)</p>
	<i>Urge surfing (2)</i>	<p>"I think for me the least useful part is 'urge surfing'. Because I need to really calm myself and be very focused, but I find I don't have time for that, and can hardly have a good environment for me to calm down and do such a practice." (0114cr; Q7)</p>
	<i>Listening to your stomach practice (1)</i>	<p>"I think for me the least useful part is, is the 'listening to your stomach practice'. I go to school everyday, and I have meals at refectory. I have breakfast at refectory, lunch at refectory, and dinner at refectory. I don't have the opportunities to find a quiet place and listen to my stomach to find out how hungry it is. So I'm sorry to say that this part for me, or for students, is not useful. My suggestion is, well, I hope you, or the scientists, can teach us how to observe whether we're hungry or not while walking, on the way to refectory, and decide how much to eat." (Bjjz99; Q7, Q8)</p>

### *Is planning useful? Plans and perceived usefulness of planning*

The intervention innovatively incorporated mindful eating skills with an “if-then” approach for implementation intentions (i.e., planning), aiming to promote the accessibility of mindful eating skills for adolescents in real life situations. We were interested in participants’ perceived usefulness of this intervention component, and what barriers they might encounter to forming and implementing the plans. Before completing post-intervention measures, participants in the Planning Group sent the three plans they made to us as requested. Participants in Planning Group were invited to talk about their perceived usefulness and barriers regarding planning by answering Question 13 (see Table 7.2). The plans and participants’ feedback on this component were analysed.

#### **Perceived usefulness of planning**

Eight participants reported on their perceived usefulness and barriers to usage of planning. Two described planning was particularly useful, as it was self-tailored and they could make plans based on their own situation: *“making plan is very good. I can extract information from the tables based on my own situation, and then apply it in my daily life, and therefore achieve the goal of losing weight.”* (10987y; Q6)

Four participants thought the plans they formed were generally helpful, but they sometimes failed to stick to the plans because they could not control impulsivity and resist temptations, or because they “forgot about the plans when busy”. For example:

“These plans indeed can help me. But in daily life, probably because I’m always too busy, sometimes I forget to stick to the plans. For example, when I’m too busy with studying and homework, or when I’m bothered by problems with family or friends... When there’re too many things to deal with, I might just forget about the plans.” (79ash; Q13)

“I think they’re useful in daily life...probably. The barrier is sometimes I can’t control my impulsivity. Although I know I should stick to the plans, I might not be able to control myself.” (Zac123; Q13)

Two participants perceived planning as not useful, but interestingly due to very different reasons. One participant thought the plans were too complicated and difficult to remember in real life situations:

“As I already mentioned, sometimes I just don’t remember to implement the plans, or maybe the plans were a little too completed, and can’t be implemented well in daily life. It’s probably my own problem. But for me, I do find it hard to actually implement those plans. Even though I made the plans, I always forget to use them. When I really encounter the situation, I just don’t remember to do as planned. Maybe the plans are too complicated that they’re not so practical?” (P1551p; Q13)

For the other participant, on the contrary, the planning was not useful because it did not provide any new information and therefore was not necessary:

“I think these plans, if you ask me, are actually not quite useful. I don’t think there’re any barriers to implementation of these plans. But I just don’t think they really helped me. Because all the plans are based on what was already taught in the previous videos, and I can just apply those methods in everyday life when I need to. There’s no need to make the extra plans. Or you can say the plans had already been implemented before they were made.” (03418jxy; Q13).

In summary, participants reported feeling able to form reasonable plans using the “if” and “then” conditions. However, some reported difficulties implementing the plans, mostly due to forgetting and lack of self-control.

#### *How could it be improved? – Suggestions for amendments*

Participants made suggestions for amendments regarding the content and delivery of the intervention by answering *Question 8, 9 and 12* during follow-up interviews, and *Question 3* of written comments (see Table 7.2). The summary of participants’ responses are presented in Table 7.18.

For intervention delivery, participants suggested that the intervention could be delivered using multiple platforms including Weibo, websites and off-line events. Particularly, some participants hoped that the intervention could be delivered using streaming live videos so it would be more interactive and engaging.

As to intervention content, participants would like to learn more knowledge in addition to what they had learned from the intervention, including nutrition information, the effects of

nutrition and snacks on body health, and specific recommendations for healthy snack choices. They also expected to learn knowledge and skills regarding physical activity that would help them lose weight. Although some of the suggestions are beyond the scope of the present study, they reflected participants' expectations about a weight-loss intervention. Also, they might indicate an open attitude of adolescents towards nutrition education programmes and PA interventions.

**Table 7.18** Summary of qualitative data across question categories showing number of participants respondents per category and indicative quote: Suggestions for amendments

<i>Responses</i>	<i>Number of participants</i>	<i>Indicative extracts</i>
<b>Use multiple platforms and be more interactive</b>	10 (written)	<p>“The course could be live streamed to make it more interactive.” (Jts964; W-Q3)</p> <p>“Set up a website and provide complementary reading materials.” (Yph002; W-Q3)</p>
<b>Cover more knowledge about and recommendations of healthy snacks</b>	5 (interview) 3 (written)	<p>“My suggestion is that when teaching how to choose healthy snacks, such as fruits and nuts, although it has already provided very detailed instructions, I hope it could present more information such as what fruit is beneficial to health, and in what way, like what kind of vitamins it contains. I mean the recommendations could be more detailed and more specific, so it'd be easier for me to make choice.” (Ww7326; Q9)</p> <p>“For this programme, if you're going to do a new version of it, I'd expect that it could cover more content and introduce some kinds of food that are tasty but low in calories, and easy to digest.” (Bjjz99; Q9)</p>
<b>Include intervention components on physical activities</b>	5 (interview) 2 (written)	<p>“I think it could cover more knowledge about proper physical activity, or healthy lifestyle, to help us better manage weight.” (0114cr; Q10)</p> <p>“I think to better control weight, besides choosing healthy snacks, it's also very important to do more physical exercise. Therefore I actually would like to know about, say, when I feel very hungry after doing exercise, what snacks can I eat that won't make me fat?” (27sy; Q10)</p>

## 7.4 Discussion

### Feasibility and acceptability

This study evaluated the feasibility and acceptability of an online mindful snacking intervention among overweight Chinese adolescents aged 16 to 18 years. Overall, the study reported satisfactory recruitment rate (61.1%), high retention rate (83.6%), and positive feedback regarding participants' perceived satisfaction and usefulness, with no adverse events and only a minor technical problem identified, indicating that this intervention was feasible and acceptable in the target population.

Previous studies on recruitment strategies for health promotion interventions recommended to use both active (e.g., face-to-face) and passive (e.g., mass-mailings) recruitment strategies to enhance recruitment rate, although there was no conclusive evidence for the superiority of either approach (Lam, Partridge, & Allman-Farinelli, 2016; Sarkin et al., 1998). The present study employed both passive (i.e., posters) and active (i.e., schoolteacher's recommendation) recruitment approaches. It should be noted that, although a favorable recruitment rate was reported compared to other weight management and healthy behaviour change programmes for young people (Daly et al., 2016; Finne et al., 2009; Lam et al., 2016; Nguyen, Kornman, & Baur, 2011), this recruitment rate was calculated only for the active recruitment strategy, as it was difficult to determine how many adolescents actually viewed the posters. School teachers' recommendation played an essential role of the successful recruitment, while posters failed to yield any participation. In the follow-up interviews, nearly half participants reported school teachers' recommendation as motivating them to take part. This is consistent with a previous study of a mindful eating programme among overweight Latino adolescent girls (Daly et al., 2016), and findings of our focus group study suggesting that Chinese adolescents are more likely to react to recruitment information they hear in school (see Chapter 4). Health behaviour change programmes for Chinese adolescents should therefore cooperate with schools to optimise recruitment. However, of three high schools we initially contacted, only one managed to actively recommend our intervention to the students. Considering the heavy teaching loads and

educational pressure that the staff in Chinese high schools are facing (Zhao et al., 2015), it could be a challenge to get support from high schools with active recruitments for health promotion programmes.

The high retention rate compared to previous online E-MBIs (Mason et al., 2018; Dibb-Smith et al., 2019) could also be partially influenced by the involvement of the school. This programme was introduced to students as part of a research course, and although participants were assured that their participation details would not be notified to their teachers or influence their course grade, this could still enhance their motivation to finish the programme. In the meanwhile, participants' feedback showed that they were overall satisfied with the intervention content as well as its entertaining features. Both groups rated high on perceived usefulness ( $M = 4.52$  and  $4.72$ , respectively) and enjoyment ( $M = 4.57$  and  $4.49$ , respectively) of the intervention. The intervention videos incorporated a wide range of pictures and animations of topics familiar to Chinese adolescents, as an attempt to increase the accessibility and attractiveness. In addition, we tried to minimum participant burden by designing a relatively short, less intensive and self-paced intervention and using brief measures. These might also contribute to the high rate of retention and measure completion.

Yardley et al. (2016) recommended digital behaviour change interventions (DBCIs) to measure participants' effective engagement using multiple approaches including qualitative analyses and proxy measures based on usage (e.g., numbers of visits/uses). The present study evaluated engagement by video views and participants' qualitative feedback about their usage of intervention content, both of which indicating high levels of engagement. However, participants' engagement can only be roughly estimated by video views, and it was difficult to obtain good user data due to privacy policy of online platforms. The qualitative data could also be biased due to the self-selected sample of the follow-up interviews. Future research on DBCIs should more carefully design valid and reliable measures of effective engagement.

### **Intervention effects**

The whole sample exhibited significant pre- to post-intervention weight loss with a large effect size ( $\eta_p^2 = .35$ ). Participants in two groups lost an average of 1.42 kg (3.13 lb) and 1.79 kg (3.95



lb), constituting 1.86% and 2.41% mean loss of initial body weight, respectively. This is relatively low compared to previous MBIs for weight loss ( $n = 16$ ) reviewed by Carriere et al. (2018), which reported an average weight loss of 6.8 lb (3.3%) at post-intervention. However, most of the reviewed MBIs were tested in predominantly obese adults with an average initial BMI above  $30\text{kg/m}^2$  (e.g., Alberts et al., 2010; Corsica et al., 2014; Delen et al., 2010; Daubenmeir et al., 2011; Mason et al., 2016). Participants in the present study had a lower initial BMI ( $M = 25.79\text{kg/m}^2$ ,  $SD = 2.05$ ), and therefore might be less likely to lose weight fast in the short term. The effect of MBIs on weight loss could also be influenced by intervention intensity. In Carriere et al. (2018)'s review, the MBIs reported long intervention hours ranging from 5 to 43.75 hours ( $M = 15.39$ ), with the average pre-post effect sizes of weight loss positively moderated by intervention hours. In comparison, the present intervention was less intensive, with its content delivered within 75 minutes. The duration and intensity of this intervention was designed based on the preferences of its target population (see Chapter 4), which was lighter than most published MBIs for weight loss (Carriere et al., 2018; Olson et al., 2015; O'Reilly et al., 2014). Considering the academic stress and long studying hours of Chinese adolescents in high school, however, it is important to design and test effective health promotion interventions with minimum participant burden for them. Only a few studies have examined the effectiveness of MBIs for weight loss among adolescents (Barnes et al., 2016; Daly et al., 2016), and compared to these studies, the present study showed favourable weight loss outcomes.

Evidence for the effects of MBIs on improving dietary intake in overweight/obese populations is relatively limited (O'Reilly et al., 2014; Warren et al., 2017). In the present study, the whole sample reported significant improvement in snacking with medium to large effect sizes ( $\eta_p^2$  ranged from .11 to .28). This adds to the growing body of literature suggesting positive dietary outcomes of MBIs (Jenkins & Tapper, 2014; Mason et al., 2016; Miller et al., 2012; Timmerman & Brown, 2012). As to eating styles and psychological outcomes, both groups significantly decreased in emotional eating, external eating, and trait food cravings, and increased eating self-efficacy, with large effect sizes for the whole sample ( $\eta_p^2$  ranged from .19 to .45). These results extend previous studies supporting the effects of MBIs on improving eating styles (e.g., Daubenmier et al., 2011; Alberts et al., 2012; Tapper et al., 2009), eating self-efficacy (Kidd et al., 2013; Timmerman & Brown, 2012) and reducing food cravings (Mason et al., 2016; Alberts

et al., 2010) in overweight/obese adults.

It has been suggested that studies on MBIs for weight loss should measure changes in mindfulness or mindful eating to determine whether improved mindfulness/mindful eating are responsible for the positive outcomes (Olson & Emery, 2015; O'Reilly et al., 2014). Only three prior studies directly examined the role of changes in mindful eating in E-MBIs (Dibb-Smith et al., 2019; Kidd et al., 2013; Mason et al., 2016), all using the MEQ (Framson et al., 2009) as a mindful eating measure. However, none of the studies found significant changes in mindful eating at post-intervention. Only Mason et al. (2016) found significant increases in mindful eating at 12-month follow-up, which mediated the intervention effect on decreasing fasting glucose levels. The authors suggested that the MEQ might fail to provide a reliable measure of mindful eating in the studied populations (Dibb-Smith et al., 2019; Kidd et al., 2013). Using a revised MEQ, the present study found a significant increase in mindful eating at post-intervention with a large effect size ( $\eta_p^2 = .40$ ), and in all subdomains of mindful eating ( $\eta_p^2$  ranged from .09 to .32).

We further explored the role of improved mindful eating in the intervention effects on main outcomes. The result of hierarchical regression showed that the increase in mindful eating significantly predicted post-intervention weight loss, suggesting that improved mindful eating may serve as a mechanism of the MBIs in promoting weight loss. Moreover, mediation analysis showed that the increased mindful eating may promote weight loss by decreasing emotional eating. Emotional eating has shown to be associated with greater presence of overeating and binge eating, which may lead to excessive calorie intakes (Ricca et al., 2009; Lopez-Cepero, Frisard, Lemon, & Rosal, 2019; Sultson, Kukk, & Akkermann, 2017). Being a more mindful eater, one can be more aware of emotional triggers for eating, and the automatic reactions to these triggers can therefore be regulated and replaced with conscious choices (Katterman et al., 2014). This finding is also consistent with the emerging evidence highlighting the significance of emotional eating in weight loss. Blair et al. (1990) found that for adults attempting to lose weight, those who reported decreases in emotional eating were more successful at achieving weight loss goal over a one-year period. Similarly, in a more recent study, Braden et al. (2016) found that greater odds of weight loss success was associated with decreased emotional eating in overweight/obese adults of a behavioural weight loss intervention, although this intervention was not designed to target emotional eating or emotional eaters. Baseline emotional eating was also found to negatively

predicted weight loss outcomes of both a behavioural weight loss programme and a surgical treatment for obese adults (Canetti et al., 2008). Taken together, these findings indicate that emotional eating might be actively involved in the process of weight change. Weight loss interventions should incorporate effective components targeting emotional eating in order to achieve better outcomes.

To our surprise, the pre- to post-intervention weight loss was not significantly correlated with the reduction in unhealthy snack consumption. Hierarchical regression showed that greater increases in mindful eating predicted greater reduction in unhealthy snack consumption. Moreover, mediation analysis showed that mindful eating might reduce unhealthy snack consumption by decreasing external eating. External eating has shown to be consistently associated with the intakes of high-calorie foods in literatures (see Chapter 2). A lab study found that a mindful eating induction significantly reduced subsequent unhealthy snack choice only in participants who were high on external eating and low on mindful eating (Allirot et al., 2018). The present study adds to these findings, suggesting that external eating may play a major role in the effects of MBIs on improving snacking. Interestingly, although the present intervention was initially designed to promote weight loss by improving snacking, it appears that the weight loss and positive dietary outcomes were achieved through different pathways. More investigations are needed to further clarify the mechanisms of MBIs for dietary intakes and weight loss.

### **Combining planning with mindful eating**

This intervention innovatively incorporated mindful eating with implementation intention in attempting to promote the accessibility of mindful eating strategies in real life situations for adolescents. In previous studies of planning interventions, low adherence (i.e., do form plans as instructed) has been consistently observed and suggested as a major concern that may attenuate intervention effects on health behavioural change (Mistry, Sweet, Latimer-Cheung, & Rhodes, 2015; Sweet et al., 2014; Wiedemann et al., 2009; Skår et al., 2011). In the present study, the Planning Group showed high levels of intervention adherence, with all participants forming good-quality plans. The most frequently selected “if” conditions are related to emotional eating and external eating, which is consistent with the results of effectiveness analysis showing the

significance of these eating styles in weight loss and dietary outcomes. As to “then” conditions, it appears that more participants tended to choose those brief and direct strategies such as reading food labels, rating hunger levels, and eating slowly. Overall, the combination of mindful eating and planning components was feasible.

Contrary to our hypothesis, however, the Planning Group did not show greater effects on improving weight loss, snacking or any other eating-related measures. This may be partly due to the short time window between the delivery of the planning component and the post-intervention assessment. By linking situational cues of unhealthy behaviour with an appropriate response, implementation intention initiates preferred response, and by performing this new response repeatedly over time, the old habitual response could be overruled (Adriaanse et al., 2009; Adriaanse et al., 2011). In the present intervention, however, the planning component did not deliver any new information, but serve as a reinforcement of what had been taught. It is possible that at post-intervention, both groups had initiated new behavioural responses to, say, emotional or external triggers for snacking, based on what they learned from the intervention. The planning component might reinforce these preferred behavioural responses in specific situations and contribute to the development of new habits in long-term, whereas further studies are needed to investigate its long-term effects.

In addition, some participants reported that they sometimes failed to execute the plans as they “forgot” about the plans or due to the lack of self-control. One proposed mechanism of implementation intentions is the heightened cognitive accessibility of the situational cues and the cue-response links (Achtziger, Bayer, & Gollwitzer, 2012; Webb & Sheeran, 2008). Participants “forgetting” to enact the plans when the cues were encountered might indicate that the if-then planning failed to heighten the activation of these cues. Another influencing factor for the unsuccessful plan enactment could be the motivation and commitment to enact the plans. Studies have found that the commitment to implementation intentions was a prerequisite for the heightened activation of the specified cues (Achtziger et al., 2012). More importantly, participants’ motivation and commitment to form and enact action plans could be distinct from their commitment and intentions to achieve the related higher-order goals (Achtziger et al., 2012; Webb & Sheeran, 2008; Mistry et al., 2015). Future interventions incorporating planning components should seek to enhance participants’ motivation and commitment specifically regarding the action

plans as well as the long-term goals.

### **Qualitative findings**

It has been suggested that mindfulness could be particularly suits to qualitative exploration as it is such an experiential phenomenon (Woolhouse, Knwoles, & Crafti, 2012). In the follow-up interviews of the present study, the adolescents showed good understanding and actual usage of the intervention components, and described improved snacking and increased mindful eating. These qualitative findings complemented the quantitative results supporting the feasibility and effectiveness of the intervention. In addition, the qualitative data further deepened our understanding of effective intervention components, meaningful changes and potential mechanisms of action.

Regarding useful intervention components, the most frequently and explicitly mentioned ones included choosing healthy snacks and reading food labels, six kinds of hunger and rating hunger level, listening to your stomach practice, and one bite at a time practice. In comparison, the components such as mindful eating meditation (i.e., exploring your six kinds of hunger practice), food cravings, urge surfing, and planning were less frequently talked about. Particularly, the adolescents reported a frequent usage and high perceived usefulness of mindful eating practices. Moreover, they showed a preference for those brief strategies and practices that help regulate eating more directly. Practices such as *listening to your stomach* and *one bite at a time* are more like informal practices of the MBIs (e.g., mindfully brushing teeth), which can be done during daily activities, and the effects of them could be more immediate and obvious. Thus, it is understandable that participants found these practices more accessible and practical. This finding is consistent with previous studies showing that informal mindfulness practices are among the most frequently chosen and most likely to be maintained practices by participants after MBIs (Barkan et al., 2016; Ribeiro, Atchley, & Oken, 2018).

In the meanwhile, the adolescents reported barriers to practicing mindful eating, describing difficulties in observing bodily sensations and finding time and environmental opportunities for practice. The meditative elements of mindful eating practices such as observing one's inner states could be novel and highly complex to the beginners. Traditional group MBIs provide good

opportunities for participants to practice mindfulness in a supportive atmosphere. In addition, these MBIs usually include an “enquiry process” in each session, during which participants share their experiences of mindfulness practice to the peers and teachers who embody a curious and non-judging attitude towards these experiences (Segal et al., 2013). This component is considered as important, as it allows participants to express any uncertainty about their experiences and learn how to relate to their experiences during mindfulness practice (Cavanagh, Strauss, Forder, & Jones, 2014). In the present study, participants did not speak about their practice experiences or difficulties encountered until the follow-up interview. Although personal contact for enquiry was encouraged throughout the intervention which could be easily done via WeChat, no one actually made contact regarding intervention content. Future online mindful eating programmes for adolescents can incorporate the enquiry component by combining off-line events or live streaming sessions, which might be beneficial to participants’ grasp of mindful eating, and therefore positive dietary and weight loss outcomes.

As to meaningful changes, participants showed an overall improved self-regulation on snacking. Specifically, they reported how their snacking changed from largely habitual and automatic into intentional behaviour. The most frequently and explicitly described mechanism of this change was the increased awareness. By paying attention to food sensory properties and bodily sensations, participants managed to better regulate their eating in response to physiological cues of hunger and satiety. Also, by eating attentively, they better tasted the food and felt satisfied with less snacks. These sorts of statements support improved awareness as a key mechanism of action of E-MBIs (Tapper, 2017; Warren et al., 2017). In addition, the adolescents reported increased perceived self-control on eating, indicating improved self-efficacy of eating behaviours. This is in line with the quantitative result demonstrating a significant increase in eating self-efficacy at post-intervention. Previous studies have found that improved eating self-efficacy was associated with greater long-term weight loss among overweight/obese adults (Flølo et al., 2019; Nezami et al., 2016). In the present study, although no quantitative association was found between improved eating self-efficacy and weight loss, qualitative findings supported it as an important meaningful change which warrants further investigation.

## **Evaluation**

There are several limitations to this study. Most importantly, body weight, dietary intakes and eating behaviours were all measured by self-report, which therefore were subject to bias and limited by participants' ability to report. The self-report of body weight could be particularly problematic, as bias has been consistently suggested in the self-report weight among adolescents (He, Cai, & Fan, 2018; Sherry, Jefferds, & Strawn, 2007; Zhou et al., 2010). More accurate measures of body weight or anthropometric obesity indexes should be adapted in future studies. In addition, caution is needed in interpreting intervention effectiveness due to the small sample size. As this study was primarily concerned with feasibility and acceptability, it only evaluated the preliminary effectiveness of the intervention with a small and homogeneous sample. Participant attrition also threatened the complete randomisation. More rigorously designed trials with large and diverse samples are needed to examine intervention effectiveness. Finally, this study did not investigate the long-term effects of the intervention. A follow-up assessment would help clarify the intervention effects on long-term weight loss and maintenance.

Despite these limitations, this study provided strong evidence for the feasibility and acceptability of the intervention. Quantitative and qualitative results were consistent and complementary to each other, suggesting intervention effects and potential mechanisms of action, which warrants further investigation. To our knowledge, this is the first study testing an online mindful eating programme in overweight Chinese adolescents. The findings add to very limited evidence for the feasibility and effectiveness of E-MBIs for weight loss among adolescents.

## **7.5 Conclusions**

This study tested the feasibility and preliminary effects of an online mindful snacking intervention for overweight Chinese adolescents. The results suggest that the intervention is feasible, engaging and has potential to improve snacking and promote weight loss. Quantitative analyses highlight the importance of increased mindful eating, and decreased emotional eating and external eating in the beneficial outcomes. Qualitative findings suggested improved awareness, self-regulation and self-efficacy as potential mechanisms of action. The combination of mindful eating with

planning showed feasible but did not exhibit greater effects in the short study duration, whereas follow-up evaluation is needed to investigate its long-term effects.



## Chapter 8. Discussion and Conclusions

### 8.1 Overview and key findings

As reviewed in **Chapter 1**, childhood obesity has become a major health concern in China. However, despite the ongoing efforts of government as well as researchers to tackle this issue, there exists a gap in knowledge of theoretical basis and active ingredients of effective interventions, particularly for older adolescents. The dynamic shifts in Chinese eating behaviours, particularly the increasing prevalence of snacking, has been suggested as an important contributor to Chinese childhood obesity. Unhealthy snacking appeared to be a potential target of weight loss interventions for overweight / obese Chinese adolescents. This doctoral research primarily aimed to develop and feasibility test a behaviour change intervention to promote weight loss among overweight Chinese adolescents. Five studies were conducted (Chapters 2 to 7). This chapter integrates the key findings of these studies, and discusses their potential theoretical and practical implications. The principal limitations of the current work and future directions are also suggested.

As only recently has snacking become a part of daily eating routine among the Chinese (Du et al., 2016), research on snacking in China is still in its infancy. Despite the increasing research attention on this topic, there is a lack of robust knowledge about Chinese adolescents' motivations, beliefs and determinants regarding their snack intake. To develop feasible behavioural change interventions, it is essential to understand the context and drivers for the targeted users' poor health behaviours (Michie et al., 2014). Driven by this, the first two studies of this research aimed to generate understanding of Chinese adolescent snacking.

First, a cross-cultural survey (**Chapter 2**) explored determinants of UK (n = 96) and Chinese (n = 182) adolescent snacking. This study particularly focused on the potential determinants of adolescent snacking at an individual level, as these may be more amenable to change through psychological intervention. Meanwhile, the cross-cultural design enabled us to understand the cultural context of snacking determinants. The literature review indicated that unhealthy eating styles (i.e., restrained eating, emotional eating, external eating) are associated with higher body weight and unhealthy dietary intake (De Cock et al, 2016; Snoek et al., 2006; Wu et al., 2017),

and moderate the stress-eating relationship. Mindfulness-based interventions showed promising results in decreasing unhealthy eating styles and promoting weight loss, especially when tailored to eating practice (i.e., E-MBIs) (e.g., Carrière et al., 2018; Tapper, 2017). However, little is known about the role of mindful eating in dietary intake and weight loss among adolescents. This survey study examined the relationship between eating styles and consumption frequency of four types of snacks (i.e., unhealthy snack foods, unhealthy beverages, fruit, and vegetables) in adolescents. The results of hierarchical regression analyses highlight the role of mindful eating in adolescent unhealthy snacking: of four eating styles, only mindful eating (measured by the MEQ) emerged as a significant predictor of both unhealthy snack food and beverage consumption. External eating (measured by the DEBQ) also showed a strong predictive effect on the consumption of unhealthy snack foods, and an effect on unhealthy beverage consumption that approached significance. Cultural and gender differences were not found in the association between eating styles and snacking frequency, suggesting that the effects of mindful eating on unhealthy snack and beverage intake were not influenced by gender or cultural background. In addition, mindful eating was found to be negatively correlated with external eating and emotional eating. These findings extended understanding of adolescent eating styles and their influence on snacking, suggesting that interventions targeting adolescent unhealthy snacking might achieve positive outcomes by improving mindful eating.

In addition, this study employed the theory of planned behaviour (TPB; Ajzen, 1991) as a theoretical framework to understand adolescent snacking. The TPB has been broadly used to explain and predict health behaviour, including adolescent snacking (Riebl et al., 2015). However, important gaps in knowledge remain. Firstly, despite the efficacy of the TPB in explaining adolescent dietary behaviour, there is still a large proportion of the variance unaccounted for by the original model. Inclusion of other relevant components has thus been suggested (Brouwer & Mosack, 2015). In this study, we examined the predictive effects of the TPB with an added component – habit strength, on adolescent snacking. Second, research on the TPB and eating behaviour has mainly focused on western populations, while evidence for its application among the Chinese is very limited. Eating behaviour and related cognitive beliefs could be greatly influenced by culture (Rozin, 1996). In this study, cultural differences in the predictive effects of the TPB components on adolescent snacking were examined, with the results partially supporting

our hypothesis drawing upon an individualistic-collectivistic value framework. Social norms emerged as a predictor of both unhealthy snack food and beverage intake among Chinese adolescents, but did not predict the intake frequency of any type of snacks in UK adolescents, suggesting a high level of conformity of Chinese adolescents regarding unhealthy snacking compared to their UK counterparts. Contrary to our hypothesis, however, snacking frequency of UK adolescents was not influenced by their attitudes, but primarily by habit strength. Habit strength emerged as a significant predictor of frequency of all four types of snacks examined in the UK sample, but not in Chinese adolescents. Gender differences were also found when applying the TPB to predict unhealthy beverage intake, with girls being more likely to be influenced by subjective norms and boys by perceived behavioural control. Overall, these findings provide a unique contribution to understanding of Chinese adolescent snacking, and extend previous applications of the TPB in predicting adolescent snacking. Based on these findings, culture- and gender-specific intervention strategies are recommended.

A focus group study (**Chapter 3**) was then conducted with two main purposes: first, to further understand and generate more detailed information about Chinese adolescent snacking; second, to understand Chinese adolescents' (i.e., end users') needs, attitudes and preferences regarding a snacking intervention. In this study, four groups of participants (n= 24) explained how external cues, emotional states and food cravings were their main triggers to snack. Particularly, adolescents described how their snacking was greatly influenced by snacking behaviour of peers as well as snacking beliefs of parents. This is in line with and complementary to the quantitative results of our survey study, suggesting an impact of social norms on Chinese adolescent snacking. Adolescents identified the healthfulness of snacks mainly based on nutrition and content, followed by family/media influence. However, they commonly expressed uncertainty about their nutrition knowledge, and a need to learn such information. Snacking interventions should therefore incorporate components of health education. When choosing snacks, availability, weight concern, and taste all came before healthfulness as important determinants. Overall, adolescents showed low to moderate levels of intentions to practice healthier snacking, with weight concern as a most common motivation. Low self-control and self-efficacy were the main barriers for them to snacking healthier. Interventions should aim at improving adolescents' intentions to engage in healthy snacking, and teach behavioural regulation strategies to help them gain better self-control

and thus self-efficacy. The findings of this study helped us understand the key features of a feasible snacking intervention for Chinese adolescents. A relatively brief, low-intensity, flexible and evidence-based intervention delivered via WeChat was produced in ways that aligned with the adolescents' preferences.

Notably, during the survey study, a methodological issue emerged concerning the assessment of mindful eating. Using the Mindful Eating Questionnaire (MEQ; Framson et al., 2009) as a measure of mindful eating, poor internal reliability of the questionnaire was observed in both the Chinese and the UK sample. As we aimed to develop and test a snacking intervention targeting mindful eating, it was very important to prepare a valid and reliable tool to measure this variable. Therefore, two studies were conducted to develop a culturally appropriate and robust measure of mindful eating. Through a think-aloud study with a sample of adults ( $n=7$ ) and a sample of adolescents ( $n=10$ ) (**Chapter 4**), we found some items of the MEQ, particularly the items on *external cues* subscale, were problematic and tended to be misinterpreted by both adult and adolescent participants. Based on the findings of this study, ten items were revised, followed by a study to validate the revised Chinese version of the MEQ in a sample of Chinese college students (**Chapter 5**). Using factor analysis and item analysis, a 23-item, 4-domain revised Chinese version of the MEQ showed improved psychometric properties compared to the original MEQ, indicating better cultural appropriateness. This is the first study revising and validating a measure of mindful eating in a Chinese sample. By producing a useful tool to assess mindful eating among the Chinese population, these two studies provide a unique contribution to future research of mindful eating.

A digital, mindfulness-based snacking intervention was developed drawing on evidence, the Behaviour Change Wheel (BCW) and a participatory approach (**Chapter 6**). The intervention combined components of nutrition education, mindful eating skills and planning, with a primary aim of promoting weight loss in overweight Chinese adolescents. The intervention showed good feasibility and acceptability in a small sample of overweight Chinese adolescents aged 16 to 18 years ( $n=46$ ) (**Chapter 7**). Significant pre- to post-intervention weight loss and reduction in snacking frequency were observed. Intervention effects were also observed on decreasing external eating, emotional eating, food craving, and increasing self-efficacy of eating. Changes in mindful eating were found to be associated with positive outcomes. Participants reported high perceived

usefulness of some intervention components. Improved regulation of snacking, more mindful snack choice, increased awareness of triggers for snacking, attentive eating and increased perceived control of eating were described by participants as meaningful changes. This is the first study developing and testing a E-MBI for Chinese adolescents. These findings of this study added to very limited knowledge regarding the feasibility of E-MBIs among adolescents, and warrant a full-scale RCT to examine intervention effectiveness.

## **8.2 General discussion**

The fundamental purpose of this research project was to develop a feasible behaviour change intervention to decrease adolescent overweight and obesity in China. This section primarily focuses on the practical implications of research studies for intervention development to tackle Chinese adolescent overweight, and for broader public health. The theoretical and methodological implications are also discussed.

### **What would make a feasible healthy eating/weight loss intervention for Chinese adolescents?**

During this research project, we found Chinese adolescents in high school aged 16 to 18 years hold overall positive and open attitudes towards healthy eating interventions. In the focus group discussions, many were keen for knowledge and strategies in relation to healthy eating. They expressed uncertainty about the nutrition knowledge they learned from parents and media, and a feeling of being ill equipped to regulate their eating behaviour. Even those who reported relatively low intentions to change eating behaviour showed curiosity about related information. The similar tendency was observed in the feasibility study. When asked about their expectations of the intervention, participants talked primarily about learning knowledge and skills that would help them gradually lose weight, rather than achieving a goal of weight loss in the short term. More importantly, adolescents expressed a need to understand the rationale behind dietary guidance and healthy eating strategies, rather than just passively following instructions. It appeared that adolescents were open to guidance and strategies, but also required sufficient information to be

persuaded to use them.

This might be a reflection of adolescents' developmental needs. During adolescence, continuing brain development leads to improved cognitive function including information processing, reasoning, decision making and conscious self-regulating (Steinberg, 2005). Youth in middle and late adolescence show increased awareness of possible risks and consideration for future consequences (Crockett & Petersen, 1993). Adolescence is also considered as a period of exploration and experimentation (Clark & Seider, 2017; Jovanovic & Brdaric, 2012). Although some researchers found curiosity during adolescence could lead to a heightened vulnerability to risky and health-compromising behaviours (Proctor, Maltby, & Linley, 2011; Steinberg, 2005), others argued that it can also provide resource and opportunities for positive psychological outcomes and behavioural change (Jovanovic & Brdaric, 2012). Another essential trait of adolescence is the increased autonomy (Smetana, 2017). Older adolescents often perceive themselves as more self-reliant and self-controlled, thereby tending to make their own choices rather than conforming to the opinion of others (Crockett & Petersen, 1993). Although some might assume that Chinese adolescents would be more obedient due to the cultural background of collectivism and Confucianism (Smetana, Wong, Ball, & Yau, 2014), cross-cultural investigations have found that Chinese adolescents experience autonomy development similar to that of their American counterparts (Jia et al., 2009; Xia et al., 2004). Health promotion interventions for adolescents should be tailored to these developmental characteristics. Future weight loss and behaviour change interventions for Chinese adolescents in high school may benefit by presenting the rationale and scientific evidence underlying the strategies delivered. Intervention programmes can also encourage adolescents to experiment with various strategies and choose the ones suit them best, as a way of triggering curiosity and improving their sense of autonomy. Interventions can be delivered in ways that do not involve parents and teachers, and using popular social media platform like WeChat.

However, adolescents still have less developed memory and sustained attention compared to adults (McAvinue et al., 2012; Posner & Petersen, 1990). In addition, Chinese adolescents in high school spend long hours studying and face a high level of academic stress (Zhao et al., 2015). Therefore, a short-term, low-intensity intervention with single or multiple short sessions could be more feasible for Chinese adolescents, which was clearly preferred by our participants. Adding

entertaining features could also increase retention and engagement of adolescent participants. It should be noted that, however, that the majority of adolescent participants in this project were recruited from urban areas of Beijing. Adolescents' attitudes, needs and preferences regarding healthy promotion interventions could vary greatly across socioeconomic groups. Their access to mobile internet and usage of WeChat might also show different patterns, which should be taken into consideration in intervention development.

### **Are E-MBIs feasible to promote Chinese adolescent healthy eating and weight loss?**

This thesis highlights the acceptability of mindful eating approaches in improving snacking and promoting weight loss among Chinese adolescents. Although unhealthy eating styles and their relationship with dietary intake and body weight of adolescents have been well documented (De Cock et al., 2016; Lluch et al., 2000; Snoek et al., 2006; Wardle et al., 1992), studies on healthy eating styles such as mindful eating have mainly focused on adults (Beshara et al., 2013; Carrière et al., 2018; Pidgeon et al., 2013). In addition, despite the accumulating evidence for the effectiveness of MBIs in promoting healthy eating and weight loss (Carrière et al., 2018; Warren et al., 2017), little research has explored the role of mindful eating in the positive outcomes. In this project, both cross-sectional and intervention studies showed an influence of mindful eating on adolescent snacking. High levels of mindful eating was found to predict low frequency of unhealthy snack and beverage intake, and an increase in mindful eating predicted a decrease in unhealthy snack consumption as well as weight loss during the feasibility and acceptability study. These findings extended to accumulating evidence on the effects of mindful eating in adults, suggesting that the addition of mindful eating components to healthy eating and weight loss interventions could be particularly beneficial for Chinese adolescents.

Moreover, this thesis indicated the feasibility and acceptability of a weight loss intervention incorporating mindful eating components for overweight Chinese adolescents. Qualitative data from the feasibility study showed that mindful eating principles and practices were accessible and accepted by adolescents. Despite the short duration and low intensity of the intervention, participants showed good understanding of mindful eating skills. Previous studies suggested that adolescents might be able to acquire mindfulness skills more quickly than adults, requiring fewer

and shorter sessions (Tan, 2015). These findings encourage future interventions for adolescent weight loss to incorporate brief mindful eating sessions to enhance effectiveness. Particularly, increased awareness and attentive eating were proposed by participants as the most useful mindful eating components. Moreover, Chinese adolescents appeared to be more likely to use mindful eating practices that are brief, less formal and can be applied in daily routines. This is in line with previous studies on MBIs for adolescents from western cultures (Tan, 2015). When developing or adapting E-MBIs for adolescents, it might be beneficial to consider how to better incorporate mindful eating within adolescents' daily activities. In addition to informal mindful eating practices, another way to increase the accessibility of mindful eating in daily life is using the "if-then" technique, as proposed and examined in this thesis. Our study suggested the feasibility and acceptability of combining mindful eating strategies with the "if-then" format of implementation intentions. However, the benefits of such combination need further investigations to be clarified. Meanwhile, in the feasibility study of this research, some adolescent participants described difficulties in receiving/observing bodily sensations. The meditative elements of mindfulness practices could be novel and highly complex to the beginners. Therefore, for interventions involving formal mindful eating or mindfulness meditation practices, an enquiry component which allows adolescent participants to talk about their experience of practicing meditation is recommended.

### **Is WeChat a new platform for eHealth interventions in China?**

In the last decade, an increasing number of eHealth programmes have been established in China, most of which targeted non-communicable or infectious diseases and were delivered via short message service (SMS) (Tian et al., 2017). Only recently, have platforms including websites and mobile apps been employed to deliver eHealth interventions (Muessig et al., 2015; Tu, Wang, & Wu, 2015). Compared to developed countries where a wide range of digital platforms and technologies are actively involved in eHealth interventions (Rose et al., 2017), China still mainly relies on 'traditional' digital methods. However, the advances in Internet technology and the popularity of smart phones have greatly changed the pattern of Internet use, especially among young generations (Long et al., 2016). Researchers should therefore explore novel platforms for



eHealth interventions targeting Chinese young people.

In this project, adolescents showed a clear preference for WeChat as a platform of healthy eating intervention. WeChat is the most widely used social networking platform in China (Gan, 2017), which reached 1.13 billion monthly active users by the end of June 2019 (Tencent, 2019). WeChat is particularly attractive to young generations (Lien & Cao, 2014). As social media such as Facebook, Twitter and YouTube are blocked, WeChat becomes one of the most important social media in China (Gan, 2017; Lien & Cao 2014). According to data in 2016, 61% of WeChat users open WeChat every day, and one third used WeChat longer than 2 hours per day (Zhang, Wen, Liang, & Lei, 2017). It appears that WeChat has become ingrained into many Chinese people's daily life (Zhang et al., 2017). With its popularity in China, WeChat appears to offer considerable potential for delivering interventions for the Chinese populations. Our studies provided preliminary evidence showing WeChat as a feasible and well-accepted platform for delivering healthy eating/weight loss intervention to Chinese adolescents. To our knowledge, this is the first attempt to develop and test health promotion interventions using WeChat.

In addition, our focus group study found that WeChat is among the main resources from which Chinese adolescents and their parents obtain health information. Health information on WeChat thus greatly influenced adolescents' nutrition knowledge and health-related perceptions. Meanwhile, adolescents expressed skepticism about the health information on WeChat. These findings are in line with a recent study showing that among a sample of 1636 adults aged 18 to 50 years in China, 97.68% reported that they have read health information on WeChat, and 32.33% reported to read health information on WeChat regularly. However, more than 60% were concerned about the quality and authenticity of health knowledge on WeChat (Zhang et al., 2017). Taken the evidence together, interventions aiming at promoting public health knowledge and awareness in China may achieve positive outcomes by delivering high-quality health information on WeChat. Further investigations are needed to explore a broader application of WeChat in eHealth of China.

## **Is the Mindful Eating Questionnaire (MEQ) a suitable measure for the Chinese population?**

In addition to the practical implications for intervention development, a methodological issue raised by this thesis is the validation of the Mindful Eating Questionnaire (MEQ; Framson et al., 2009) as a measure of mindful eating among Chinese adolescents and young adults. Although research on mindfulness to date has largely relied on self-report measures, researchers have become increasingly concerned with the validation of such method (Baer, 2011; Bergomi et al., 2013; Davidson & Kaszniak, 2015; Grossman, 2011). One frequently suggested challenge concerning self-report measures of mindfulness is that understanding of mindfulness items might vary across different populations. For example, meditators and non-meditators might interpret some typically used words in mindfulness items such as “notice” and “awareness” differently (Baer, 2011; Grossman, 2011). In our think-aloud study, we found Chinese adolescents and young adults who had no experience in mindfulness or meditation tended to interpret “notice”, “awareness” or “appreciate” as a passive consequence rather than an conscious and intentional act. These findings highlight the importance of understanding how participants with different age, culture and meditation experience interpret mindful eating items when measuring their mindful eating. Such investigations could considerably contribute to the development of age- and culturally-appropriate measures of mindful eating, and the compilation of mindful eating items that are uniformly interpreted across different groups, thereby improving the validation of mindful eating assessed through self-report (Bergomi et al., 2013; Davidson & Kaszniak, 2015). In conclusion, we found that with some items revised using a think-aloud approach, the Chinese version of the MEQ showed good psychometric properties and is suitable to measure mindful eating in the Chinese populations.

It should be noted that response biases caused by misinterpretations of questionnaire items are not specific to mindfulness/mindful eating measures. Studies using qualitative methods frequently identified misinterpretations of questionnaire items assessing various psychological and behavioural constructs (e.g., French et al., 2007; Evans et al., 2016; Hegarty et al., 2019; van Oort et al., 2010). The inconsistency in item interpretation and response might contribute to the

so-called replication crisis in psychology (Shrout & Rodgers, 2018), while replicable findings build on a measure causing common misinterpretations could be even more worrisome (French et al., 2007; Rotello, Heit, & Dube, 2015). It is therefore recommended to apply think-aloud methods during self-report measure development or adaptation to assess its comprehension, acceptability and consistency of responses, and optimise its appropriateness for the intended population (Johnston, Benyamini, & Karademas, 2016).

### **Is the Theory of Planned Behaviour a useful theory for understanding Chinese adolescent snacking?**

Research in snacking behaviour in China is in its infancy. Applications of sophisticated and extensively applied theories in understanding health behaviour could be particularly beneficial to the establishment of knowledge base, and therefore is recommended in future research on snacking among the Chinese population. Despite the extensive application of the TPB in explaining and predicting healthy behaviour among western populations, knowledge about its utility in understanding Chinese adolescent snacking is very limited. Only two previous studies have explored the efficacy of the TPB in explaining healthy eating intentions of Chinese adolescents (Chan & Tsang, 2011; Chan et al., 2016), but neither measured eating behaviour. The survey study of this research provides initial evidence supporting the efficacy of the TPB in understanding unhealthy snacking of Chinese adolescents, and underscored the role of subjective norms.

Meanwhile, however, the TPB tended to explain a smaller amount of variance in snacking frequency of Chinese adolescents compared to that of UK adolescents. The TPB also did not show predictive effects on frequency of fruit and vegetable intake in Chinese adolescents. Habit strength as an added component, although showed as an important predictor of snacking among UK adolescents, failed to explain Chinese adolescent snacking frequency. More investigations are needed to further explore the utility of the TPB in understanding Chinese adolescent snacking, and the inclusion of other relevant components to improve its efficacy.

### 8.3 Strengths, limitations and future directions

A key strength of this suite of studies is that it addressed a major gap in both understanding and improving snacking among Chinese adolescents. In addition, it made a significant step towards contributing to a gap in provision of digital interventions for Chinese adolescents' weight management. Mixed methods were employed at each step from understanding adolescent snacking behaviour and potential determinants, developing a culturally appropriate measure of mindful eating, to developing and feasibility testing a digital intervention. Mix-methods approaches activate their complementary strengths of qualitative and quantitative methods.

A further strength is the use of theory – specifically BCW - and a participatory approach to develop a behaviour change weight loss intervention for Chinese adolescents. The use of the behaviour change model and framework helped clarify key intervention characteristics and likely active ingredients. Engaging with end-users is now accepted as fundamental to the production of acceptable interventions and we were able to respond to many of the adolescents' preferences for the digital tool. The intervention is thoroughly built on previous evidence, with a novel inclusion of the mindfulness approach and planning techniques.

The principal limitation of this research project is that all data collected were self-report, and therefore may suffer from systematic response biases. Another limitation is the homogeneous study samples. Most study samples consisted of participants recruited from a single school, which could lead to a low sample representativeness. The UK sample of the survey study is relatively small, which limited the statistical power. In addition, a major limitation of the feasibility study is that the intervention was delivered and evaluated by the same researcher, which could increase bias in the study outcomes. These limitations should be taken into consideration when interpreting and generalising the research findings.

The set of studies in this thesis suggests a number of future directions. First, the results of the feasibility study suggested that a pilot RCT is warranted to examine the effectiveness of a mindfulness-based snacking intervention in promoting weight loss. A long-term follow-up is needed to determine the maintenance of any weight loss. Second, future research should investigate the added value of implementation intentions to mindful eating interventions. Such investigations may considerably contribute to our understanding of active ingredients of the

intervention, or augment its effectiveness. Third, future research should employ more objective assessments of body weight, dietary intake and mindful eating. More informative measures of obesity such as waist circumference or waist-to-hip-ratio are recommended, but difficult to secure when delivering digital / online interventions. Snack intake can be assessed using food diary, food photography or digital camera record (Stumbo, 2013), including SenseCam (Kamar, Evans, & Hugh-Jones, 2016). Alternatives to self-report of mindful eating are also worth exploring. Increasingly used approaches in mindfulness research such as experience sampling and cognitive tasks (Davidson & Kaszniak, 2015) might provide novel assessments of mindful eating. Fourth, our study showed the feasibility of delivering mindful eating skills through brief online sessions. Future investigations may further explore the feasibility and effectiveness of incorporating mindful eating skills into eHealth-based micro-interventions targeting adolescent overweight. Finally, alternative to large scale trials, n-of-1 methods (McDonald et al., 2017) can be applied to examine the effects of the mindful eating intervention and understand how snacking behaviour change and weight loss occurs over time within individuals.

#### **8.4 Conclusions**

In conclusion, this research suggested the important role of mindful eating in predicting and improving adolescent snacking. The theory of planned behaviour showed efficient in explaining adolescent snacking, and cultural context should be taken into account applying this theory. Chinese adolescent snacking is greatly influenced by subjective norms, especially by their peers' snacking behaviour and parents' snacking beliefs. The snacking behaviour of UK adolescents is largely habitual and less influenced by cognitive beliefs. The cultural differences in determinants of adolescent snacking suggest different intervention strategies for each group. Chinese adolescents showed an open attitude towards snacking interventions. Interventions teaching nutrition knowledge and eating regulation skills could be particularly effective in improving Chinese adolescent snacking. A revised Chinese version of the Mindful Eating Questionnaire was developed, and exhibited good psychometric properties in a sample of Chinese college students. Finally, a mindfulness-based snacking intervention was developed incorporating components of nutrition education, mindful eating and planning. This intervention showed good feasibility and

acceptability in a sample of overweight Chinese adolescents aged 16 to 18 years. Intervention effects on weight loss, snacking frequency and related eating variables were also observed.

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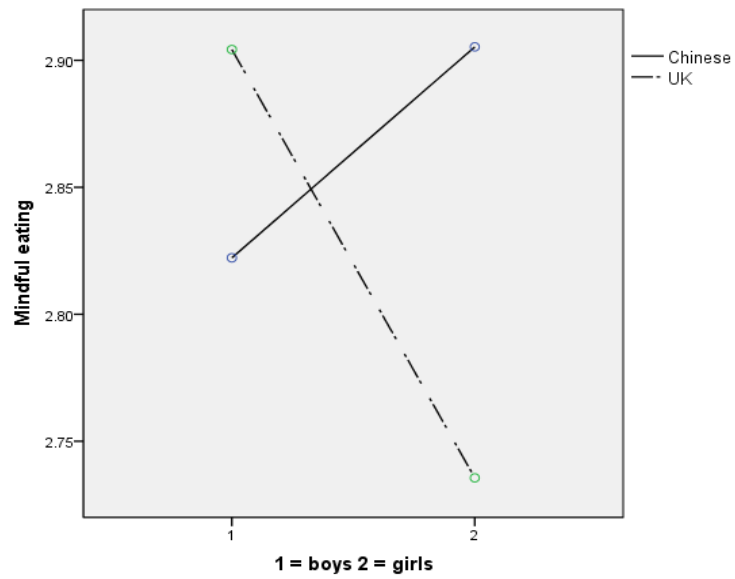
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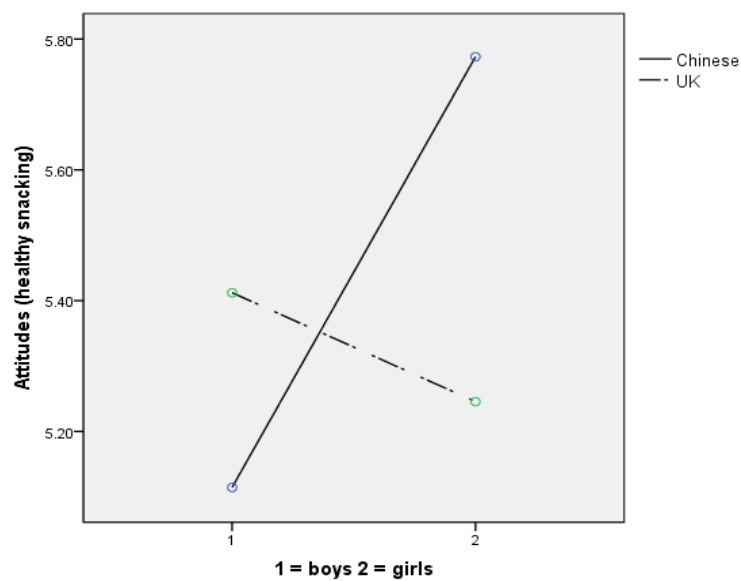
## Appendices

### Survey study (Chapter 2)

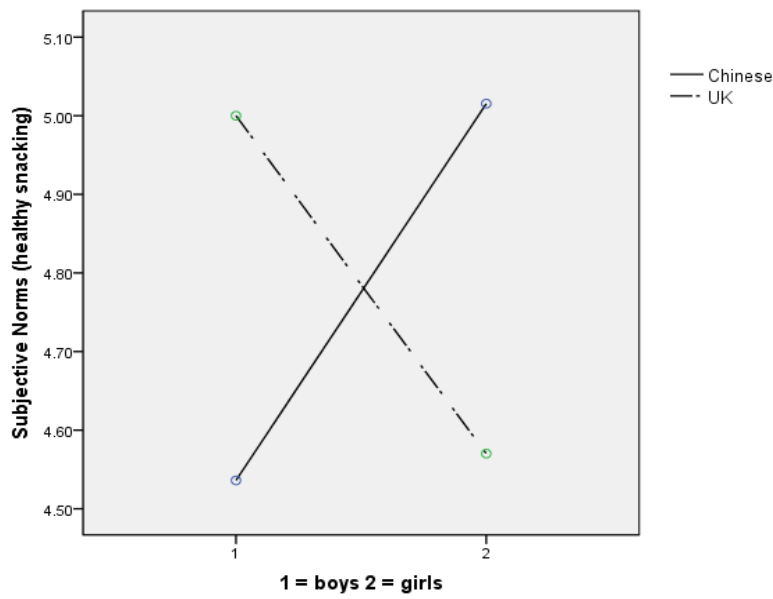
#### Appendix 1 Figures showing significant interaction effects of culture and gender on eating-related measures



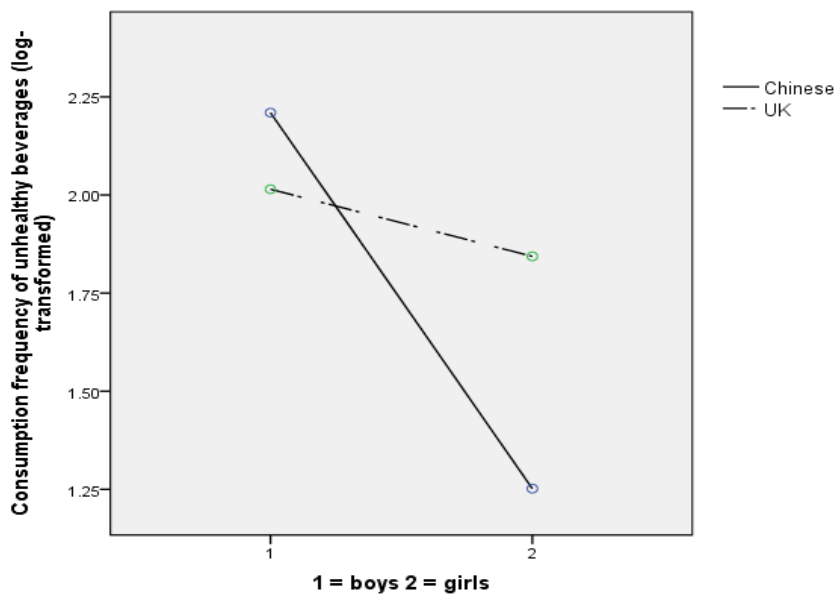
**Figure 1.** The interaction effect of culture and gender on mindful eating



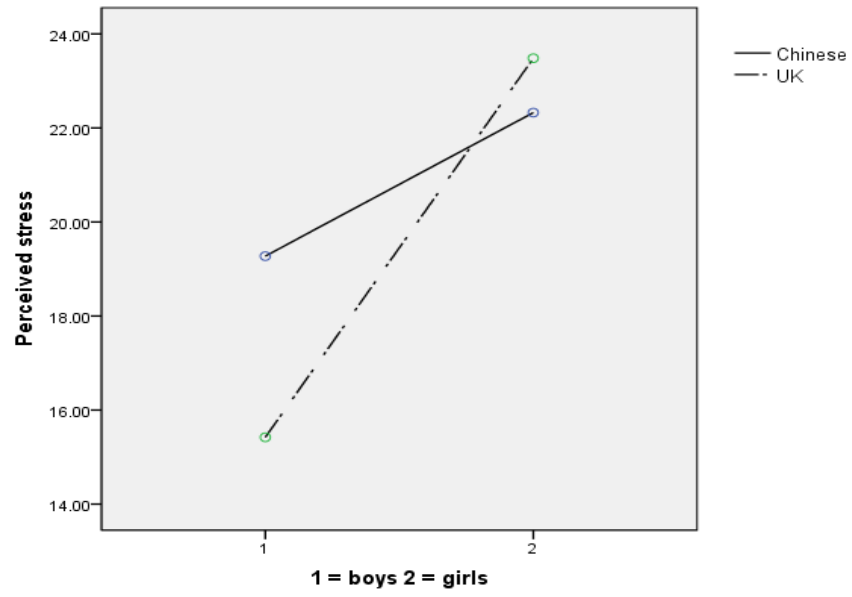
**Figure 2.** The interaction effect of culture and gender on attitudes towards healthy snacking



**Figure 3.** The interaction effect of culture and gender on subjective norms related to healthy snacking



**Figure 4.** The interaction effect of culture and gender on consumption frequency of unhealthy beverages (log-transformed)



**Figure 5.** The interaction effect of culture and gender on perceived stress

## **Appendix 2 Participant information sheet + survey questionnaire**

### **Participant Information Sheet**

School of Psychology  
University of Leeds  
Leeds LS1 9JT, UK



**Would you like to contribute to health psychology and help young people at your age by being a part of research in the University of Leeds?**

#### **What is this study about?**

A PhD research study by the University of Leeds about eating patterns and beliefs of young people aged 16 -18 years in UK and China.

#### **What does it involve?**

- You will be answering an online survey for up to 30 minutes.
- The survey will be about YOUR eating habits and beliefs about yourself, others and food.
- It is NOT a test, there are no “right” or “wrong” answers for any question in the survey.
- This research is anonymous so NO NAMES will be asked in the questionnaires.

#### **What’s in it for you?**

You will:

- Be a representative of young people.
- Be a part of an important research project in the University of Leeds.
- Help scientific researchers understand young people and develop a health program for youth.
- Better understand your own eating habits and beliefs.

#### **How will your participation and information be kept confidential?**

- All the data will be anonymous.
- All electronic data will be held on a password protected computer accessed only by the researcher.

- The paper questionnaires will be stored in a locked cabinet accessed only by researcher.
- Your responses to the questions will be used for the purpose of this project only. The results of this study will be reported in a doctoral dissertation and might be reported in academic journal.

**Do you have to take part in the study?**

No, although we will really appreciate your participation, it is up to you to decide. You can also stop completing the survey at any time without any need to give a reason. However, as the survey is anonymous, you cannot withdraw from the study once you submit the survey.

If you have any questions about the study, you can contact the researcher or the supervisor on the email addresses below.

**What happens now?**

If you are aged 16 to 18 years, currently live in UK and are interested in this research, please confirm the statements below and complete the survey.

- 1. I have read and understand all information in this Participant Information Sheet.
- 2. I have had answers to any questions (or N/A if no questions asked).
- 3. The procedures regarding confidentiality have been clearly explained to me.
- 4. I freely agree to participate in this study.

**For any further questions or queries please contact us on:**

Researcher: Qian Zhang [psqz@leeds.ac.uk](mailto:psqz@leeds.ac.uk)

Supervisor: Dr Siobhan Hugh-Jones [s.hugh-jones@leeds.ac.uk](mailto:s.hugh-jones@leeds.ac.uk)

**Ethics number and date of approval by a University of Leeds Research Ethics Ctte (Faculty of Medicine and Health): Reference No.: 16-0289; Date of Approval: 08-Nov-2016.**

## Thanks for agreeing to full out this survey!

The questionnaire you are about to complete is very important. The information you share with us will be used to develop health programs for young people. Please answer every question carefully. Your help with this study is greatly appreciated.

This is NOT a test. Your name will NOT be on the survey. Please be as honest as you can in your responses.

**Date:** \_\_\_\_\_

*Let's start with some general questions about you.*

**1. What is your age?**

1. 15 or younger
2. 16
3. 17
4. 18
5. 19 or older

**2. What year are you in school?**

1. Year 11
2. Year 12
3. Year 13

**3. Are you...?**

1. Male
2. Female
3. Others \_\_\_\_\_

**4. What is your ethnic group?**

\_\_\_\_\_

**5. Are you currently trying to:  
(You may choose more than one)**

1. Lose weight
2. Stay at the same weight
3. Gain weight
4. I am not trying to do anything about my weight
5. I am bothered by my weight
6. I am not bothered by my weight

**6. How tall are you?**

\_\_\_\_\_feet \_\_\_\_\_ inches

**Or** I don't know

**7. How much do you weigh?**

\_\_\_\_\_stones\_\_\_\_\_ pounds

**Or** I don't know

**8. Which of these best describes your mother's highest level of education?**

1. Did not finish secondary school
2. Finished secondary school
3. Attended college or further training
4. Has a university degree
5. Master's degree or PhD
6. I don't know

**9. Does your mother or equivalent guardian...**

1. Work full-time for pay
2. Work part-time for pay
3. Neither of these
4. I don't know
5. Not applicable

**10. Which of these best describes your father's highest level of education?**

1. Did not finish secondary school
2. Finished secondary school
3. Attended college or further training
4. Has a university degree
5. Master's degree or PhD
6. I don't know

**11. Does your father or equivalent guardian...**

1. Work full-time for pay
2. Work part-time for pay
3. Neither of these
4. I don't know
5. Not applicable

**12. Does your family own**

1. 0 car
2. 1 car
3. 2 cars
4. 3 or more cars

**13. How many siblings do you have?**

1. One
2. Two
3. Three
4. Four
5. Five
6. Six
7. Seven or more
8. None

***In the next two parts, we would like to ask some questions about your eating styles.***

***Part A***

Please answer the following questions as carefully and honestly as possible. Read each question and choose the appropriate response for you.

		<i>Never</i>	<i>Seldom</i>	<i>Some- times</i>	<i>Often</i>	<i>Very Often</i>
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 to 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 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 a bakery 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
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

		<i>Never</i>	<i>Seldom</i>	<i>Some- times</i>	<i>Often</i>	<i>Very Often</i>
22	Do you have a desire to eat when things are going against you or when things have gone wrong?	1	2	3	4	5
23	If you see others eating, do you also have a desire to eat?	1	2	3	4	5
24	How often do you try not to eat between meals because you are watching your weight?	1	2	3	4	5
25	Do you have a desire to eat when you are frightened?	1	2	3	4	5
26	Can you resist eating delicious foods?	1	2	3	4	5
27	How often in the evening do you try not to eat because you are watching your weight?	1	2	3	4	5
28	Do you have a desire to eat when you are disappointed?	1	2	3	4	5
29	Do you eat more than usual when you see others eating?	1	2	3	4	5
30	Do you think about how much you weigh before deciding how much to eat?	1	2	3	4	5
31	Do you have a desire to eat when you are upset?	1	2	3	4	5
32	When you see someone preparing a meal, does it make you want to eat something?	1	2	3	4	5
33	Do you have a desire to eat when you are bored or restless?	1	2	3	4	5
34	Do you eat more when you feel stressed?	1	2	3	4	5
35	Do you eat less when you feel stressed?	1	2	3	4	5

**Part B** How strongly do you agree with the following statements?

		<i>Never/ Rarely</i>	<i>Some- times</i>	<i>Often</i>	<i>Usually/ Always</i>
1	I eat so quickly that I don't taste what I'm eating.	1	2	3	4
2	When I eat at "all you can eat" buffets, I tend to overeat.	1	2	3	4
3	At a party where there is a lot of good food, I <u>notice</u> when it makes me want to eat more food than I should.	1	2	3	4
4	I <u>recognize</u> when food advertisements make me want to eat.	1	2	3	4
5	When a restaurant portion is too large, I stop eating when I'm full.	1	2	3	4
6	My thoughts tend to wander while I am eating.	1	2	3	4
7	When I'm eating one of my favourite foods, I don't recognize when I've had enough.	1	2	3	4
8	I <u>notice</u> when just going into a movie theatre makes me want to eat sweets or popcorn.	1	2	3	4
9	If it doesn't cost much more, I get the larger size food or drink regardless of how hungry I feel.	1	2	3	4
10	I notice when there are subtle flavours in the foods I eat.	1	2	3	4
11	If there are leftovers that I like, I take a second helping even though I'm full.	1	2	3	4
12	When eating a pleasant meal, I notice if it makes me feel relaxed.	1	2	3	4
13	I snack without noticing that I am eating.	1	2	3	4
14	When I eat a big meal, I notice if it makes me feel heavy or sluggish.	1	2	3	4
15	I stop eating when I'm full even when eating something I love.	1	2	3	4

16	I appreciate the way my food looks on my plate.		1	2	3	4
17	When I'm feeling stressed at school, I'll go find something to eat.	___I don't feel stressed at school	1	2	3	4
18	If there's good food at a party, I'll continue eating even after I'm full.		1	2	3	4
19	When I'm sad, I eat to feel better.		1	2	3	4
20	I notice when foods and drinks are too sweet.		1	2	3	4
21	Before I eat I take a moment to appreciate the colours and smells of my food.		1	2	3	4
22	I taste every bite of food that I eat.		1	2	3	4
23	<u>I recognise</u> when I'm eating and not hungry.	___I never eat when I'm not hungry.	1	2	3	4
24	<u>I notice</u> when I'm eating from a dish of sweets just because it's there.		1	2	3	4
25	When I'm at a restaurant, I can tell when the portion I've been served is too large for me.		1	2	3	4
26	I notice when the food I eat affects my emotional state.		1	2	3	4
27	I have trouble not eating ice cream, cookies, or crisps if they're around the house.		1	2	3	4
28	I think about things I need to do while I am eating.		1	2	3	4

### **Part C**

***Sometimes, how you feel can affect the way you eat. We would like to know more about your feelings during the last month.***

The questions in this part ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way.

***Never Almost Some- Fairly Very***

		<i>Never</i>	<i>times</i>	<i>Often</i>	<i>Often</i>
1	In the last month, how often have you been upset because of something that happened unexpectedly?	1	2	3	5
2	In the last month, how often have you felt that you were unable to control the important things in your life?	1	2	3	5
3	In the last month, how often have you felt nervous and “stressed”?	1	2	3	5
4	In the last month, how often have you felt confident about your ability to handle your personal problems?	1	2	3	5
5	In the last month, how often have you felt that things were going your way?	1	2	3	5
6	In the last month, how often have you found that you could not cope with all the things that you had to do?	1	2	3	5
7	In the last month, how often have you been able to control irritations in your life?	1	2	3	5
8	In the last month, how often have you felt that you were on top of things?	1	2	3	5
9	In the last month, how often have you been angered because of things that were outside of your control?	1	2	3	5
10	In the last month, how often have you felt that difficulties were piling up so high that you could not overcome them?	1	2	3	5

### **Part E**

***In this part, we would like to know your opinions about snacking.***

The first section is about healthy snacks.

Healthy snacks may include:

wholemeal bread, brown rice, potatoes, pasta and other starchy foods, e.g., rice crackers, scones or hot cross buns with low-fat spread, wholegrain cereal, whole-wheat toast, whole-wheat pitta bread, baked potato.

Fruit and vegetables, e.g., carrot, cucumber or celery sticks with a tablespoon of reduced-fat cottage cheese, reduced-fat hummus or Greek yogurt and fresh herbs;

a large slice of melon or pineapple.

Milk and dairy foods, e.g., a low-fat yogurt or fromage frais; a low-calorie hot chocolate mix made with skimmed milk.

Other good snacking foods high in protein, e.g., a handful of nuts or seeds; oily fish like sardines, salmon or pilchards; a hard-boiled egg.

**1. Generally, my eating healthy snacks is**

<i>Unenjoyable</i>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<i>Enjoyable</i>
<i>Unpleasant</i>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<i>Pleasant</i>
<i>Unimportant</i>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<i>Important</i>
<i>Harmful</i>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<i>Beneficial</i>

**2. To what extent do your family / friends / significant others think your eating healthy snacks is important?**

<i>Unimportant</i>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<i>Important</i>
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**3. How often do you think that most of your family/friends/significant others eat healthy snacks?**

<i>Never</i>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<i>Very often</i>
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**4. How much control do you have over whether or not you eat healthy snacks?**

<i>No control</i>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<i>Complete control</i>
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**5. For me to eat healthy snacks would be**

<i>Very easy</i>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<i>Very difficult</i>
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**6. Eating healthy snacks is something...**

	<i>Strongly Disagree</i>				<i>Strongly Agree</i>		
I do frequently.	1	2	3	4	5	6	7
I do automatically.	1	2	3	4	5	6	7

I do without having to consciously remember.	1	2	3	4	5	6	7
that makes me feel weird if I do not do it.	1	2	3	4	5	6	7
I do without thinking.	1	2	3	4	5	6	7
that would require effort not to do it.	1	2	3	4	5	6	7
that belongs to my daily routine.	1	2	3	4	5	6	7
I start doing before I realise I'm doing it.	1	2	3	4	5	6	7
I would find hard not to do.	1	2	3	4	5	6	7
I have no need to think about doing.	1	2	3	4	5	6	7
That's typically "me".	1	2	3	4	5	6	7
I have been doing for a long time.	1	2	3	4	5	6	7

**The next section is about unhealthy snacks.**

Unhealthy snacks may include: foods and drinks high in fat and/or sugar, e.g., sweets, chocolate, non-diet soft drinks, pastries, biscuits, desserts, high-fat crisps, fries, cream, butter, fast foods.

**7. Generally, my eating unhealthy snacks is**

*Unenjoyable*      1    2    3    4    5    6    7      *Enjoyable*

*Unpleasant*      1    2    3    4    5    6    7      *Pleasant*

*Unimportant*      1    2    3    4    5    6    7      *Important*

*Harmful*              1    2    3    4    5    6    7      *Beneficial*

**8. To what extent do your family / friends / significant others think your eating unhealthy snacks is important?**

*Unimportant*      1    2    3    4    5    6    7      *Important*

**9. How often do you think that most of your family/friends/significant others eat unhealthy snacks?**

*Never*                      1    2    3    4    5    6    7      *Very often*

**10. How much control do you have over whether or not you eat unhealthy snacks?**

*No control*    1    2    3    4    5    6    7    *Complete control*

**11. For me to eat unhealthy snacks would be**

*Very easy*    1    2    3    4    5    6    7    *Very difficult*

**12. Eating unhealthy snacks is something...**

	<i>Strongly Disagree</i>			<i>Strongly Agree</i>			
	1	2	3	4	5	6	7
I do frequently.	1	2	3	4	5	6	7
I do automatically.	1	2	3	4	5	6	7
I do without having to consciously remember.	1	2	3	4	5	6	7
that makes me feel weird if I do not do it.	1	2	3	4	5	6	7
I do without thinking.	1	2	3	4	5	6	7
that would require effort not to do it.	1	2	3	4	5	6	7
that belongs to my daily routine.	1	2	3	4	5	6	7
I start doing before I realise I'm doing it.	1	2	3	4	5	6	7
I would find hard not to do.	1	2	3	4	5	6	7
I have no need to think about doing.	1	2	3	4	5	6	7
That's typically "me".	1	2	3	4	5	6	7
I have been doing for a long time.	1	2	3	4	5	6	7

**Part F**

***We'd like to end with some questions about the foods and drinks you had over the past week.***

Please think about what you ate during the past week, while you were at school, and while you were not at school, for example when you are at home, at a friend's house, or at a restaurant.

You are going to mark the column that shows, on average, how many times you ate the food at school and not at school. If you did not eat this food or drink this beverage during the past week, please mark "never or less than 1 per week."

This first section is about beverages (or drinks).

Type of drink		Location	How often did you drink these beverages in the past week? (mark one in each row)						
			Never of less than 1 per week	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4+ per day
1	Orange juice, apple juice and other 100% juices	At school							
		Not at school							
2	Fruit drinks (such as Capri Sun)	At School							
		Not at school							
3	Sport drinks (such as Lucozade or PowerAde); these drinks usually do not have caffeine.	At school							
		Not at school							
4	Flavoured water (such as Oasis, Ribena or vitamin waters); these drinks usually do not have caffeine.	At school							
		Not at school							
5	Fizzy drinks contain sugar and caffeine (such as Coke, Pepsi, Coke Life).	At school							
		Not at school							
6	Caffeine-free fizzy drinks contain sugar (such as 7-up, Fanta, Sprite, ginger beer,	At school							
		Not at							



	caffeine-free Cola)	school							
7	Sugar-free fizzy drinks contain caffeine (such as Diet Pepsi, Pepsi One, Pepsi Max, Coke Zero)	At school							
		Not at school							
8	Fizzy drinks which are free of sugar or caffeine (such as Diet 7-up, 7-up Free, Sprite Zero, Diet ginger beer)	At school							
		Not at school							
9	Energy drinks (such as Red Bull, and Monster); these drinks usually have caffeine.	At school							
		Not at school							
10	1% or non-fat milk (sometimes called skimmed, fat-free, or low-fat milk; includes chocolate milk).	At school							
		Not at school							
11	Regular or 2% milk (sometimes called whole, reduced fat, or 4% milk fat; include chocolate milk).	At school							
		Not at school							

This next section is about foods.

Type of food	Location	How often did you drink these beverages in the past week? (mark one in each row)						
		Never of less than 1 per week	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4+ per day
12 Low-fat or non-fat crisps, tortilla crisps (such as Reduced-fat Doritos, Fat-Free Pringles)	At School							
	Not at School							
13 Regular crisps, tortilla crisps, and puffs (Pringles, Doritos, Walkers).	At School							
	Not at School							
14 Other salty snacks (such as Ritz crackers, salted nuts).	At School							
	Not at School							

15	Sweets and chocolate (including chocolate bars; excludes cookies and cakes)	At School							
		Not at School							
16	Doughnuts, pop tarts or other breakfast pastries (such as croissants).	At School							
		Not at School							
17	Cookies, brownies, sweet pastry pies and cakes (include cake bars covered in chocolate, such as mini-rolls).	At School							
		Not at School							
18	Low or non-fat frozen desserts such as low fat ice cream, frozen yogurt and ice-lollies.	At School							
		Not at School							
19	Regular (i.e. NOT low fat) ice cream, lollies & milkshakes (include all flavours).	At School							
		Not at School							
20	A serving of vegetables such as green salad, peas, green beans or corn? (do not count potatoes or chips).	At School							
		Not at School							
21	A serving of fruit such as a banana, apple or grapes.	At School							
		Not at School							

***Thank you for completing this survey!***

### Appendix 3 School invitation letter for survey study

#### **School of Psychology**

University of Leeds  
Leeds LS1 9JT, UK



**UNIVERSITY OF LEEDS**

**Invitation to take part in a study:** Factors influencing adolescent healthy and unhealthy snacking behaviour: a cross-cultural study.

**Researcher:** Qian Zhang ([psqz@leeds.ac.uk](mailto:psqz@leeds.ac.uk)) **Supervisor:** Dr Siobhan Hugh-Jones ([s.hugh-jones@leeds.ac.uk](mailto:s.hugh-jones@leeds.ac.uk)) School of Psychology, University of Leeds, Leeds, LS2 9JT.

#### **Dear School**

This is an invitation to support student recruitment for a research project. I am a PhD student in Health Psychology at the University of Leeds. As part of my PhD project, I am comparing eating behaviours and eating norms of teenagers from the UK and China, as well as the role of stress in eating behaviours. Before you agree to support recruitment for this study, it is important that you understand why the research is being carried out and what it involves. Please read through the information provided and decide if you are happy for me to recruit participants and administer a survey for in your school. If you have any questions, please contact me or my supervisor via the details at the top of the page.

#### **Background**

Nutritional deficits and poor eating habits established during adolescence have long-term health, growth and development consequences. It is important to identify the influential factors on their eating patterns in order to improve health education programs and effective interventions for teenagers. Based on the theory of planned behaviour (TPB), this cross-cultural study aims to explore the attitudes, norms, habits, and perceived control of healthy and unhealthy snacking behaviour among British and

Chinese teenagers aged 16-18 years, and how these factors affect their eating patterns. The role of stress on eating will also be examined. The findings of this study will help us to develop an intervention program which aims to help teenagers who are ready to change their relationships with foods and to improve their eating habits.

### **What are the benefits of taking part?**

By taking part of this study, your students will have the opportunity to:

- Be a representative of young people.
- Be a part of an important research project in the University of Leeds.
- Help scientific researchers understand young people and develop a health program for youth.
- Better understand their own eating habits and beliefs.

### **How can you help?**

You will be asked to (i) invite any 16 -18 year olds in your school to take part in a survey and then (ii) to give them the paper-based survey to complete in school. This will take approximately 30 minutes in total. I am happy to attend school to explain the study and administer the survey, or to simply supply the materials which you can return in pre-paid envelopes provided. The study may be particularly interesting to your students studying Psychology. Students will be asked to complete a range of questions of basic information about themselves and then five questionnaires about eating styles, eating norms, perceived stress and snacking behaviour. The survey will have a participant information sheet which contains our contact details.

### **Ethics**

This study has been approved by the University of Leeds (School of Psychology) Research Ethics Committee (**Reference: 16-0289; Date of Approval: 08/Nov/2016**) and follows the ethical guidelines set by the British Psychological Society. These guidelines include providing participants with sufficient information before starting the study. Participants will be consenting to take part in the study by completing the survey. They may choose not to answer any particular questions or stop completing the survey at any time without giving a reason. The survey is anonymous so the name of participants will not be known by anyone

including the researchers. Only the immediate research team will have access to the raw data and it will be stored in line with University protocol to ensure data security. The results of the study will be used to develop a health program for youth and may also contribute to a published paper; in any reports, no participants or schools will be identifiable.

I hope this information letter helps you to understand the study. If you have any further questions or queries contact myself, or supervisor at the address stated above.

Thank you for taking the time to read this. I would be very grateful if you would be happy for me to recruit participants in your school. If you consent to this, please could you email me the text below and let me know which teacher (s) I can contact in order to arrange delivery of the survey.

Qian Zhang  
PhD Student

**Consent Email to [psqz@leeds.ac.uk](mailto:psqz@leeds.ac.uk)**

I am happy to confirm that you can recruit in this school for the study entitled 'Factors influencing adolescent healthy and unhealthy snacking behaviour: a cross-cultural study',

You may email \_\_\_\_\_ to arrange delivery and administration of the survey.

## Focus group study (Chapter 3)

### Appendix 4 Participant Information sheet for focus group study

#### School of Psychology

University of Leeds  
Leeds LS1 9JT, UK



UNIVERSITY OF LEEDS

## Foodies Wanted!

If you are 16 or 18 year old foodies and interested in this opportunity, move now! We only have positions for six boys and six girls at each age!

### **What is this study about?**

A PhD research study by the University of Leeds trying to understand the views and thoughts about snacking of Chinese young people.

### **What does it involve?**

- You will be sharing your views and thoughts about eating and snacking in a group with five peer students and a researcher who is eager to listen to your ideas.
- The group discussion will take up to one hour.
- It is NOT an evaluation, there are no “right” or “wrong” answers for any question in the discussion – we just want to know your real thoughts and feelings!
- The discussion will be audio recorded, but NO NAMES will be asked during the discussion and the researchers will have no way to identify you from the audio recording. Faculty and administrators from your school will neither be present at the discussion nor have access to raw notes, transcripts or audio recordings.

### **What’s in it for you?**

You will:

- Be a representative of Chinese young people and get your ideas and feelings heard.
- Be a part of an important research project in the University of Leeds and get a sense of how psychological research is conducted.

- Help international scientific researchers in health psychology understand Chinese young people and develop a health program for youth.
- Better understand your and your peers' eating habits and beliefs by sharing and listening.
- Receive 20 yuan for your time and efforts in your participation.

**How will your participation and information be kept confidential?**

- All the data will be anonymous.
- All electronic data will be held on a password protected computer accessed only by researchers.
- The paper informed consent you sign will be taken back to the UK and stored in a locked cabinet accessed only by researchers.
- Anything you say in the discussion will be used for the purpose of this project only. The results of this study will be reported in a doctoral dissertation and might be reported in academic journal.
- For research purpose, data from this study will be stored for 5 years.

**Do you have to take part in the study?**

No, although we will really appreciate your participation, it is up to you to decide. You can also stop and leave the discussion at any time without any need to give a reason. However, as the focus group is anonymous, you cannot withdraw from the study once the group discussion is completed.

If you have any questions about the study you can contact the researcher or the supervisor on the email addresses below.

**For any further questions or queries please contact us on:**

Researcher: Qian Zhang [psqz@leeds.ac.uk](mailto:psqz@leeds.ac.uk)

Supervisor: Dr Siobhan Hugh-Jones [s.hugh-jones@leeds.ac.uk](mailto:s.hugh-jones@leeds.ac.uk)

**Ethics number and date of approval by a University of Leeds Research Ethics Ctte (Faculty of Medicine and Health) : Reference: 17-0143; Date of Approval: 12/05/2017**

## **Appendix 5 School Invitation Letter for focus group study**

### **School of Psychology**

University of Leeds  
Leeds LS1 9JT, UK



**UNIVERSITY OF LEEDS**

**Invitation to take part in a study:** Understanding Chinese adolescent snacking behaviour using focus groups

**Researcher:** Qian Zhang ([psqz@leeds.ac.uk](mailto:psqz@leeds.ac.uk))

**Supervisor:** Dr Siobhan Hugh-Jones ([s.hugh-jones@leeds.ac.uk](mailto:s.hugh-jones@leeds.ac.uk))

School of Psychology, University of Leeds, Leeds, LS2 9JT.

### **Dear School**

This is an invitation to support student recruitment for a research project. I am a PhD student in Health Psychology at the University of Leeds. As part of my PhD project, I am developing a programme aiming to help improve Chinese adolescent eating behaviour. Before you agree to support recruitment for this study, it is important that you understand why the research is being carried out and what it involves. Please read through the information provided and decide if you are happy to recruit participants for me. If you have any questions, please contact me or my supervisor via the details at the top of the page.

### **Background**

The considerable increases in overweight and obesity among children and adolescents have led to universal concerns. In China, the prevalence of overweight and obesity in 2013 was 23.0% for boys and 14.0% for girls under twenty years. There is consistent evidence demonstrating that childhood and adolescent overweight and obesity have negative health consequences not only in youth, but also in adulthoods. Snacking has been suggested as a major part of unhealthy diets among adolescents, which is contributing to overweight/obesity. Poor snacking habits is also shown to be related with negative emotions and cognitive deficits of young people. Thus, it could be significantly beneficial to health outcomes and obesity prevention for adolescents to improve their healthy snacking.

Given that young people often do not intend to engage in certain health-related behaviour, it is essential to understand their behaviour and their needs before developing effective



health behaviour change programmes for them. However, snacking behaviour among Chinese adolescents is understudied. Focus group is a qualitative research method providing a range of ideas or feelings that people have about a topic, and uncovering factors that influence opinions, behaviour or motivations. Via focus group discussions with Chinese adolescents, this study aims to understand their perceptions of healthy and unhealthy snacking, to explore the facilitators and barriers for healthy snacking, and to investigate their acceptance and preference of a healthy eating programme for Chinese adolescents. The information and knowledge gained in this study will be used in the design and development of a programme aiming to improve Chinese adolescent healthy eating.

### **What are the benefits of taking part?**

By taking part of this study, your students will have an opportunity to:

- Be a representative of Chinese young people and get their ideas heard.
- Be a part of an important research project in the University of Leeds and get a sense of how psychological research is conducted.
- Help international scientific researchers understand Chinese young people and develop a health program for youth.
- Better understand their own and their peers' eating habits and beliefs by sharing and listening.
- To thank them for their time and effort, each participant will receive 20 yuan for their participation.
- If you wish, we will send you the findings of this study.

### **How can you help?**

You will be asked to invite students in your school who are interested in talking about their opinions of eating and snacking to take part in a focus group discussion. We aim to recruit six girls and six boys aged 16 years, and six girls and six boys aged 18 years. Students will be asked to share their views and thoughts about eating and snacking in a group with five peer participants and a researcher. The group discussion will take up to one hour. Each participant will be provided with a participant information sheet which contains our contact details.

### **Ethics**

This study has been approved by the University of Leeds (School of Psychology) Research Ethics Committee (**Reference: 17-0143; Date of Approval: 12/05/2017**) and follows the ethical guidelines set by the British Psychological Society. These guidelines include providing participants with sufficient information before starting the study. Participants will be consenting to take part in the study by completing the survey. They may choose not to answer any particular questions or stop completing the survey at any time without giving a reason. The survey is anonymous so the name of participants will not be known by anyone

including the researchers. Only the immediate research team will have access to the raw data and it will be stored in line with University protocol to ensure data security. The results of the study will be used to develop a health program for youth and may also contribute to a published paper; in any reports, no participants or schools will be identifiable.

I hope this information letter helps you to understand the study. If you have any further questions or queries contact myself, or supervisor at the address stated above.

Thank you for taking the time to read this. I would be very grateful if you would be happy for me to recruit participants in your school. If you consent to this, please could you email me the text below and let me know which teacher (s) I can contact in order to arrange delivery of the survey.

Qian Zhang  
PhD Student

**Consent Email to [psqz@leeds.ac.uk](mailto:psqz@leeds.ac.uk)**

I am happy to confirm that you can recruit in this school for the study entitled 'Factors influencing adolescent healthy and unhealthy snacking behaviour: a cross-cultural study',

.  
You may email \_\_\_\_\_ to arrange delivery and administration of the survey.

## Appendix 6 Transcript examples of the focus group study (in Chinese)

- 1 小组访谈文字稿 Group 1: 高一男生
- 2 Q1: 你们都爱吃什么?
- 3 A (众): 冰棍儿, 薯片, 奥利奥, 奶茶, 沙冰, 晚上会去 711 买点儿三明治, 还有寿司...
- 4 Q: 上一次吃零食是在什么时候?
- 5 A (1): 昨天晚上去 711 买了个金枪鱼三明治, 因为昨天晚上晚餐的时候, 当时觉得吃饱了但是后  
6 来还是感觉没吃饱, 就去买了, 买了之后感觉好像挺好吃的。
- 7 Q: 饱了么?
- 8 A (1): 没有...但是过了一会儿就感觉好点儿了。所以就没再吃别的了。
- 9 Q: 所以主要是因为饿了。
- 10 A (1): 嗯, 还有一些经济的原因, 我们买不起其它的...
- 11 Q: 你们是走读还是住校?
- 12 A: 4 住校 / 2 走读。
- 13 Q: 所以你那个是在宿舍吃的?
- 14 A: 宿舍。
- 15 A (2): 我上次吃零食是在昨天, 昨天在教室里, 我是走读, 但是早上我没太怎么吃早饭, 所以早  
16 上就吃了小卖部的那种妙脆角, 吃的不多就吃了一些吧, 相当于就垫吧垫吧。吃完之后虽然也没有  
17 什么果腹感, 但是还行吧, 就也没有那么饥饿了反正。
- 18 A (3): 我就是今天上午上完体育课去买的那个沙冰。
- 19 Q: 你们学校有卖的吗?
- 20 A (3): 有。因为感觉太热了。喝完之后感觉比较凉快点儿了。主要打完球解渴。
- 21 Q: 所以你们夏天比较爱喝...
- 22 A (3): 凉奶茶, 沙冰之类的。
- 23 Q: 你们爱喝碳酸饮料之类的么?
- 24 A (众): 一般 / 我不爱喝 / 不爱喝...
- 25 Q: 果汁饮料呢?
- 26 A: 果汁饮料就佳得乐, 就运动饮料或者果汁饮料。
- 27 A (4): 我上次就是第三节课上课, 上历史课的时候, 喝沙冰。
- 28 Q: 你们上课允许喝东西么? 理论上讲。
- 29 A (4): 理论上不能, 但是管不住呗。
- 30 Q: 你们管得严么?
- 31 A (众): 看老师...有的老师比较好就不太管。就会喝一些。
- 32 Q: 那吃东西么?
- 33 A: 吃东西不行。喝冰沙起码介于水和吃的东西之间。
- 34 Q: 为什么喝?
- 35 A (4): 因为无聊了, 听课没劲...
- 36 Q: 你那个什么时候买的呢?
- 37 A (4): 上课之前, 课间去买的。
- 38 A (6): 我感觉无聊没事儿干的时候也会吃零食。

- 39 A (2) : 我也是, 玩手机, 然后吃零食。
- 40 Q : 你们无聊的时候经常吃零食吗 ?
- 41 A : 我反正经常吃。
- 42 A (5) : 我吃是昨天, 外教开了个 party. 然后那里边儿有薯片, 奥利奥, 烤馒头, 妙脆角, 还有蛋糕...其实当时我并不饿, 但是我一看那个两眼就放光, 我就去吃去了...然后吃完了跟没吃是一样的,
- 43 只是舌头得到了满足。
- 44
- 45 Q : 那你就跟没吃一样是你吃的不够多是吗 ?
- 46 A (5) : 我肚子好像从来都没有觉得饱过, 就是不停的吃。
- 47 Q : 你们那个 party 是个什么形式 ?
- 48 A (6) : 我昨天晚上是跟宿舍一起出去吃饭, 路过看见他们开 party 进去吃了块儿蛋糕就走了。
- 49 A (5) : 其实我去那儿就是为了吃东西。先是那个外教邀请我, 我问那儿有吃的吗, 他说有吃的,
- 50 我说那行吧。然后我去了, 他们负责做活动, 我就负责吃。
- 51 Q : 吃的怎么样 ?
- 52 A (5) : 反正挺好吃的。挺开心的。不吃白不吃。
- 53 A (6) : 我是今天早上英语课的时候, 我同位给我一块糖, 我就吃了。
- 54 Q : 你们上午是几节课 ?
- 55 A (6) : 五节。
- 56 Q : 所以你们一般上课或者在教室、宿舍吃东西, 你们会分吗 ?
- 57 A (6) : 不用分, 一般如果让别人看见就没了。
- 58 A (众) : 对 !
- 59 Q : 就是你们不一定会分, 但是他们会抢 ?
- 60 A (5) : 鲜血能引来鲨鱼的食物。
- 61 Q : 还有别的常吃的零食吗 ? 哎你们吃辣条吗 ?
- 62 A (众) : 辣条现在改名叫大面筋了。已经在那个 711 正式上架了。已经变正规产品了, 出口到国外了。那个应该比较健康了。711 卖的比较贵。那一大包四五块钱。
- 63
- 64 Q : 它会比之前那些干净或者好吃吗 ?
- 65 A (众) : 应该还是比较干净的...
- 66 Q2 : 你们平时会从健康不健康的角度来考虑吃的食物吗 ?
- 67 A (1) : 我不考虑。我们只会听我们的舌头的。
- 68 A (2) : 有些时候会我考虑, 看心情。就比如说在睡醒的时候, 无聊的时候, 掐着自己肚子上一块儿肉, 唉, 又胖了...所以我吃完这包薯片, 我再继续减肥吧。有些时候会想想吃这些会不会不健康啊。
- 69
- 70
- 71 Q : 什么时候 ? 除了你刚才说的觉得自己长肉了 ?
- 72 A (2) : 就比如说, 晚上去 711 买吃的的时候, 有时候我会买完吃的顺便带一瓶果汁, 比较天然,
- 73 补充一点儿维生素 c。
- 74 Q : 这种时候多么 ?
- 75 A (2) : 有些时候会, 就想起来里面可能会含有什么玩意儿...
- 76 Q : 那你觉得果汁是比较健康的食物, 补充维生素。那你想选择比较健康的食物时还会选择什么 ?
- 77 A (2) : 还有就是看它的加工过程吧。比如我喜欢泡椒凤爪, 但是我觉得那个就完全不健康。我听说用化学试剂加工的。但我去 7-11 还是老买。
- 78
- 79 A (2) : 附近除了 711 就没有其它的了。
- 80 Q : 你们学校里面有商店吗 ?
- 81 A (众) : 学校里那个不行 ! 更贵 ! 又贵还什么都没有。

- 82 Q：咱们学校的商店东西比外面贵吗？
- 83 A (2)：比如说，一瓶矿泉水，它愣是能卖两块。我去超市买一瓶 1.5 升的，能买两块八。
- 84 Q：你刚才说还会去 711 买什么？
- 85 A (2)：比如说蔬菜晒成干儿了之类的。蔬菜干。虽说没试过，但是想着有些时候是不是就不买三
- 86 明治了，因为量又少又贵，它还吃不饱。虽说里面有点儿东西吧，但它太少了。
- 87 Q：所以也会考虑性价比是吗？
- 88 A (2)：对。并且也会想想，就是那儿也有卖炒菜的，我想买一点儿试试。
- 89 A (1)：我真的啥都不考虑，看见啥好吃我就（吃）。
- 90 Q：那你觉得都什么好吃？
- 91 A (1)：除了正餐以外的东西。就是，比如说炸鸡啊，鸡排啊，只要我一去南锣鼓巷我就买各种各
- 92 样东西。
- 93 A (2)：他除了辣椒什么都吃。
- 94 A (1)：啊对我不吃辣。像鱼丸什么的，基本上，除了那些辣的，各种菜系只要能吃的我都觉得好
- 95 吃。
- 96 Q：果汁什么的呢？
- 97 A (4)：果汁我觉得还可以，不过有些加糖的不一定很健康。
- 98 Q：蔬菜类的呢？
- 99 A (1)：蔬菜干就算了，那个没有。我跟菜绝缘。我基本跟菜绝缘，除了薯片那种用土豆做的...
- 100 Q：为什么不吃菜？
- 101 A (1)：我对菜就没有兴趣，不爱吃。
- 102 A (3)：我是，基本上就是每周六一大早就出门去逛一趟 7-11，提一大袋子回来。然后一般周末中
- 103 午就没了。
- 104 Q：你买的时候会考虑健不健康吗？
- 105 A (3)：一般想吃什么就买什么。一般是买乐事，然后呀土豆之类的。
- 106 A (1)：啊对，呀土豆贼好吃。
- 107 A (3)：我喜欢蜂蜜的那个...
- 108 Q：所以你是主要考虑口味，然后不太考虑其它的。
- 109 A (3)：不太考虑。
- 110 Q：您呢？（对 A4）
- 111 A (4)：我...也考虑，但是它不卫生的也没多少，所以也不会考虑多少。
- 112 Q：所以你主要是从卫生不卫生的角度来考虑？
- 113 A (4)：对。
- 114 Q：所以一般是避免不太正规或者小摊的东西？
- 115 A (4)：对。我一般实在没得选了才买那些，就是小摊的东西。那些不卫生，一般比较脏。
- 116 Q：所以只要是正规的店，东西比较卫生就可以是吗？
- 117 A (4)：对。
- 118 Q：然后其它方面就？
- 119 A (4)：其它方面不太考虑。
- 120 Q 3：一般什么原因会让你们想吃零食？刚才说到饿了，无聊了，上课不想听了，还有热了喝冷饮...
- 121 还有别的么？
- 122 A (1)：比如看见同学在那儿吃着，就想过去凑热闹也吃上。
- 123 A (2)：还有看电视，看电影的时候回想吃。

- 124 A (3) : 写作业, 玩儿游戏的时候。
- 125 Q : 你们现在看电视、玩儿游戏的是多么 ?
- 126 A : 还可以, 想玩儿就多, 不是很忙…
- 127 Q : 还有什么时候? 你们觉得不高兴的时候会想吃东西么 ?
- 128 A (众) : 没有, 不会。
- 129 Q : 压力大的时候呢 ?
- 130 A (3) : 压力大的时候会解决压力 (不会吃东西)。
- 131 A (4) : 我觉得差不多女生才会不高兴的时候想吃东西…
- 132 A (5) : 喂喂喂! 我不高兴的时候就会吃…
- 133 Q : 你不高兴的时候想吃 ?
- 134 A (5) : 我是每时每刻几乎都在吃…
- 135 Q : 刚才还说到 party, 一般你们聚会的时候会吃吗 ?
- 136 A (6) : 狂吃 !
- 137 Q : 一起出去玩儿的时候呢 ?
- 138 A (6) : 狂吃 !
- 139 Q : 你也是每时每刻都吃是么 ?
- 140 A (6) : 不, 我并不是每时每刻都吃。我是见到好吃的再吃。要是它们没有吸引我的我就不吃了。
- 141 Q : 什么东西不吸引你 ?
- 142 A (6) : 菜! 和辣椒。
- 143 Q : 除了他你们平时会吃辣的零食吗? 比如周黑鸭之类的 ?
- 144 A (众) : 吃吃吃! 那个吃! 鸭舌! 鸭脖儿 !
- 145 Q : 吃的多么 ?
- 146 A (1) : 就写作业或者看电视的时候有时候吃一点儿。
- 147 A (2) : 周黑鸭真的是辣的…
- 148 Q : 你们是自己买还是爸妈给你们弄 ?
- 149 A (n) : 都有…
- 150 A (6) : 可以网购! 网购就寄来一大箱吃的。
- 151 Q : 你们一般在宿舍的时候吃, 教室的时候吃, 出去玩儿的时候吃…
- 152 A (3) : 在家的時候吃, 上课外班的时候吃…
- 153 Q : 那你们一般是自己的时候吃的更多还是跟朋友一块儿的时候吃的更多 ?
- 154 A (众) : 和朋友一块儿的时候。自己吃没劲 !
- 155 A (2) : 我觉得应该都差不多, 因为自己吃的时候就会把朋友都吸引过来, 然后就是一块儿吃了。
- 156 Q : 那在家的時候会跟家人一起吃吗 ?
- 157 A (众) : 不会 / 爸妈都不吃 / 他们都不让我们吃。
- 158 Q : 爸妈会管吗 ?
- 159 A (1) : 不管。
- 160 A (2) : 有些会管。
- 161 A (3) : 有的时候会管。
- 162 Q : 怎么管法儿 ?
- 163 A (3) : 口头的说。
- 164 A (2) : 一般就是说说而已, 也没什么说再不然你碰之类的。
- 165 Q : 具体内容是什么 ?
- 166 A (4) : 不健康会长胖。
- 167 A (2) : 对对。你以后胖啊, 就减不下来啦。

168 A (1) : 还会说, 你现在已经够胖了, 再吃更胖!

169 Q : 所以爸妈会关心体重问题。所以爸妈的标准是什么啊?

170 A (3) : 就是怕你吃的东西会不干净, 会拉肚子之类的。

171 Q : 他们会说不干净不卫生, 那会说比如油大的之类的吗?

172 A (2) : 哎我妈会说, 会说什么油大的盐大的, 说以后老了之后会硬化什么之类的。

173 A (1) : 这个我妈也会说。我妈会说什么最近新闻又曝光了啥啥啥...

174 Q : 爸妈会跟你们说具体的什么东西不健康吗?

175 A (4) : 路边小店那种...零食一般还是说的少, 就是超市里包装的那种, 一般就还可以。

176 Q : 所以一般是卫生安全就可以?

177 A (5) : 但是我听说油盐大的东西对健康不好, 老了以后会动脉硬化。反正就是我妈老爱研究这种东西。

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179 Q : 就是她对营养和养生比较有兴趣?

180 A (5) : 对对对对对。

181 Q : 你们宿舍跟学校都有无线吗?

182 A (众) : 哇你想太多了。在学校只能蹭隔壁单位的网。

183 Q : 你们会出于社交的目的吃零食吗? 比如去亲戚家作客之类的?

184 A (1) : 去亲戚家作客爸妈都在那儿看着!

185 Q : 所以一般爸妈在的时候你们会比较收敛是么?

186 A (1) : 嗯...

187 A (2) : 我妈其实就不太管这事儿。

188 A (3) : 我妈会给我讲, 但是 (不太限制) ...

189 A (4) : 如果别人家的孩子先吃的话, 我妈肯定让我吃。

190 Q : 你们会拿好吃的东西当奖品吗给自己?

191 A (众) : 不会。因为平时就已经都吃了。

192 Q : 你们压力大的时候, 比如考试期间, 会更想吃、吃不下还是没什么影响?

193 A (众) : 没什么影响。

194 A (1) : 零食其实基本就是附加品。

195 A (2) : 就算吃饱了也能吃下去。

196 A (1) : 对。

197 Q : 你们一般吃零食什么频率啊?

198 A (众) : 无时无刻。 / 上课的时候其实也会吃。 / 一般睡醒了不知道该干什么的时候就吃。

199 Q : 你们平时能出校门吗?

200 A (众) : 白天不让出, 放学之后可以。课间不行。一般课间就在学校小卖部直接买了。

201 Q : 刚才你们俩不在的时候, 我们讨论的问题是平时你们选零食时会不会在意健不健康这个问题。

202 A (5) : 其实这个就很少。更多的时口感。

203 A (4) : 我减肥的时候会刻意少吃零食, 但主要是考虑身材, 不是健康。

204 A (5) : 嗯! 现在因为觉得年轻嘛, 不太怕生病...

205 A (1) : 这个鸡腿儿就...到处都是油, 肯定不健康! 但是该吃还得吃。

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207 Q : 你们觉得不健康的, 就是刚才提到卫生不卫生, 安全不安全, 还有油多的、盐多的...刚才那边说比较健康的就是果汁、蔬菜什么的。你们觉得还有什么零食比较健康吗?

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209 A (1) : 坚果。

210 A (2) : 就家长吃那种, 砸的那个核桃嗑的那个瓜子。

211 A (3) : 那个不健康, 那个油还特大!

- 212 A (4)：燕麦饼干。就最普通的那种饼干。它也不算健康的，也就是比其它的好点儿...基本上零食  
213 都没什么健康的...
- 214 Q：所以你们觉得零食大致上都不健康？
- 215 A (1)：我跟你说，零物都不健康！如果要健康就别吃零食！



## Think-aloud study (Chapter 4)

### Appendix 7 Participant Information Letter for think-aloud study

#### School of Psychology

University of Leeds  
Leeds LS1 9JT, UK

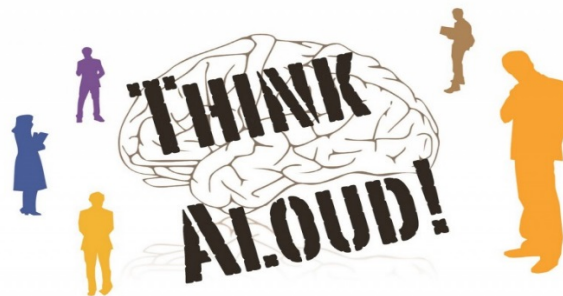


**Study title:** What do Chinese people think about when they answer the Dutch Eating Behaviour Questionnaire and the Mindful Eating Questionnaire: a “think aloud” study

Study Information Letter: date 07/06/2017

### **An invitation to a “think aloud” study**

If you are 16 years or older and a native Chinese speaker, this letter invites you to take part in a psychological study.



#### **What is this study about?**

This study is part of PhD research conducted under the supervision of the School of Psychology, University of Leeds, UK. It aims to understand how Chinese people interpret the questions in two Chinese version questionnaires assessing eating styles. The study has been approved by the University of Leeds (Faculty of Medicine and Health) Research Ethics Committee: reference: 17-0169; date: 07/06/2017.

### **What does it involve?**

- You will be completing two questionnaires including 61 brief questions asking about your eating styles (e.g., Do you have a desire to eat when you are fed up?). You will need to answer each question by indicating how often you act as described in the question (e.g., never, seldom, sometimes, often, very often).
- At the same time, you will need to talk aloud constantly to tell me everything you are thinking as you read each question and decide how to answer it. You will not need to plan out what you say or try to explain what you are saying; just act as if you are speaking to yourself.
- It will take about 30 minutes to complete the questionnaires.
- There will be no “right” or “wrong” answers to the questions, or any evaluation on your thoughts. What we are interested in is how you actually understand the questions.
- You will be asked to sign a consent form and will be given a copy of the information letter and consent form to keep for your records.
- Your “thinking aloud” while completing the questionnaires will be audio recorded, but NO NAMES will be asked during this study and the researchers will have no way to identify you from the audio recording.

### **What’s in it for you?**

By taking part you will:

- Be a part of an important research project in the University of Leeds and get a sense of how psychological research is conducted.
- Get an opportunity to explore your own eating styles.
- Receive 30 yuan for your time and efforts in your participation.

### **How will your participation and information be kept secure?**

- No names will be asked during the study; all the data will be anonymised.
- All data will be stored on a password-protected computers accessed only by researchers.

- The questionnaire you complete the and paper informed consent you sign will be taken back to the UK in sealed envelopes and stored in a locked cabinet accessed only by researchers. These will be destroyed after 2 years.
- Anything you say during the study will be used for the purpose of this project only. We will transcribe the recordings of your “thinking aloud” so we can analyse the data. This will be stored securely. The results of this study will be reported in a doctoral dissertation and might be reported in academic journal.
- For research purposes, data from this study will be stored for 5 years.

**Do you have to take part in the study?**

No, although we will really appreciate your participation, it is up to you to decide. You can also stop and leave the study at any time without any need to give a reason. You can also ask to withdraw your data up to one month after your participation of the study, by providing your participation number.

Please consider taking part. If you have any questions about the study you can contact the researcher or the supervisor on the email addresses below. If you would like to take part, that’s great – please email the research, Qian, to let me know within the next two days if possible. The last date to let me know if you would like to take part is xx/xx/xx.

**For any further questions or queries please contact us on:**

Researcher: Qian Zhang, School of Psychology, University of Leeds [psqz@leeds.ac.uk](mailto:psqz@leeds.ac.uk)

Supervisor: Dr Siobhan Hugh-Jones, School of Psychology, University of Leeds [s.hugh-jones@leeds.ac.uk](mailto:s.hugh-jones@leeds.ac.uk)

### **Appendix 8 Think-aloud study - instruction**

We are exploring how different eating styles may affect individuals' eating behaviour, and how a healthy eating programme may change participants' eating style. We are using two questionnaires translated from English to assess people's eating styles. We want to check that people understand the questions in the way that they were intended. To do this, I am going to ask you to think aloud as you complete the questionnaire. What I mean by "think aloud" is that I want you to tell me everything you are thinking as you read each question and decide how to answer it. I would like you to talk aloud constantly. I don't want you to plan out what you say or try to explain to me what you are saying. Just act as if you are alone in the room speaking to yourself. If you are silent for any long period of time, I will ask if you need some help. Please try to speak as clearly as possible, as I shall be recording you as you speak. Do you understand these instructions?

(The instructions were adapted from *French et al., 2007*)

## Appendix 9 Think-aloud study – transcript examples (translated from Chinese)

Mindful Eating Questionnaire

Responses: 1 – Never/Rarely 2 – Sometimes 3 – Often 4 – Usually/Always

### Adult sample (n = 7)

#### **Q1. I eat so quickly that I don't taste what I'm eating.**

- a. Sometimes. Sometimes I gorge on food, usually when I'm very hungry. (2)
- b. This rarely happens, only when I'm too hungry. I care about the bodily sensations that food gives me, and the taste of the food, so I always taste my food. (1)
- c. In fact I eat quite slowly, so my answer is 1. I enjoy the experience of eating very much, so I taste whatever I'm eating. (1)
- d. Sometimes. **I think about other things, usually things about work.** (2)
- e. Rarely. I always taste while eating. (1)
- f. The answer is 2, sometimes. Sometimes there's very little time to eat because of work, so I have to finish my meal very quickly. But in most cases I taste what I eat. (2)
- g. Eat so quickly that I don't taste...Rarely. Sometimes I eat very quickly and don't taste in the working lunch, but there's nothing worth tasting in working lunch. So I'll choose 1. (1)

#### **Q2. When I eat "all you can eat" buffets, I tend to over eat. ("Not applicable" option: I don't eat at buffets.)**

- a. Ah, this one is *often*. Although I try to restrain it, but still often. (3)
- b. Often. Because when I go to buffets I usually choose those foods that I like, such as steaks, so I often eat a lot. I choose 4. (4)
- c. Er...Often. I did overeat every time when eating at buffets, and every time I felt so stuffed. (3)
- d. I never go to buffets voluntarily, but sometimes my friends choose to meet there. Usually I eat very little at buffets as I feel stressed, also foods at buffets are never tasty... So *rarely*. (1)
- e. Well, yes, every time I go to buffets I eat a lot. Often like this. I'll choose 3, often. (3)
- f. Always, it's 4. Because buffets, you know, it's free, or you have to eat more so it's worth the money you paid, so I always eat a lot. This might make me feel uncomfortable, but still I always do so. (4)
- g. This one... Never or rarely. I just take what I need at buffets, but of course I overate (at buffets) when I was younger... I'll choose *sometimes*. It doesn't happen anymore. (1)

#### **Q3. At a party where there is a lot of good food, I notice when it makes me want to eat more food than I should.**

- a. I need to read it again. Ah, I see. I think so, but maybe not often. I usually know how much I need, and how much I want, but... Yes, I think I can notice when I want to eat more than I need. I can notice it. (3)
- b. This one, usually it's at family reunions on holidays or new years. I might eat more on these occasions. I choose 3, *often*. (3)
- c. I indeed can notice it, but it doesn't mean I can control it, and sometimes I have already eaten too much when I notice it. So I choose 2, sometimes. (2)
- d. At parties I usually eat less, just as when at buffets, because I feel satisfied just seeing so many foods. So it never makes me want to eat more than I should, and this assumption doesn't exist, so which one should I choose...? If it ever happens, then I think I'll notice it. Just a guess. (3)
- e. Hum...Rarely notice it. (Read the question again) What does this mean...? I can't quite understand it, but I don't think I notice it. I choose 1. (1)
- f. Yes, it's 4, I can always notice it, because I am a foodie, and I love all kinds of foods. (4)
- g. Ah, yes, of course I can notice it, 4. (4)

**Q4. I recognise when food advertisements make me want to eat. (Not applicable option: Food ads never make me want to eat).**

- a. Sometimes. Sometimes food ads make me want to eat. Mainly when it was something I had forgotten about and the ads reminded me of it, so I suddenly had a desire to have it, probably that's why. (2)
- b. Eh...I don't think just watching food ads can make me have an appetite to eat. Usually it's something internal, a feeling of my body that makes me have the desire to eat. This kind of external cues rarely (make me want to eat). So I think it's *rarely*. (1)
- c. Yes, yes, that's me. Always. Especially when I see ads of those delicious foods late at night, it'd really make me want to eat. I choose 4. (4)
- d. I can recognise it. Sometimes I want to eat sometimes I don't. (3)
- e. I can recognise it, yes. This one is *often*. (3)
- f. The answer is 1. Because I think for the foods I like, I don't need food ads to stimulate my stomach (?). (1)
- g. Yes, those good food ads do make you want to eat. 4. (4)

**5. When a restaurant food portion is too large, I stop eating when I'm full.**

- a. Yes, often so. Actually the larger portion it is, the more cautious it'd make me to be. I'll make me feel like it's a little bit too much, so I'll eat less deliberately. If the portion is just right or a little too small, I might need to order two and then eat too much. Besides, having some food left makes me feel that I'm restrain myself, which can give me a sense of accomplishment. (3)
- b. It rarely happens. It's a habit from childhood, that I always try to eat up what I've ordered. (1)
- c. (missed)
- d. Always so, I cannot eat more when I'm full. (4)

- e. I do, but of course I overeat too, just *rarely*. (1)
- f. The answer is 1, never or rarely. Because I have a big appetite, and by far it never happens to me that the food portion is larger than I need when eating at restaurant, so I always eat it up. It is my eating habit, and also I don't want to waste any food. Food is never easy to get. (1)
- g. Eh, yes, always. (4)

**6. My thoughts tend to wander when I'm eating.**

- a. No...my thoughts never wander. I'll say *rarely*...never is too absolute. (1)
- b. This often happens, because I think human minds tend to rest when eating, that's when your eyes drift out of focus and your thoughts wander. (3)
- c. Let me see...I always eat alone; sometimes I read or watch TV when eating. Does that count as "thoughts wander"? It should be... it should be! I'll choose 3. Sometimes when two or more people eat together, I tend to more focus on what I eat and my thoughts are less likely to wander. (3)
- d. Always like this, my thoughts start wandering while I'm eating. (4)
- e. Yes, yes, always. (4)
- f. It should be 2, sometimes. Because sometimes need to think of something else, that's why sometimes my thoughts wander. (2)
- g. Wander...when eating... Aren't' your thoughts supposed to wander when you're eating? Well not really... sometimes then, sometimes my thoughts wander, when I'm not really interested in the food. (2)

**7. When I'm eating one of my favourite foods, I don't recognise when I've had enough.**

- a. Well, always so. If I like this food very very much. All I care is when I can eat it again, so I might ignore the fact that I have already had a lot. (3)
- b. Well... I'm not sure what kind of "recognition" it is here, but anyway I surely have lost my "recognition" of self-control...but when I'm full it'll make me feel like the food I'm eating does not taste good, like it's not that delicious. So I choose 2, *sometimes*. (2)
- c. I'll choose...4. Yes, I tend to eat a lot when eating the food I like, and have had too much when I realised it. (4)
- d. I can recognise it, but still I want to continue. (1)
- e. Yes, sure, always. (4)
- f. I think it's 1, rarely or sometimes, as I always can recognise when I've had enough. (1)
- g. It could happen, when I eat dumplings for example, I tend to overeat if it taste very good. Bud not often, *sometimes*. (2)

**8. I notice when just going into a movie theatre makes me want to eat sweets or popcorn (not applicable option: I never eat sweets or popcorn).**

- a. Often. Usually I have a desire to eat when I watch something. Because watching this (movies)

makes me feel happy, and eating makes me happy too. The combination of two happy things makes me happier. So I always want to buy some food when going to a movie theatre. (3)

- b. Often. It often makes me want to eat sweets or popcorn, or other drinks. Movie theatre surely is a very...very impressive venue in terms of provoking appetites. (3)
- c. Rarely. I rarely eat sweets or popcorn at movie theatres. I don't like popcorn and sweets, don't like these kinds of food, except when the smell is very good, and I'm too hungry, I might choose to have some. Otherwise, rarely.
- d. I never eat sweets or popcorn. (1)
- e. I don't want to eat sweets, but popcorn. Which one should I choose? *Sometimes*. (2)
- f. It's 6. I don't like eating sweets, or popcorn. (6)
- g. This doesn't happen to me. This kind of connections between something and some food does not often occur to me. So it's rarely or sometimes. But of course I might eat when I'm there...*Sometimes* then. (2)

**9. If it doesn't cost much more, I get the larger size food or drink regardless of how hungry I feel.**

- a. Sometimes...Rarely. *Sometimes*. It's actually not that definite...and it doesn't have much to do with the price. (2)
- b. I did before. But after 30, the metabolic rate slows down, and eating too much can easily make me fat, so I start to restrain myself, trying to eat less and not to order it just because it's in larger size. (2)
- c. I always order the small size, because I...I choose 2, as I buy larger size when I'm hungry, and buy small ones when I'm not. Yes, *sometimes*. (2)
- d. I don't, as I'll be concerned that I cannot finish it and it's a waste, so I'll order the small size. When I'm alone. It's another story when I'm with the others. So it's *rarely* when I'm alone. (1)
- e. Yes, that's me. (4)
- f. I choose 4. I always do so, as usually I can finish all these foods or drinks. (4)
- g. Sure, sure, *often*. (3)

**10. I notice when there are subtle flavours in the foods I eat.**

- a. Rarely. I'm not demanding when it comes to food. If it has subtle flavours I don't think I can notice it. (1)
- b. This is *always* for me. I choose 4. I'm a picky eater. (4)
- c. Yes, I'm very sensitive to this. I know what kind of ingredients the food contains by just eating it. I choose 4. But I'm not sure about the so-called subtle flavours. I'm wondering what are subtle flavours? Does it mean good flavours, or flavours different than usual? (4)
- d. Yes, I can notice it very much. I have very sensitive taste buds. (4)
- e. I can't notice it. I like strong flavours. I choose 1. (1)
- f. It's 4. I can always notice it. (4)



- g. Rarely. Subtle flavours...my sense of taste is not quite sensitive. (1)

Adolescent sample (n = 10)

**19. When I'm sad, I eat to feel better.**

- a. I think sometimes it could be good to feel sad, it can make you calm, so usually I don't try to ease it by this way. It's *rarely*. (1)
- b. Never. (1)
- c. Sad...I don't eat because of it. (1)
- d. This often happens, as eating makes me feel fulfilled spiritually. (3)
- e. Yes. (3)
- f. Well... rarely. (1)
- g. Sometimes, depends on how sad I am. I lose appetite when feeling too sad, but may want to eat something to cheer myself up when just feeling a moderate level of sadness. (2)
- h. Sometimes. (2)
- i. Will it make one feel better when feeling sad? It cost money to eat, and I feel even sadder thinking about money, so I won't want to eat. Never/rarely. (1)
- j. Food does help to improve my mood, but when feeling sad, when feeling bad, I lose my appetite. I go to my friends when feeling sad, (talking about) why upset, why so sad. Eating, rarely, unless it's something very good, tastes very different at the first bite. Otherwise I don't have the mood to eat, I don't even have the mood to drink water. So I rarely eat to feel better. (1)

**20. I notice when foods and drinks are too sweet.**

- a. Well, it's quite obvious to me. Especially when eating something I had before or something I like, I notice it clearly. (4)
- b. Yes, often. (3)
- c. Notice when too sweet. Always. (4)
- d. My taste is not quite sensitive to this...Sometimes maybe, not often. Sometimes. (2)
- e. Too sweet? I like strong flavours, so I may not be able to notice it when it's too sweet for other people. (3)
- f. Sometimes. If it's something I often eat or drink, I notice it when it's sweeter than usual. (2)
- g. This is always. I think anyone would notice it when it's too sweet. (4)
- h. Sometimes. (2)
- i. I always notice when foods and drinks are too sweet. Things too sweet don't taste good, and could make me feel sick. I always notice it. (4)
- j. Of course I notice it. Foods and drinks too sweet throat sore. So I have to notice it. Always. 4. (4)

**21. Before I eat I take a moment to appreciate the colours and smells of my food.**

- a. Sometimes, but not often. It's a basic process to get to know the food, when you firstly see it...

(2)

- b. Sometimes. Sometimes I don't pay attention to it when I'm hungry. (2)
- c. Rarely. (1)
- d. I think it rarely happens in China. Those homemade food or meals at school, you get bored of them just watching them, let alone appreciate them. (1)
- e. Yes, the colours and smells of food... (3)
- f. Well, rarely. (2)
- g. Often, as I often find it interesting and good looking. (3)
- h. Sometimes. (2)
- i. This one is similar to a previous one too. I do take a moment to appreciate the colours and smells. Like some people like taking photos to post on WeChat, I don't like taking photos to post, but I do take a look of it, appreciate it. I often appreciate it. (3)
- j. Of course, I do it all the time. Before eating I take a moment to appreciate it. You have to appreciate how the good food looks before tasting it. Maybe take a photo of it when it really looks good. I always do this. (4)

**22. I taste every bite of food that I eat.**

- a. Depends on my mood, or what I was going to do or what I just did before eating. When I was in a hurry or in a bad mood I wouldn't do it. So it's sometimes. (2)
- b. Time is too tight, no way to taste it. (1)
- c. Rarely. (1)
- d. Although they always say to eat slowly and chew thoroughly, but there no such time to taste every bite. Normally people have to eat quickly. I choose sometimes. (2)
- e. Taste every bite...Rarely. (1)
- f. Rarely. (1)
- g. Sometimes. I definitely don't taste when I'm too hungry. But I might do it when in leisure time or when eating desserts. (2)
- h. Sometimes. Depends on the food, if it's tasty then I'd taste every bite of it, if it's not then there's no need to taste it. (2)
- i. It's too absolute to say "every bite". I don't taste every bite of the food I eat. I eat mostly to satisfy my hunger, I don't have time to taste it, it's too time-consuming. So, sometimes. (2)
- j. When I want to eat it really badly, well, I eat it with my full attention. I mean, when I really want it, or when it's something I cook myself, I feel like I have to taste it with intently, otherwise I'd feel like it's my loss. Well, the question is not asking when I eat something I like... Every bite... I think I taste every bite only when I'm in good mood, or when there's plenty of time, or it tastes very good at the first bite. But when I'm in a hurry, I don't have time to taste it. Every bite... There're always several bites that you don't bite... Rarely, I choose 1. (1)

**23. I recognise when I'm eating and not hungry. ("Not applicable" option: I don't eat when I'm**

**not hungry)**

- a. This often happens. At school I go to buy food when I feel like eating, sometimes I'm not hungry but just have a desire to eat. (3)
- b. Sometimes. (2)
- c. I don't eat when I'm not hungry. (6)
- d. It is so usually in the mornings. As I get up late in mornings, and probably because I've eaten a lot at the nights before, I don't feel quite hungry in mornings. But I have to eat breakfast, as breakfast is most important. Always like this. (4)
- e. Yes. (4)
- f. Sometimes. Sometimes I eat when I have nothing to do. (2)
- g. Yes, often, because snacking is...I choose to snack because I'm not very hungry. (4)
- h. Always. (4)
- i. I eat only when I'm hungry, so never/rarely. (1)
- j. Yes. When I didn't try to lose weight, I ate whenever I wanted to, no matter how hungry I was. I knew I was not hungry but I wanted to eat, that was a cause of weight gain. That is when I eat and am not hungry. I choose 4. (4)

**24. I notice when I'm eating from a dish of candy just because it's there.**

- a. This one, sometimes. Sometimes I want to eat when I see it. It won't do any harm anyway. (2)
- b. Probably so, often. (3)
- c. I eat from it basically because the food is tasty. I choose *sometimes*. (2)
- d. I rarely buy snacks, so of course I eat them once I buy some. I choose *often*. (3)
- e. Yes. (3)
- f. Well, sometimes. When I see it and have nothing else to do, I would probably eat it. (2)
- g. Never. I eat snacks mainly because they taste good and draw my attention, not because they are there. (1)
- h. Sometimes. (3)
- i. Well this one, often. When I study my mum always put some fruits or snacks beside me. And I start eating while doing my homework, eat and eat, minutes later I haven't done much homework but finished all the food. Often like this. *Often*. (3)
- j. Well, this did happen. I did have the desire to taste it when food was there. And sometimes I don't like my mouth empty. But it rarely happens now, and I try my best to restrain myself – no you cannot eat. I choose *sometimes*. (2)

**25. When I'm at a restaurant, I can tell when the portion I've been served is too large for me.**

- a. Rarely. I don't know how much I can eat when I order food.
- b. I can't tell. Never.
- c. Always.
- d. Well, sometimes. Depends on how to identify "too large". I can't tell when the food tastes very

good.

- e. Yes.
- f. Rarely.
- g. Rarely. I don't know how to tell it, also the amount of food I need could be different at different times.
- h. Sometimes.
- i. When eating at a restaurant... When I eat at a restaurant with adults, the portion is always small; when eating with my friends...yes I can tell when the portion is too large. I can tell it, as the portions vary among different restaurants. Often. (3)
- j. Of course I can. No wait, not really, you need to eat it first, and decide it's too large when you finish it. So, I rarely can tell it. Well, I can also estimate just by the size of plates, but there's a chance that I'm in good mood and eat it all anyway. So *rarely*, I choose 1. (1)

**26. I notice when the food I eat affects my emotional state.**

- a. Sometimes. For example the meals at school taste very bad sometimes, which could affect my emotional state.
- b. It affects my emotional state when I eat something does not taste good. Sometimes.
- c. Never.
- d. Often so. When the food I eat is not good, or not to my taste, too spicy or too salty or too bland. It did quite often affects my emotional state. (4)
- e. Emotional state... Probably so.
- f. Well, sometimes. I feel happy when eating something delicious.
- g. Often. When it tastes bad while I'm very hungry, I'd be very upset.
- h. Never.
- i. Missed.
- j. Oh yes. For example you may feel nothing special before start eating, but when the food tastes very good, it'll give you a very good mood. Like in heaven. I can't say always, but often. I choose 3. (3)

**27. I have trouble not eating ice cream, biscuits, or crisps if they're around the house.**

- a. This rarely happens. My stomach is not very healthy so I can't eat ice cream, and I'm not interested in biscuits, and crisps hurt my throat, so I won't want to eat them.
- b. I do want to eat them badly, often.
- c. Have trouble not eating...Sometimes. As it's very convenient when they're around, I don't need to go somewhere to get them. Then I'd want to eat them.
- d. Since they're around the house, why don't I eat them?
- e. Yes.
- f. Well, rarely.
- g. Never. I don't like any of these three foods.

- h. Often.
- i. I don't eat ice cream; biscuits, maybe; crisps, no. It depends on what kind of biscuit it is, and I eat biscuit only when I'm hungry. Biscuits sometimes. (2)
- j. Yes, as they are for you to eat. And I'm a foodie, so I can't help eating them. Especially when I play on my smartphone, I like keeping my mouth full. But not I'm trying to lose weight, so I have to control myself even it's hard. I choose often. Sometimes I can control it since I want to lose weight. (3)

**28. I think about things I need to do while I'm eating.**

- a. This often happens. When I have something to do afterwards, or when there are schoolmates around to talk with, I think about other things. (3)
- b. No. I'm very focused when eating. Never. (1)
- c. It's *often* for this. (3)
- d. I often do this. As when eating I choose to read a book or magazine at the same time. That makes me feel fulfilled. I choose to always do so. (3)
- e. Sometimes. (2)
- f. Often. I think about what I need to do later. (3)
- g. Always. (4)
- h. Sometimes. When the time is tight and there're things need to do right after the meal, I think about those things and don't focus on my meal. (2)
- i. This one is similar to a previous one too. Well, eating is a behaviour, which does not take up much of my mind, so I do have other things on mind, or think about what I need to do, what I plan to do, and things like that. Always. (4)
- j. Rarely. I'm very concentrated when eating. I keep my eyes on the food, and all I can think about in my mind is how happy I am. I don't have time to think about anything else. All I think about is the food. So rarely. (1)

## Intervention development (Chapter 6)

### Appendix 10 Intervention video scripts (translated from Chinese)

#### **Video 1: Welcome and a brief introduction of the programme (3')**

Hi everyone, welcome to I love snacking project. I'm Qian, currently a PhD student studying psychology at Faculty of Medicine and Health, University of Leeds in England. This project you are participating in is part of my PhD research programme, which is developed by me, and my two supervisors. Thank you very much for your interest and your time to explore in the area of psychology and behavioural science with us.

The purpose of this project is to help young people who love snacking and want to lose weight achieve the goal of weight loss by developing healthier snacking habits. We've made a series of videos to introduce knowledge and skills regarding how to promote weight loss through wiser snacking choices and better snacking habits based on the scientific evidence in psychology and behavioural science. What you'll be asked to do is to spend twenty minutes or so to watch the videos, and try to apply the knowledge and skills that you think might be useful for you in your daily life. Before starting to make these videos, I went to several high schools in Beijing and conducted group interviews with the students there, in order to find out what they'd expect to learn from such a project. In the interviews, they brought up many interesting questions, such as:

How is snacking related to psychology?

(Movie clip 1 – “I eat when I'm upset” from *Kung Fu Panda*)

What if I'm particularly addicted to some kind of food?

(Movie clip 2 – A guy singing “BBQ chicken wings I love to eat” from *Flirting Scholar*)

What if I feel like eating whenever I see food?

(Movie clip 3 – Mr. Bean at buffet from *Mr. Bean*)

What if I can't stop eating once I start?

(Movie clip 4 – Chihiro's parents could not stop eating and eventually turned into pigs... from *Spirited Away*)

How to make healthier choice for snacking?

If you also find these questions interesting, or confusing, you can try to find some answers from the videos of this project.

Besides, thank you very much for completing our online survey at the beginning of the project. We will ask you to fill out another survey at the end of the project, and if you're interested, we will also invite you to participate in our WeChat interview. The surveys and the interviews are extremely important to our research, so thank you very much for taking the time to complete them.

Now, if you are ready, let's start the exploration.

## **Video 2: Making wiser choices for snacking. (7'55'')**

Hello everyone, the topic I want to discuss with you in this video is: do you need to quit snacking to lose weight? In other words, does snacking necessarily make you fat?

### **Does snacking make you fat?**

Many people see no benefits of snacking – snack foods are usually high in calories and low in nutrients, which cannot provide any nutrition to our body, but only make us fat. Your parents might also occasionally or frequently remind you: don't snack! But is that the fact?

Health psychologists and nutritionists found that snacking could be an important source of essential nutrients, and does not necessarily make you fat. In fact, healthy snacking habit could help you better maintain your weight. It is not uncommon for people to feel hungry between meals due to the long meal interval. If you do not eat in order to avoid weight gain but waiting for the next meal, it is possible that you will get too hungry and eat too much food during that meal. But if you snack properly when you feel hungry, to timely replenish energy and satisfy your taste buds, then you can largely avoid the out-of-control appetite in meals. Therefore, eating some healthy snacks when you are hungry will not increase your calorie intake, but might reduce the total calorie intake of the day, and also avoid the potential damage to your stomach and digestive system caused by the fasting state.

Snacking may not make you fat, but always choosing the fattening foods for snacking is still

guaranteed to make you gain weight. You don't need to 'quit' snacking, but this does not mean that you can snack whatever you want. For the sake of weight loss, you still need to consider what and how much to snack.

### **What to snack?**

Unfortunately, high-fat and high-sugar foods are still the enemy of weight loss. To choose low-sugar, low-fat foods is still one of the best weight loss tips. And you can make the wiser choice by reading the ingredients list and the nutrition information on the snacks' package.

### **Ingredients list**

For the pre-packaged snacks and beverages, the ingredients are listed on the package, with the main ingredient first. You can read the ingredients list to find out the information on materials and additives of the food. Generally, the shorter ingredients list is, the less additives the food contains, which might make it a better choice.

### **Nutrition information**

The nutrition information table shows the basic information about nutrition contained in the food. The left column is the name of the nutrient, the middle column is the nutrient content per 100 grams of the food. Some nutrition information table also has the rightmost column of nutrition reference value, which means the percentage that the nutrients contained in every 100 grams of food take up of the recommended nutritional intake. For example, every 100 grams biscuit showed contains 22.7g fat, taking up 38% of the recommended daily fat intake. So when you eat 300g of it, you have already taken more than enough fat for the day.

Here I have three very popular tea drinks: Assam Milk Tea, Tea  $\pi$ , and Mate Xiaoming. Let's find out how many sugars each of them contains by reading the labels.

Let's start with the Tea  $\pi$ . From the ingredients list we can see that water, fructose syrup, and white sugar account for the top three. It seems that this bottle of beverage contains a lot of sugar. What is strange is that the sugar content is not indicated in the nutrition label. As this one was sold in the UK, there is an English label on the bottle, which shows that the sugar content is 6 grams per 100ml, that is to say, this bottle of 500ml tea contains 30 grams of sugar.

The Taikoo Cube Sugar sold in the market is about 4.5 g for each cube. So drinking this bottle of beverage is equivalent to eating 6.7 cubes.

The same to Mate Xiaoming, sugar content is not shown in the Chinese nutrition label. But



the English label shows clearly: each 100ml contains 10g of sugar. This 480ml beverage contains 48g of sugar, which is equivalent to 10.6 sugar cubes.

Assam milk tea, the nutrition label on the bottle shows that the sugar content is 7.2g per 100ml. This bottle of 500ml Assam tea contains 36g of sugar, which is equivalent to 8 sugar cubes.

You may find there are some beverages that do not show the sugar content in the nutrition labels on the package. Don't worry, all beverages are labeled with the carbohydrates content. The main source of carbohydrates is sugar and starch. In beverages, the carbohydrates content is roughly equal to the sugar content.

Months ago I went to several high schools in Beijing to talk with the students there, asking about their views of snacks. Many of them told me that they think dried fruit is a very healthy snack choice. I have a pack of dried mango here, let's find out together how many sugars it contains.

This bag of dried mango is 100g, and from the nutrition label, it can be seen that the sugar content of 100g dried mango is 74.2g. If you eat this bag up, you'll eat about 16.5 sugar cubes.

### **How much to eat?**

Another question you need to think about is how much to eat, even when you have made some healthy choice for what to eat. For example, nuts is a good choice for snacking, but it is important to note that nuts are mostly high in calories and fats, and can make you eat too much without noticing it, which would result in excessive calorie intake. According to the recommended intake of the Chinese Nutrition Society, it is best to eat 50 to 70 grams of nuts every week, which is about 15 to 20 peanuts, 2 to 3 walnuts, or 4 to 5 chestnuts per day. Another example is fruits. Although fruits are recognized as healthy snacks, some of them are not low in sugar and eating too much will also make you fat. According to the balanced dietary structure recommended by the Chinese Nutrition Society, eating about half a catty a day would be the best choice. In addition, most of the juices sold in the market contain added sugars, and you need drink more juice to have the sense of satiety compared with eating fruits. Therefore, fresh fruits are better choice than juices.

So, how much fat and sugar should you eat every day? According to the recommendation of

the NHS, the total intake of added sugar per day should be no more than 30g per day; and the intake of saturated fat should be no more than 30g per day for men and 20g per day for women. Try to choose the low-sugar and low-fat snacks and beverages based on the information provided on food labels.

What I need to clarify here is that we are not encouraging you to over-calculate your daily calorie intake, sugar intake or fat intake. And what we've just discussed does not mean that you need to absolutely avoid any high-sugar, high-fat food. We just want to provide a way that you can use when you want to make some wiser choices. In the following week, when you buy or choose snacks, try to use the method we discussed in this video to make healthier and more weight-friendly choices in your favorite snacks.

### **Video 3: The six kinds of hunger (9')**

Link: [https://v.youku.com/v\\_show/id\\_XMzgxODkwODc2MA==.html?spm=a2hzp.8253869.0.0](https://v.youku.com/v_show/id_XMzgxODkwODc2MA==.html?spm=a2hzp.8253869.0.0)

Password: leedsINKNOW

In a previous video we talked about the relationship between snacking and weight, and found that eating healthy, low-sugar, low-fat snacks when you are hungry can actually help you maintain or even lose weight. But now the question is – are you sure you're hungry?

Hunger is one of the most basic physical sensations of human. Even a newborn baby knows when he/she's hungry, and asks for food by crying. However, as the world around us becomes more and more complex, the feeling of our hunger has also become complicated.

You may not have noticed that there are actually different kinds of hunger. Let's explore together your seven kinds of hunger.

#### ***Eye hunger***

Have you ever had the experience that you were very full, but still decided "I could eat that" when you saw the dessert tray? That you did not feel hungry, but your stomach started roaring when you saw pictures of delicious food on Weibo? This is the eye hunger – the hunger caused by the sight of attractive food. Sometimes, not only do we decide if we are hungry with our eyes, we also let the eyes decide how much to eat. In some studies, researchers invited participants to laboratories and offered them snacks without telling them the real purpose of the study. They found that those who got larger portions of snacks generally ended up consuming more calories

than those got smaller portions (Hetherington & Blundell-Birtill, 2018; Zlatevska, Dubelaar, & Holden, 2014). When you look at a bag of snack and decide: I'm going to eat that up, you have probably ignored the actual amount of food in that bag, and ignored how much food your body really needs at the moment. Especially nowadays when the portion sizes of foods and beverages are increasing, it is more likely to overeat than ever when making the decision by your eyes.

If you often let your eyes decide how much to eat, try to choose small size of snacks and beverages when you buy them, or remind yourself that you don't have to eat the whole package at a time. The right amount to eat depends on how much food your body needs, rather than how much food you've got.

### ***Nose hunger***

The nose can be hungry too. For many of us, smelling the food is even more tempting than just seeing it. Your nose could be hungry smelling the aroma from kitchen when you are studying, or from the bakery's that you walk by. Next time before putting food into your mouth, try to take a moment to smell the aroma of food and satisfy your nose.

### ***Mouth hunger***

Except the stomach, the mouth may be the one that most frequently feels hungry. You might find that the mouth sometimes could be even harder to satisfy than the stomach – there were many times when the stomach felt too full while the mouth still wanted more. However, when the stomach tells you “I'm full”, you have already eaten enough food that your body needs. If you continue eating in order to satisfy your mouth, it will result in an excessive intake of calories, which can eventually lead to weight gain. Also, it could be cruel to fill your stomach when it is already full. After all, it is your mouth that enjoys the taste, but the stomach that accommodates too much food and feels sick.

In fact, mouth hunger is the taste buds needing stimulation, which has little to do with the amount of food that you eat. However, if you eat too fast, the mouth will not have the opportunity to carefully taste the food, and the taste buds cannot be satisfied. When you are eating, try to slow down and carefully taste the food, to let your taste buds be sufficiently stimulated. In this way, your mouth hunger can be satisfied, without having to eat too much.

### ***Stomach hunger***

As mentioned earlier, the stomach is a container. When the container becomes empty, it sends

signals to remind you: time to eat. When the stomach is hungry, you might feel emptiness, growl, or subtle uncomfortable feelings in the stomach. Some of you may choose deliberately ignore these signals while trying to diet to loss weight. However, the long-term fasting could hurt the stomach. And when the feeling of hunger becomes too strong, it is likely that the dieter will loss control and overeat. That is why diets do not work. Eating when the stomach feels hungry – which means your body needs food, and stopping when the stomach feels full, generally will not lead to excessive calorie intake.

However, “eat when hungry and stop when full” is actually not so easy to do. We can easily ignore the signals from the stomach in many situations. For example, the satiety hormones that signal that we have had enough to eat begin to be released 30 minutes after we begin eating. If we eat too quickly, we’ll miss the signals. When we realize we are full, we have already had too much.

Before you eat, try to take a moment and explore your feelings in your stomach, to decide if you are really hungry or not. Try to slow down when eating, so that you’ll have enough time to receive the signals from your stomach, and know when your stomach is full. You can also try to evaluate how hungry your stomach is on a scale – being 0 starved and 10 stuffed, how hungry is your stomach at the moment? Don’t wait too long and start to eat when you feel starved and can eat everything in the house; the best time to eat is when your hunger level is 3 to 4, when you have signs of physical hunger but not too much. And the best time to stop eating is at 6 to 7, when you start feeling a sensation of fullness but not too full yet.

### ***Mind hunger***

The mouth wants more tastes, the stomach wants the right amount of food, and the cells want energy and nutrients.... Sometimes, however, we choose to ignore all the signals from our body, but to let our mind decide when, what and how much to eat.

We live in an age of information overload. You’ve probably heard of a variety of tips that claim to make you healthier and thinner, such as the widely circulated “eight glasses of water” or “six lemons each day”. There are also some “legendary” ways to lose weight: no eating after noon, avoid staple food, apple and yogurt diet, etc. Sometimes your mind decides to eat when you are not hungry, but just because it is time for dinner. The mind makes decisions about eating based on information we’ve learnt, which could be confusing or even false in many situations. And

when we get accustomed to let the mind make the decisions, we begin to ignore the signals our body gives us, failing to meet the real needs of the body, and failing to take good care of ourselves.

If you listen, your body knows what it needs. In this respect, the body could be wiser than the mind. Next time before you “think” to eat, try to ask your body first, to find out what the body really wants.

### ***Heart hunger***

Sometimes when your mouth is not hungry, your stomach is not empty, and your cells are not asking for energies, however, you still feel an urge to eat. In some of these cases, what you want to fill up is not your stomach, but your heart. Feeling lonely, bored or upset could often drive us to eat as a way of self-soothing – that is how our emotions can make us feel hungry. We’ll talk more about this in the next video.

Of the seven kinds of hunger we just discussed, some you might have often felt in your daily life, some you might find harder to observe. But it’s OK. In the following week, when you feel a desire to eat, take a moment to explore the feelings in your eyes, nose, mouth, stomach, body, mind and heart, try to find out who is hungry there.

Next time when you snack, let your stomach decide how much to eat, and try to explore how you can satisfy the other kinds of hunger at the same time. Maybe try to slow down, chew your food thoroughly to really taste the food, at the same time pay attention to the feeling in your stomach, so you’ll know the best time to stop.

### **Video 4: Listening to your stomach exercise (4’)**

We have explored the six kinds of hunger, and found that in order to avoid eating more food than your body needs, it is better to let your stomach decide how much to eat. In this video, we are going to do a brief exercise together, practicing to listen to our stomach, and evaluate your hunger and fullness using a scale. You can take a look at of the scale showed here.

Now let’s do this practice together. Settle into a comfortable position. You can sit on a chair; allow your back to adopt an erect and comfortable posture. Put your hands on your knees, and your feet flat on the floor. Or, you can adopt other postures you like, as long as you feel relaxed

and comfortable. If you like, you can close your eyes. Take a few deep breaths. Now bring your attention along with your next inbreath. Notice your sensations when breathe in, breathe out, and the slight pause between the inbreath and the following outbreath. There is no need to control your breath in any way – simply let the breath breathe itself. Simply pay attention to it, and notice any of your feelings as best you can.

Now when you are ready, bring your attention to the stomach area, remembering to bring a curious attention, without judgment, to explore how your stomach feels at the moment. Is it hungry? Full? Or you feel nothing in there? Now if possible, try to evaluate how hungry, or how full your stomach feels, on a scale of 0 to 10, being 0 staved, and 10 stuffed. How does your stomach feel? If you don't get any information, that is fine. Maybe try it later.

Now if you're ready, open your eyes and take a few deep breaths.

This is a very simple practice. In the following week, at least once a day, before you start eating, try to take a few minutes to listen to your stomach using this practice. In the halfway of your eating, pause and briefly listen to your stomach again. Ask how your stomach feels at the moment, and evaluate your hunger or fullness on the scale of 0 to 10. Try to respect your stomach – if it says it's full, then maybe it is time you stop.

### **Video 5: Emotional eating and external eating (9'16")**

We have explored the seven kinds of hunger together in a previous video, and also mentioned that it is OK to eat some healthy snacks when you feel hungry. However, the relationship between “hunger” and “eating” is not so straightforward as it looks like. Sometimes you might find that you are not hungry, but still feel an urge to eat. When you are surfing the Internet, playing with the mobile phone, or doing homework, you could eat up a whole bag of crisps without even noticing it. In this video, one thing I want to explore with you is that except for being hungry, what else would make you want to eat?

#### **Why would you want to snack when you are not hungry?**

##### *Emotional eating*

Evidence from scientific research shows that, emotion is one of the most important causes of your appetite – that is the “heart hunger” we have talked about. For example, when you feel

lonely, bored, or upset, you might want some delicious food to cheer yourself up. Feeling stressed during exam periods? A package of Latiao (a Chinese spicy snack) might calm you down. Not only negative feelings, but also positive emotions could improve your appetite for food. When we feel good at parties or during festivals, we enjoy tasty food to make our life even better.

It is not so wrong to celebrate the good days or fight the bad days using food. However, eating in response to emotions could easily become habitual. And once you've formed this habit, you will have the desire to eat each time you feel bored, upset or stressed out. Psychologists call this habitual eating style *emotional eating*. This habit may bring some problems: firstly, when feeling upset or stressed, people tend to choose those high-sugar, high-fat foods. For example, many people find that when feeling upset, only sweets and desserts can comfort them. Also, your self-control can be affected by your emotional state. When eating in response to emotions, it could be more difficult to stop when feeling full than usual, and is more likely to lose control and overeat. In addition, from the psychological point of view, eating is not really an effective way of emotion regulation, but can only temporarily ease the negative feelings. Especially for those who are trying to lose weight, eating too much when feeling bad could make them guilt and feel even worse, then they try to deal with the worse feelings by eating more... Overeating is very likely to occur once you've been caught in this circle.

How to break this circle then? Next time when you find you are not hungry but have a desire to eat, do not rush to food. Take a moment first to look at what do you want to eat for – to relieve stress, to kill boredom, or to cheer yourself up? If you find it is about negative feelings, maybe try some other ways to regulate your emotion. Talk with your friends, take a walk outside, or do something else that would make you relaxed without being regretful afterwards. And, if you still decide to enjoy some snacks that you like, try to decide how much to eat before you start eating, in case that you will eat too much before you notice it. When you eat, try to slow down and taste every bite of it, so the food can be really enjoyable and help you get rid of the bad feelings. You can also try to observe how your emotional state changes when you eat. Maybe you'll find that you don't need to eat the whole bag of crisps to feel better. Sometimes, just a few bites of your favourite food can make you feel happier.

#### *External eating*

Some of you might be thinking: it's not that complicated! I snack when I'm not hungry, just

because I want to eat when I see food.

Just like eating in response to emotions, eating in response to external cues is another common behaviour pattern. People who show this pattern are usually very sensitive to food-related cues. Their appetite could be stimulated by seeing food, smelling food, or even just hearing food's name. Every time when they see others eat, they feel like eating too. For people who tend to eat in response to external cues, it could be particularly "dangerous" to be in places where there is a lot of food, such as an all-you-can-eat buffet or a night market. They'll find it very hard to resist the temptation of so many choices of delicious food.

There are also some external cues that are not as direct as seeing or smelling food, but could also trigger your appetite. For example, if you always snack while playing with your mobile phone, then overtime, playing with mobile phone could turn out to be a cue that makes you feel like snacking. Or, if you drink Coke and eat popcorn every time you go to a cinema, cinema will become a cue for Coke and popcorn to you. Overtime, these will become habitual behaviours, and your appetite will be automatically triggered by the cues.

If you are one of those who always feel like eating for food-related external cues, maybe try to keep snacks out of sight at home or in your dorm. If you do need to store snacks in case of getting hungry, the best choice is to store those low-sugar, low-fat snacks that will not make you gain weight, those snacks that you love, but not love too much. In addition, if you find yourself always snack when playing with the mobile phone, surfing the Internet or doing your homework without even noticing it, maybe try to stop the other things you are doing and just relax and enjoy your snacks next time. In this way, you can avoid eating too much for being distracted from your own bodily feelings of satiety, and also breaking the connection between snacking and playing with mobile phone or surfing the internet.

Eating for emotional reasons or external cues when not hungry will make you consume more calories than your body needs. When you cannot burn these calories, the energy will be stored as glycogen or fat to use at a later time. Overtime, continual excessive calorie intake will cause your body fat stores to expand, resulting in weight gain. The most direct and natural way of avoiding excessive calorie intake is to only eat when hungry and stop eating when feel full. To do this, you need to observe and be aware of your physical feelings of hunger and fullness. Next time when you feel like snacking, pause and take a moment to explore it is what that makes you want to eat.



Is it being hungry? Being in bad mood? Or being stimulated by some external cues? You might find that food is not what you really need at the moment. And, if you do find yourself want some snacks and decide to eat, then just relax, and enjoy it.

### **Video 6: Exploring the six kinds of hunger (9')**

In the previous video we talked about the six kinds of hunger you may have. In this video, we will explore your seven kinds of hunger through a brief exercise. We are going to use the snack you've prepared for this exercise, so if you don't have one at hand now, you need to get some before coming back to this video.

Let's start by settling into a comfortable position. You can sit on a chair; allow your back to adopt an erect and comfortable posture. Put your hands on your knees, and your feet flat on the floor. Or, you can adopt other postures you like, as long as you feel relaxed and comfortable. If you like, you can close your eyes. Take a few deep breaths.

Now imagine that you are a scientist on a space ship. Your mission lasted longer than expected and your ship is running out of food. You decide to land on a hospitable planet to look for something to eat. Unfortunately, the landing was rough and all your scientific testing equipment was destroyed. The planet has breathable air so you venture out. The surface of the planet is bare dirt and rock, and no one has seen any obvious life forms yet. The food supplies on your spaceship are running low, however, and everyone is getting hungry. As you walk around you find a small object lying on the ground. You do not know what it is, and there is no equipment you can use to test it. So you decide to use the only equipment you have – your senses – to explore it.

Now if your eyes are closed, open them and take the object you've found. Hold it in the palm of your hand.

*Eye hunger.* First you investigate this object, with your eyes. Look at its colour, shape, and surface texture. You are going to investigate it with the only tools you have, your five senses. You have no idea what this object is. You have never seen it before. What does the mind say that it could

be? Now rate your eye hunger for this item. On a scale of zero to ten – zero being no hunger at all and 10 being most intense hunger – how much hunger do you have for this object based upon what your eyes see?

*Nose hunger.* Now you investigate it with your nose. Smell it, refresh the nose, and sniff it again. You may smell something or you may not. Does it change your idea of whether it might be edible? Now rate nose hunger. On a scale of zero to ten – zero being no hunger at all and 10 being most intense hunger – how much hunger do you have for this object based upon what your nose smells?

*Mouth hunger.* Now you investigate this object with your mouth. Place it in your mouth but do not bite it. You can roll it around and explore it with the tongue, do not bite it. What do you notice?

Now you can bite this mysterious object, but only once. After biting it once, roll it again in the mouth and explore it with the tongue. What do you notice? Now rate your mouth hunger. On a scale of zero to ten, how much hunger do you have for this object based upon what the mouth tastes and feels? In other words, how much does the mouth want to experience more of it?

*Stomach hunger.* Now you decide to take a risk and eat this unknown object. You chew it slowly, noticing the changes in the mouth in texture and taste. You swallow it. You notice whether there are still any bits in the mouth. What does the tongue do when you have finished eating it? How long can you detect the flavour?

Now rate stomach hunger. Is the stomach full or not? On a scale of zero to ten, rate stomach hunger. In other words, how much does the stomach want more of this food?

*Mind hunger.* Now you realize this object is very similar to some food you have had before on the earth. Can you hear what the mind is saying about that food? What information is your mind telling you about this food? Now rate mind hunger. On a scale of zero to ten, how much would the mind like you to have more of this food?

*Heart hunger.* Is the heart saying anything about this food? Does it have any memories or emotions having to do with raisins? Is this food soothing or comforting? On a scale of zero to ten, how much would the heart like you to have more of this food?

The purpose of this exercise is to help you be more aware of your body sensations, and better receive signals from different parts of your body. By increasing the awareness of your body sensations, you can better decide when, what and how much to eat. You may find that for you it is harder to evaluate some kinds of hunger than others. It is fine. Your awareness of the bodily feelings will gradually increase with practice. In the following week, you can try to do this practice with different kinds of snack that you like.

### **Video 7: One bite at a time exercise (5')**

When we talked about the six kinds of hunger, we mentioned that the signals from the stomach could be ignored by us in many situations. The satiety hormones that signal that we have had enough to eat begin to be released 30 minutes after we begin eating. And if we eat too quickly, we'll miss the signals. However, as we live in a very busy world, many of us eat very fast habitually. In this video, I'd like to invite you to do a brief exercise with me. The purpose of this exercise is to help you slow down when you eat.

You'll need a piece of snack in this exercise. It could be a quarter of apple, a small chocolate bar, or any snack that you like. If you haven't got one, please pause this video, go to get some, and come back.

Now we'll do this exercise together. Let's begin with holding your snack in your hand, and take a moment to look at it carefully, exploring it with your eyes. How does it look? Notice its color, shape, and the surface texture. You can also smell it, notice its aromas.

Now take one bite, and put the rest of the piece of fruit down, removing your hand from the fruit. Notice where in the mouth the flavours are the strongest. Notice changes in textures. Notice when the urge to swallow appears.

If you've chewed thoroughly and swallowed the first bite, take a breath, and pick up the snack and take another bite. Put it down while paying full attention to the sensations in the mouth.

Chew slowly and savor, as with the first bite.

Continue with the rest of the snack, putting it down between bites.

How do you feel when doing this exercise? What do you notice when eating in this way? In the following week, try to practice putting the snack down between bites at least once a day. Bring full attention to the mouth, and wait until one bite is chewed well and swallowed before picking up the food to take another bite. If you eat using utensil such as chopsticks or spoon, put the utensil down between bites. Notice any discoveries or reactions to eating this way.

## **Video 8: Food cravings (9'17")**

### **Food craving**

In this video, I'd like to talk about your food craving.

Were there times when you felt an intense desire to have a specific food, but did not want to eat anything else? You felt like at the moment, only that food can satisfy you, and your mind was occupied by it. This is what we call food craving.

Food craving is different from normal hunger. The hunger usually does not point to a specific food, as different kinds of food can all provide energies to our body, fill our stomach up, and satisfy our taste buds. Food craving, on the contrary, is usually quite specific. It relates to specific foods or flavours. You may have had such experience: when you crave spicy food, you can never get satisfied by eating sweets no matter how tasty they are. Food craving may or may not be related to hunger. In fact, many times, hunger doesn't play a prominent role in food craving.

### **Why do we crave certain foods?**

The most straightforward explanation is that, we like them more than other kinds of food. In other words, eating these foods can bring us more enjoyment and pleasure, which is partly due to the way in which our body and brain react to the foods. Food cravings are quite common. Studies showed that more than 70% of young people have had food craving, especially for food high in sugar, fat, and salt.

#### *Sugar craving*

It is perfectly natural for humans to desire sweetness. There was a long time in history when humans had to spend a lot of time and energy just to get enough energy to survive. Sugar as an energy-boosting food, was rare and precious, and that's when we were able to derive great pleasure in a small and infrequent sweet treat. Scientific research has found that eating sugar does make people feel happier. For example, studies have found that when one experiences acute stress, activities in the hippocampus of the brain are inhibited. Consuming sugars is associated with higher activity in the hippocampus, which therefore could reduce the negative feelings of stress (Tryon et al., 2015). However in nowadays, sugar has become an ingredient that is overused in the produce of snacks and drinks. The excessive intake of sugar is not only a major risk factor for overweight, but also can cause diseases such as diabetes and heart disease. There is also evidence showing that sugar could be addictive. Some studies found that after weeks to months of chronic sugar intake, the period in between sugar intake could cause physiological and behavioural reactions that is similar to drug withdrawal (DiNicolantonio, O'Keefe, & Wilson, 2017).

#### *Fat craving*

In fact, when you crave chocolate, ice cream or cheesecakes, sugar might not be the only thing you desire. Another common feature of these foods is their high fat content. Other examples of high-fat food that make you "addictive" include fried chicken, crisps and BBQ. Our body loves fat, as in the age of food scarcity, our body relied on fat to store up energies for the cold winters. In these days, however, just as with sugar, food manufacturers always use too many fats, especially trans fats, to improve the taste of snacks and processed foods. And too many "bad" fats, without surprise, can really make you fat. In addition, some psychological studies have found that long-term high-fat diet have a negative impact on cognitive function (Freeman, Haley-Zitlin, Rosenberger, & Granholm, 2014). In other words, eating too much fat might not only make you fat, but also make you "less smart".

#### *Salty and spicy food cravings*

In our interviews with Chinese young people, we found that another kind of food craving that frequently mentioned is cravings for salty and spicy food. Spicy hot pot, spicy crawfish, spicy duck neck... Many told me that they couldn't live without these salty and spicy foods.

The salty and spicy foods people crave are usually very strong in flavours, thus they can better stimulate and satisfy one's taste buds. Salt appeals to our taste buds also because it is

essential to human survival. Our hearts, brains and other organs all need salt to maintain functioning. Everyone has tasted the salt in their own tears, sweat, and blood. We have a desire for salt, because our body knows it needs salt. However, just as sugar and fat, the high salt intake is also a risk factor for obesity (Ma, He, & MacGregor, 2015). And long-term high salt intake could lead to raised blood pressure and cardiovascular diseases. As to spicy foods, the possible reason they are highly addictive is also related to its impact on our body. Actually, the “hotness” or “spiciness” of spicy foods is not a taste but rather a sensation of burning. When they reach the tongue, a compound contained in spicy peppers called capsaicin tricks the cells in your mouth into thinking they’re coming into contact with something that is literally hot to the touch. Interpreting this sensation as a threat of pain, the body then releases endorphins to relieve the pain. Endorphins not only can help relieve pain, but also induce feelings of pleasure or euphoria. This might explain why you love the feelings of eating spicy food.

### **How to deal with your food cravings?**

Psychological research shows that except for physical needs and reactions, the food cravings are always linked to our mood states. As we discussed in a previous video, food cravings are more likely to occur when one feels anxious or stressed, and it is quite common that people crave high-sugar, high-fat food in these cases. When you experience a food craving, you can take a look at if it is linked with anxiety or stress. If so, maybe take a breath and try to do something to make you calm down and relax. Besides, long-term diet and restriction on certain foods that you like can also increase your cravings for these foods. So when you try to lose weight, it is important to avoid over-control of your eating. Give yourself permission to the “forbidden” foods when you really want them, and when you eat them, make sure you slow down to taste and enjoy every bite of it.

When you experience a food craving, you may find it overwhelming. Sometimes it may feel like there is nothing you can do to stop it. It may feel like you can think of nothing but getting that food or drink. In fact, research says that your cravings won’t last forever. They are like waves in the ocean – just as waves ebb and flow, our wave of craving is bound to recede and disappear in time. The reason we find them lasting and powerful is that they are fed by our struggle. The more we try to get rid of them, the more we end up thinking about it; the harder we try to control them, the more likely we are controlled by them. It feels like we have a little angel on one shoulder

and a little devil on the other, and the more they argue the more stressed we become. As the stress increases the power of the cravings also increase, so the devil wins.

Next time when you experience a craving for food, try to observe it. You can try to explore the how your body feels, how your emotion changes, and your thoughts during the craving period. Try to investigate it with curiosity, without judging or reacting to it. Do this experiment with yourself, to find out how your craving changes with time.

But if you find that you really want to eat the food you have in mind, don't worry about that. Tell yourself that it is your right to enjoy the food you like. You don't need to over-control yourself, or feel guilty for enjoying some food. And, although you might feel like eating a lot of the food you are craving to get satisfied, actually there is evidence showing that a small portion of food can just satisfy your cravings as good as the much larger portions (Kleef, Shimizu, & Wansink, 2013). So don't get yourself into extremes of "none" or "too much". When you really want the food, relax and enjoy it, and maybe do the experiment with yourself to find out how much of it can satisfy your cravings.

### **Video 9: Urge surfing (6')**

In the last video, we talked about food cravings. Now we know that your urge to eat during the craving periods is like ocean waves, just as waves ebb and flow, our wave of urge will recede and disappear in time. When the waves of food craving come, you can surf it, like you surf in the sea. In this video, we are going to practice how to surf your urge.

In this exercise, we'll use a piece of snack that you usually crave. Make sure you have one before you continue with this practice.

Now let's start. Settle into a comfortable position. You can sit on a chair; allow your back to adopt an erect and comfortable posture. Put your hands on your knees, and your feet flat on the floor. Or, you can adopt other postures you like, as long as you feel relaxed and comfortable. Take a few deep breaths. Now bring your attention along with your next inbreath. Notice your sensations when breathe in, breathe out, and the slight pause between the inbreath and the following outbreath.

Now pick up your crave food and look at it, smell it, touch it. As best you can, let yourself fully experience the thoughts, emotions and physical sensations of craving this food.

Now when you're ready, put the food down. You can close your eyes if that's more comfortable for you. Shift your attention from thinking to being curious about where in the body you experience craving – what are the physical sensations in the body associated with craving?

As best you can, rest a kindly attention and gentle curiosity on those physical sensations in the body. Be curious about them noticing if there's a tightness or holding, warmth or coldness, pulsing, fasting breathing or any sensation you might notice. There are no right sensations of feel.

When you notice you are thinking about the crave food or anything else, briefly observe what you are thinking, then bring your attention back gently to the physical sensations in your body.

Keeping your attention on these physical sensations, notice how they rise and fall, intensify, change, dissipates –ride the wave of these physical sensations like a surfer rides the ocean waves.

Whenever your attention leaves the physical sensations in the body and goes to thinking or gets caught up in an emotion, without criticism simply bring your attention back to noticing the texture, temperature, strength or weakness, presence or disappearance of the physical sensation.

Now taking a deeper breath in and as you exhale open your eyes, and look at the food again. How do you feel now?

Next time when you experience food craving, instead of trying to suppress it or control it, surf it as we just did. Explore your physical sensations, and how they change during the craving period. If you find it's hard to do - don't worry, surfing is never easy to learn. Just be patient and try a few more times.

### **Video 10: Planning (8'20")**

In the previous videos, we have talked about many ways of avoiding overeating and excessive consumption of calories, such as being aware of your bodily sensations of hunger and fullness, chewing thoroughly and savoring your snacks, stop eating when you feel full. However, you may find that even though you decide to use these methods and skills to improve your snacking habit and loss weight, they are not always easy to do in your daily life. In this video,



let's try an effective technique in health psychology – planning, to help you better use the skills you've learned in this course.

Planning is probably not a strange thing to you. Most of us have made many plans on many things in our life – although some of them never get the chance to be implemented. In health psychology, planning is a very commonly used behavioural change technique. Plenty of evidence has shown the effectiveness of planning in promoting dietary behaviours and habits that can help people lose weight. Specifically, the plan I'm inviting you to make is not about how much to eat per day or how many calories to consume per week, but about your behaviours. This technique of formulating behavioural plans is called “if-then”. You'll need paper and pen to write down your plans, or you can take notes using your mobile phone. Please get your tools prepared before continuing with this video.

Now let's work together to develop your own behaviour plans. You will see 16 sentences that start with “if”. These “ifs” describe situations you may encounter in your daily life that could make you want to have snacks or beverages, or some behavioural patterns that are likely to cause overeating and excessive calorie intake. Most of these situations and eating patterns have been discussed in the previous videos, such as emotional eating and external eating. As the first step of developing your own plans, you are invited to go through the 16 “ifs”, and choose three that you think you most frequently encountered in daily life, and write them down. I'll read these items one by one for you, and when you see your “ifs”, you can pause the video and write them down.

(16 “ifs”, see in chapter 7)

Please record your three “ifs” before continuing with this video.

Now you have selected the three “ifs” that belong to you. There are the barriers you have in your daily life to losing weight. The next step of developing your plans is to find a solution for each barrier. I will provide you with 14 sentences beginning with “then”. These sentences describe the wiser actions you can take in these situations, based on what you've learned in this course. I will read each “then” for you. Please choose one most suitable “then” for each “if” that you've just selected. Please note that there is no one-to-one correspondence between the barriers and the solutions, and therefore no right or wrong matches. What I am asking you to do is to choose the solutions to each barrier that could work best for you. Find the solutions that you think would be most effective for you, and you'll be happy to use in real life. In other words, choose YOUR

solutions. After choosing the best “then” for an “if”, write the “then” after the “if” part that you just wrote down, to form a complete sentence.

(14 “thens”, see in chapter 7)

Now you’ve got three unique behavioural plans. The next step I’ll invite you to do, is to read the complete sentences for several times, to make sure you know the plans you have just made. After reading each plan, please take a moment, close your eyes and imagine when the “if” actually happen, and how you’ll react as described by the “then”. Please take your time, and really try to think about it in details, as evidence shows that this is an effective way to help you implement the plans.

In the following week, try to implement the plans you’ve just made. You’ve matched each “if” with a most suitable “then”, now please try to let them meet each other in your real life.

## Feasibility study (Chapter 7)

### Appendix 11 Participant information sheet for feasibility study

#### School of Psychology

University of Leeds  
Leeds LS1 9JT, UK



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**Study title:** Promoting weight loss by improving snacking: a feasibility test of a mobile intervention for Chinese overweight adolescents

Study Information Letter: date xx/xx/xx

### **An invitation to a weight loss programme**

Do you love snacking as most of us do, but are a little bothered by your weight, wishing to learn some new ways to better control your weight, and in the meantime better enjoy your snacks?

This letter invites you to take part in a WeChat weight loss programme if you are:

(1) Aged 16 to 18 years;

(2) Have a body mass index over 24;

*\*(Body mass index = weight (kg)/height (m)<sup>2</sup>; for example, for a girl whose weight is 60kg and height is 160cm, her body mass index = 60/1.60<sup>2</sup>= 23.4 (kg/m<sup>2</sup>).*

(3) Wishing to lose weight by making wiser choices for snacking.

#### **What is this programme about?**

This programme is part of PhD research conducted under the supervision of the School of Psychology, University of Leeds, UK. It aims to help Chinese young people loss weight by improving snacking habits. The study has been approved by the University of Leeds (Faculty of Medicine and Health) Research Ethics Committee: reference PSC-325; date 24/04/2018.

### **What does this programme involve?**

- By taking part of the study, you will get free access to our WeChat weight-loss course. In this course you will learn how to better manage your weight by making wiser choices for snacking through several interesting short videos.
- The course is self-paced. You can freely choose when and where to watch the videos. However, for the research purpose, we will expect you to finish the course within one month. It will take no more than 90 minutes in total to watch all the videos.
- You will be sent an information letter and a consent form via email, and you will be asked to reply to this email to confirm your consent.
- You will also be invited to answer an online survey before and immediate after you participate in the course. The survey will be about your eating habits and snack intakes, which will take up to 20 minutes. It is not a test; there are no “right” or “wrong” answers for any question in the survey. We will send you the link to the survey on WeChat, you can simply click the link and answer the survey at your convenient time.
- NO NAMES will be asked during the course or in the survey. The researchers will have no way to identify you from the survey. However, you will be asked to generate a unique identifier so that we can link your responses.

### **What’s in it for you?**

By taking part you will:

- Be a part of an important research project in the University of Leeds and get a sense of how psychological research is conducted.
- Get free access to a WeChat weight-loss course designed for Chinese young people. Based on the scientific evidence in health psychology, this course was developed by a Chinese PhD student under the supervision of the School of Psychology, University of Leeds, UK.
- Help international scientific researchers understand Chinese young people and improve the health program for youth.

### **How will your participation and information be kept secure?**

- No names will be asked during the study; all the data will be anonymised.
- All data will be stored on a password-protected laptop accessed only by researchers.
- The consent email you send to us will be stored in a password-protected laptop accessed only by researchers. These will be destroyed after 2 years.
- Your answers to any question of the survey will be used for the purpose of this project only. The data will be downloaded and stored securely. The results of this study will be reported in a doctoral dissertation and might be reported in academic journal.

- For research purposes, data from this study will be stored for 5 years.

**Do you have to take part in the study?**

No, although we will really appreciate your participation, it is up to you to decide. You can also stop and leave the study at any time without any need to give a reason. You can also ask to withdraw your data up to one week after your participation of the study, by emailing me (Qian) and providing your participation number.

Please consider taking part. If you have any questions about the study you can contact the researcher or the supervisor on the email addresses below. If you would like to take part, that's great – please email the research, Qian, to let me know within the next two days if possible. The last date to let me know if you would like to take part is xx/xx/xx/.

**For any further questions or queries please contact us on:**

Researcher: Qian Zhang, School of Psychology, University of Leeds [psqz@leeds.ac.uk](mailto:psqz@leeds.ac.uk)

Supervisor: Dr Siobhan Hugh-Jones, School of Psychology, University of Leeds [s.hugh-jones@leeds.ac.uk](mailto:s.hugh-jones@leeds.ac.uk)

Appendix 12 Recruitment poster for feasibility study



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心理学研究 + 课程招募!!!



欢迎参加英国利兹大学在线健康饮食 + 减肥课程：  
我♥吃零食！

**课程内容：**

- 看短视频，告诉你如何更明智地选择零食，用更聪明的方法享受零食，以更科学的办法管理体重；
- 视频链接通过微信或邮件发送给你，7月7日 - 10月1日之间任选开始时间，一个月内啥时候有空啥时候看（总时长不超过90分钟）；
- 课程为英国利兹大学医学与健康学院心理学研究项目的一部分，以心理学和行为学领域的科学理论和研究证据为基础，由英国心理学家参与设计制定。

**招募要求：**

(1) 年龄：16 - 18岁（在校高中生）；

(2) 身高体重指数（Body Mass Index）不低于24；

身高体重指数 = 体重 (kg) ÷ 身高(m)<sup>2</sup>；举例来说，一个女生的体重是60kg，身高是160cm，她的身高体重指数 = 60/1.62<sup>2</sup> = 23.4 (kg/m<sup>2</sup>)

(3) 希望通过建立更健康的零食习惯来达到控制体重或减肥的目的。

扫描二维码  
获取更多信息：



## Appendix 13 Recruitment PowerPoint slides for feasibility study

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# 心理学研究 + 课程招募 !!!

## 我❤️吃零食

英国利兹大学医学与健康学院心理学系  
健康饮食与减肥项目 2018

爱吃零食？

但是又...

担心体重想减肥？

看看吃什么能瘦

---

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### 课程内容

### 研究内容

- 看短视频，告诉你如何更明智地选择零食，用更聪明的方法享受零食，以更科学的办法管理体重；
- 视频链接通过微信或邮件发送给你，7月7日 - 10月1日期间任意选择开始时间，一个月内啥时候有空啥时候看（总时长不超过80分钟）；
- 课程为英国利兹大学医学与健康学院心理学研究项目的一部分，以心理学和行为学领域的科学理论和研究证据为基础，由英国心理学家参与设计制定。

除了参加课程看视频，还需要请你：

- 在课程开始前和结束后填写两次在线问卷，每次需要的时间不超过20分钟；
- 课程结束后，自由选择是否参加微信语音访谈，为我们提供你对课程的反馈和建议；访谈时间不超过半小时，访谈后将收到50元钱作为感谢。
- 整个研究和课程过程将保持匿名，你的一切信息和数据将被严格保密。

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### 课程开发 + 研究团队

### 课程开发 + 研究团队

张倩，博士在读生，利兹大学医学与健康学院，心理学系。英国心理学会会员。  
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### 招募要求

### 联系我们

- (1) 年龄：16 - 18岁（在校高中生）；
- (2) 身高体重指数（Body Mass Index）不低于24；  
 身高体重指数 = 体重 (kg) ÷ 身高(m)<sup>2</sup>；举例来说，一个女生的体重是60kg，体重是160cm，她的身高体重指数 = 60/1.62<sup>2</sup> = 23.4 (kg/m<sup>2</sup>)
- (3) 希望通过建立更健康的零食习惯来达到控制体重或减肥的目的。

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Scan the QR code to add me on WeChat

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#### **Appendix 14 Acceptability questionnaire (post-intervention)**

Response format: 1 = Strongly disagree; 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Strongly agree.

1. Overall, I am very satisfied with my experience in taking part in this programme.
2. Overall, taking part in this programme did not cause any stress for me.
3. Taking part of this programme via WeChat is easy and convenient to me.
4. Now I know more knowledge/information of how to lose weight by improving healthy snacking.
5. I have learned more skills about healthy eating and weight control.
6. Overall, I find what I learned from this programme useful.
7. Overall, taking part of this programme is interesting experience.
8. I have been using the knowledge/skills that I learned from the programme in my daily life.
9. I will continue to use the knowledge/skills that I learned from the programme in my daily life.
10. What do you find was the most useful part of the programme?
11. What do you find was the least useful part of the programme?
12. How do you think the programme could be improved?