# A STUDY ON THE ASSOCIATION BETWEEN STRESS AND EATING BEHAVIOUR AMONG MALAYSIAN ADOLESCENTS

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FACULTY OF MEDICINE UNIVERSITY OF MALAYA KUALA LUMPUR

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### A STUDY ON THE ASSOCIATION BETWEEN STRESS AND EATING BEHAVIOUR AMONG MALAYSIAN ADOLESCENTS

#### ABSTRACT

**Background:** The concurrent increasing prevalence of mental health and obesity among adolescents worldwide has been attributed to urbanization and changes in lifestyle. Expectation to achieve academic excellence has been reported to be an important stressor identified among the adolescents. There is a shortage of such research evidence among Malaysian adolescents.

**Aims:** This study aims to explore the level of stress experienced by Malaysian adolescents during near examination period and normal school days and investigate its impact on their eating behaviour.

**Method(s) Procedures:** A cohort study was conducted among 797 school going, 16year-old multi-ethnic Malaysian adolescents. Baseline data were collected two weeks before the final-year national school examination  $[T_0]$ . Follow-up data were collected at least three months before major national school examination  $[T_1]$ . Stress and eating behavior data were collected at both time points. The stress level was assessed by both subjective and objective measures. The objective measurement was based on validated Cohen Perceived Stress Scale questionnaire score while the objective measurement was based on saliva cortisol level of a subsample of 262 participants. The saliva biomarkers were analyzed and assayed by Enzyme Immunoassay method. Eating behaviours were explored using validated self-reported Child Eating Behaviour questionnaire. Baseline data collected include coping strategies adopted by the adolescents to deal with stress using validated brief COPE questionnaire, weight, height, body fat composition and waist circumference. Data were analyzed using IBM SPSS Statistics version 24.0. Linear regression and logistic regression analysis were applied. **Results:** Majority of participants were Malays (74.9%), female (60.2%) and from urban schools (60.5%). The prevalence of high stress level among the adolescents was high ( $T_0$ :29.1%,  $T_1$ :30.9%); highest among female and urban adolescents. Saliva cortisol level was significantly higher during near exam period ( $T_0$ :3.8 nmol/L [95%CI: 3.4, 4.3];  $T_1$ :3.0 nmol/L [95%CI: 2.6, 3.4]). No significant correlation was observed between perceived stress and saliva cortisol level. Change in perceived stress level is positively associated with transition in emotional overeating (r=0.18, p<0.01) and food responsiveness (r=0.14, p<0.01) behavior. Logistic regression revealed that students who experienced an increase in stress level (OR=1.9, 95%CI: 1.3, 2.9), do not plan (OR=2.0, 95%CI: 1.1, 3.5) and adopted emotional support to cope with stress (OR=1.7, 95%CI: 0.9, 3.1) were more likely to have a negative transition of emotional overeating behavior. Students who experienced an increase in stress level (OR=1.4, 95%CI: 0.9, 2.0) and self-blame (OR=1.6, 95%CI: 0.9, 2.7) when coping with stress were more likely to experience a negative transition of food responsiveness behavior.

**Conclusions/ Implications:** Stress is a significant mental health problem among Malaysian adolescents and expectation to achieve academic excellence in school examination is identified as an important stressor. Change in stress level is a significant predictor of transition in emotional overeating and food responsiveness behavior. The choice of coping strategy adopted to deal with stress for example, planning is thus very crucial to prevent the increment in stress level as it influences the direction of the transition of adolescent's eating behavior; positively or negatively.

Key words: stress, saliva cortisol, eating behaviour, adolescents, school examinations

### KAJIAN MENGENAI HUBUNG KAIT DI ANTARA TEKANAN DAN TABIAT PEMAKANAN DI KALANGAN REMAJA DI MALAYSIA

#### ABSTRAK

Latar belakang: Peningkatan kadar kesihatan mental yang selari dengan peningkatan kadar kegemukan di kalangan remaja di seluruh dunia telah dikaitkan dengan urbanisasi dan perubahan gaya hidup. Harapan untuk mencapai kecemerlangan akademik telah dilaporkan sebagai salah satu daripada punca tekanan utama yang dikenal pasti di kalangan remaja. Bagaimanapun, terdapat kekurangan bukti penyelidikan berkaitan hal tersebut di kalangan remaja di Malaysia.

**Tujuan kajian:** Justeru, kajian ini bertujuan untuk mengkaji tahap tekanan yang dialami oleh remaja semasa tempoh hampir peperiksaan dan tempoh hari persekolahan biasa dan mengkaji impak tekanan tersebut terhadap tabiat pemakanan mereka.

**Perkaedahan kajian**: Satu kajian kohort telah dijalankan di kalangan 797 remaja di Malaysia daripada pelbagai etnik yang berumur 16 tahun dan masih bersekolah. Data asas dikumpulkan dalam tempoh dua minggu sebelum peperiksaan akhir tahun [T<sub>0</sub>]. Data susulan dikumpulkan pada hari persekolahan biasa, sekurang-kurangnya tiga bulan sebelum peperiksaan utama [T<sub>1</sub>]. Data tekanan dan tabiat pemakanan dikumpulkan pada kedua-dua tempoh lawatan pengumpulan data. Tahap tekanan dinilai secara subjektif dan objektif. Penilaian secara objektif adalah berdasarkan skor borang soal selidik Skala Tanggapan Tekanan Cohen yang telah divalidasi penggunaannya di kalangan remaja. Penilaian secara subjektif adalah berdasarkan tahap kortisol di dalam air liur yang diperolehi daripada 262 peserta sub sampel. Sampel air liur peserta dianalisa dan diuji menggunakan kaedah 'Enzyme Immunoassay'. Tabiat pemakanan dikaji menggunakan borang soal selidik Tabiat Pemakanan Kanak-Kanak yang dilaporkan sendiri oleh peserta dan telah divalidasi penggunaannya. Data asas lain yang turut dikumpul merangkumi strategi mengatasi tekanan yang digunakan oleh remaja menggunakan borang soal selidik ringkas COPE, berat badan, ketinggian, komposisi lemak tubuh dan lilitan pinggang. Data dianalisa menggunakan perisian IBM SPSS Statistics versi 24.0. Regresi linear dan regresi logistik digunakan untuk menganalisa data.

Hasil kajian: Majoriti peserta adalah Melayu (74.9%), perempuan (60.2%) dan dari sekolah di bandar (60.5%). Kadar tahap tekanan tinggi di kalangan remaja adalah tinggi (T<sub>0</sub>:29.1%, T<sub>1</sub>:30.9%); paling tinggi di kalangan remaja perempuan dan remaja di bandar. Tahap kortisol di dalam air liur adalah signifikan tertinggi ketika hampir waktu peperiksaan (T<sub>0</sub>:3.8 nmol/L [95%CI: 3.4, 4.3]; T<sub>1</sub>:3.0 nmol/L [95%CI: 2.6, 3.4]). Tiada korelasi signifikan didapati antara tanggapan tekanan dan tahap kortisol di dalam air liur. Perubahan di dalam tanggapan tekanan berkait positif dengan peralihan di dalam tabiat makan berlebihan akibat emosi (r=0.18, p<0.01) dan perlakuan responsif terhadap makanan (r=0.14, p<0.01). Analisa regresi logistik mendapati bahawa remaja yang mengalami peningkatan tahap tekanan (OR=1.9, 95%CI: 1.3, 2.9), tidak melakukan perancangan apabila berhadapan dengan tekanan (OR=2.0, 95%CI: 1.1, 3.5) dan menggunakan sokongan emosi untuk menangani tekanan (OR=1.7, 95%CI: 0.9, 3.1) lebih cenderung untuk mengalami peralihan negatif tabiat makan berlebihan akibat emosi. Remaja yang mengalami peningkatan tahap tekanan (OR=1.4, 95%CI: 1.0, 2.1), tidak menggunakan jenaka (OR=1.4, 95%CI: 0.9, 2.0) dan tidak menyalahkan diri (OR=1.6, 95%CI: 0.9, 2.7) apabila berhadapan dengan tekanan adalah lebih cenderung untuk mengalami peralihan negatif tabiat responsif terhadap makanan.

**Kesimpulan:** Tekanan perasaan adalah antara salah satu masalah kesihatan mental yang penting di kalangan remaja di Malaysia. Harapan untuk mencapai kecemerlangan akademik dalam peperiksaan di sekolah dikenal pasti sebagai salah satu punca tekanan yang penting. Perubahan dalam tahap tekanan adalah dengan signifikan mempengaruhi

tabiat makan berlebihan akibat emosi dan responsif terhadap makanan. Pemilihan strategi bersesuaian dalam menangani tekanan seperti membuat perancangan untuk mengatasi masalah dihadapi adalah amat penting untuk mencegah kenaikan tahap tekanan kerana ia mempengaruhi halatuju arah perubahan tabiat pemakanan individu, sama ada bertambah baik atau bertambah buruk.

Kata kunci: tekanan, kortisol di dalam air liur, tabiat pemakanan, remaja, peperiksaan

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### LIST OF SYMBOLS AND ABBREVIATIONS

ACTH	:	Adrenocorticotropic Hormone				
BMI	:	Body Mass Index				
CEBQ	:	: Child Eating Behavior Questionnaire				
CPSS	:	Cohen Perceived Stress Scale				
CRH	:	Corticotropin-Releasing-Hormone				
DALY	:	Disability Adjusted Life Years				
DASS	:	Depression-Anxiety-Stress-Score				
DD	:	Desire to Drink				
EIA	:	Enzyme Immunoassay				
ELISA	:	Enzyme-Linked Immunosorbent Assay				
EOE	:	Emotional over eating				
EOF	:	Enjoyment of food				
EUE	:	Emotional under eating				
FF	:	Food fussiness				
FR	÷	Food responsiveness				
GHQ	:	General Health Questionnaire				
HMPS	:	Healthy Mind Program Survey				
HPA	:	Hypothalamus-Pituitary-Adrenal				
HRP	:	Horseradish Peroxidase				
IOTF	:	International Obesity Task Force				
IPH	:	Institute of Public Health				
LKKPN	:	Lembaga Pembangunan dan Perpaduan Keluarga Negara				
		(LPPKN)				
МОН	:	Ministry of Health				

MyHeART	:	Malaysian Health and Adolescents Longitudinal Research Team
		Study
NCD	:	Non-communicable Disease
NHMS	:	National Health Morbidity Survey
NSDE	:	Non-stress driven eaters
NPFDB	:	National Population and Family Development Board, Malaysia
RQC	:	Reporting Questionnaire for Children
SDE	:	Stress-driven eaters
SDQ	:	Strength and Difficulties Questionnaire
SE	:	Slowness in eating
SPM	:	Social and Preventive Medicine
SR	:	Satiety responsiveness
TMB	:	Tetramethylbenzidine
TPB	:	Theory of Planned Behaviour
UM	:	University of Malaya
WHO	:	World Health Organization
WC	Ċ	Waist circumference
YLD	:	Years Lived with Disability

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#### **CHAPTER 1: INTRODUCTION**

#### **1.1** About this Work

This study was a sub cohort of an ongoing larger longitudinal study, the Malaysian Health and Adolescents Longitudinal Research Team (MyHeART) study that focuses on the health of adolescents in the states of Selangor, Perak and Kuala Lumpur in Malaysia. The study is being conducted through a collaboration fostered between the University of Malaya and Ministry of Education, Malaysia that began in 2011. Under the auspices of and with the cooperation of the state education department of the above three states, the current study is one of several being undertaken by various researchers with funding from the University of Malaya Postgraduate Research Grant (PPP).

### 1.2 Background

Malaysia is located in Southeast Asia. It consists of thirteen states and three federal territories with total landmass of 330,803 square kilometers separated by the South China Sea into two regions, the Peninsular Malaysia and the East Malaysia or also known as Malaysian Borneo (Figure 1.1).



Figure 1.1: Map of Malaysia (Department of Statistics, 2016)

Malaysia is a multi-ethnic and multi-cultural country with an estimated total population of 31.7 million in 2016 (Figure 1.2). More than half of the population is ethnic Bumiputera (68.6%). Bumiputera consisted of mainly the ethnic Malays and a minority of the indigenous people or also known as Orang Asli. The Malaysian Chinese were the second largest community (23.4 %) followed by the Malaysian Indians (7.0 %). In 2016, Selangor recorded the highest percentage of population (19.9%). Perak and Kuala Lumpur were populated by 7.8% and 5.6% of population respectively (Department of Statistics, 2016).



### Figure 1.2: Population Distribution by Ethnic Group in Malaysia in 2016 (Department of Statistics, 2016)

Following the rapid economic growth in Malaysia in the latter half of the 20<sup>th</sup> century, the Malaysian population has benefited from a well-developed health care system, clean water and sanitation as well as increased health literacy among the population. In 2017, life expectancy at birth in Malaysia is 74.8 years (Department of Statistics, 2017). Non-communicable diseases such as heart disease, hypertension, cancer and diabetes account for most incidences of mortality and morbidity. Major risk factors identified include raised blood pressure, high body mass index, raised blood sugar levels and abnormal serum lipid concentrations (MOH, 2013). Malaysian National Health and

Morbidity Survey revealed a drastic three-fold increase in the prevalence of mental health disorders among adults aged 16 years and above in Malaysia from a decade ago; from 10.7% in 1996 to 29.2% in 2015 (Institute for Public Health, 2015).

#### **1.2.1** Stress and health

The World Health Organization (WHO) defines stress as the reaction people may have when presented with demands and pressures that are not matched to their knowledge and abilities and which thus challenge their ability to cope. Interactions of individuals with environmental threats and challenges which strain or exceed their ability to adapt and threaten their well-being will result in stress. Different perceptions of stress and varied stress responses among individuals reflect variations in personality, as well as physical strength and general health (Myers, 2005). Numerous studies have demonstrated the association between stress and the development of other mood disorders such as anxiety and depression (Ahmad, Cheong, Ibrahim, & Rosman, 2014; Kaur et al., 2014; Lim, Chong, Khoo, & Kaur, 2014). Studies have shown that stress and other mental illnesses directly or indirectly cause or contribute to, and sometimes in fact worsen, a huge number of diseases and disorders such as hypertension, hypercholesterolemia and cardiac diseases (Davidson, Mostofsky, & Whang, 2010; Lesser & Ginsburg, 2000; "Mental Health: Towards Economic and Social Inclusion," May 2013).

#### **1.2.2** Stress among adolescents

The WHO defines an adolescent as a person between the age of 10 and 19. Adolescence is a transitional phase of growth and development between childhood and adulthood and it is one of the most rapid phases of human development. This transitional stage is the most challenging phase of life as adolescents have to deal with abrupt and rapid physical, emotional, sexual and social changes (Sham, 2015). Being in this most challenging phase of life thus places adolescents among the vulnerable populations at higher risk of developing stress-related illnesses. Forced to deal with the internal pressure of puberty problems, parental relationships and academic expectations, adolescents may also have to face with external demands and influences such as peer pressure, drugs, violence and sexual temptation. Inability to cope with such challenges may lead to negative consequences that are mainly mental health related, such as stress, low selfesteem and involvement in high-risk behaviours (Groesz et al., 2012).

#### 1.2.3 Stress, eating behaviour and coping skills

Coping can be defined as using conscious effort to solve personal and interpersonal problems, and learning to master, minimize, and tolerate stress or conflict (Weiten, Lloyd, Dunn, & Hammer, 2008). It refers to the thoughts and actions an individual uses to deal with stress. Feeling stressed or not depends on whether an individual is equipped with the coping resources and the ability to adopt the appropriate coping strategies to deal with the challenges faced. A national survey conducted in America in 2007 reported that nearly half of the general population stated that they feel more stressed compared to five years ago, with 43% reporting that they utilized food as a coping mechanism to deal with stress (Groesz et al., 2012).

Eating behavior is a complex interplay of physiologic, psychological, social, and genetic factors that influence food intake in three ways which are (1) food preference, (2) quantity of food intake, and (3) meal timing (Grimm & Steinle, 2011). Psychological stress has been suggested to change dietary pattern towards more unhealthy food preference and as such contribute to overweight. A study on 437 children aged between 5 to 12 years reported positive associations between emotional, peer, conduct and hyperactivity problems and the consumption of both sweet and fatty foods which are known to contribute to children becoming overweight (Michels et al., 2012).

However, it has also been postulated that overweight may not just be contributed by the food preference but by the tendency to overeat resulting in excessive quantity of food intake. Hootman et al, 2018 in her study on 264 college freshmen reported that freshmen with a greater tendency to overeat in response to external cues and emotions tended to have greater weight, BMI and waist circumference. She also reported in her study that males with higher perceived stress at college entrance subsequently gained significantly more weight in the first semester (Hootman, Guertin, & Cassano, 2018). This finding is in line with an earlier study by Caccialanza et al, 2004 which stated that some of the factors that have been considered to contribute to obesity among obese subjects were having a lower response to the internal satiety stimulus; having a higher response to external food stimuli; and emotionally overreacting to stressful life events (Caccialanza et al., 2004).

The association between emotion-drive impulsiveness and snack food consumption among 1039 European adolescents aged 12 to 18 years has also been investigated by Coumans et al, 2017 in his study in 2013/2014 (Coumans et al., 2018). Coumans et al, 2017 reported that adolescents with a stronger emotion-driven impulsiveness tendency reported a higher snacking frequency. This is coherent with the findings of some earlier studies that stated the suggested problems with energy intake is that people eat highly palatable and energy-dense foods between meals or also referred to as snacking (Larson, Miller, Watts, Story, & Neumark-Sztainer, 2016; Myhre, Loken, Wandel, & Andersen, 2015; Ovaskainen, Tapanainen, & Pakkala, 2010)

Stress-related eating has thus been postulated to be one of the factors contributing to the currently increasing prevalence of overweight and obesity. However, the studies on the relationship between stress, eating behaviour and body composition among the adolescent population are limited (Groesz et al., 2012; Jaaskelainen et al., 2014; MartynNemeth, Penckofer, Gulanick, Velsor-Friedrich, & Bryant, 2009). Despite the emotional state of an individual is considered to be an important determinant of eating behaviour, it should also be reminded that eating behaviour may also be influenced by other factors including internal and external determinants such as the availability of food, knowledge, attitude and individual experience (Wardle, 2007). This field is thus a very complex and wide area to be explored.

Nevertheless, the weight gain problem among Malaysian adolescents, which is becoming increasingly prevalent, has triggered a sense of urgency among the policy makers, stakeholders and researchers who are seeking to identify modifiable behaviours that contribute towards obesity. One of the aspects of this problem that needs to be better understood is the eating behaviour pattern of adolescents. Poor eating behaviour such as overeating with excessive intake of energy and poor lifestyle practices are very closely related to a higher prevalence of overweight and obesity and need to be seen as important public health issues. This study will focus on the major aspect of overeating tendency rather than food preference or snacking.

#### **1.3** Problem Statement

Globalization, industrialization and urbanization have had a major impact on the lifestyles of individuals worldwide. Lately, stress and mental health have been associated with a busy and hectic lifestyle. Also, Vigo, Thornicroft and Atun (2016) reported that the global burden of mental illness had been underestimated. Vigo et al. (2016) estimated that the global burden of mental illness had increased from earlier estimates of 21.2% of years lived with disability (YLDs) and 7.1% of disability-adjusted life-years (DALYs) to 32.4% and 13.0%, respectively. In Malaysia, the NHMS also demonstrated a rising trend in the prevalence of mental illness in the general population above 16 years old from 10.7% in 1996 to 29.2% in 2015 (Institute for Public Health, 2015). The prevalence

among children and adolescents aged 15 years and below also showed a rising trend from 13% in 1996 to 20% in 2011 (Institute for Public Health, 2011).

In addition to mental health, the rising prevalence of chronic diseases in the population is also thought to be associated with changes in the eating habits and lifestyles of the population. Concurrent with the rising prevalence of mental illnesses among the Malaysian adult population, the NHMS also revealed an increasing prevalence of non-communicable diseases over time. The prevalence of hypertension in Malaysia increased from 14.4% in 1986 to 30.3% in 2015 while the prevalence of diabetes almost tripled from 6.3% in 1986 to 17.5% in 2015 (Institute for Public Health, 2015). The prevalence of hypercholesterolemia also increased from approximately one third (35.1%) of the population in 2011 to 47.7% in 2015 (Institute for Public Health, 2015).

Obesity due to sedentary lifestyles and inappropriate eating behaviour has also been found to be a major contributor to the global burden of non-communicable diseases. In Malaysia, the NHMS reported that among Malaysians aged more than 18 years old the prevalence of overweight (body mass index (BMI) of 25 to 30 kg/m<sup>2</sup>) doubled from 16.6% in 1996 to 33.4% in 2015 while the prevalence of obesity (BMI of more than 30 kg/m<sup>2</sup>) increased from 4.4% in 1996 to 30.6% in 2015 (MOH, 2015). As for Malaysian children and adolescents aged below 18 years old, it has been reported that 6.1% were obese in 2011 compared to 11.9% in 2015 (Institute for Public Health, 2011, 2015)

The long-term health consequences of obesity among adolescents will have a major impact on the nation because obese children and adolescents are increasingly susceptible to complicated and chronic illnesses especially cardiovascular diseases and diabetes mellitus. Obesity will also lead to psychological problems including poor body image and low self-esteem that can be followed by social isolation and finally depression (Yusoff, Abdul Rahim, & Yaacob, 2010). Therefore, gaining an understanding of the

relationship between stress and eating behaviour is of importance to public health because such knowledge will help to halt the increasing prevalence of both stress and obesity especially among adolescents.

A proper understanding of this relationship will lead to the development of effective prevention and treatment strategies to combat unhealthy eating behaviours and prevent their negative consequences; obesity among adolescents. It is also important to note that adolescents are assets to a nation's development. An unhealthy future generation will have major socio-economic implications for the nation. On this basis, the promotion, protection and restoration of mental health should be regarded as a vital concern of individuals, communities and societies throughout the world.

### 1.4 Rationale for the Study and its Public Health Significance

Unhealthy eating behaviour had always been in the limelight, but the eating drive such as emotional eating, which has also been found to be an important factor underlying obesity, is understudied and has even been identified as a growing area of research (Groesz et al., 2012). Previous research has identified several determinants of emotional eating that can be classified as psychological (eg. stress), situational (eg. knowledge, food literacy) or biological factors (eg. obesogenic factors). The psychological drive to eat and the ability of the mind to psychologically control this drive thus are one of the important factors in determining food intake. However, the focus of health promotion programmes is usually on educating, creating awareness and advising the community on the importance of healthy eating behaviour. The psychological aspect such as stress which is highly prevalent in the society is commonly overlooked.

Two longitudinal studies that investigate the relationship between stress, eating behaviour and adiposity among adolescents have been undertaken in the West (De Vriendt et al., 2012; Jaaskelainen et al., 2014), but nothing as specific has been conducted in Southeast Asia, including Malaysia. Jaaskelainen et al. (2014) conducted a prospective population-based cohort study in Finland among adolescents to investigate the relationship between stress-related eating and obesity (Jaaskelainen et al., 2014) while another observational study was conducted among European adolescents to investigate the association between perceived stress and adiposity (De Vriendt et al., 2012). Despite these two studies being longitudinal studies, eating behaviour does not seem to have been explored from the angle addressed in this study which looks specifically at the transitions of eating behaviour, positively or negatively following the changes in stress level, whether the stress level increases or decreases.

Cross sectional studies on the association between stress and eating behaviour or dietary habits have also been conducted in Western countries (Cartwright et al., 2003; Groesz et al., 2012). In the case of Asia, a number of cross-sectional studies were found including one by Hou et al. (2013) among Chinese adolescents in Jiangsu Province, China that sought to explore the relationship between emotional symptoms, life stress and eating behaviour. Hou et al. (2013) claim that their study is the first to investigate the eating behaviour of adolescents in China. In Malaysia specifically, a number of cross-sectional studies have been conducted on stress and eating behaviour, but most of them focused on adults and university students (Gan, Mohd Nasir, Zalilah & Hazizi, 2011; Ganasegeran et al., 2012b; Ngan et al., 2017; Ortega, Abdullah, Ahmad & Ibrahim, 2013). One cross-sectional study on Malaysian adolescents was found, but the generalizability of the study to the Malaysian population was very limited because it only covered the population of one district (Esra Tajik et al., 2015).

The relationship between stress and eating behaviour is thus an area that merits further investigation especially due to the increasing prevalence of stress and obesity worldwide. Furthermore, this relationship is understudied especially among the adolescent population. It is very important that this group remains healthy because an
unhealthy future generation will have major socio-economic implications for the nation. The changes in adolescence have health consequences not only in adolescence, but also over the life-course. It is also important to study this issue across different cultures in order to gain a clearer understanding of any similarities and differences among diverse population groups. Studies are also warranted to acquire a deeper understanding of the topic in order to guide appropriate and effective prevention and intervention strategies.

Therefore, this study aims to investigate the stress level experienced by Malaysian adolescents and its impact on their eating behaviour. It is hoped that the results of the study will assist in the development of effective prevention and treatment strategies to combat unhealthy eating behaviours and prevent their negative consequences, one of which is obesity among adolescents.

### **1.4.1 Public health implications**

The results of this study may be used as a strong basis upon which to formulate an evidence-based intervention. The increasing prevalence of stress, obesity and noncommunicable diseases nationwide has triggered the need to understand the relationship between changes in the stress level and the influence of stress on transitions in eating behaviour. Obesity is a major and common nutritional problem among adolescents. The knowledge gained about adolescents' eating behaviour will help the public health sector to further understand the obesity pathway. This will assist in designing obesity intervention programmes that are more effective

One of the key aims of this study is to improve the current stress management and obesity prevention programmes that are targeted at adolescents, specifically in Malaysia. The Clinical Practice Guidelines (CPG) on management of Obesity developed in 2004 by Ministry of Health, Malaysia focused mainly on adults with only three pages dedicated to childhood and adolescent obesity management. This study also aims to give a strong emphasis to incorporating emotional and behavioural factors into the design of preventive programmes. This study is also geared towards achieving the goals of the National Strategic Planning of Non-Communicable Diseases Prevention (NSP-NCD) 2016-2025 which are targeted on combating obesity among children and adolescents. It is also hoped that this study will promote more research on this understudied area that looks into the possible factors underlying obesity especially among the younger Malaysian population (0–14 years), which accounts for approximately 24.5% of the total population in 2016 (Department of Statistics, 2016).

# **1.5** Research Questions (RQ):

RQ1: What is the magnitude of stress experienced by adolescents in Malaysia?

**RQ2**: What are the distribution of stress among the Malaysian adolescent population? **RQ3**: Do school examinations affect the stress level of Malaysian adolescents? And if so, is it a significant life stressor?

RQ4: Do Malaysian adolescents practise healthy eating behaviour?

**RQ5**: How are eating behaviours distributed among the Malaysian adolescent population?

**RQ6**: Does a change in the stress level experienced by adolescents affect their eating behaviour patterns?

RQ7: How do Malaysian adolescents cope with stress?

**RQ8**: What are the factors that may significantly influence the transition of eating behaviour pattern among Malaysian adolescents?

# 1.6 Study Objectives

#### **1.6.1** General objective

The general objective of this study is to investigate the association between stress and transition in eating behaviours of Malaysian adolescents.

### **1.6.2** Specific objectives (SO)

The specific research objectives pursued to achieve the research questions are:

- i. To determine the prevalence and distribution of stress among Malaysian adolescents;
- To determine the prevalence and distribution of eating behaviours among Malaysian adolescents;
- iii. To study the effect of change in stress levels on transition of eating behaviours among Malaysian adolescents;
- iv. To determine the coping strategies adopted by Malaysian adolescents to overcome stress; and
- v. To study the factors that may affect the transition of eating behaviours among Malaysian adolescents.

The first specific objective will answer RQ1 and RQ2. The research being a cohort study of two time points will enable the researcher to investigate and compare the prevalence and distribution of stress between the near examination period and during normal school days. This aspect of the research will provide answer to RQ3. The second specific objective will answer RQ4 and RQ5 while the third specific objective will provide answer to RQ6. The fourth specific objective will answer RQ7. The fifth objective focus on answering RQ8.

# **1.7** Research Hypothesis

## N<sub>0</sub> (null):

Stress is not associated with a stronger drive to eat and a lower ability to control eating. The change in stress level of an adolescent between two time points do not affect the transition of his/her eating behaviour; whether it improves or worsens. The coping strategies adopted when dealing with stress do not mediate the relationship between stress and the transition of eating behaviour patterns.

### N<sub>alt</sub> (*alternative*):

Stress is associated with a stronger drive to eat and a lower ability to control eating.

The change in stress level of an adolescent between two time points affects the transition of his/her eating behavior; whether it improves or worsens.

The coping strategies adopted when dealing with stress mediate the relationship between stress and the transition of eating behaviour patterns.

## **1.8 Operational Definitions**

- 1. <u>Perceived stress</u>: Perceived stress is defined as the feelings or thoughts that an individual has about how much stress they are under at a given point in time or over a given time period (Phillips, 2013).
- 2. <u>Eating behaviour</u>: Eating behaviour is defined as the behavioural response associated with eating which may include mode of feeding, pattern of feeding and time interval of feeding (Wardle, Guthrie, Sanderson, & Rapoport, 2001).
- 3. <u>Satiety responsiveness</u>: The ability to reduce food intake (Wardle et al., 2001).
- 4. <u>Food responsiveness:</u> The urge to eat when one sees, smells or tastes palatablefood (Wardle, 2007).

### **1.9** Assumptions

The assumptions for this study are:

- 1) Stress level and eating behaviours patterns are measurable.
- The information related to personal background, perceived stress level, stress coping strategies and eating behaviours obtained are assumed to be true.

3) The participants in the study represent 16-year-old students who normally would experience more stress prior to major school examinations compared to normal days.

### **1.10** Organization of the Thesis

Chapter 1 provides an overview of the global burden of mental illness and its health consequences, focusing specifically on stress and eating behaviour among the adolescent population in Malaysia and in other countries, as well as justifying the significance of the current study. Chapter 2 describes the literature reviewed concerning stress and eating behaviour. Chapter 3 details the method and instruments used to conduct this study. Chapter 4 describes the results and the findings of the study. Some of the findings have been submitted to journals during the submission of the thesis and are pending publication. Chapter 5 discusses the results in relation to what is known from previous works as mentioned in the literature review and also in local settings. Chapter 6 concludes this study by placing the findings in the context of existing policies and frameworks for adolescent health in Malaysia.

# 1.11 Summary

Chapter 1 explained why it is vital to study the health of Malaysian adolescents and described how this should be done, focusing specifically on mental health and obesity. The research questions and objectives presented in this chapter are in line with the research that has already been conducted on this topic. The study will be of value to other research conducted on similar areas.

#### **CHAPTER 2: LITERATURE REVIEW**

#### 2.1 About this chapter

Chapter 2 attempts to present a current, broader picture of stress and eating behaviour among adolescents. This is done by reviewing the popular theories on the association between stress and eating behaviour, the conceptual framework used and the policies pertaining to this issue both globally and locally. The literature search was undertaken from the year 2000 onwards to maintain relevancy. The definitions commonly used, prevalence of this issue and the factors associated with this topic are also discussed.

# 2.2 Perceived Stress and 'True Stress'

A person's perception of the level of stress that affects their health is conceptually distinct from the amount of stress an individual actually experiences. An individual could report experiencing very little stress and yet stress could be having a huge physical impact on their health. Stress is psychological in nature, thus the concept of stress has become one of the psychological concepts that are measurable by the use of questionnaires. Over time, psychological symptoms in order to assess the psychological factors that are associated with stress in humans. Among the widely used perceived stress questionnaires is the Cohen Perceived Stress Scale (CPSS) questionnaire, which was first developed and tested in 1983 (Cohen & Janicki-Deverts, 2012; Cohen, Kamarck, & Mermelstein, 1983).

The CPSS subjectively measures the degree to which a situation in a person's life is appraised by them as stressful. The items were designed to tap how unpredictable, uncontrollable and overloaded respondents find their lives. It has adequate internal and test-retest reliability and is correlated in the expected manner with a range of self-report and behavioural criteria (Cohen & Janicki-Deverts, 2012). The questionnaire has been empirically validated with populations of mainly college students and workers in various cultures and countries and has been translated into 25 languages other than English (Lee, 2012). In Malaysia, this questionnaire has been translated into the national Malay language also known as 'Bahasa Melayu' and its usage has been validated among Malaysian adolescents (Al-Dubai, Al-Naggar, Alshagga, & Rampal, 2011).

The interpretation of a situation as being stressful by an individual will trigger the activation of the hypothalamic–pituitary–adrenal (HPA) axis whereby neurons in the hypothalamus releases a hormone called corticotropin-releasing hormone (CRH). The release of CRH triggers a subsequent reaction and the release of another hormone called adrenocorticotropin (ACTH) from the pituitary gland in the brain. Then, ACTH travels in the blood and reaches the adrenal gland located above the kidneys and triggers the secretion of 'stress hormones'. There are two main types of stress hormone: glucorticoids and catecholamines. Cortisol is the major glucorticoid produced in the adrenal cortex while epinephrine and norepinephrine are the major catecholamines (Carrasco & Van de Kar, 2003). Under a normal non-stressed condition, cortisol secretion shows circadian rhythmicity whereby concentrations are highest in the morning and drop to their lowest value at night (Hucklebridge, Hussain, Evans, & Clow, 2005).

In response to stress, the cortisol level rises independently of the circadian rhythm (Miller, Chen, & Zhou, 2007). In blood, 5 to 10% of cortisol is in an unbound or biologically active form. The unbound serum cortisol enters saliva through intracellular mechanisms and remains unbound to protein. Studies have consistently reported a high correlation between serum and saliva cortisol, which indicates that saliva cortisol can reliably estimate serum cortisol levels (Daniel et al., 2006). Over the past few years, salivary cortisol has become the most popular biomarker in stress studies in which it is used as an objective measurement of stress level (Hellhammer, Wust, & Kudielka, 2009). The saliva cortisol level is sometimes referred to as the measurement of 'true stress'.

Many assay techniques are available to quantify free cortisol from saliva samples. The most common assay is the enzyme immunoassay (EIA). The technique relies on the principle of competitive binding between free cortisol and reagents. Cortisol in standard solutions and saliva samples will compete with cortisol conjugated to horseradish peroxidase (HRP) for the antibody binding sites on a microtiter plate coated with monoclonal anti-cortisol antibodies. This process is shown in Figure 2.1.



**Figure 2.1: Test Principle of Competitive Immunoassay** 

After incubation, the unbound components are washed away. The bound cortisol enzyme conjugate is then measured by the reaction of the HRP enzyme to the substrate tetramethylbenzidine (TMB), which produces a blue colour. This process is shown in Figure 2.2.



Figure 2.2: Reaction of HRP to TMB Substrate

The use of an acidic solution stops the HRP enzyme reaction to the TMB substrate, forming a yellow colour. The optical density of each well is then read on a standard plate reader at 450 nm. The amount of cortisol enzyme conjugate detected is inversely proportional to the amount of cortisol present in the sample (Salimetrics, 2016).

### 2.2.1 Prevalence of stress among Malaysian adolescents

In Malaysia, according to NHMS IV, 2011, the prevalence of stress among Malaysian adolescents below 15 years old rose from 13% in 1996 to 20% in 2011 (Institute for Public Health, 2011). The overall prevalence was reported to have fallen to 12.1% during NHMS 2015 (Institute for Public Health, 2015). The explanation of the decrement in survey findings should consider the instrument used and target population. The survey in NHMS V, 2015 used the Strength and Difficulties Questionnaire (SDQ: 25 items) while the previous NHMS surveys used the Reporting Questionnaire for Children (RQC: 10 items). Both assessment tools obtained information on the mental health of the children from parents or guardians. There was also a marked difference between the sample sizes of the surveys conducted. A total of 5768 participants were involved in the NHMS IV, 2011 survey and 5182 were involved in the NMHS V, 2015 survey, which is

a much lower number than the 14,550 and 11,949 participants who took part in the surveys conducted in NHMS II, 1996 and NHMS III, 2006, respectively (Ahmad et al., 2015) . The percentage of participants involved aged between 13 and 15 years old also showed a marked difference with only 7% in 1996 as compared to 24% and 26% in 2006 and 2011, respectively. It is thus questionable as to whether the rise and reduction in the prevalence rate is a true reflection of the situation in the country or a result of differences among the samples. It should also be noted that it is stated that the aim of NHMS IV, 2011 was to analyse the data only up to the national level, unlike NHMS II, 1996 and NHMS III, 2006 which aimed to analyse the data up to the state level (Ahmad et al., 2015). For adults aged 16 years and above, the General Health Questionnaire (GHQ: 12 Items) was used and the prevalence of mental health was reported to have also increased, in this group from 10.7% in NHMS II, 1996 to 29.2% in NHMS V, 2015 (MOH, 2015).

Another major survey in Malaysia is the Healthy Mind Programme Survey (HMPS), which was first conducted in 2013 and involved 157 secondary schools. The HMPS reported that 7% out of 19,919 16-year old secondary school students were experiencing severe and extremely severe stress, anxiety and depression (New Straits Times, online, Monday, 06 January 2014 08:23). The survey used the Depression-Anxiety-Stress-Score (DASS) questionnaire as the survey instrument. Despite the very large sample size of the HMPS, the percentage of stress reported is not as high as that reported by all the NHMS surveys. Nevertheless, the HMPS survey result alerted the authorities to the seriousness of the mental health problem among adolescents in the country. The survey was therefore extended to involve another two batches of 14-year old and 17-year old secondary students for the subsequent years. It was also scheduled to be conducted annually.

In addition, a study by Ahmad et al, 2014 reported that, based on the Malaysia Global School Health Survey conducted in 2012, the prevalence of suicidal ideation among Malaysian adolescents was 7.9% and positively associated with stress (Ahmad et al., 2014). The prevalence was found to be higher in females and non-Malays. Another study conducted in 2010 among Malaysian government secondary schools reported a higher prevalence of suicidal ideation of 26.1% (Yusoff, Abdul Rahim, & Yaacob, 2010). However, the population studied was small (n = 100) and involved only Malay students in the state of Kelantan, a state that is highly populated by Muslims. Therefore the result is not representative of the Malaysian general population which is multi-ethnic and multicultural. In 2011, the WHO expected figures of mental health problems among adolescents was approximately 20%, thus the prevalence in the study by Yusoff et al. (2010) was found to be relatively higher (World Health Organization, 2012).

### 2.2.2 Academic excellence as an important stressor

This study aims to investigate the perceived stress level of adolescents during the near-exam period and normal school days and the transition in the stress level between the two time points. It is hypothesized that adolescents are exposed to higher stress during the near-exam period as compared to during normal school days because of the expectation of parents and teachers that they achieve academic excellence. Some earlier studies have identified academic expectations as an important stressor among Malaysian adolescents (Ahmad et al., 2014; Hashim, 2007). In the HMPS that was conducted in 2013, among the stress risk factors identified, besides individual personality, social, family and interpersonal problems, was the high expectations of parents that their children achieve academic excellence (Ahmad et al., 2014). Another study on stress, coping and social support in adolescent years conducted among 209 Form 4 adolescents in rural and urban settings in Malaysia reported that adolescents generally consider their life stressful

(Hashim, 2007). Among the identified stressors reported by Hashim (2007) are academic expectation (77%), relationship at home (34%) and relationship at school (31%). The strength of Hashim's (2007) study lies in the fact that it covered both the urban and rural population and participants were interviewed rather than asked to complete a questionnaire themselves. However, details of the validation of the questionnaire were not included (Hashim, 2007). Another study on stress, stressors and coping strategies also reported that academic-related problems are among the major stressors identified among adolescents (M. S. Yusoff, Abdul Rahim, & Yaacob, 2010). The main concern of expressed by the participants in the study by Yusoff et al. (2010) was whether they would be able to secure a place in tertiary education. However, the study was limited in that all the participants were Malay, thus generalization to the wider Malaysian population is not appropriate.

The earlier studies conducted in Malaysia on stress among adolescents were crosssectional studies, thus the results presented relate to only a single time point. Longitudinal and observational studies are thus warranted to better understand the changes in the mental health of Malaysian adolescents at different time points, which will enable the plotting and prediction of their mental health pattern. This study is the first cohort study to assess the stress level of the same cohort of students at two different time points and the identification of any changes in stress level between the two time points would provide a new perspective on the problem in Malaysia.

# 2.3 Stress and Eating Behavior

Studies on both humans and animals have linked stress to changes in eating behaviours. It has been shown that stress is associated with greater food intake. Laboratory studies on animals have reported that exposure to chronic stress increases consumption of palatable food by animals (Dallman et al., 2003; Groesz et al., 2012). Human laboratory studies have also reported that exposure to ego threats leads to greater cortisol reactivity which results in the subject eating a greater quantity of sweet and high-fat foods (Epel, Lapidus, McEwen, & Brownell, 2001). In another observational study on a human cohort exposed to stress in a real-life situation, high cortisol reactivity and greater snack intake were observed in stressed participants (Newman, O'Connor, & Conner, 2007). However, there are contradictory findings in some of the literature, which states that stress may affect eating in two different ways. Most individuals increase food consumption during stress but some may experience a reduction in food intake followed by a loss of weight during or after stress (Epel et al., 2001). Therefore, understanding the physiological mechanism underlying the relationship between stress and eating behaviour is essential to assist in development of an effective intervention.

## 2.3.1 Physiological response to stress

Life is stressful and exposure to numerous stressors is unavoidable. Stressors can be short term, known as acute stress, or can occur on a daily basis, known as chronic stress (Torres & Nowson, 2007). Acute stress triggers both the active 'flight and fight' pattern through the activation of the sympathetic adrenal medullary axis and the passive pattern through the HPA axis (Figure 2.3).



Figure 2.3: Physiological Response to Stress (Torres & Nowson, 2007)

The initial stimulation of the HPA axis leads to the release of CRH which has been reported to suppress appetite to allow the body to deal with the stressful stimulation. However, during the later stage of the event, while recovering from stress, cortisol is released and this is known to be the factor that stimulates appetite and increases food intake (Torres & Nowson, 2007). While the stimulation of the HPA pathway explains its possible role as a mediator for obesity, the release of hormones through the sympathetic adrenal medullary pathway contributes to the development of non-communicable diseases such as hypertension and hypercholesterolemia. Managing daily stressors appropriately and preventing extreme stress is thus very important for dealing with the rising trend of obesity and the prevalence of non-communicable diseases worldwide. Ghrelin is another hormone that is associated with feeding behaviour and energy homeostasis. It is principally synthesized in the stomach but is also expressed in other tissues such as the pancreas and kidneys. Recent studies highlight that ghrelin targets the brain to regulate a diverse number of functions including learning, motivation, stress responses, anxiety and mood by regulating the HPA axis. Studies to date report a variable association between ghrelin and mood disorders and the use of ghrelin as an intervention has yet to be extensively investigated (Spencer et al., 2012).

#### 2.3.1.1 Stress, obesity and adiposity

Obesity/overweight and underweight are terms used to define individuals who fall into a weight range that is respectively above or below what is generally considered healthy for a given height. These terms are commonly applied based on the use of the BMI, which is defined as the weight in kilograms divided by the square of the height in metres (kg/m<sup>2</sup>). The BMI value is independent of age or gender. A higher BMI is usually associated with higher health risks; however, the interpretation of the range may differ between populations. The BMI cut-off points for adults in Asian and Pacific populations for example are postulated to differ from those for Europeans (WHO expert consultation, 2004). The amount of an individual's body fat does correlate with the BMI. However, the BMI does not measure body fat. Thus, it is important to realize that well-built individuals such as athletes may have a BMI that puts them in the overweight range, but that this is not actually due to excess body fat. Skinfold thickness, waist circumference (WC) measurement and waist-to-hip (WTH) circumference ratios are some of the other methods that can be used to estimate body fat distribution. The WC reflects the amount of abdominal fat, which help in predicting the risk of obesity-related diseases.

In children, a high amount of body fat can lead to weight-related diseases and other health issues. For children and teenagers, the BMI is age and sex specific, thus it is often referred to as a BMI for age. The BMI of children and teenagers is expressed as a percentile, which is obtained from a graph. The BMI derived from age percentile growth charts is the most commonly used indicator for measuring the size and growth pattern of children and teenagers. The categories and corresponding percentiles are based on expert committee recommendations (Centre for Disease Control, USA). The International Obesity Task Force (IOTF) index has also been used to define overweight and obesity in girls and boys at different ages between 2 and 18 years old. The index was initially published in 2000, based on data collected on 180,000 children in Brazil, the United Kingdom (UK), Hong Kong, Netherlands, Singapore and the USA (Cole, Bellizzi, Flegal, & Dietz, 2000). In 2007, Cole and colleagues published a new curve defining underweight in children and adolescents. Like overweight, BMI for underweight also varies with age and gender (Cole, Flegal, Nicholls, & Jackson, 2007).

Reports on the associations between stress exposure and adiposity among adults are available but there is limited data on children and adolescents. A prospective population-based cohort study conducted in Finland by Jaaskelainen et al. (2014) reported that the prevalence of stress-related eating is higher among adolescent girls at 43% compared with boys at only 15%. The authors found that stress-related eating is associated with obesity and that the obese adolescents consumed sweet and fatty foods more often than peers without stress-driven eating behaviour. However, the OR is low at only 1.18 (95% CI: 1.02-1.36, p = 0.018). Jaaskelainen et al. (2014) also reported that, in general, stress-driven eaters (SDEs) have greater BMI and WC as well as a more frequent consumption of chocolates, sweets and soft drinks as compared to non-stress-driven eaters (NSDEs). However, their study did not investigate the association between stress and eating behaviour. The participants were grouped into a SDE and a NSDE group based on answering a single question that inquires whether they try to cope with stress by eating. The association between sweet, salty snack-type foods and body composition parameters

was then tested for the two groups. The strength of the study by Jaaskelainen et al. (2014) lies in the large sample size of a population-based cohort. However, the assessment tool, which was a non-standardized self-administered questionnaire may have affected the accuracy and validity of the results. The authors also state that there is a need for more studies to describe the etiological relationship between stress and eating behaviour during adolescence (Jaaskelainen et al., 2014).

Another observational study, which was conducted among European adolescents by De Vriendt et al. (2012) investigated the association between perceived stress and adiposity. In the study, it was reported that perceived stress is significantly associated with increased measures of general and abdominal adiposity in girls, whereas no such relationship between perceived stress and adiposity measures was observed in boys. De Vriendt et al. (2012) also reported that school is an important source of adolescent stress and should be the focus of stress management campaigns. Hudson (2014) in another European study reported that the psychological factor of a recent stressful life event is associated with the BMI only in adolescent girls. Furthermore, a cross-sectional study on the association between stress and dietary practices among European adolescents reported that stress is associated with a greater amount of fatty food intake, less fruit and vegetable intake, more snacking, and a reduced likelihood of daily breakfast consumption (Cartwright et al., 2003).

Tajik et al, 2014 conducted a systematic review involving ten articles from 1989 to November 2013 concerning stress and the contributing factors that lead to obesity among adolescents concluded that obesity is a consequence of stress among adolescents and is exacerbated by the wrong eating attitude (E. Tajik, Zulkefli, Baharom, Minhat, & Latiff, 2014). Thus, developing appropriated food choices especially among the younger generation may help prevent obesity and other complications in adulthood. The review

also stated that gender and economic status are the main components that affect obesity in stressed adolescents. Tajik et al., 2014 recognized limitation in their study and suggested that laboratory studies are needed to measure the stress level in acute or chronic stress in order to better demonstrate the presence of significant overeating. This limitation is addressed by this study, which uses the saliva cortisol biomarker as an objective stress measurement.

#### 2.3.2 Theories on stress mechanism and eating behaviour

The theory of cognitive appraisal proposed by Lazarus and Folkman in 1984 is remarkable and remains the cornerstone of psychological stress and coping research across multiple fields (Lazarus, 1985). The theory explained the mental process which influence stressors; in which a person's evaluative judgement of a situation determines his or her emotional response to it. According to Richard Lazarus, stress is a two-way process which involves the production of stressors by the environment and the response of individual subjected to these stressors. The theory stated that cognitive appraisal occurs when a person considers two major factors that majorly contribute in his response to stress which are (1) the threatening tendency of the stress to individual and (2) the assessment of resources required to minimize, tolerate and eradicate the stressor and the stress it produces. The key components of his theory focus on problem focused and emotion focused coping taxonomy (Lazarus, 1985). The finding of this study may thus help in further advancement in this field by looking into the stressors, resources (family and environmental factors) and coping strategies adopted by the adolescents as potential mediators of their eating behaviour outcome.

The theory of planned behaviour (TPB) is another theory that may help guide the focus of this research. The TPB theory initially started as the Theory of Reasoned Action in 1980. It was developed to predict an individual's behaviour to engage in a behaviour

at a specific time and place. The theory helped to explain all behaviours over which people have ability to exert self-control. TPB states that behavioral achievement depends on both motivation (intention) and ability (behavioral control). TPB model suggests that intention is directly driven by three major constructs which are attitude, subjective norms and perceived behavioural control. The stronger the intention, the more likely an individual will perform the behaviour. In the case of eating behavior, TPB has been utilized in some country as a theoretical framework to identify attitudes that promote healthy eating and discrete food choices behavior (Fila & Smith, 2006; McDermott et al., 2015). A review by McDormett et al, 2015 on 42 journal articles and four unpublished dissertations reported that higher intention-behaviour associations were found for older, compared to younger age groups individuals

#### 2.3.3 Psychological factors affecting eating behavior among adolescents

Research among the adult populations has shown that stress is associated with both increases and decreases in food consumption. However, there is a lack of research on this topic among the adolescents; especially in the Asian population. In Malaysia, Ganasegeran et al. (2012a) conducted a study on 132 medical students at university in order to assess the relationship between the patterns of their eating habits and associated social and psychological factors and reported that the eating habit score is lower in those with poor psychological factors. The authors considered their study to be novel because no studies in Malaysia had ever tried to relate psychological factors such as stress with eating habits or behaviours. However, the study by Ganasegeran et al. (2012a) focused on medical students who are in their early adulthood, rather than on adolescents. Since no study as such was found in Malaysia that tackles this issue among adolescents aged below 18 years of age, as reported by Ganasegeran et al. (2012a), this study will fill an important gap in knowledge regarding the relationship between the psychological factor of stress and eating behaviour among school-going adolescents. Another study in Malaysia by Gan et al. (2011) was also conducted among undergraduate medical students in order to examine the mediating role of psychological distress in disordered eating. However, the study focused more on disordered eating among the underweight such as those with bulimia and anorexia than on those who were overweight and obese (Gan, Mohd Nasir, Zalilah, & Hazizi, 2011). In Asia, a crosssectional study among Chinese adolescents in Jiangsu Province China revealed a positive correlation between emotional symptoms, life stress and eating behaviour (Hou et al., 2013). The authors declared that theirs was the first study to investigate adolescent eating behaviours in China. The literature search revealed that a limited number of studies have investigated the association between stress, eating behaviour and adiposity among adolescents in Asia as compared to the West. The results of this study thus will provide a clearer understanding of the similarities and differences across different cultures.

Worldwide, there is also a lack of research reviews on stress and its link to changes in eating behaviour. A systematic research review and meta-analysis was only recently published by Hill et al in 2018 (Hill, Moss, Sykes-Muskett, Conner, & O'Connor, 2018) involving 28,070 participants aged between 8 to 18 years old in 13 studies. Hill et al, 2018 reported that overall stress was not associated with a change in overall eating behaviours. However additional analysis indicated that stress was associated with unhealthy eating behaviours in both younger and older children, with the impact of unhealthy eating may begin as early as 8 or 9 years old. Out of the 13 studies selected, the review included only 1 longitudinal study while the other 12 studies were cross sectional in nature. Hill et al, 2018 also highlighted in her report the need of a longitudinal study to investigate how stress could influence children's health over time and the detrimental impact of stress on the children's weight status as they move into adulthood. A need for a longitudinal research in this field thus is very much indicated, to investigate further the role of psychological, behavioural and endocrine factors in the development of stress-related eating in children and to fill the gaps of having very limited longitudinal studies focusing on this area.

#### 2.3.3.1 Other determinants of eating behaviour

Eating behaviour may be influenced by both internal and external determinants including food availability, knowledge, attitudes, emotional state and the experiences of the individual (Wardle, 2007). An interesting study on healthy eating behaviour was conducted to identify factors influencing eating behaviour among Ecuadorian adolescents from the different perspectives of parents, school staff and the adolescents themselves (Verstraeten et al., 2014)<sup>-</sup> It was a large qualitative study involving 20 focus groups consisting of 144 participants from both rural and urban areas. The study used a socio-ecological model to assess the influence of behavioural and environmental factors on eating behaviours in low- and middle-income countries.

Verstraeten et al. (2014) reported that parents, school staff and adolescents are aware of the importance of healthy eating and acknowledged the impact of the sociocultural environment on the adolescent eating pattern. The perceived barrier to healthy eating identified includes the high cost of healthy food and its availability. However, this barrier differs between socio-economic groups because the higher-income population reported that they do not feel that cost is a barrier (Verstraeten et al., 2014). The conceptual framework designed by Verstraeten et al. (2014) included individual factors such as financial autonomy, habit, peer norms and lack of self-control (Figure 2.4).



Figure 2.4 : Conceptual Framework for Eating Behavior in Ecuadorian adolescents (Verstraeten et al., 2014).

However, emotional and psychological factors such as stress were not included in the conceptual framework. Other important factors not included in the framework but that may affect the eating behaviour of adolescents are environmental factors. The school environment for example may provide poor nutritional quality food whether in the cafeteria or sold by vendors outside the school compound. Home and family environment may also play an important role in influencing the eating behaviour of adolescents. This include parents acting as role models for healthy eating habits, the quality and type of food prepared at home and the family meal pattern such as the habit of eating at home versus frequent restaurant and fast food meals. In their report, Verstraeten et al. (2104) acknowledged that the depth of the stress among adolescents was not explored as much as compared to the stress exposure and effect among adults. The factors and limitation mentioned above will be addressed by this study to fill the gaps identified.

Numerous studies on the eating behaviours of Malaysian adolescents are available (Chin & Mohd Nasir, 2009; Loh, Moy, Zaharan, & Mohamed, 2013; Soo, Shariff, Taib, & Samah, 2008), but research on the association between stress and eating behaviours have only been conducted among university students and working adults (Gan, Mohd, Zalilah, & Hazizi, 2011; Ganasegeran et al., 2012). A study on eating behaviours among 407 multi-ethnic female adolescents in Kuantan, Pahang using a self-administered questionnaire reported that the majority of participants were normal weight (75.4%), 18.7% of the participants were overweight and only 5.9% of the participants were underweight. Approximately 30% of the participants never skipped main daily meals but 52.6% skipped at least one major meal per day. Also, 11.5% reported frequently skipping all three major meals in a day. The unhealthy eating behaviours identified among these adolescents mainly are meal skipping, snacking and practising weight loss attempt behaviours. Meal skipping was found to be associated with ethnicity, body weight status and the presence of eating companions. However, the association between eating behaviour and stress was not studied (Chin & Mohd Nasir, 2009).

Another study among 554 adolescents in secondary schools in Kuala Lumpur reported that among the important factors influencing eating behaviour identified were gender, ethnicity and weight status (Loh et al., 2013). In the study by Loh et al. (2013), obese adolescents were reported to express attraction towards food. The two studies (Chin & Mohd Nasir, 2009; Loh et al., 2013) investigated body composition as a predictor of eating behaviour patterns. However, both studies are cross-sectional studies and the findings relate to only a single time point.

In Northern California, USA, another cross-sectional study among women with a mean age of 28.5 years old that was conducted to assess the relationship between stress, the drive to eat and the food consumption pattern found that higher reported stress is associated with a stronger drive to eat and ineffective attempts to control eating (Groesz et al., 2012). The authors also reported that exposure to stress in these women leads to a greater drive to eat and this was found to be an important factor in promoting excessive weight gain among these women. Groesz et al. (2012) reported that perceived stress is

associated with inability to control overeating (r = 0.321, p < 0.001), greater hunger (r = 0.327, p < 0.001) and frequent binge eating (r = 0.362, p < 0.001). The authors also reported that perceived stress is associated with decreased healthy eating of foods such as vegetables and wholegrain foods. The study by Groesz et al. (2012) is a pioneer study as it tests the association between stress exposure and drive to eat indices in a large sample population (n = 561). Moreover, the study improves our understanding of the role of the drive to eat in relation to stress, but again, this is a cross-sectional study based on data from a single time point (Groesz et al., 2012).

Based on the results of a meta-analysis on 14 cohorts examining the association between psychosocial stress and objectively measured adiposity by Wardle et al, 2011, it was reported that 69% of the analyses found no significant relationship between stress and adiposity. However combining results in meta-analysis showed that stress was associated with increasing adiposity and effects were stronger for men than women. (Wardle, Chida, Gibson, Whitaker, & Steptoe, 2011). Psychosocial stress thus is a risk factor for weight gain despite the effects are small. This thus indicates that there is a need for more longitudinal studies to further investigate the relationship between stress and obesity, and these studies should also consider the eating drive as a potential mediator.

### 2.3.4 Intervention programmes for stress and eating behaviour

To date, there are no intervention programmes for Malaysian adolescents that specifically integrate the issues of stress and eating behaviour. However, the Ministry of Health, Malaysia has implemented a number of initiatives to promote a healthy lifestyle among the population. The main programme conducted annually by the ministry is the National Healthy Lifestyle Campaign which has been conducted annually since 1991 and promotes the theme 'Be Healthy for Life'. The campaign targets the general population emphasizing five main components: healthy eating, managing stress, adequate exercise, physical activity and not smoking (Ministry of Health, 2010). However, the execution of the campaign on stress and healthy eating had been conducted as two separate entities without highlighting the association and interaction effect between the two components.

Programmes developed specifically to address nutritional issues are included in the National Plan of Action for Nutrition of Malaysia (NPANM) 2006–2015. The NPANM programmes include those that promote infant and young child nutrition, adolescent nutrition and adult nutrition through healthy eating. Stress and mental health is being tackled as a separate issue through the mental health awareness campaign whereby the focus regarding the potential effect of stress is more on involvement with high-risk behaviours such as alcoholism, drug abuse, violence and suicide attempts (Ministry of Health, 2010). The relationship between stress, the drive to eat and obesity is considered a new field that is in need of more supportive evidence before the issue can be incorporated into health promotional programmes that are more comprehensive in scope.

# 2.4 Coping Strategies for Stress

Coping is often defined as efforts to prevent or diminish threat, harm and loss, or to reduce associated distress (Carver & Connor-Smith, 2010). Stress is experienced by every human being when they confront situations that exceed their ability to manage them. Individuals respond to these threats by coping in diverse ways. Human coping abilities are thus essential in determining the outcome of stress perceived by each individual, whether positive or negative. In adolescents specifically, persistent high stress levels will in the long run impair their academic achievement, as well as their personal and professional development.

### 2.4.1 Theories on Improving Adolescent Stress Responses

A research by Yeager et al in 2016 has integrated the biopsychosocial model (BPS) model of challenge and threat with implicit theories of personality to show how beliefs can impact situation-specific appraisals and regulate responses to social stressors (Yeager, Lee, & Jamieson, 2016). Yeager et al, 2016 in his study reported that adolescents taught an incremental theory of personality, which is the belief that people have the potential to change exhibited improve cognitive, physiological (neuroendocrine and cardiovascular) and behavioral (task performance) responses to acute social stress compared to controls. His study demonstrated that by delivering scheduled personality intervention to adolescents, the HPA-axis activation was reduced evidenced by significant reduction in cortisol and DHEA-S which later resulted in improving grades. He concluded in his study that an incremental theory of personality thus reduced threattype reactions known to compromise cognitive function both in short term and chronically thus mediate effects on school performance. Thus, it is important that adolescents view social difficulties as events that can be overcome and appraise them as challenges. Such appraisal would exhibit more adaptive coping thus setting in motion a positive recursive process that gains strength through its repetition (Yeager et al., 2016).

### 2.4.2 Coping strategies adopted by Malaysian adolescents

A study in Malaysia by Yusoff et al. (Yusoff et al., 2011) used the Brief COPE questionnaire to identify methods for managing stress. The originally developed COPE questionnaire initially consisted of 60 items with 15 coping dimensions. Then, in 1997, the Brief COPE was proposed, which consisted of only 14 scales with two items in each dimension (Carver, 1997). Since then, it has been used widely all over the world and a systematic review of its usage was published in 2011 (Krageloh, 2011). It was translated into the Malay language in 2011 and its usage has been validated among Malaysian

adolescents (Yusoff et al., 2011). The Brief COPE measures the frequency of an individual adopting the stated items to cope with stressful situations in daily life, which is rated by using four categories of responses from using it a lot (4) to not using it at all (1).

Another study by Yusoff et al among 505 secondary school students in Malaysia reported that the main coping strategy adopted by Malaysian adolescents is to turn to religion (M. S. B. Yusoff et al., 2011). However, it is not possible to generalize this result because the participants were predominantly Malay (99%). The authors reported that other coping strategies include the use of instrumental support, active coping, positive reinterpretation, planning and use of instrumental support (M. S. B. Yusoff et al., 2011). They also reported that distressed students tend to use negative coping strategies such as denial, behavioural disengagement and self-blame rather than positive ones. Also, students with low academic performance who adopt behavioural and self-blame as coping strategies have a greater risk of developing distress, whereas those who use planning as a coping strategy are at lower risk of developing distress (M. S. B. Yusoff et al., 2011). The authors however acknowledged that the sample size of the study was not representative of the study population in terms of school type because only four schools were selected. And they were a mix of national, technical, boarding and religious schools (M. S. B. Yusoff et al., 2011). The selected schools thus varied in terms of the academic and curricular system. The limitation in Yusoff et al, 2011 study is addressed in this study by its use of a large sample size, adolescents' populations from three different states, and from both urban and rural schools so that the results will be representative of the multicultural and multi-ethnic Malaysian population

Another study in Malaysia by Hashim (2007) that was conducted among 209 Form 4 students in Penang reported that a variety of coping strategies were used by adolescents depending upon the problem faced. The author also suggested that further investigations should be undertaken to determine how different types of coping affect an individual (Hashim, 2007). Hashim (2007) did not use any specific validated tool to measure coping; rather the coping strategy was measured by asking the students to report on the things they had done, still do and would do to overcome the problems faced. Some of the strategies reported by students when faced with academic problems were to study harder, to discuss the issue with their peer groups, request help from older brothers and sisters and to talk with teachers. Other problems faced such as relationships at home were dealt with by ignoring the problems and by talking to friends. The author suggested that research on coping should move beyond describing the type of coping and focus on how different types of coping affect different situations (Hashim, 2007). This gap will be addressed in this study by investigating the association between the coping strategies adopted by the adolescents and both the changes in stress level and the transition in eating behaviors.

# 2.5 Conceptual Framework

A conceptual framework was designed by the researcher to illustrate the main important variables to be explored by this study (Figure 2.5). This conceptual framework of this study was developed based on socio-ecological model. The socio-ecological model was first introduced as a conceptual model for understanding human development by Urie Bronfenbenner in 1970's and later formalized as a theory in the 1980s (Kilanowski, 2017). This model is a theory-based framework for understanding the multifaceted and interactive effects of personal and environmental factors that determine behaviours. This framework placed the adolescent in the center surrounded by various systems; thus, it considers an adolescent's behavioural development within the context of the systems of relationship that form his or her environment.



Figure 2.5 : Conceptual Framework developed by Researcher

The aim of this study is to investigate the relationship between stress and eating behaviour among adolescents; carefully considering and acknowledging other possible confounding factors in this association. In this research, the main predictor investigated is stress and the main outcome of interest is eating behaviour. Coping strategies adopted by adolescents are investigated as a possible mediator of the association between stress and eating behaviour. The independent variables are also comprised of possible confounding factors of eating behaviour that are divided into three main categories: individual, family and environmental. Numerous studies have reported that these categories of factors are possible determinants of eating behaviours of an individual. At the same time, these factors could also affect the stress level of an individual. The variables included in Figure 2.5 above represent the main factors on which this study aims to obtain findings.

The conceptual framework designed by Verstraeten et al., 2014 was also based on socio-ecological model and included individual factors such as financial autonomy, habit, peer norms and lack of self-control in his model. However, emotional and psychological

factors such as stress were not included in the conceptual framework. Other important factors not included in Verstraeten et al, 2014 framework; but these factors may affect the eating behaviour of adolescents are environmental factors. The school environment for example may provide poor nutritional quality food whether in the cafeteria or sold by vendors outside the school compound. Home and family environment may also play an important role in influencing the eating behaviour of adolescents. This include parents acting as role models for healthy eating habits, the quality and type of food prepared at home and the family meal pattern such as the habit of eating at home versus frequent restaurant and fast food meals. The missing factors were added into this conceptual framework, thus it is hope that this will add more information to help in understanding the relationship between stress and eating behavior among the adolescents.

# 2.6 Summary

In summary, stress and eating behaviour among adolescents is a very important topic, but there has been limited exploration of this topic, especially in Asia, and in Malaysia in particular. Where this topic has been studied in detail by investigating its prevalence, measurement and associated factors, most of the studies have been crosssectional and conducted among the adult population instead of among adolescents. This gap will be filled by this study because it draws on the strength of a longitudinal study that allows observation of changes in stress and transitions in eating behaviour instead relying on data from a single time point. The literature review revealed that the use of a suitable measurement tool is one of the key points to consider in designing a study to extend knowledge on this topic. The usage of the salivary cortisol biomarker as an objective measurement of stress in this study addresses this particular limitation. The usage of this biomarker will help in gaining a better understanding of the biological effect of stress on general health. The literature review also revealed that stress, eating behaviour and adiposity is a significant problem in the Malaysian population, but the extent and nature of the relationship among these factors is still underexplored in Malaysia. It is therefore hoped that this study will bridge the research gap that currently exists due to the limited data on stress, stressors, and eating behaviour as mediating factors and coping strategies among secondary school students especially in Malaysia.

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#### **CHAPTER 3: METHODOLOGY**

#### **3.1** About this Chapter

The earlier part of chapter 3 outlines the study design, study populations and sampling in general. The following description on sample size calculation, method of data collection and instruments will be discussed in two separate sections. The first section described on the methodology of the main study inclusive of questionnaire and anthropometric measurement methods. The second section focused on the study of the subsample participants selected for saliva cortisol analysis. Ethical consideration, information on data collected and attrition rate, statistical analysis used in this research and data weightage were described for both sections at the end of the chapter. The flow of this research and the details of the phases are shown in Figure 3.1 on the next page.



Figure 3.1: Study Flow Chart

# 3.2 Study Design

This study is a prospective cohort study on an ongoing larger longitudinal cohort study, the Malaysian Health and Adolescents Longitudinal Research Team Study or best known as MyHeART (Hazreen et al., 2014). The MyHeART study was a study conducted among students at the selected 15 public secondary schools in Malaysia. Secondary education in Malaysia lasted for five years with initial enrolment at 13 years old. The MyHeART study were initiated in 2012 involving the 13-year-old students as the pioneer cohort. This current study was initiated in 2015 when the cohort participants were 16-year-old. Prior to this study, the MyHeART cohort had been studied twice; in the year 2012 and 2014 respectively. The overview of the current study in relation to the original MyHeART study was shown in Figure 3.2.



Figure 3.2: Overview of Study Design

Two points data collection was applied in this study. The first data collection sessions in the selected schools were conducted in September and October 2015. The visits conducted were within two weeks prior to the final year national school examination. Second data collection sessions or also addressed as the follow up sessions were conducted approximately six months later in March and April 2016 when the students were 17-year-old. The follow up data collection sessions were conducted early of the year and thus were within at least three months away from major national school examinations. The follow up sessions were conducted together with the scheduled MyHeART follow up. No intervention was applied in this study thus it will not affect the outcome of the original MyHeART cohort in the long run.

During baseline data collection sessions in 2015, it was hypothesized that within this period the participants were under more stressful condition compared to normal days as final year school examinations were just around the corner. During the follow up sessions in early 2016, it was hypothesized that the students were relatively not in a very stressful condition as major examinations were quite a comfortable duration away. At baseline, socio-demographic and anthropometric data of participants were collected. Data on stress coping strategies were also collected using validated questionnaire to determine stress coping methods adapted by students when facing the stress of final year examination. Data on stress level and eating behaviour were collected at both time points. Stress level and eating behaviour patterns were measured subjectively using validated questionnaires on all participants. Objective measurement of stress was conducted using salivary biomarkers on subsamples participants.

# **3.3** Settings and Study Population

The target study population was from the original MyHeART study which included 1361 adolescents. These adolescents were recruited from selected 15 public secondary schools in three states in the northern and central zone of Malaysia namely Selangor, Perak and Kuala Lumpur (Hazreen et al., 2014). Federal territory of Kuala Lumpur is the national capital of Malaysia, the fastest growing metropolitan region in South East Asia. Selangor is Malaysia's most populous state with the nation's biggest conurbation, the Klang Valley which is centered in Kuala Lumpur. Perak is the second largest state in Peninsular Malaysia after Selangor. The MyHeART study area were shown in Figure 3.3.



Figure 3.3: Map of Malaysia highlighting the Study Area (Hazreen et al., 2014)

The participants for this study were school children of both genders aged 16 years who were attending the fourth year of these schools and were literate in Malay Language. Malaysian Ministry of Education has classified all the schools in Malaysia as either urban or rural school. Schools within a city or town municipality are considered as urban schools and the others are categorized as rural schools (Abdullah, 2003). All vernacular schools,
vocational, boarding schools, religious schools, private schools and schools for handicapped were excluded. The reason of exclusion was that they were not representative of Malaysian schools where majority of students attended. The syllabus, curricular activities and the rulings of these schools may affect the stress level of the students differently than the government funded secondary schools.

## 3.4 Sampling

## 3.4.1 Sampling frame

The sampling frame consisted of adolescents who met the inclusion and exclusion criteria from the selected schools. Those who met the criteria were considered as eligible for the study. The inclusion and exclusion criteria were listed below:

# 3.4.2 Subjects: Inclusion and exclusion criteria

#### 3.4.2.1 Inclusion criteria

Students aged 16 years old and in form four of the selected government's secondary schools, healthy and able to read and understand the national Malay language, Bahasa Melayu or English Language.

# 3.4.2.2 Exclusion criteria

Students who were diagnosed with psychiatric illnesses, confirmed by a psychiatrist and students with pre-existing chronic diseases or any known organic causes for obesity or underweight and on long term medications. Students who did not obtain consent from their parents were also excluded.

#### 3.5 Section I: Main Study

This section described on the methodology of the main study inclusive of sample size calculation, subject recruitment and sampling procedure of the main sample. The methods of data collection and study instrument used will focus on the questionnaire preparation and distribution and anthropometric measurement.

#### 3.5.1 Sample size calculation

The sample size to determine the perceived stress level and eating behaviour patterns among adolescents was calculated by using the G\*Power 3.1.9.2 software. Previous similar studies on the adolescents have never been conducted in this region thus the effect size was calculated based on the findings by Groesz et al, 2012 (Groesz et al., 2012). The partial correlation between stress and the 'drive to eat' indices control for age, BMI, education and income were being considered for sample size calculation. The statistical exact test: correlation of bivariate normal mode and type of power analysis; A priori to compute required sample size was selected. Alpha level of 0.05 was taken at the power of 80%. The one-sided test (one tail) was used as there is restriction on the direction of deviation of the sample from the null hypothesis. The null hypothesis is that in the population the true correlation  $\rho$  between two bivariate normally distributed random variables has the fixed value  $\rho$ 0. The alternative hypothesis is that the correlation coefficient has different value:  $\rho \neq \rho$ 0. The results of sample size calculation were shown in Table 3.1.

Stress Measures	Drive To Eat Indices	Pearson correlations (r)	P - value	Exposed	Non- Exposed	Total Sample Size
Perceived Stress	Palatable non- nutritious food intake	0.154	0.001	259	259	518
Perceived Stress	Hunger	0.327	< 0.001	56	56	112
Perceived Stress	Disinhibition	0.321	< 0.001	58	58	116
Perceived Stress	Frequent Binge Eating	0.362	<0.001	45	45	90
Stress Exposure	Palatable non- nutritious food intake	0.165	0.0001	225	225	450
Stress Exposure	Hunger	0.254	< 0.001	94	94	188
Stress Exposure	Disinhibition	0.233	<0.001	112	112	224
Stress Exposure	Frequent Binge Eating	0.289	<0.001	72	72	144

Table 3.1: Results of sample size calculation based on different effect size.

Based on the sample size calculation using the different effect size of the eating behavior indices, the effect size of the association between perceived stress and palatable non-nutritious food intake was selected. The minimum sample size required for the study was 518 subjects. However, a sample size of 783 subjects was selected in order to accommodate a non-response rate of 51% as encountered in the initial recruitment of the MyHeART cohort. Based on the MyHeART sample of 1361 subjects from 15 schools, the estimated sample to be recruited were approximately 90 subjects per school. The number of school to be selected randomly to achieve the sample size of 783 subjects from the cohort will be at least nine schools.

## 3.5.2 Subject recruitment and sampling procedure

The recruitment process of samples was initially discussed and finalized with MyHeART's principal investigator and coordinators. The lists of 15 schools involved in the MyHeART study were obtained. Eight schools are in the urban area and seven schools are in the rural area. Total participants of the initial cohort recruitment were 1361 students. Based on the sample size calculation, recruitment size required for this study was 783 participants. The number of schools decided to be recruited in this study thus were 11 schools.

Multistage sampling method was used to select the subjects. The method of sampling and randomization was based on two stages of cluster sampling. The primary sampling units were the schools and the secondary sampling units were the students. Random cluster sampling was performed and 11 schools were selected as clusters. Seven schools were located in the urban area and four schools were in the rural area. The selected schools were listed in Table 3.2 and shown on map in Figure 3.4.

No.	School Name	State	Location
1.	SMK Tasek Permai	Selangor	Urban
2.	SMK Datok Lokman	Kuala Lumpur	Urban
3.	SMK Desa Petaling	Kuala Lumpur	Urban
4.	SMK Datok Abu Bakar Baginda	Selangor	Urban
5.	SMK Sayong	Perak	Rural
6.	SMK Tun Perak	Perak	Rural
7.	SMK Sultan Abdul Aziz Shah	Selangor	Urban
8.	SMK Pinji	Perak	Urban
9.	SMK Seri Permaisuri	Kuala Lumpur	Urban
10.	SMK Raja Lope Nor Rashid	Perak	Rural
11.	SMK Tapah	Perak	Rural

 Table 3.2: Name of selected schools



**Figure 3.4: Location of Selected Schools** 

Prior to data collection, approval from the respective department were obtained. This include Ministry of Education, Malaysia and State Education Departments of Selangor, Perak and Federal Territory of Kuala Lumpur. The local authorities provided letters of authorization to the researcher for verification of the survey and team members involved. The selected eleven schools were visited and approval from the school principals were sorted out. The researcher also met the teachers in charged to set the date to conduct the study in the selected schools. All students involved in the previous MyHeART study in the selected schools were invited to participate in this research. Parent's consent form and introductory letter introducing the researcher and information sheets explaining the purpose of the research were distributed to interested participants. The forms were returned to the teachers in charged and collected by the researcher. Prior to the data collection process, the researcher met the potential subjects to determine whether they were qualified and meeting the inclusion and exclusion criteria. The response rate for this study was 79.6%. The sampling process was shown in Figure 3.5.



Figure 3.5: Stages of Subject Recruitment and Sampling Procedure

## 3.5.3 Study variables

In this study, eating behaviour was the main outcome and stress was the predictor investigated. Coping strategies were the main mediator of interest investigated by the researcher. Stress was analyzed in two ways; (1) according to baseline stress level of (i) high, (ii) moderate and (iii) low; and (2) according to change in stress level from baseline to follow up which include (i) increase, (ii) no change and (iii) decrease level. Since this is a cohort study, the final outcome studied was the transition of eating behavior from baseline to follow up; following the adolescents' stress reaction towards school examination. The transition of eating behavior was categorized into three which are (i) improved, (ii) no change or (iii) worsened. The relationship of the variables of interest were shown in Figure 3.6.



Figure 3.6: Transition of Eating Behavior Patterns following adolescents' stress reaction

All the variables were the outcome measures of socio-demographics background data, participants' stress level, eating behaviour patterns and coping strategies adopted by adolescents when dealing with stress.

The variables in this study are shown in Table 3.3.

### **INDEPENDENT VARIABLES**

#### Socio-demographics Background

(Categorical)

I.

#### **Background variables**

- i) Gender
- ii) Ethnicity
- iii) School's Location
- iv) Academic Achievement

#### **Individual Factors**

- i) Financial Autonomy
- ii) Intention to reduce weight
- iii) Eating as Coping Strategy
- iv) Body Mass Index
- v) Stress Coping Strategy

## **Family Factors**

- i) Parent's Education Level
- ii) Parents Marital Status
- iii) Family Meal Pattern
- iv) Parents as Role Model

#### **Environmental Factors**

- i) Canteen Food
- ii) Junk Food Vendor Outside School Compound
- iii) Purchasing Food Sold From Vendors Outside School
- iv) Frequency of Fast Food Consumption

## (Continuous)

- i) Anthropometric Measurements (Height, weight, body fat and waist circumference)
- ii) Stress Coping Strategy Score

#### II. Stress Level

(Categorical)

i) Baseline Stress Level

ii) Change in Stress Level (from baseline to follow up)

(Continuous)

i)	Subjective Stress Measurement	CPSS Score
ii)	<b>Objective Stress Measurement</b>	Saliva Cortisol Level

# **DEPENDENT VARIABLES**

# (Categorical)

i) Transition of Eating Behavior

#### (Continuous)

i) Eating Behavior Items Score

## 3.5.4 Data Collection and Study Instruments

Three types of data collection methods were utilized in this study which include (i) questionnaires, (ii) anthropometric measurement and (iii) salivary biomarkers sampling. This section will discuss only on the first two methods. Salivary Biomarkers sampling will be discussed in section II of this chapter. Study instruments used in this study included a set of self-administered questionnaires and calibrated equipment to measure the anthropometric measurements.

Baseline data collection was performed by a team consisted of three research assistants and led by the researcher herself. These assistants were briefed and trained by the researcher and competent officers prior to the data collection sessions. Follow up data collection were executed together with the MyHeART team consisting of approximately 20 officers and research assistants during each session. Prior to the follow up data collection process, the researcher and the assistants participated in a day of training session by principal investigator to familiarize them with the objectives, methodology and conduct of field work. The assistance was briefed on handling the adolescents having difficulties to answer the questionnaires. The training also included mock practical of measuring the anthropometric measurement.

To ensure the smoothness of the data collection process, the team leader made an appointment with the teachers in charged in every school through the school principal ahead of time to perform data collection. The team visited the selected schools and sorted with the teacher on the exact date and time and to ensure an appropriate and most convenient venue agreed by both parties to perform the data collection.

#### 3.5.4.1 Questionnaires

Data were collected using a set of self-administered questionnaire. On the morning of the data collection session, the teacher in charged gathered the students well prepared in a room or hall. Participants were briefed on what they were requested to do by the team leader. Questionnaires and pencils were distributed by the assistants. Participants completed the self-administered questionnaires without guidance from researcher approximately within 20 to 30 minutes and collected by the researcher immediately after completion.

Four sets of questionnaires were used to collect the data in this study, as attached in Appendix A. The questionnaires used were:

- 1. Socio-demographic background questionnaire
- 2. Cohen Perceived Stress Scale (CPSS) questionnaire
- 3. Child Eating Behavior Questionnaire (CEBQ) questionnaire
- 4. Brief COPE questionnaire

Explanation for each questionnaire were as follow:

# (1) Socio-demographic background questionnaire

The socio-demographic background questionnaire was developed by the researcher to obtain demographic data related to gender, ethnicity and possible confounding factors of eating behavior which include the individual factors, family factors and environmental factors.

The description of the question is as follow:

#### a. Individual factors

## i) Academic achievement

Academic achievement is being determined by inquiring students on their PT3 results; categorized into 4 categories which are: 1) 7As or more, 2) 4A to 6As, 3) 1A to 3As or 4) No A. PT3 stands for *Pentaksiran Tingkatan 3* or Form 3 Assessment. It is one of the major national school examination prepared by Malaysia Education Ministry's Examinations Board. PT3 is compulsory for all Form Three students attending public secondary schools in Malaysia. The minimum number of exam papers a student is required to sit for is eight subjects thus achieving 8As is considered as an excellent achievement.

#### ii) Pocket money

Pocket money is being determined by inquiring students on the daily pocket money received from their parents or caretakers. The amount used is in RM (Ringgit Malaysia) and categorized as follow: 1) RM10 or more; 2) RM5 or more but less than RM10; 3) More than RM 1 but less than RM5 and 4) RM1 or less.

iii) Intention to reduce weight

The question inquiring this is as follow:

Are you in the process of reducing weight?

The answer is either 1) yes or 2) no.

iv) Eating as coping strategy

The question inquiring this is as follow:

Do you usually eat to cope with stress?

The answer is either 1) yes or 2) no.

## b. Family factors

#### i) Parent's education level

The education level is categorized into four categories as follow: 1) No formal education; 2) Primary; 3) Secondary and 4) Tertiary or more. Primary education in Malaysia is compulsory; begins at the age of 7 and lasts for a period of 6 years. Secondary education included three years of general education and two years of a choice between arts and science streaming; begins at 13 years old and ends at 17 years old. Tertiary education follows the completion of secondary education. It includes university as well as institutions that teaches specific capacities of higher learning.

#### ii) Parents marital status

The marital status is being categorized into four which are: 1) Married; 2) Divorced;

3) Widowed and 4) others.

#### iii) Family meal pattern

The question inquiring this is as follow:

*Do you frequently have daily meals with your family members at home?* The answer options are as follow: 1) frequently; 2) sometimes or 3) never.

#### iv) Parents as role model

The question inquiring this is as follow:

Do you look up to your parents as your role model? The answer options are either: 1) yes or 2) no.

## c. Environmental factors

#### i) <u>Perception on canteen food</u>

This question explores the student's perception on the nutritional status of food served in the school's canteens. The question inquiring this is as follow:

In your opinion, are the food sold in your school's canteen healthy?

The answer options are either: 1) yes; 2) no or 3) not sure.

#### ii) Junk food vendor outside school compound

This question investigates the availability of non-nutritious food just outside of the school compound. The question inquiring this information is as follow:

Is junk food being sold outside your school compound?

The answer options are either: 1) yes; 2) no or 3) not sure.

iii) Purchasing food sold from vendors outside school

This question investigates the purchasing habit of students from the junk food vendor selling outside of the school compound. The question inquiring this information is as follow:

Did you frequently buy junk food from the vendors outside your school compound?

The answer options are either: 1) frequently; 2) sometimes or 3) never.

# iv) Frequency of fast food consumption

This question investigates the frequency students had meal in fast food premises. The question inquiring this information is as follow:

Do you frequently eat at western food premises such as KFC, McDonalds, Pizza Hut, Ramly Burger, Kyros Kebab?

The answer options are either: 1) frequently; 2) sometimes or 3) never.

The questionnaire was reviewed by expert panels, finalized and pre-tested in both languages, English and Malay prior to implementation of the actual study. The questionnaires were pre-tested among 56 adolescents visiting the adolescent centre, Kafe@Teen at the National Population and Family Development Board Headquarters at Kuala Lumpur in June 2015 prior to the study. This questionnaire was distributed only at baseline (Appendix A1).

## (2) Cohen Perceived Stress Scale questionnaire (CPSS-10)

The original perceived stress questionnaire was developed by Sheldon Cohen and his colleagues in 1983 to measure the degree to which one perceived one's life as stressful (Cohen et al., 1983). It was designed for use among community samples with at least a junior high school education. The items are easy to understand and the response alternatives are simple to grasp. The questions are also quite general in nature and relatively free of content specific to any subpopulation group.

The CPSS-10 questionnaire consisted of 10 items. It is used as a self-report measure of stress and usage has been validated among Malaysian adolescents (Al-Dubai et al., 2011). Following the study by Al-Dubai et al, 2011 on 242 students in Malaysia, the Malay version of the PSS-10 showed adequate psychometric properties. Exploratory factor analysis yielded 2 factors that accounted for 57.8% of the variance. Cronbach's alpha coefficients for the 2 factors were 0.85 and 0.70, respectively. The reliability test showed an ICC of 0.82 (95% CI: 0.70, 0.89).

Prior permission was obtained from the author prior to usage. The respond to each question used a 5-point Likert scale as follows: 0 =never; 1 =almost never; 2 =sometimes; 3 =fairly often and 4 =very often. The score indicates how often the participants experienced stressful event within the past one month. The total scores ranged from 0 to 40. Higher scores indicate greater perceived stress. Items 1, 2, 3, 6, 9 and 10 were negatively stated representing 'perceived distress' whereas items 4, 5, 7 and 8 were positively represented representing 'perceived coping'. This questionnaire was distributed at both time points (Appendix A2).

#### (3) Child Eating Behavior questionnaire (CEBQ-35)

The original CEBQ questionnaire consisted of 35 items (Wardle, 2007). It is used to measure eating behavior among children below 12 years old. It was originally designed as a parent-report questionnaire. The self-reported CEBQ was later developed and validated. It was further translated to Malay and usage has been validated among Malaysian adolescents in 2013 (Loh et al., 2013).

Following the study by Loh et. al, 2013 on 362 students in Malaysia, the Malay version of the CEBQ showed that it is a valuable psychometric instrument. Exploratory factor analysis revealed a 35-item, 9-factor structure with 'food fussiness' scale split into two. In confirmatory factor analysis, a 30-item, 8-factor structure yielded an improved model fit. Cronbach's alpha for each subscale of the self-reported CEBQ ranged from 0.48 to 0.76. The reliability estimates of the eight factors were acceptable. Prior permission was obtained from the author prior to usage.

The CEBQ used in this study consisted of eight eating behaviour items. These items represented three categories of eating patterns which are (1) emotional eating, (2) externally induced eating and (3) restrained eating.

## (1) Emotional eating

Emotional eating pattern indicates that subject eat in response to emotions such as nervousness, happiness or excitement. It consisted two eating behavior items which are: (i) emotional over eating (EOE) and (ii) emotional under eating (EUE).

#### (2) Externally induced eating

This pattern indicates eating in response to stimuli such as smell and taste of food. This pattern consisted of three items which are: (i) food responsiveness (FR), (ii) enjoyment of food (EF) and (iii) desire to drink (DD).

(3) <u>Restrained eating</u>

Restrained eating pattern reflects that subject had control over eating and tries to refrain from eating. It consisted three items which are: (i) satiety responsiveness (SR), (ii) slowness in eating (SE) and (iii) food fussiness (FF).

The response options of this questionnaire used a 5-point Likert scale as follows: 1 = never; 2 = rarely; 3 = sometimes; 4 = often and 5 = always (Wardle, 2007) (Appendix A3). This questionnaire was distributed in both visits.

### (4) Brief COPE questionnaire (COPE-28)

The original COPE questionnaire consisted of 60 items with 15 coping dimensions (Bolger, 1990). The brief COPE was proposed in 1997, consisting only of 14 scales with two items in each dimension (Carver, 1997). The questionnaire was further translated to Malay language and usage among adolescents has been validated (Yusoff M.S.B., 2011).

Following the study by Yusoff MSB in 2011 on 100 school students in Malaysia, the Malay version of the Brief COPE had good psychometric value. The factor analysis shown that the Malay Brief COPE had a good construct. The 26 items fit very well into the nine components; with loading factors less than 0.3. The total Cronbach's alpha coefficients was 0.83. Most of the coping strategies showed acceptable internal consistency as having Cronbach's alpha values more than 0.5. The reliability analysis suggested that the Malay Brief COPE shown high internal consistency with Cronbach's alpha value of more than 0.7 (M. S. Yusoff, 2011).

The brief COPE measures the frequency of an individual adopting the stated items to cope with stressful situation in daily life. The dimensions of coping strategies investigated in this study were listed on Table 3.4.

1	Self-Distraction
2	Active Coping
3	Denial
4	Using Food
5	Use of Emotional Support
6	Use of Instrumental Support
7	Behavioral Disengagement
8	Focus On and Venting of Emotion
9	Positive Reinterpretation
10	Planning
11	Humor
12	Acceptance
13	Religion
14	Self-Blame

**Table 3.4: Dimensions of Coping Strategy** 

The 28 items investigated were rated using four categories of responses as follows: 1 = not at all; 2 = a little bit; 3 = a medium amount and 4 = a lot. The interpretation of participants' total score in each dimension were shown in Table 3.5.

Score	Interpretation
Score of 2 and below	Haven't been doing this at all
2.01 to 4.00	Have been doing this a little bit
4.01 to 6.00	Have been doing this a medium amount
6.01 to 8.00	Have been doing this a lot

 Table 3.5: Interpretation of brief COPE Score

Self-distraction coping technique involves using behavior such as watching television, exercising, reading or engaging in other pleasurable activities to distract oneself from the stressful event. Distraction is a passive coping strategy in that the person

cope without directly confronting the situation or trying to solve the problem. (Allen & Leary, 2010). Active coping involves awareness of the stressor followed by attempts to reduce the negative outcome. This is in contrast with avoidant coping which is characterized by ignoring the issue and attempt to avoid the stressful situations rather than solve them, often resulting in activities that aid in denial of the problem. Behavioral disengagement means withdrawing effort from coping with a stressor; an opposite of a proactive action behavior. Venting of emotions means expressing or releasing of pent-up thoughts or feelings or one's anger out forcefully.

Previous study in Malaysia has reported that the score for items 7 and 8 which are coping by means of substance abuse could not be calculated due to similar variances; indicating that all participants gave similar answer. (M. S. Yusoff, 2011). The questions referred to were as follow:

No. 7: I have been using alcohol or other drugs to make me feel better.

No. 8: I have been using alcohol or other drugs to help me get through it.

In this study, both the items were modified to coping by using food rather than using drugs and alcohol (Appendix 4). The modified questions were as follow:

No.  $7_m$ : I have been using food to make me feel better.

No.  $8_m$ : I have been eating to help me get through it.

This questionnaire was distributed only at baseline to identify coping strategies adapted by the adolescents when dealing with the stress of preparing for final year school examination.

## 3.5.4.2 Anthropometric measurement

Anthropometric measurements of participants were conducted by the researcher herself assisted by three trained research assistants during every visit. These assistants were re-briefed by the researcher prior to every data collection sessions to ensure standard method of measuring. Anthropometric measurements measured include height, weight, body fat composition and waist circumference. BMI was derived from the height and weight of participants. All equipment used for measurement were calibrated.

# (i) Height

Height of participants was measured using vertical stadiometer (Seca Portable 217, Seca, UK), as shown in Figure 3.7. Height was taken without socks and shoes and without hair ornaments; recorded to the nearest 0.1 cm.



Figure 3.7: Stadiometer (Seca Portable 217, Seca, UK)

# (ii) Weight and body fat composition

Weight and body fat composition were measured using digital electronic Tanita Portable Scale: SC-240 Body Composition Analyzer (Tanita Europe B.V., The Netherlands) as shown in Figure 3.8. Weight and body fat composition of participants were measured without socks and shoes and wearing either school uniform or t-shirts and tracksuits; recorded to the nearest 0.1 kg.



Figure 3.8: Tanita Portable Scale: SC-240 Body Composition Analyzer (Tanita Europe B.V., The Netherlands)

# (iii) Waist circumference

Waist circumference was measured using non-elastic Seca Measuring Tape (Seca 201, Seca, UK) as shown in Figure 3.9. Waist circumference was measured with the tape positioned mid-way between the lowest rib margin and the iliac crest with clothes on; recorded to the nearest 0.1 cm.



Figure 3.9: Seca Measuring Tape (Seca 201, Seca, UK)

# 3.6 Section II: Study on Subsample Participants

In this study, objective measurement of stress level was conducted using salivary biomarkers which are the saliva cortisol level. Due to cost constraint, the saliva cortisol analysis could not be conducted on the whole sample. The saliva analysis thus was conducted only on subsamples participants. This section described on the methodology of the study on the subsample participants which include the sample size calculation of the subsamples and sampling methods of the subsample participants. The section focused on the methods of saliva sample collection and the analysis highlighting on the instrument and equipment used.

## 3.6.1 Subsample size calculation

The sample size to determine stress level using objective measurement of saliva cortisol was calculated using the Open Epi version 3 software. The calculation was based on the prevalence rate of morbid mental health among children and adolescents below 15 years old of 0.2 from the NHMS IV in 2011 (Institute for Public Health, 2011) at an alpha of 0.05 with 95% confidence interval and the power of 80%. The minimum sample size required was 188 subjects. The final sample size determined to accommodate a non-response rate of 30% was 245 subjects.

## 3.6.2 Subject Recruitment and Sampling Procedure

Following the main sample size calculation in section I, eleven schools were recruited in this study. Seven schools are in the urban area and four schools are in the rural area. Total participants of the recruitment were 802 students. Systematic random sampling method was used to select the subsample subjects. 265 participants were selected to participate in the saliva cortisol analysis. The intention to collect saliva samples were included in the information sheets distributed with the introductory letter explaining the purpose of the research. The sampling process for saliva subsamples was shown in Figure 3.10.

Main Sample												!
School	1	2	3	4	5	6	7	8	9	10	11	Total
Subjects (N)	36	75	109	51	83	125	113	48	54	78	30	802
						•						
Subsample		C	Sys	stemati	ic Rano	dom Sa	ampling	3				
		Ţ	+	•	+	<b>'</b>		•	+	+		
Subjects (n)	16	25	36	17	26	44	27	15	18	31	12	265
												1

Figure 3.10: Stages of Sampling Procedure of Subsample Participants

#### 3.6.3 Data collection and study instrument

This section discusses on the data collection methods and instruments required for salivary biomarkers sampling and analysis. The instruments used in this study included the saliva collection kit, the saliva analysis kit and laboratory equipment used during the analysis. Saliva collection process was conducted by a team consisted of three research assistants led by the researcher herself. These assistants were briefed and trained by the researcher and competent officers prior to the data collection sessions to familiarize them with the conduct of field work, both at baseline and follow up. The training included methods on handling, collection, labeling, storage and transportation of the saliva samples.

#### 3.6.3.1 Saliva sample collection

Saliva samples of participants were collected only once per visit; between 9 am to 11 am as this was the most convenience for the students, the teachers and the researcher. Prior to the saliva collection process, the selected subsample students were gathered in a room and a brief explanation was given by the researcher. All selected participants were given a cryovial sample tube and a saliva collection aid each. The instruments were as shown in Figure 3.11.



Figure 3.11: Cryovial sample tube and Saliva Collection Aid

The tubes and the collection aids were purchased from Salimetrics Europe LTD (United Kingdom). Participants were required to first wash and clean their mouth.

Collection of the saliva were performed by the students themselves by passively drooling approximately 1 ml of saliva; assisted by the saliva collection aid into the given cryovial sample tubes. All participants completed the collection process approximately within 5 to 20 minutes. Once completed, the tubes were handled to the researcher immediately. The tubes were coded for identification purpose. Time and date of sample collection were recorded. The samples were immediately stored in a specified ice box. It is important to keep samples cold in order to avoid bacterial growth in the specimen. The samples were then transported to the Department of Social and Preventive Medicine Laboratory in University of Malaya and stored frozen in the laboratory refrigerator below -80°C.

#### 3.6.3.2 Saliva cortisol analysis kit

The saliva samples collected were analyzed using Saliva Cortisol EIA Analysis Kit; purchased from Salimetrics Europe LTD (United Kingdom). The Salimetrics Cortisol Enzyme Immunoassay Kit is a competitive immunoassay specifically designed and validated for the quantitative measurement of salivary Cortisol (Salimetrics, 2016). 14 units of the kits were purchased by the researcher in stages from December 2015 to February 2016 and stored at 5°C in the refrigerator at Department of Social and Preventive Medicine Laboratory, University of Malaya. All kits are stable at 2 to 8 degree Celcius until the kit's expiration date. (Salimetrics, 2016). The kits were as shown in Figure 3.12.



Figure 3.12: Saliva Cortisol EIA Analysis Kit; purchased from Salimetrics Europe LTD (United Kingdom)

The detail of materials supplied with each saliva cortisol analysis kit purchased was

listed on Table 3.6.

No	Item	Description
1.	Microtitre Plate (1/96 well)	Coated with monoclonal anti-Cortisol antibodies
2.	Cortisol Standard (6 vials/ 500µL each)	On a saliva-like matrix. Traceable to NIST standard: 3.0, 1.0, 0.333, 0.111, 0.037, 0.012 μg/dL (82.77, 27.59, 9.19, 3.06, 1.02, 0.33 nmol/L). Contains: <i>Cortisol, buffer, preservative</i>
1.	Cortisol Controls (2 vials / 500µL each)	High, Low, in a saliva-like matrix. Contain: <i>Cortisol, buffer preservative</i> .
4.	<b>Cortisol Enzyme Conjugate</b> (1 vial/ 50µL)	Concentrate. Diluted with Assay Diluent. Contains: <i>Cortisol conjugated to HRP, preservative.</i>
5.	Assay Diluent (1 bottle/ 60 mL)	Contains: phosphate buffer, pH indicator, preservative.
6.	Wash Buffer Concentrate (10X) (1 bottle/ 100 mL)	Contains: phosphate buffer, detergent, preservative.
7.	<b>TMB Substrate Solution</b> (1 bottle/25 mL)	Ready to use.
8.	Stop Solution (1 bottle/ 12.5 mL)	
9.	<b>Non-Specific Binding (NSB)</b> <b>Wells</b> (1 strip)	Do not contain anti-Cortisol antibody.

# Table 3.6: Materials supplied in Salimetrics Cortisol Enzyme Immunoassay Kit

## 3.6.3.3 Conducting the laboratory analysis

The saliva cortisol analysis of all the saliva samples from subsample participants were conducted solely by the researcher. Prior to conducting the analysis, the researcher had undergone two sessions of laboratory training between November and December 2015 in University of Malaya. The first session was a two days session conducted by Julius Centre, Department of Social and Preventive Medicine in University of Malaya under the supervision of Dr Nasrin Aghamohammadi, a senior lecturer and an Environmental Engineer. The second training, also a two days session was conducted by Department of Medical Microbiology in University of Malaya under the supervision of a senior lecturer and a virologist. The training involved all essential steps in conducting the analysis which include reagent preparation, handling the equipment and performing the procedure. It was conducted theoretically and practically.

The final analysis was conducted by the researcher herself in the Medical Microbiology Laboratory in the Department of Medical Microbiology under the supervision of Associate Professor Dr Keivan Zandi. A total of 14 analysis were conducted to analyze all the saliva samples collected. The laboratory was an accredited laboratory and all laboratory equipment used were calibrated. The analysis was conducted rigorously by following the protocol guideline (Protocol No.: 1-3002 (5PK 1-3002-5).

The steps and procedure applied in conducting every analysis were described as follow:

#### I. Saliva samples, reagent and equipment preparation

On the day of assay, the saliva samples were thawed completely, vortex and centrifuged at 1500 x g for 15 minutes. Centrifuging removed particulate matter and precipitated mucin formed during freezing, which may interfere with antibody binding and affect results. All the samples were ensured to be at room temperature before starting the analysis.

All reagents were brought to room temperature and mixed before use. A minimum of 1.5 hours was provided for the assay diluent to come to room temperature. The microtiter plate was also brought to room temperature. It was kept in foil pouch until warmed to prevent humidity from affecting the coated wells. The wash buffer was freshly prepared during every session by diluting 50 mL of wash buffer concentrate with 450 mL room-temperature deionized water. All equipment needed to conduct the procedure which include precision multichannel pipette ( $50\mu L - 200\mu L$ ), precision pipette ( $15-25 \mu L$ ), plate rotator, centrifuge, pipette tips and disposable polypropylene tubes were checked and prepared prior to analysis.

## II. Plate layout determination

The plate layout was determined prior to conducting the analysis, for identification purpose and to ensure smoothness of the assay procedure. Standards, controls and saliva samples were assayed in duplicate. The plate layout in this study was prepared as shown in Figure 3.13. The saliva samples analyzed for every kit were 38 samples.

	1	2	3	4	5	6	7	8	9	10	11	12
A	3.000 Std	3.000 Std	Ctrl-H	Ctrl-H	SMP 7	SMP 7	SMP 15	SMP 15	SMP 23	SMP 23	SMP 31	SMP 31
В	1.000 Std	1.000 Std	Ctrl-L	Ctrl-L	SMP 8	SMP 8	SMP 16	SMP 16	SMP 24	SMP 24	SMP 32	SMP 32
C	0.333 Std	0.333 Std	SMP 1	SMP 1	SMP 9	SMP 9	SMP 17	SMP 17	SMP 25	SMP 25	SMP 33	SMP 33
D	0.111 Std	0.111 Std	SMP 2	SMP 2	SMP 10	SMP 10	SMP 18	SMP 18	SMP 26	SMP 26	SMP 34	SMP 34
E	0.037 Std	0.037 Std	SMP 3	SMP 3	SMP 11	SMP 11	SMP 19	SMP 19	SMP 27	SMP 27	SMP 35	SMP 35
F	0.012 Std	0.012 Std	SMP 4	SMP 4	SMP 12	SMP 12	SMP 20	SMP 20	SMP 28	SMP 28	SMP 36	SMP 36
G	Zero	Zero	SMP 5	SMP 5	SMP 13	SMP 13	SMP 21	SMP 21	SMP 29	SMP 29	SMP 37	SMP 37
Η	NSB*	NSB*	SMP 6	SMP 6	SMP 14	SMP 14	SMP 22	SMP 22	SMP 30	SMP 30	SMP 38	SMP 38

\*NSB = Non-specific binding wells.

\*SMP = Sample, STD = Standard, Ctrl-H = Control High, Ctrl-L = Control Low

**Figure 3.13: Plate Layout** 

## III. Standards, controls and saliva samples pipetted into the microplate

The microtiter plate supplied by the kit was a plate coated with monoclonal anticortisol antibodies. The standards, controls and saliva samples were placed into appropriate wells using the precision pipette;  $25 \ \mu$ L into each well.  $25 \ \mu$ L of Assay Diluent were placed into the two 'Zero' labelled wells and into the two 'NSB' labelled wells. This procedure was shown in Figure 3.14.



Figure 3.14: Pipetting the Standards, Controls and Saliva Samples into the Microtitre Plate

# IV. Diluted cortisol enzyme conjugate solution pipetted into the microplate

Cortisol enzyme conjugate was cortisol conjugated to the enzyme, horseradish peroxidase (HRP). The enzyme conjugate was diluted by adding 15  $\mu$ L of the conjugate to 24mL of assay diluent in a disposable tube. The tube was centrifuged for a few minutes to bring the liquid down to the tube bottom. 200  $\mu$ L of the diluted conjugate solution was added to each well using a multichannel pipette. Following the addition of the cortisol enzyme conjugate solution, the cortisol in standards and samples compete with cortisol conjugated to HRP for the antibody binding sites on the plate (Figure 3.15).



Figure 3.15: Test Principle of Competitive Immunoassay

Once added, the wells turned into pinkish color as shown in Figure 3.16. The plate was then mixed on a plate rotator for 5 minutes at 500 rpm and incubated at room temperature for a total of 1 hour. A stop watch was used to ensure time precision.



Figure 3.16: Microtitre plate wells turns pink following addition of 200  $\mu$ L of diluted conjugate solution in each well

# V. Post incubation plate washed

After an hour of incubation, the microtiter plate was washed four times manually.  $300 \ \mu$ L wash buffer prepared earlier was added into each well using the multichannel pipette. The liquid was then discarded over the sink. After each wash, the plate was thoroughly blotted on paper towels before turning upright. The act of adding wash buffer, discard it over the sink and blotting the plate on paper towels were repeated four times to ensure good washing technique. This step ensure unbound components are washed away.

# VI. TMB solution added

After washing the plate, 200  $\mu$ L of tetramethylbenzidine (TMB) Substrate Solution was added to each well using the multichannel pipette. Bound cortisol enzyme conjugate is measured by the reaction of HRP enzyme to the substrate TMB (Figure). This reaction was illustrated in Figure 3.17 producing blue color as shown in Figure 3.18.



Figure 3.17: Reaction of HRP to TMB Substrate



Figure 3.18: Microtitre plate wells turns blue after the addition of TMB substrate solution

The plate was mixed on a plate rotator for 5 minutes at 500 rpm, covered with a sheet of aluminum foil and incubated in a dark room at room temperature for an additional 25 minutes.

# VII. Stop solution added

After the incubation period of 30 minutes, 50  $\mu$ L of stop solution was added to each well using the multichannel pipette. Stop solution is an acidic solution that stopped the reaction of the HRP enzyme to TMB substrate, forming yellow color as shown in Figure 3.19. The plate was mixed on a plate rotator for three minutes at 500 rpm.



Figure 3.19: Microtitre plate wells turns yellow after the addition of stop solution

# VIII. Microtitre plate read

The plate was read in the Microplate Reader: Infinite 200 Pro Multiple Reader supplied by Tecan Group Ltd (Mannedorf, Switzerland) at 450nm within 10 minutes after adding the Stop Solution. The plate reading determined the optical density (OD) for all the wells. The amount of cortisol enzyme conjugate detected is inversely proportional to the amount of cortisol present in the saliva sample.

## IX. Cortisol level determined

The cortisol level was determined using the online Salimetrics software, MyAssays at https://www.myassays.com. The software required for the raw data, which were the OD of each wells to be entered (Figure 3.20).

MyAssays1 Find your assay/data analysis here Search Home List Tools Account	unt Profile Suj
Salivary Cortisol (µg/dL) 🔀	
Salimetrics Competitive enzyme immunoassay (EIA) for the quantitative measurement of salivary	
Cortisol (µg/dL). Calculations are made by subtracting the mean of the NSB measurements from the provided optical densities. The B/S0 is calculated from the corrected values using the mean of the B0 group. Concentrations are calculated using a Four Parameter Logistic Fit (4PL) and dilution factors are applied.	Kit Booklet
1 Measurements	
Supply your measurement data:	
0.152         0.144         0.356         0.338         0.800         0.806         0.944         0.970         0.565         0.557         0.676         0.683           0.342         0.340         1.344         1.309         0.485         0.514         1.471         1.240         1.331         1.294           0.772         0.755         1.098         1.008         1.204         1.217         0.600         0.519           1.385         1.340         0.660         0.647         0.587         0.589         0.794         0.739         0.500         0.519           1.385         1.340         0.660         0.647         0.587         0.585         0.575         0.812         0.586         0.565           1.706         1.801         0.622         0.552         0.838         0.757         1.201         1.153         2.332         2.401         0.994         0.983           1.945         1.949         0.877         0.757         0.737         0.584         0.777         0.584         0.877         0.823         0.838           1.945         1.952         0.544         0.877         0.784         1.275         1.224         1.331         1.357         0.22	
Paste PFlag Positions	.::
2 Microplate	1
3 Standard Concentrations	1
4 Dilution Factors	1
5 Sample IDs	1
6 Run Notes	1
Calculate	

Figure 3.20: Salimetrics Online Software for Salivary Cortisol Analysis

The software automatically calculated the average OD of all duplicated wells and percent bound for each standard, control and saliva sample. The concentration of the controls and saliva samples were determined by interpolation using data reduction software based on a 4-parameter non-linear regression curve fit. An example is shown in Figure 3.21.



Figure 3.21: Example of a 4-Parameter non-linear regression curve fit

#### **3.7** Ethical Considerations.

This study involved numerous organizations and individuals thus the ethical considerations considered involvement of many parties specifically the authorities, the respondents and the team members.

#### **3.7.1** Ethics towards authorities

This study obtained approval from the Medical Ethics Committee of University of Malaya Medical Centre on 4 May 2015. Approval from the Ministry of Education, Malaysia, the respective states Education Department of Perak, Kuala Lumpur and Selangor and the respective school principals involved were obtained within February 2015 to September 2015.

## 3.7.2 Ethics towards respondents

Prior to enrollment into study, all potential participants were given information sheets detailing the study and consent form for their parents to sign. Those who agreed to participate in the study received an explanation of the risk, benefit and study purpose by the researcher at the study site. All information regarding participant's details and performance was strictly confidential and the participants were assured of the confidentiality of the information disclosed during the study. The questionnaires contained no identifying information and were kept safe and locked in a cabinet in SPM Department at University of Malaya by the researcher. This study was completely voluntary. No participants were forced into joining the study without their own will or parent's agreement.

This was an observational study with no intervention programs thus this study had no direct effect on the participants and no risks to subject were expected. Nevertheless, subjects detected with health risks were referred to appropriate health care providers. All collected data were analyzed in a collective manner for study purposes only without revealing participant's or any institution's weaknesses. To express gratification to the schools, at the end of the day tokens of appreciation were handled to the school principals by the team leader. Coffee breaks and lunch were provided to the teachers and students involved in every data collection sessions.

# 3.7.3 Ethics pertaining to assistance

This study includes two data collection sessions. First session involved 11 schools and the second session involved 14 schools. Some of the schools were located far from the university and thus required days of traveling and staying overnight in some cities. Commitments from the team members thus are very important.

After the completion of every data collection sessions, assistance crosschecked the questionnaires for completeness, collected and handled them to the researcher or team leader. Difficulties and problem faced were reported and discussed. Formalizing each session helped team members to continue with the research without undermining their health or well-being, avoid burnout, build synergy, improve team dynamics and achieve better quality of work output. Coffee breaks and lunch were provided to all team members during every data collection sessions.

## **3.8 Data Collected and Attrition Rate**

Baseline data were collected during the two weeks prior to the final-year national school examination. The follow up data were collected six months later during normal school days, which were at least three months away from major scheduled school examination. Throughout the report, the baseline data were referred to as Time 0 ( $T_0$ ) and the follow up data were referred to as Time 1 ( $T_1$ ).
### **3.8.1** Total number of main sample participants

At baseline, a total of 802 students from 11 schools participated in the study. Out of these, five participants were excluded; three were due to incomplete questionnaires and two due to no anthropometric measurement leaving 797 samples analyzed. During the follow up visits, 200 students were loss to follow up. Out of the 597 students participated, five were excluded due to incomplete questionnaires leaving 592 data analyzed. The attrition rate for total sample was 25.6% which was acceptable in cohort studies (Fewtrell et al., 2008). Reasons of the attrition were detailed out in Table 3.7.

No.	Reason of Loss To Follow Up	Questionnaires	Saliva
1	Absence	48	5
2	Moved to another school	17	1
3	Participated in simultaneously organized activity	132	20
4	Refused	0	0
5	Died	3	1
	Total	200	27

Table 3.7 : Reasons of Loss to Follow Up during baseline study

### 3.8.2 Total number of subsample participants

At baseline, 265 students were selected as subsample participants. Four participants were excluded. One was due to incomplete questionnaire while three participants gave inadequate amount of saliva leaving 261 saliva samples analyzed. During the follow up visits, 27 students were loss to follow up resulting in 234 saliva samples collected. Out of this, five participants were excluded due to incomplete questionnaires and one due to inadequate amount of saliva leaving 228 samples analyzed. The attrition rate for saliva subsamples participation was 11.7%.

Figure 3.22 showed the total number of students participated at both time points and final samples of questionnaires, anthropometric measurement and saliva samples analyzed in both visits.



Figure 3.22: Total number of data collected and analyzed at baseline (T<sub>0</sub>) and follow up (T<sub>1</sub>).

### **3.9 Data Entry and Statistical Analysis**

### 3.9.1 Data entry

Following the collection of the questionnaires administered, all data collected from the study which include data from the questionnaires, anthropometric measurement and saliva analysis results were entered into licensed IBM SPSS Statistics 24.0 (United States) software. Data entry was performed by the researcher and a trained assistant. For the baseline data, 100% of samples were entered inclusive of 802 questionnaires, 800 anthropometric measurement data and 263 saliva cortisol results. 18.8% of data entry were audited by a trained assistant to ensure consistency. For the follow up data, 100% of samples collected were entered inclusive of 592 questionnaires, 592 body composition data and 235 saliva cortisol results. 100% of data entry were cross checked by trained assistants to ensure consistency.

Data cleaning was performed, checking for consistency, errors and correctness of data entered. Any parts not matching were checked with original hardcopy of questionnaire accordingly. Any duplicate entries were also identified and removed. Outliers were checked by running the frequencies of all variables and checking the coding of each variable. The data was ensured completeness, no missing responses, double entry or other errors by researcher before data analysis was conducted. Participants with missing data of perceived stress level or eating behaviors questionnaires were excluded. The entry and cleaning and checking was done over a period of months. All questionnaires were being kept safely in a locked storage area within the university premises, accessible only to researchers working on the project.

### 3.9.2 Data analysis

Following data entry and data cleaning, data transformation was done to get the variables needed to determine the score of eating behavior and the score of perceived stress carefully considering the negative scoring. New variables using the transform, recode and compute command were created accordingly. The cleaned data were analyzed solely by the researcher under the supervision of Associate Professor Dr. Karuthan Chinna, a statistician in the Department of Social and Preventive Medicine in University of Malaya. All files were backed up from time to time for safety purposes.

### Analytical measures

- Descriptive statistic using univariate approaches were used to describe the study population and measure of the variance of participant's socio-demographic data. Descriptive statistics were also used to determine prevalence and distribution of stress and eating behaviour patterns of the adolescents. Results were expressed as mean ± standard deviation for continuous variables and as count and percentage for categorical variables. The data were weighted appropriately and a file plan was created for the weightage of the data.
- 2. Continuous data were checked for normality by testing skewness, kurtosis values and using Shapiro-Wilk test of normality. Where the distribution does not appear to be not normally distributed, they were transformed appropriately using the log 10 or square root of these variables where appropriate before further analysis were performed. Some continuous measures were regrouped to enable meaningful further analysis and interpretation.
- 3. Independent sample T-Test, Paired-Sample T-Test and Chi-square Test were used to analyze the variations in continuous and categorical variables accordingly.

- 4. Multiple Linear Regressions and Pearson Correlation analyses were used to determine the strength and direction of relationships between groups of selected variables such as:
  - Perceived stress level and salivary cortisol measurement
  - Perceived stress level and eating behaviour scores
  - Saliva cortisol and eating behaviour scores
  - Perceived Stress Level and Coping strategies
  - Coping strategies and eating behaviour scores
- ANOVA and ANCOVA were used to determine differences in eating behaviour and stress level across the demographical categories, obesity categories and stress level categories.
- 6. General Linear Model was conducted to determine factors associated with the main outcome which were the transition of eating behavior among the adolescents.
- 7. Multinomial Logistic Regression using complex sampling analysis was performed to investigate the relationship between change in stress level, baseline stress level, stress coping strategies adapted, all confounding factors of individual, family and environmental factors investigated with the main outcome: Transition of Eating Behaviour.

For multivariate logistic regression, aim to show association of all independent variables with eating behaviour transition, the p-value of less than 0.25 was preset as the cut off value to choose independent variables from the univariate analysis be entered into the multivariate logistic regression model. The independent variables were taken as control. The cut off value of p<0.25 was chosen so as not to miss significant independent variables which may have been confounded during the univariate analysis (Hosmer,

Lemeshow, & Sturdivant). Predictors of p value less than 0.25 from the univariate analysis thus were fitted jointly into multivariate logistic model.

For all other test, the results analysis used alpha level of 0.05, 95% Confidence Interval and p-value. The p-value of less than 0.05 were considered statistically significant.

### **3.10** Weightage of Data

The sampling process involved two stages of selection which include the selection of the schools and selection of students from the schools selected. Therefore, weightage of the data was divided into two steps, the weightage of the schools and weightage of the students.

### 3.10.1 Weightage of the schools

The weightage of the schools was calculated based on the total number of the schools upon the strata of its state and residency and the total number of selected schools in the strata. The numbers of these schools were depicted in Table 3.8.

State	Ре	rak	Sela	ngor	Kuala Lumpur
School's Area	Urban	Rural	Urban	Rural	Urban
Total Number of	103	94	166	54	89
Schools in the Strata					
Total Number of	1	4	3	0	3
Selected Schools					

**Table 3.8: The Strata of the Schools** 

Using the formula as stated below, the weightage of the schools was calculated and were shown in Table 3.9.

$$Weightage of schools = \frac{Total \ schools \ in \ strata}{Total \ selected \ schools \ in \ strata}$$

No.	Schools	Area	Total No of Schools in the Strata	No of Selected Schools in the Strata	School's Weightage
1.	SMK Tasek Permai	Selangor	166	3	55.3
2.	SMK Datok Abu Bakar Baginda	Selangor	166	3	55.3
3.	SMK Sultan Abdul Aziz Shah	Selangor	166	3	55.3
4.	SMK Seri Permaisuri	Kuala Lumpur	89	3	29.7
5.	SMK Datok Lokman	Kuala Lumpur	89	3	29.7
6.	SMK Desa Petaling	Kuala Lumpur	89	3	29.7
7.	SMK Raja Lope Nor Rashid	Perak	94	4	23.5
8.	SMK Tapah	Perak	94	4	23.5
9.	SMK Pinji	Perak	103	1	103
10.	SMK Tun Perak	Perak	94	4	23.5
11.	SMK Sayong	Perak	94	4	23.5

### Table 3.9: The School's Weightage

### 3.10.2 Weightage of the students

The weightage of the students was calculated based on the total number of students at baseline, which include form four students in the selected schools over the total number of students who participated in the study. The weightage of the students was calculated using the formula as stated below:

 $Weightage of Students = \frac{Total \ Form \ Four \ students \ in \ school}{Total \ respondents \ in \ school}$ 

The results of the weightage of students were depicted in Table 3.10.

No.	Schools	Area	Total No of Form 4 Students in the Schools	Total No of Students who participated	Student's Weightage
1.	SMK Tasek	Selangor	136	36	3.78
	Permai				
2.	SMK Datok Abu Bakar Baginda	Selangor	245	51	4.80
3.	SMK Sultan Abdul Aziz Shah	Selangor	463	112	4.13
4.	SMK Seri Permaisuri	Kuala Lumpur	214	53	4.04
5.	SMK Datok Lokman	Kuala Lumpur	286	75	3.81
6.	SMK Desa Petaling	Kuala Lumpur	211	107	1.97
7.	SMK Raja Lope Nor Rashid	Perak	182	78	2.33
8.	SMK Tapah	Perak	39	30	1.30
9.	SMK Pinji	Perak	204	48	4.25
10.	SMK Tun Perak	Perak	146	124	1.18
11	SMK Sayong	Perak	96	83	1.16

## Table 3.10: The Student's Weightage

## 3.10.3 Final weightage

The final weightage was calculated based on the results of weightage of the schools and weightage of the students. Final weightage was calculated using the formula as stated below:

Final Weightage = Weightage of School x Weightage of Students

Table 3.11 showed the calculated final weightage of the samples.

No.	Schools	Area	School's Weightage	Student's Weightage	<ul> <li>Final</li> <li>Weightage</li> </ul>
1.	SMK Tasek	Selangor	55.3	3.78	209.0
	Permai				
2.	SMK Datok Abu Bakar Baginda	Selangor	55.3	4.80	265.8
3.	SMK Sultan Abdul Aziz Shah	Selangor	55.3	4.13	228.7
4.	SMK Seri Permaisuri	Kuala Lumpur	29.7	4.04	119.8
5.	SMK Datok	Kuala	29.7	3.81	113.1
	Lokman	Lumpur			
6.	SMK Desa	Kuala	29.7	1.97	58.5
	Petaling	Lumpur			
7.	SMK Raja Lope Nor Rashid	Perak	23.5	2.33	54.8
8.	SMK Tapah	Perak	23.5	1.30	30.6
9.	SMK Pinji	Perak	103	4.25	437.8
10.	SMK Tun Perak	Perak	23.5	1.18	27.7
11.	SMK Sayong	Perak	23.5	1.16	27.2

 Table 3.11: The Final Weightage

## 3.11 Summary

This study used various tools put together to measure stress and eating behavior as well as various factors found to be associated with it from pervious literature review. This is to the best of my knowledge the first cohort study on stress and eating behaviour among adolescents in Malaysia. Previous research conducted was cross sectional studies. The advantage of this study being a cohort study is that it enables us to study the transition of adolescents' eating behavior as the individuals stress level change.

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### **CHAPTER 4: RESULTS**

### 4.1 About this chapter

The following section describe findings gathered on stress, eating behavior, coping strategies adapted by the participants and possible associated factors. The analysis of the data was divided into two sections which are:

(I) Descriptive Statistics	: Section 4.2 to section 4.8
(II) Hypothesis Testing	: Section 4.9 to section 4.11

The analysis enables the researcher to determine associations and correlations between variables. At the end of the analysis, a model was created to predict the main outcome investigated in this study which is transition of eating behavior.

### 4.2 Demographic Characteristics of Participants

The demographic characteristics of participants at baseline were presented in Table 4.1. The table showed the unweighted count, estimation of the count in the population and the percentage of estimation. Majority of participants at baseline were female (60.2%, n = 480), from urban schools (60.5%, n = 482) and of Malay ethnicity (74.9%, n = 597). Analysis of weighted data estimated the study population to represent a total of 99,685 adolescents. Female, urban and Malay participants were estimated to represent majority of the population at 61.7% (n = 61,553), 89.1% (n = 88,800) and 71.9% (n = 71,678) respectively.

Variables		Number of Participants (Unweighted Count)	Estimation in the Population
Total		n (%)	n(%)
		797(100)	99 685(100)
Gender	Male	317 (39.8)	38 132(38.3)
	Female	480 (60.2)	61 553(61.7)
School Location	Urban	482 (60.5)	88 800(89.1)
	Rural	315 (39.5)	10 885(10.9)
Ethnicity	Malay	597 (74.9)	71 678(71.9)
	Chinese	93 (11.7)	6 656 (6.7)
	Indian	69 (8.7)	17 356(17.4)
	Others	38 (4.8)	3 994 (4.0)

Table 4.1: Demographic characteristics of participants at baseline.

Demographic characteristics of participants at the two time points are shown in Table 4.2. Majority of participants were female ( $T_0$ : 60.2%;  $T_1$ : 66.2%) and from urban schools ( $T_0$ : 60.5%;  $T_1$ : 56.4%). The samples comprised mainly of Malay students ( $T_0$ : 74.9%;  $T_1$ : 74.2%) followed by Chinese ( $T_0$ :11.7%;  $T_1$ :11.7%) and Indians ( $T_0$ : 8.7%;  $T_1$ : 9.5%). Other ethnicity which comprised mainly of Orang Asli were the minorities ( $T_0$ : 4.8%;  $T_1$ : 4.7%). The attrition rate was found highest among the male students (36.9%) and the urban populations (30.7%). The explanation of the attrition rate was mainly due to a large number of urban participants participated in simultaneously organized activity as the scheduled data collection date, as described earlier in section 3.8.1 (Table 3.7).

Variables		Baseline	Follow Up	% of Attrition
Total		N (%)	N (%)	
		797(100)	592(100)	25.6
Gender	Male	317 (39.8)	200 (33.8)	36.9
	Female	480 (60.2)	392 (66.2)	18.3
School	Urban	482 (60.5)	334 (56.4)	30.7
Location	Rural	315 (39.5)	258 (43.6)	18.1
Ethnicity	Malay	597 (74.9)	439 (74.2)	26.5
	Chinese	93 (11.7)	69(11.7)	25.8
	Indian	69 (8.7)	56(9.5)	18.8
	Others	38 (4.8)	28(4.7)	26.3

Table 4.2 : Demographic characteristics of participants in both visits.

# 4.2.1 Possible confounding factors of eating behaviour studied among participants at baseline

The possible confounding factors of eating behaviour studied among the participants were divided into three categories which were; (i) individual factors, (ii) family factors and (iii) environmental factors. The body composition measurements of participants which comprised of (i) body mass index (BMI), (ii) body fat composition (BF) and (iii) waist circumference (WC) were incorporated as the individual factors.

### 4.2.1.1 Individual factors

The individual factors of participants investigated at baseline were shown in Table 4.3, which include academic achievement, pocket money, intention to reduce weight and admitting to consume food when coping with stress.

### i. <u>Academic achievement</u>

Academic achievement was determined by the PT3 results variable. As there is category with very few numbers, the initial four categories of (i) 7As or more, (ii) 4A to 6As, (iii) 1A to 3As and (iv) No A were regrouped so as to collapse the variables into fewer categories for a meaningful analysis. The categories were regrouped and relabeled as follow: (i) 7As and above = Good; (ii) 4As to 6As = Average and (iii) 3As and below = Below Average. Majority of participants (72.5%) had below average academic achievement level. Out of these, majority were rural students (76.9%). More urban student (6.5%) significantly ( $\chi^2$ =6.70; p<0.05) had good academic achievement level compared to the rural students (3.2%).

### ii. Pocket money

Pocket money received by students is initially categorized into 4 categories; (i) RM10 or more; (ii) RM5 or more but less than RM10; (iii) More than RM 1 but less than RM5 and (iv) RM1 or less. As there is category with very few numbers, the categories were regrouped so as to collapse the variables into fewer categories for a meaningful analysis. The categories were regrouped and relabeled as follow: (i) High = RM5 or more; (ii) Medium = More than RM 1 but less than RM5 and (iii) Low = RM1 or less. Urban students significantly ( $\chi^2$ =120.09; p<0.01) had higher pocket money (60.5%) compared to the rural students (21.8%). Majority of the rural students (76.0%) had medium level of pocket money. Despite acknowledging the importance of pocket money as a possible confounding factors for eating behavior, the analysis is being conducted carefully taking into consideration that a large number of Malaysian students may still bring prepared packed food from home. Furthermore, the price of canteen food in rural schools may also be cheaper than the rural schools.

### iii. Intention to reduce weight

More than half of the students (57.9%) expressed concern of their body image by admitting initiative towards weight reduction. This was observed higher among the urban (59.2%) than the rural students (56%).

### iv. Admit eating to cope with stress

Majority of participants (66.4%) also denied to practice eating as a stress coping strategy. This practice however was observed higher among the rural (37.9%) than the

urban students (33.6%). Both the differences between the urban and rural adolescents

were however not significant.

Individual Factors		Overall n (%)	Urban n (%)	Rural n (%)	$\chi^2$
Academic	Good	41 (5.2)	31 (6.5)	10 (3.2)	6.70
achievement	Average	176(22.3)	114 (23.9)	62 19.9)	$(p=0.04)^*$
[n=789 (477/312)]	Below Average	572(72.5)	332 (69.6)	240 (76.9)	
Pocket money	High	358(45.2)	290 (60.5)	68 (21.8)	120.09
[n=792 (479/313)]	Medium	413(52.1)	175 (36.5)	238 (76.0)	(p<0.01)*
	Low	21 (2.7)	14 (2.9)	7 (2.2)	
Attempts to	Yes	456(57.9)	283 (59.2)	173 (56)	0.80
reduce weight [n=787 (478/309)]	No	331(42.1)	195 (40.8)	136 (44)	(p=0.37)
Admit eating to	Yes	278(35.3)	161 (33.6)	117 (37.9)	1.49
cope with stress [n=788 (479/309)]	No	510(64.7)	318 (66.4)	192 (62.1)	(p=0.22)

Table 4.3: Individual Factors of Participants according to School Location atBaseline

Variation between school location tested with Chi-square test.

\* The difference is significant at the 0.05 level (2-tailed)

### v. <u>Body composition measurement of participants at baseline</u>

The mean body mass index (BMI), mean body fat (BF) and mean waist circumference (WC) of participants at baseline were depicted according to demographic characteristics in Table 4.4. Mean BMI of participants at baseline was  $22.1 \pm 5.6$  kg/m<sup>2</sup>. There were no significant difference of BMI across the genders, school locations or ethnicities (p>0.05). The trend however showed slightly higher BMI among female students ( $22.2 \pm 5.7$  kg/m<sup>2</sup>) compared to the male students ( $21.9 \pm 5.4$  kg/m<sup>2</sup>) and among the urban ( $22.4 \pm 5.7$  kg/m<sup>2</sup>) compared to the rural students ( $21.7\pm5.5$  kg/m<sup>2</sup>). Between ethnicities, BMI trend was observed highest among the Malays at  $22.3 \pm 5.8$  kg/m<sup>2</sup>.

There are significant difference in mean body fat composition and mean waist circumference between the male and female students (p<0.01). Body fat composition was higher among the female students but interestingly waist circumference was significantly

higher among the male students. No significant difference of body fat composition and waist circumference was observed between school locations and ethnicities (p>0.05).

Variables	n	Mean BMI	Р	Mean BF	Р	Mean WC	Р
		(kg/m <sup>2</sup> )	value	(%)	value	( <b>cm</b> )	value
Overall	797	$22.1\pm5.6$	-	$23.6 \pm 11.0$	-	$73.8 \pm 11.5$	
Gender							
Male	317	$21.9\pm5.4$	0.55	$15.1\pm8.7$	$<\!0.01^*$	$75.2 \pm 11.9$	$<\!\!0.01^*$
Female	480	$22.2\pm5.7$		$29.2\pm8.6$		$72.8 \pm 11.0$	
School Loca	ation						
Urban	482	$22.4\pm5.7$	0.12	$24.1 \pm 10.8$	0.08	$74.2 \pm 11.7$	0.25
Rural	315	$21.7\pm5.5$		$22.7 \pm 11.3$		$73.2 \pm 11.2$	
Ethnicity							
Malay	597	$22.3\pm5.8$	0.49	$23.7 \pm 11.2$	0.62	$74.0 \pm 11.9$	0.21
Chinese	93	$21.6\pm4.6$		$22.7 \pm 10.6$		$71.8\pm9.0$	
Indian	69	$21.6\pm5.3$		$24.4\pm9.9$		$75.1 \pm 10.7$	
Others	38	$21.6\pm5.0$		$22.0\pm12.1$		$72.5\pm9.6$	

Table 4.4: Body composition of participants at baseline

Variation between gender and school location tested with t-test; between ethnicity tested with ANOVA.

\* The difference is significant at the 0.05 level (2-tailed)

The BMI was further classified into categories using the International Obesity Task Force (IOTF) standards and shown in Table 4.5: BMI Categories of participants at baseline.. The result showed that nearly half of the participants had normal BMI (44.5%, n=355). At baseline, the prevalence of overweight and obesity were 14.7% (n=117) and 11.7% (n=93) respectively. Following weightage, estimation of the overweight and obese adolescents in the population were 15.5% (n=15,415) and 12.0% (n=11,971) respectively.

<b>Table 4.5:</b>	BMI	Categories	of partici	ipants at	baseline.
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Categories	Unweighted Count n(%)	Estimation in the population n(%)
Overall	797(100)	99 685(100)
Underweight	232(29.1)	28 180(28.3)
Normal Weight	355(44.5)	44 119(44.3)
Overweight	117(14.7)	15 415(15.5)
Obese	93(11.7)	11 971(12.0)

### 4.2.1.2 Family factors

The family factors of participants investigated at baseline were shown in Table 4.6, which includes parent's level of education, parent's marital status, regarding parents as role model and frequency of having meal with family members.

### i. <u>Parent's level of education</u>

Approximately 20% of participants did not know their parents' level of education. Approximately half of participants' parents had secondary education. There are significant difference in both father and mother's education between the urban and rural students (p<0.01). More urban parents had tertiary education; (24.9% of the fathers; 22.6% of mothers) compared to the rural parents (10.5% of fathers; 7.3% of mothers).

### ii. <u>Parent's marital status</u>

Majority of participants' parents are married (86.2%). More urban parents are single parent (14.3%) compared to the rural parents (13.0%).

### iii. <u>Regard parents as role model</u>

83.1 % of students regard their parents as role model. This fact is observed to be significantly (p<0.05) more predominant among the rural students (86.7%) compared to the urban students (80.7%).

### iv. Meal with family

An interesting observation but unfortunately the finding is not significant is that more urban students (43.2%) reported to have frequent meal with family compared to the rural students (36.5%).

Family 1	Factors	Overall	Urban	Rural	$\chi^2$
		n (%)	n (%)	n (%)	
Father's education	Not Known	166 (20.8)	108 (22.4)	58 (18.4)	33.48
[n=797 (482/315)]	Tertiary	153 (19.2)	120 (24.9)	33 (10.5)	$(p < 0.01)^*$
	Secondary	401 (50.3)	210 (43.6)	191 (60.6)	
	below	77 (9.7)	44 (9.2)	33 (10.5)	
Mother's education	Not Known	156 (19.6)	99 (20.5)	57 (18.1)	36.96
[n=797 (482/315)]	Tertiary	132 (16.6)	109 (22.6)	23 (7.3)	$(p < 0.01)^*$
	Secondary	425 (53.3)	229 (47.5)	196 (62.2)	
	Primary and below	84 (10.5)	45 (9.3)	39 (12.4)	
Parents' marital	Married	687(86.2)	413(85.7)	274(87.0)	0.27
status [n=797(482/315)]	Single Parent	110(13.8)	69(14.3)	41(13.0)	(p=0.60)
Regard parents as	Yes	652(83.1)	384(80.7)	268(86.7)	4.89
role model [n=785(476/309)]	No	133(16.9)	92(19.3)	41(13.3)	(p=0.03)*
Meal With family [n= 792 (477/315)]	Frequently	321 (40.5)	206 (43.2)	115 (36.5)	3.54
	Sometimes	461 (58.2)	265 (55.6)	196 (62.2)	(p=0.17)
	Never	10 (1.3)	6 (1.3)	4 (1.3)	

### Table 4.6: Family Factors of Participants according to School Location at Baseline

Variation between school locations tested with Chi-square test.

\* The difference is significant at the 0.05 level (2-tailed)

### 4.2.1.3 Environmental factors

The environmental factors of participants investigated at baseline were shown in Table 4.7, which includes student's opinion on the nutritional status of the canteen food served, presence of junk food vendor outside the school compound, purchasing habit of junk food from the vendors and frequency of fast food consumption.

### i. Opinion on canteen food

51% of urban students reported that their school canteen served non-nutritious food whereas only 43.8% of rural students had the same view. More rural students (51.7%) were not sure of the nutritional value of the food served in their canteen as compared to the urban students (41.5%). These differences however are not significant.

### ii. Presence of junk food vendor outside school compound

70.1% of urban students acknowledged the presence of junk food vendor outside their school compound. This is significantly higher ( $\chi 2=52.43$ ; p<0.01) compared to only 45% in the rural populations.

### iii. Purchasing habit of junk food from vendor

2.7% of urban students and 1.3% of rural students frequently purchased junk food

from the vendors.

### iv. Fast food consumptions

Fast food consumptions were reported significantly higher ( $\chi 2=9.41$ ; p<0.01) among the urban students (7.3%) compared to rural students (2.5%) (Table 4.7).

Environmen	tal Factors	Overall	Urban	Rural	χ <sup>2</sup>
		n (%)	n (%)	n (%)	
Opinion on canteen	Nutritious	50 (6.3)	36 (7.5)	14 (4.4)	9.24
food	Not Nutritious	384 (48.2)	246 (51.0)	138 (43.8)	(p=0.10)
[n=797 (482/315)]	Not Sure	363 (45.5)	200 (41.5)	163 (51.7)	
Presence of junk	Yes	479 (60.3)	338 (70.1)	141 (45.0)	52.43
food vendor outside	No	169 (21.3)	84 (17.4)	85 (27.2)	(p<0.01)*
school compound	Not Sure	147 (18.5)	60 (12.4)	87 (27.8)	
[n=795 (482/313)]					
Bought junk food	Frequently	17 (2.1)	13 (2.7)	4 (1.3)	2.10
from vendor	Sometimes	472 (59.4)	288 (59.8)	184 (58.8)	(p=0.35)
[n=795 (482/313)]	Never	306 (38.5)	181 (37.6)	125 (39.9)	
Fast food	Frequently	43 (5.4)	35 (7.3)	8 (2.5)	9.41
consumption	Sometimes	737 (92.5)	439 (91.1)	298 (94.6)	$(p = < 0.01)^*$
[n=797 (482/315)]	Never	17 (2.1)	8 (1.7)	9 (2.9)	

Table 4.7: Environmental Factors of Participants according to School Location
at Baseline

Variation between school locations tested with Chi-square test.

\* The difference is significant at the 0.05 level (2-tailed)

## 4.3 BMI Category according to Demographic characteristics, Individual, Family and Environmental Factors

According to baseline BMI category, there is a significant association between school location and BMI category ( $\chi^2$ =7.63, p=0.02). The prevalence of obese and overweight among the urban students was higher (27.6%) compared to the rural students (24.4%). No significant association observed between BMI category and gender and between BMI category and ethnicity. Across gender, the trend showed that prevalence of overweight and obese category was higher among the male students (28.7%) compared to the female students (24.8%). Indian students showed highest prevalence of overweight and obesity (29.0%) followed by Malays students (27.0%) and Chinese students (24.7%).

There was also a significant association between the BMI category and attempts to reduce weight. 39.5% of the participants who admitted that they are in attempts to reduce weight was in the obese and overweight category while 53.5% who are not in attempts to reduce weight were in the underweight category. No significant association observed between the BMI category and all other individual, family and environmental factors investigated (Table 4.8). Another interesting observation but unfortunately is a non-significant finding is that among the obese and overweight category participants, higher prevalence sometimes or never had meal with family members (28.9%) compared to those who frequently had meal with family members (22.7%). Prevalence of obese and overweight were also highest among students' father with highest level of education (32.7%) but among student's mother with lowest level of education (28.6%). The prevalence was also higher among students with single parents (30%) compared to those with married parents (25.8%).

		Overall	Overweight&	Normal	Underweight	$\chi^2$
		n (%)	Obese	Weight	n (%)	
Demographic Fac	tors	217(20.0)	n(%)	n (%)	100/21.5	1.00
Gender	Male Female	317(39.8) 480(60.2)	91(28.7) 119(24.8)	126(39.7) 229(47.7)	100(31.5) 132(27.5)	4.90 (p=0.09)
Location	Urban	482(60.5)	133(27.6)	226(46.9)	123(25.5)	7.63
	Rural	315(39.5)	77(24.4)	129(41.0)	109(34.6)	(p=0.02)
Ethnicity	Malay	597(74.9)	161(27.0)	260(43.6)	176(29.5)	9.37
	Chinese	93(11.7)	23(24.7)	48(51.6)	22(23.7)	(p=0.15)
	Indian	69(8.7)	20(29.0)	24(34.8)	25(36.2)	
	Others	38(4.8)	6(15.8)	23(60.5)	9(23.7)	
Individual Factor	S					
Academic	Good	41 (5.2)	11(26.8)	20 (48.8)	10 (24.4)	0.57
achievement	Average	176(22.3)	46(26.1)	77(43.8)	53(30.1)	(p=0.97)
	Below Average	572(72.5)	151(26.4)	255(44.6)	166(29.0)	
Pocket money	High	358(45.2)	91(25.4)	167(46.6)	100 (27.9)	2.89
	Medium	413(52.1)	113(27.4)	180(43.6)	120 (29.1)	(p=0.58)
	Low	21 (2.7)	5(23.8)	7(33.3)	9 (42.9)	
Attempts to	Yes	456(57.9)	180(39.5)	227(49.8)	49(10.7)	199.00
reduce weight	No	331(42.1)	27(8.2)	127(38.4)	177(53.5)	(p<0.01)*
Eat to cope with	Yes	278(35.3)	66(23.7)	129(46.4)	83(29.9)	1 43
stress	No	510(64.7)	141(27.6)	223(43.7)	146(28.6)	(p=0.49)
						4)
Family Factors						
Father's	Not Known	166(20.8)	45(27.1)	72(43.4)	49(29.5)	8.50
education	Tertiary	153(19.2)	50(32.7)	58(37.9)	45(29.4)	(p=0.20)
	Secondary Primary and	401(50.3)	94(23.4)	185(46.1)	122(30.4)	
	below	77(9.7)	21(27.3)	40(51.9)	16(20.8)	
Mother's	Not Known	156(19.6)	37(23.7)	70(44.9)	49(31.4)	2.01
education	Tertiary	132(19.6)	34(25.8)	59(44.7)	39(29.5)	(p=0.92)
	Secondary	425(53.3)	115(27.1)	186(43.8)	124(29.2)	ý v
	Primary and below	84(10.5)	24(28.6)	40(47.6)	20(23.8)	
Parents' marital	Married	687(86.2)	177(25.8)	305(44.4)	205(29.8)	1.58
Status	Single Parent	110(13.8)	33(30.0)	50(45.5)	27(24.5)	(p=0.45)
Regard parents	Yes	652(83.1)	172(26.4)	287(44.0)	193(29.6)	0.85
as role model	No	133(16.9)	34(25.6)	64(48.1)	35(26.3)	(p=0.65)
Meal with family	Frequently	321(40.5)	73(22.7)	149(46.4)	99(30.8)	3.74
	Sometimes or Never	461(59.5)	136(28.9)	204(43.3)	131(27.8)	(p=0.15)
Environmental Fa	Nutritions	50(6.3)	13(26.0)	23(46.0)	14(28.0)	1.08
canteen food	Not Nutritious	384(48.2)	109(28.4)	23(40.0) 169(44.0)	106(27.6)	(n-0.74)
cancen 100a	Not Sure	363(45.5)	88(24.2)	163(44.9)	112(30.9)	(p=0.74)
D (; )			121(25.2)		141(20.4)	2.41
Presence of junk	Yes	479(60.3)	131(27.3)	207(43.2)	141(29.4)	3.41
1000 vendor	INO Not Sum	109(21.3)	40(27.2)	$\delta 1(4/.9)$	42(24.9)	(p=0.49)
compound	Not Sure	14/(18.5)	33(22.4)	66(44.9)	48(32.7)	
Bought junk	Frequently	17(2.1)	2(11.8)	10(58.8)	5(29.4)	2.79
food from	Sometimes	472(59.4)	130(27.5)	204(43.2)	138(29.2)	(p=0.59)
vendor	Never	306(38.5)	78(25.5)	140(45.8)	88(28.8)	
Fast food	Frequently	43(5.4)	10(23.3)	22(51.2)	11(25.6)	2.01
consumption	Sometimes	737(92.5)	196(26.6)	327(44.4)	214(29.0)	(p=0.73)
	Never	17(2.1)	4(23.5)	6(35.3)	7(41.2)	

# Table 4.8: BMI Category according to Demographic Characteristics, Individual, Family and Environmental Factors of Participants

Variation between school locations tested with Chi-square test.

\* The difference is significant at the 0.05 level (2-tailed)

### 4.4 Prevalence and Distribution of Stress among Adolescents

In this study, stress level was measured using two methods; by (1) subjective and (2) objective measurements. The subjective measurement reflect perceived stress of the adolescents based on using the Cohen Perceived Stress Scale (CPSS) Score (Cohen et al., 1983). Objective measurement reflects the stress level that is shown by biomarkers or sometimes referred to as 'true stress' in this report. It is based on using the saliva cortisol level of subsample participants as the stress biomarkers. Both the objective and subjective measurements were conducted at two time points; at baseline ( $T_0$ ) which were within two weeks duration prior to final year national school examination and during follow up ( $T_1$ ) six months later which were at least three months duration away from major school examinations.

### 4.4.1 Stress Based on Subjective Measurement of Stress Level

The prevalence and distribution of perceived stress among the adolescents were initially analyzed based on mean CPSS score. The CPSS score was later used to categorize the participants into three stress level categories; the low, moderate and high level of perceived stress.

### 4.4.1.1 Stress Based on Mean CPSS Score

Mean CPSS score of the participants in both visits ( $T_0$ : n=797;  $T_1$ : n=592) were shown in Table 4.9: Prevalence and Distribution of Stress Based on Cohen Perceived Stress Scale Score . Perceived stress level at baseline and follow up showed no changes with exact same score of 18.7 (95%CI: 18.4, 19.0). Analyzing the complete cohort (n=592) for comparison between the two time points, no significant difference in CPSS score was observed with p-value of 0.71.

### Gender and school location

CPSS score was significantly higher among the female students in both visits (p < 0.01). The mean CPSS score was also higher among the urban students in both visits but the difference was significant only at baseline (p=0.02). There was no significant difference in CPSS score across the genders and school locations between the two time points. The male students however showed increasing trend of CPSS score unlike the female students, who actually demonstrated a reduction.

### Ethnicity

There was significant difference in CPSS score between the ethnicities at both time points ( $T_0$ : p=0.02;  $T_0$ : p<0.01). At baseline, mean CPSS score was highest among the Chinese students ( $T_0$ : 19.2 [95% CI: 18.5, 19.9]) but during follow up it was highest among the Malay students ( $T_1$ :18.9 [95% CI: 18.6, 19.3]). Indian students had significantly lowest mean CPSS score in both visits ( $T_0$ :17.3 [95% CI: 16.3, 18.3];  $T_1$ : 16.8 [95% CI: 15.5, 18.0]) compared to both the Chinese and Malays students. There was no significant difference in CPSS score across the ethnicity between the two time points.

### **BMI** category

At baseline, mean CPSS score was highest among the obese and overweight  $(T_0:19.0 [95\% CI: 18.4, 19.5])$  and lowest among the underweight  $(T_0:18.5 [95\% CI: 18.0, 19.1])$ . During follow up, the normal weight and the obese and overweight categories both had higher CPSS Score of 18.7 compared to the underweight  $[T_1: 18.6 (95\% CI: 18.1, 19.2)]$ . There was no significant difference in CPSS Score between the obesity categories at both time points and between the two visits across all BMI categories (p>0.05).

### Individual factors

At baseline, CPSS score was highest among students with below average academic achievement ( $T_0$ : 18.9 [95% CI: 18.5, 19.3]) but during follow up, the score was highest among students with highest academic achievement ( $T_1$ : 19.4 [95% CI: 17.8, 20.9]). Students with below average academic achievement demonstrated significantly higher mean CPSS score than the average achiever at both baseline and follow up with p-value of <0.01 and 0.02 respectively. Students with good academic achievement showed a significant increment of CPSS score from baseline ( $T_0$ : 17.0 [95% CI: 15.1, 18.9]) to follow up ( $T_1$ : 19.4 [95% CI: 17.8, 20.9]) with p-value of 0.046.

At baseline, mean CPSS Score was observed highest among students with highest pocket money ( $T_0$ : 18.9 [95% CI: 18.4, 19.4]) but during follow up highest CPSS Score was observed among students with lowest pocket money ( $T_1$ :20.0 [95% CI: 17.7, 22.3]). The difference between the financial autonomy categories however was not significant at both time points. No significant difference was observed between the two visits.

At both time points, students who admitted that they were in attempts to reduce weight perceived higher stress level than those who were not (T<sub>0</sub>: 18.8 [95% CI: 18.4, 19.3]; T<sub>1</sub>: 18.8 [95% CI: 18.4, 19.3]). Interesting but unfortunately again the difference however was not significant. Students who admitted to practice eating as a stress coping strategy had significantly higher stress level in both visits (T<sub>0</sub>: 19.5 [95% CI: 18.9, 20.0]; T<sub>1</sub>: 19.4 [95% CI: 18.8, 20.0]) with p-value at both time points of <0.01. No significant difference in mean CPSS score between the two visits were observed across these categories Table 4.9.

	Cohen Perceived Stress Scale [Mean CPSS Score(95%CI)]									
	All Participants				Complete Cohort of Both Visits					
Characteristics	n	Baseline (T <sub>0</sub> )	р	n	Baseline (T <sub>0</sub> )	р	Follow Up (T1)	р	$(T_0/T_1)$	
Overall	797	18.7 (18.4,19.0)		592	18.6 (18.3,18.9)		18.7 (18.4,19.0)		0.71	
Gender										
Male	317	17.9(17.4,18.3)	$< 0.01^{*}$	200	17.7(17.1,18.2)	<0.01*	18.1 (17.5,18.6)	< 0.01*	0.21	
Female	480	19.3 (18.9,19.6)		392	19.1(18.7,19.5)		19.0(18.6,19.4)		0.59	
School Type										
Urban	482	19.1 (18.7, 19.5)	$< 0.01^{*}$	334	19.0 (18.6.19.4)	$0.02^{*}$	19.0 (18.5,19.4)	0.06	1.00	
Rural	315	18.1 (17.7,18.6)		258	18.2 (17.7.18.7)		18.3 (17.8,18.8)		0.59	
Ethnicity										
Malay	597	18.8 (18.5.19.2)	$0.02^{*}$	439	18.8(18.4.19.1)	0.02 *	18.9 (18.6.19.3)	< 0.01*	0.38	
Chinese	93	19.2 (18.5,19.9)	*Mal-Ind	69	19.2(18.4,20.0)	*Mal-Ind	18.8 (18.0,19.7)	*Mal-Ind	0.43	
Indian	69	17.3 (16.3,18.3)	*Chi-Ind	56	17.1(16.2,18.1)	*Chi-Ind	16.8 (15.5,18.0)	*Chi-Ind	0.55	
Others	38	18.3 (17.1,19.5)		28	18.0(16.5,19.5)		18.2 (16.6,19.8)		0.85	
BMI category										
Obese& OW	210	19.0 (18.4,19.5)	0.50	151	19.0 (18.4,19.7)	0.30	18.7 (18.0,19.3)	0.97	0.37	
Normal Weight	355	18.7(18.3,19.1)		267	18.6 (18.1,19.1)		18.7(18.2,19.2)		0.59	
Underweight	232	18.5(18.0,19.1)		174	18.3(17.7,18.9)		18.6(18.1,19.2)		0.37	
Academic achievement	789			587						
Good	41	18.4(16.9,20.0)	0.01*	23	17.0(15.1.18.9)	0.01*	19.4(17.8,20.9)	$0.02^{*}$	$0.046^{*}$	
Average	176	17.9(17.3,18.5)	*Av-	139	18.0(17.3,18.7)	*Av-	17.9(17.1,18.6)	*Av-	0.77	
Below Av	572	19.0(18.7,19.3)	BelowAv	425	18.9(18.5,19.3)	BelowAv	18.9(18.5,19.3)	BelowAv	0.95	
Pocket money	792			589						
High	358	18.9(18.5,19.4)	0.12	241	18 9(18 4 19 4)	0.32	19.0(18.5,19.5)	0.15	0.72	
Moderate	413	18.4(18.1,18.9)		337	18.5(18.1.18.9)		18.4(18.0,18.9)		0.81	
Low	21	19.9(17.8.22.0)		11	17.6(15.1,20.0)		20.0(17.7.22.3)		0.11	
Attempts to reduce weight	787			584						
Yes	456	18.9(18.5,19.3)	0.14	338	18.8(18.4.19.3)	0.17	18.8(18.4,19.3)	0.41	0.99	
No	331	18.5(18.0,18.9)		246	18.4(17.9,18.9)		18.6(18.0,19.1)		0.49	
Eating to cope with stress	788			587						
Yes	278	19.7(19.2,20.2)	< 0.01*	212	19.5(18.9,20.0)	< 0.01*	19.4(18.8,20.0)	< 0.01*	0.68	
No	510	18.2(17.8,18.5)		375	18.1(17.7,18.5)		18.3(17.9,18.7)		0.38	

### Table 4.9: Prevalence and Distribution of Stress Based on Cohen Perceived Stress Scale Score

Variation within group tested with Independent t-test and ANOVA. Variation between visits tested with paired t-test. \* The difference is significant at the 0.05 level (2-tailed)

### 4.4.1.2 Prevalence and distribution of stress according to stress level category

The CPSS score was further used to categorize the participants into three stress level categories as follow: 1) the low, 2) the moderate and 3) the high level of perceived stress. The low stress category included participants with CPSS score of 13 and below. The moderate stress category include participants with score from 14 to 26 and the high stress category include participants with CPSS score of 27 and above (Cohen & Williamson, 1988). The following table (Table 4.10) showed the prevalence and distribution of stress among the adolescents according to stress level categories.

Majority of participants had moderate level of perceived stress both at baseline (61.9%, n=493) and during follow up (60.5%, n=358). Percentage of participants who had high perceived stress level slightly increased from baseline at 29.1% (n=232) to 30.9% (n=183) during follow up. Statistically significant associations were observed between gender and perceived stress level at both time points. Majority of participants in the high stress level category were female students (T<sub>0</sub>: 34.4%, T<sub>1</sub>: 33.4%) whereas low stress level category was predominated by the male students (T<sub>0</sub>: 12.0%, T<sub>1</sub>: 12.0%). Urban students predominated the high stress level category both at baseline and follow up (T<sub>0</sub>:32.6%, T<sub>1</sub>: 31.4%). The association was however significant only during the near exam period ( $\chi^2$ =7.87, p=<0.05).

Across ethnicities, Chinese students predominated the high stress level category both at baseline (34.4%) and follow up (33.3%). Indian students predominated the low stress level category at both time points ( $T_0$ : 13.0%,  $T_1$ : 17.9%). Comparing between the BMI Categories, high perceived stress was predominant among the obese and overweight category both at baseline (33.8%) and follow up (33.1%). No statistically significant association was observed between ethnicity and perceived stress level; and between obesity categories and perceived stress level at both time points.

Variables	Baseline (T0)nStress Level Category		Pearson Chi-Square $(\chi^2)$	n	l Stre	Follow Up (1 ss Level Cat	Pearson Chi-Square $(\chi^2)$			
	Total	Low	Mod	High	· _	Total	Low	Mod	High	-
Overall	797(100)	72(9.0)	493(61.9)	232(29.1)		592(100)	51(8.6)	358(60.5)	183(30.9)	
Gender										
Male	317(39.8)	38(12)	212(66.9)	67(21.1)	18.72	200(33.8)	24(12.0)	124(62.0)	52(26.0)	6.49
Female	480(60.2)	34(7.1)	281(58.5)	165(34.4)	$p = < 0.01^*$	392(66.2)	27(6.9)	234(59.7)	131(33.4)	<i>p</i> =0.04*
School Type										
Urban	482(60.5)	38(7.9)	287(59.5)	157(32.6)	7.87	334(56.4)	25(7.5)	204(61.1)	105(31.4)	1.25
Rural	315(39.5)	34(10.8)	206(65.4)	75(23.8)	$p = 0.02^{*}$	258(43.6)	26(10.1)	154(59.7)	78(30.2)	<i>p</i> =0.54
Ethnicity										
Malay	597(74.9)	53(8.9)	366(61.3)	178(29.8)	al	439(74.2)	35(8.0)	260(59.2)	144(32.8)	a2
Chinese	93(11.7)	7(7.5)	54(58.1)	32(34.4)	FE: 8.27	69(11.7)	4(5.8)	42(60.9)	23(33.3)	FE:10.9
Indian	69(8.7)	9(13.0)	49(71.0)	11(15.9)	( <i>p</i> =0.21)	56(9.5)	10(17.9)	36(64.3)	10(17.9)	( <i>p</i> =0.08)
Others	38(4.8)	3(7.9)	24(63.2)	11(28.9)		28(4.7)	2(7.1)	20(71.4)	6(21.4)	
BMI Category										
Obese & Overweight	210(26.3)	19(9.0)	120(57.1)	71(33.8)	3.30 p=0.51	151(25.5)	11(7.3)	90(59.6)	50(33.1)	0.84 p=0.93
Normal Weight Under weight	355(44.5) 232(29.1)	33(9.3) 20(8.6)	224(63.1) 149(64.2)	98(27.6) 63(27.2)	p olei	267(45.1) 174(29.4)	25(9.4) 15(8.6)	162(60.7) 106(60.9)	80(30.0) 53(30.5)	p size

### Table 4.10: Prevalence and Distribution of Stress among the Adolescents according to Stress Level Category

a1: 1 cells (8.3%) have expected count less than 5. The minimum expected count is 3.43 a2: 2 cells (16.7%) have expected count less than 5. The minimum expected count is 2.41 Fisher exact (FE) p-value was used in cells with expected count less than 5.

### 4.4.2 Stress based on using objective measurement of saliva cortisol biomarker

The prevalence and distribution of stress among the adolescents based on objective measurement were analyzed based on mean saliva cortisol level at both time points.

# 4.4.2.1 Prevalence and distribution of stress based on using mean saliva cortisol level

Mean saliva cortisol level measured on subsamples of participants in both visits (T<sub>0</sub>: n=261; T<sub>1</sub>: n=228) were shown in Table 4.11. Unlike by using CPSS score, there was a significant difference in mean saliva cortisol level of participants between the two time points. Mean saliva cortisol level of participants was significantly higher at baseline (T<sub>0</sub>: 3.7 nmol/L (95% CI: 3.2, 4.1]) than during follow up (T<sub>1</sub>: 3.0 nmol/L (95% CI: 2.6, 3.4]) with the p-value of 0.02.

### Gender and School Location

Contradicting with CPSS score findings which demonstrated significantly higher score among female at both time points, mean saliva cortisol was observed higher among male than female students at both time points ( $T_0$ : 4.3 nmol/L [95% CI: 3.5, 5.1];  $T_1$ : 3.2 nmol/L [95% CI: 2.6, 3.8]). The difference between genders at both time points were not significant but a significant reduction from baseline to follow up was observed among the male students (p-value: 0.049).

In line with CPSS score findings, saliva cortisol was observed to be higher among urban students at both time points (T<sub>0</sub>:3.9nmol/L [95%CI: 3.3, 4.4]; T<sub>1</sub>:3.3nmol/L [95%CI: 2.8, 3.9]). The difference was significant only during follow up with p-value of 0.04. Between visits, no significant difference of saliva cortisol level was observed across school locations.

### Ethnicity

At baseline, mean saliva cortisol level was highest among the Indians ( $T_0$ : 5.7 nmol/L [95%CI: 3.4, 8.0]) but during follow up, it was highest among the other ethnicity ( $T_1$ : 3.7 [95%CI: 0.6, 6.9]). This difference was however significant only at baseline between the Indians and the Malay (p-value: 0.03). All ethnicities showed reduction of mean cortisol level from baseline to follow up. Between visits, no significant difference of saliva cortisol level was observed across the ethnicities.

### BMI category

At baseline, mean saliva cortisol level was highest among the underweight participants (T<sub>0</sub>: 4.5 nmol/L (95% CI: 3.4, 5.6]) but during follow up, it was highest among the obese and overweight students (T<sub>1</sub>: 3.3 nmol/L [95% CI: 2.4, 4.1]). No significant difference in mean cortisol level was observed across the BMI category at both time points. There is however a significant reduction in mean saliva cortisol among the underweight adolescents from baseline to follow up (p>0.01).

### Individual factors

Contradicting with CPSS findings which demonstrated highest CPSS score among the below average academic achievement students at baseline, students with good academic achievement had the highest saliva cortisol level during this near exam period ( $T_0$ : 5.7 nmol/L [95% CI: 2.0, 9.3]). During normal school days, highest saliva cortisol was observed among the below average academic achiever students ( $T_1$ : 3.2nmol/L (95% CI: 2.7, 3.7]). The good and average academic achiever categories both showed significant reduction of saliva cortisol level from baseline to follow up with p-value of 0.02 in both categories. At baseline, students with highest pocket money had highest saliva cortisol ( $T_0$ : 3.8 nmol/L [95%CI: 3.2, 4.5]) but during follow up, students with lowest pocket money demonstrated highest saliva cortisol level (T<sub>1</sub>: 4.6nmol/L [95%CI: 1.1, 10.3]).

At baseline, students who denied are in attempts to reduce weight and denied to practice eating when coping with stress had higher saliva cortisol level. Both group of students who denied that they were in attempts to reduce weight and denied to practice eating as a coping strategy also demonstrated significant reduction of mean saliva cortisol from baseline to follow up. No significant difference in mean saliva cortisol was observed across the academic achievement category, pocket money category, attempts to reduce weight and eat to cope with stress at both time points (Table 4.11).

	Saliva Cortisol (nmol/L) [Mean(95%CI)]									
	All Participants				Complete Cohort of Both Visits					
Variables	n	Baseline (T <sub>0</sub> )	р	n	Baseline (T <sub>0</sub> )	р	Follow Up (T1)	р	$(T_0/T_1)$	
Overall	261	3.8 (3.4,4.3)		228	3.7 (3.2,4.1)		3.0 (2.6,3.4)		0.02*	
Gender										
Male	100	4.3 (3.5,5.1)	0.08	80	4.2 (3.3,5.1)	0.11	3.2 (2.6,3.8)	0.52	$0.049^{*}$	
Female	161	3.5 (3.0,4.0)		148	3.4 (2.9,3.9)		2.9 (2.4,3.4)		0.14	
School location										
Urban	152	3.9 (3.3,4.4)	0.84	135	4.0(3.3,4.6)	0.16	3.3 (2.8,3.9)	$0.04^*$	0.12	
Rural	109	3.8 (3.0,4.5)		93	3.3(2.6,4.0)		2.5 (2.0,3.0)		0.06	
Ethnicity										
Malay	193	3.5 (3.0.3.9)	$0.03^{*}$	171	3.4 (2.9.3.8)	0.05	2.9 (2.5.3.4)	0.85	0.14	
Chinese	34	4.5 (3.0,5.9)	*Mal-Ind	31	4.0 (2.6,5.4)		2.9 (1.7,4.1)		0.24	
Indian	22	5.7 (3.4,8.0)		19	5.6 (3.0,8.3)		3.4 (2.1,4.7)		0.13	
Others	12	4.3 (1.3,7.3)		7	4.3 (0.2,8.8)		3.7 (0.6,6.9)		0.62	
BMI category										
Obese& Overweight	79	3.5 (2.8,4.2)	0.18	68	3.3(2.5,4.0)	0.28	3.3 (2.4, 4.1)	0.30	0.97	
Normal Weight	111	3.6 (3.0,4.2)		- 98	3.6(3.0,4.2)		3.1 (2.5,3.8)		0.24	
Underweight	71	4.5 (3.4,5.6)		62	4.2(3.1,5.4)		2.5 (2.0,3.0)		$< 0.01^{*}$	
Academic achievement	258			226						
Good	10	6.0(2.5,9.4)	0.13	8	5.7(2.0,9.3)	0.25	1.9(0.6,3.1)	0.14	$0.02^{*}$	
Average	61	3.5(2.7,4.3)		56	3.6(2.7,4.4)		2.4(1.9,3.0)		$0.02^{*}$	
Below Av	187	3.8(3.3,4.3)		162	3.6(3.0,4.1)		3.2(2.7,3.7)		0.29	
Pocket money	258			226						
High	115	3.9(3.3,4.5)	0.96	95	3.8 (3.2,4.5)	0.88	3.3(2.6,4.0)	0.24	0.19	
Moderate	139	3.8(3.2,4.5)		127	3.6(2.9,4.3)		2.7(2.2,3.3)		$0.03^{*}$	
Low	4	3.3(0.8,5.8)		4	3.3(0.8,5.8)		4.6(1.1,10.3)		0.66	
Attempts to reduce weight	255			223						
Yes	149	3.5(3.0,4.0)	0.12	128	3.3(2.8,3.9)	0.17	3.1(2.5,3.6)	0.35	0.44	
No	106	4.2(3.4,5.0)		95	4.0(3.2,4.8)		2.7(2.2,3.2)		< 0.01*	
Eating to cope with stress	256			226						
Yes	84	3.2(2.6,3.9)	0.08	74	3.0(2.4,3.7)	0.06	2.6(2.0,3.2)	0.22	0.32	
No	172	4.1(3.5,4.7)		152	4.0(3.4,4.6)		3.1(2.6,3.6)		$0.03^{*}$	

Variation within group tested with Independent t-test and ANOVA. Variation between the two visits tested with paired t-test.

\* The difference is significant at the 0.05 level (2-tailed)

### 4.4.3 Pearson correlation between CPSS score and saliva cortisol level

There was no significant correlation between the CPSS score and saliva cortisol level at both time points of baseline (T<sub>0</sub>: r = -0.78; p=0.21) and follow up (T<sub>1</sub>: r = 0.01; p=0.94).

### 4.4.4 Transition of stress level from baseline to follow up

It was hypothesized that stress level potentially would be higher at baseline as data were collected within the duration of two weeks prior to final year school examinations and lower during follow up as the visits were conducted within the duration of at least three months away from any major school examinations. The transition of participants' stress level from baseline to follow up were analyzed using both the subjective and objective measurement of stress.

### 4.4.4.1 Transition of stress level based on change in CPSS score

The transition of participants' perceived stress from baseline to follow up six months after was analyzed based on the change in CPSS score and shown in Table 4.12. It was observed that 46.6% (n=276) participants experienced an increase in stress level, 43.6% (n=258) demonstrated a decrease in stress level and minority of students (9.8%, n=58) did not demonstrate any changes in the CPSS score. Pearson Chi-square test revealed no significant association between all the socio-demographic characteristics or the individual factors and transition of stress level (p > 0.05).

### Gender and school location

The increase stress level group was predominated by the male students (51.0%) compared to the female students (44.4%). The decrease stress level group was predominated by the female students (45.7%) compared to the male students (39.5%).

Between school locations, increase stress level group was predominated by the rural students (47.3%) compared to the urban students (46.1%). The decrease stress level group was predominated by the urban (44.0%) compared to the rural students (43.0%).

### Ethnicity

Across ethnicities, increase stress level was predominated by the other ethnicities students (53.6%). Chinese students had lowest percentage in this group (40.6%). The decrease stress level group was predominated by the Chinese and Indian students with similar percentage of 46.4%. Other ethnicities students demonstrated the lower percentage in the decrease stress level group at 39.3%.

### BMI category

Underweight adolescents predominated the increase stress level group (51.7%) while the obese and overweight adolescents predominated the decrease stress level group (48.3%). The obese and overweight students had the lowest percentage in the increase stress level group (41.7%) while the underweight adolescents were the lowest percentage in the decrease stress level group (39.1%).

### Individual factors

The good academic achievement students predominantly experienced an increase in stress level at 56.5% compared to the normal weight students who predominated the decrease stress level group (45.3%). All categories of pocket money demonstrated an increase in stress level; highest percentage observed among the lowest pocket money category (72.7%). Students who denied are in attempts to reduce weight predominantly demonstrated an increase in stress level (48.8%). Majority of students who admitted to practice eating in coping with stress (47.2%) experienced a decrease in stress level whereas majority of students who denied this practice actually experienced an increase in stress level (50.1%).

		Overall	Increase	No	Decrease	
Variables				Change		Pearson Chi
	n	592	276	58	258	Square
	(%)	(100)	(46.6)	(9.8)	(43.6)	$\chi^2$
Gender	Male	200(33.8)	102(51.0)	19 (9.5)	79 (39.5)	2.42
	Female	392(66.2)	174(44.4)	39 (9.9)	179(45.7)	(p:0.30)
School location	Urban	334(56.4)	154(46.1)	33 (9.9)	147(44.0)	0.08
	Rural	258(43.6)	122(47.3)	25 (9.7)	111(43.0)	(p:0.96)
Ethnicity	Malay	439(74.2)	208(47.4)	42 (9.6)	189(43.1)	2.32
·	Chinese	69(11.7)	28 (40.6)	9 (13.0)	32 (46.4)	(p:0.89)
	Indian	56(9.5)	25 (44.6)	5 (8.9)	26 (46.4)	
	Others	28(4.7)	15 (53.6)	2 (7.1)	11 (39.3)	
<b>BMI</b> Cat	Ow &Ob	151(25.5)	63(41.7)	15(9.9)	73(48.3)	3.46
	Normal wt	267(45.1)	123(46.1)	27(10.1)	117(43.8)	(p:0.48)
	Underweight	174(29.4)	90(51.7)	16(9.2)	68(39.1)	
Academic	Good	23(3.9)	13(56.5)	1(4.3)	9(39.1)	2.24
achievement	Average	139(23.7)	60(43.2)	16(11.5)	63(45.3)	(p:0.69)
	Below Av	425(72.4)	200(47.1)	40(9.4)	185(43.5)	
Pocket money	High	241(40.9)	110(45.6)	26(10.8)	105(43.6)	3.71
·	Moderate	337(57.2)	156(46.3)	32(9.5)	149(44.2)	(p:0.45)
	Low	11(1.9)	8(72.7)	0(0)	3(27.3)	
Attempts to	Yes	338(57.9)	153(45.3)	39(11.5)	146(43.2)	2.99
reduce weight	No	246(42.1)	120(48.8)	18(7.3)	108(43.9)	(p:0.22)
T. 4.4	V	010(26.1)	97(41.0)	25(11.0)	100(47.2)	101
Eat to cope	r es	212(30.1)	$\frac{8}{(41.0)}$	25(11.8)	100(4/.2)	4.94
with stress	INO	5/5(63.9)	188(50.1)	32(8.5)	155(41.3)	(p:0.09)

 Table 4.12: Transition of stress level based on change in CPSS score from baseline to follow up according to demographic characteristics

Variation within group tested with Pearson Chi Square.

\* The difference is significant at the 0.05 level (2-tailed)

### 4.4.4.2 Transition of stress level based on change in saliva cortisol level

The transition of participants' stress (n=228) from baseline to follow up was analyzed based on the changes in saliva cortisol level and shown in Table 4.13. All participants demonstrated either an increase or a decrease in saliva cortisol level. Majority of participants (n=142, 62.3%) demonstrated a decrease in saliva cortisol level. Pearson Chi-square test revealed no significant association between all the socio-demographic characteristics or the individual factors and transition of saliva cortisol level (p>0.05) except for one, which is the BMI category.

### Gender, school location and ethnicity

All other socio-demographic categories also predominantly demonstrated a decrease in saliva cortisol level; observed higher among the female (65.0%), urban (65.2%) and the Indian students (73.7%).

### BMI category

A significant association was observed between the BMI category and transition of saliva cortisol level ( $\chi^2$ =7.97, *p*=0.02). The normal weight and the underweight categories predominantly demonstrated a decrease in saliva cortisol level with highest percentage among the normal weight category adolescents (69.4%). Contradicting with the CPSS score findings which demonstrated higher percentage of the obese and overweight adolescents in the decrease stress level group, the obese and overweight category however predominated the increase in saliva cortisol level group (51.5%).

### Individual factors

The good academic achievement group and high pocket money group demonstrated highest percentage of students experiencing a decrease in saliva cortisol level 87.5% and 65.3% respectively. Students who denied are in attempts to reduce weight predominantly demonstrated a decrease in saliva cortisol level (66.3%).

### Stress Level Category (based on CPSS score)

No significant association was observed between stress level category and change in saliva cortisol level. The high stress level category however predominated the increase in saliva cortisol group (42.4%) compared to the moderate and low stress level category. The decrease saliva cortisol group was predominated by the moderate stress level category at 64.4%.

			Changes i Corti	n Saliva sol	Pearson Chi
Characteristics		Overall	Increase	Decrease	Square
	n (%)	228 (100)	86 (37.7)	142 (62.3)	χ²
Gender	Male Female	80(35.1) 148(64.9)	28(35.0) 58(39.2)	52(65.0) 90(63.4)	0.39 (p:0.53)
Location	Urban Rural	135(59.2) 93(40.8)	47(34.8) 39(41.9)	88(65.2) 54(58.1)	1.19 (p:0.28)
Ethnicity	Malay Chinese Indian Others	171(75.0) 31(13.6) 19(8.3) 7(3.1)	66(38.6) 12(38.7) 5(26.3) 3(42.9)	$105(61.4) \\ 19(61.3) \\ 14(73.7) \\ 4(57.1)$	1.12 (p:0.75)
BMI Cat	Ow & Ob Normal Wt Underweight	68(29.8) 98(43.0) 62(27.2)	35(51.5) 30(30.6) 21(33.9)	33(48.5) 68(69.4) 41(66.1)	7.97 (p:0.02*)
Stress Level	High Moderate Low	66(28.9) 146(64.0) 16(7.0)	28(42.4) 52(35.6) 6(37.5)	38(57.6) 94(64.4) 10(62.5)	0.90 (p:0.64)
Academic Achievement	Good Average Below Av	8(3.5) 56(24.8) 162(71.7)	1(12.5) 18(32.1) 66(40.7)	7(87.5) 38(67.9) 96(59.3)	3.54 (p:0.17)
Pocket Money	High Moderate Low	95(42.0) 127(56.2) 4(1.8)	33(34.7) 50(39.4) 2(50.0)	62(65.3) 77(60.6) 2(50.0)	0.76 (p:0.68)
Attempts to Reduce Weight	Yes No	128(57.4) 95(42.6)	52(40.6) 32(33.7)	76(59.4) 63(66.3)	1.12 (p:0.29)
Eat to Cope	Yes No	74(32.7) 152(67.3)	28(37.8) 57(37.5)	46(62.2) 95(62.5)	0.002 (p:0.96)

 Table 4.13: Transition of stress level based on change in saliva cortisol level from baseline to follow up according to demographic characteristics

Variation within group tested with Pearson Chi Square.

\* The difference is significant at the 0.05 level (2-tailed)

# 4.4.5 Pearson correlation between transition in CPSS score and change in saliva cortisol level

There was a significant weak negative correlation (r = -0.16, p=0.02) between the transition in CPSS score and change in saliva cortisol level from baseline to follow up.
# 4.5 Prevalence and Distribution of Eating Behaviour among Malaysian Adolescents

Eating behaviour of participants were analyzed using the Malay validated selfreported Child Eating Behaviour questionnaire (CEBQ) (Loh et al., 2013). The CEBQ used in this study explored eight eating behaviour items which represented three eating patterns. The three eating patterns studied were (1) emotional eating, (2) externally induced eating and (3) restrained Eating.

Emotional eating included two items which are: (i) emotional over eating (EOE) and (ii) emotional under eating (EUE). Externally induced eating included 3 items which are: (i) food responsiveness (FR), (ii) enjoyment of food (EOF) and (iii) desire to drink (DD). Restrained eating consisted of three items which are: (i) satiety responsiveness (SR), (ii) slowness in eating (SE) and food fussiness (FF). The eating behavior scores reflected participants mean response from never (1) to always (5). This section describes the prevalence and distribution of eating behavior among Malaysian adolescents at baseline and the trend observed from baseline to follow up.

# 4.5.1 Prevalence and distribution of eating behavior among Malaysian adolescents at baseline (T<sub>0</sub>)

Baseline eating behavior mean scores of all participants ( $T_0$ : n = 797) is shown in Table 4.14. Mean score was observed to be significantly highest on the EOF item (3.69 [95% CI: 3.62, 3.74]) and lowest on EOE item (2.34 [95% CI: 2.28, 2.40]). Similar trends were observed across genders, school locations, ethnicity and BMI categories.

#### Genders and school location

Emotional eating pattern scores were observed to be significantly higher (p < 0.01) among female compared to male students; depicted by higher EOE (2.41 [95% CI: 2.34, 2.49]) and EUE items (2.75 [95% CI: 2.69, 2.82]). Female students also demonstrated significantly higher score than male (p < 0.01) in FR (2.95 [95% CI: 2.87, 3.02]) and EOF (3.78 [95% CI: 3.70, 3.85]). Female students also showed significantly higher score (p < 0.01) in SR scale with the score of 2.68 (95% CI: 2.63, 2.73).

Between the urban and rural students, significant differences were observed only on two items, the FF and EUE items. FF item was significantly higher (p=0.03) among the urban (3.00 [95% CI: 2.96, 3.05]) compared to the rural adolescents (2.92 [95% CI: 2.86, 2.98]). The EUE item was also significantly higher among the urban students (p=0.047) with the score of 2.73 (95% CI: 2.66, 2.79).

#### Ethnicity

Significant differences were observed in all three items of externally induced eating pattern (p<0.01). FR score was significantly higher in Malay (2.95 [95% CI: 2.89, 3.02]) compared to Indian students (2.51 [95% CI: 2.34, 2.68]). The Malay and Chinese students showed significantly higher score in EOF item compared to the Indians. Malay students also had significantly higher score than the Chinese students in DD item with the score of 2.46 (95% CI: 2.39, 2.53).

Analyzing the restrained eating pattern, Other ethnicity demonstrated significantly higher score in SE item (2.89 [95% CI: 2.71, 3.08]) compared to the Malay (2.61 [95% CI: 2.57, 2.66]) and Chinese students (2.55 [95% CI: 2.44, 2.66]). The Malay students had significantly higher score in SR (2.66 (95% CI: 2.62, 2.71]) compared to the Chinese (2.51 [95% CI: 2.41, 2.60]) and Indians (2.46 [95% CI: 2.31, 2.62]).

Emotional eating pattern analysis revealed significantly higher EOE score among the Malay students (2.42 [95%CI: 2.35, 2.48]) compared to the Indians (1.98 [95%CI: 1.80, 2.15]) with p-value of <0.01.

## BMI category

Significant differences were observed across the BMI category only in the EOF and FR items (p < 0.01). Both items were scored significantly highest among the underweight (EOF: 3.80 [95%CI: 3.69, 3.91)]; FR: 3.02 [95%CI: 2.91, 3.13]) and significantly lowest among the overweight and obese adolescents (EOF: 3.39 [95%CI: 3.28, 3.51]; FR: 2.70 [95% CI: 2.60, 2.80]).

#### Stress level category

Comparing across the baseline stress level categories, FR eating behavior items was observed to be significantly highest among the high stress level category participants (3.09 [95%CI: 2.99, 3.20]) compared to both the moderate and low stress level participants (p < 0.01). High stress level category adolescents also demonstrated significantly higher score in both EOE (2.60 [95% CI: 2.49, 2.71]) and EUE items (2.83 [95% CI: 2.74, 2.92]) compared to both low and moderate level stress categories. SR item was also observed to be significantly higher among the high stress category with the score of 2.73 (95% CI: 2.66, 2.80) compared to both the moderate and low stress level categories (p < 0.01).

				Baseline	Eating Behaviour	[Mean Score (95%	6 CI)]			
Eating Behavior		Emotional	l Eating	R	estrained Eating		_	Exte	rnally Induced Eati	ng
Items	n	EOE	EUE	SR	SE	FF		DD	EOF	FR
Overall	797	2.34(2.28,2.40)	2.69(2.63,2.74)	2.62(2.59,2.66)	2.63 (2.59,2.66)	2.97 (2.93,3.01)		2.40 (2.34,2.46)	3.69 (3.62,3.74)	2.89 (2.83,2.94)
Gender										
Male	317	2.22 (2.14,2.31)	2.58 (2.50,2.66)	2.54 (2.48,2.60)	2.63 (2.57,2.69)	2.94 (2.88,3.00)		2.48 (2.38,2.57)	3.54 (3.45,3.63)	2.80 (2.71,2.88)
Female	480	2.41 (2.34,2.49)	2.75 (2.69,2.82)	2.68 (2.63,2.73)	2.62 (2.57,2.67)	2.99 (2.94,3.04)		2.35 (2.27,2.43)	3.78 (3.70,3.85)	2.95 (2.87,3.02)
		[p:<0.01 <sup>*</sup> ]	[p:<0.01*]	[p:<0.01 <sup>*</sup> ]	[p:0.88]	[p:0.19]		[p:0.046]	[p:<0.01 <sup>*</sup> ]	[p:0.01 <sup>*</sup> ]
Location										
Urban	482	2.37 (2.30,2.44)	2.73 (2.66,2.79)	2.66 (2.61,2.70)	2.65 (2.60,2.70)	3.00 (2.96,3.05)		2.40 (2.32,2.48)	3.72 (3.65,3.80)	2.92 (2.85,2.99)
Rural		2.29 (2.19,2.39)	2.62 (2.54,2.70)	2.58 (2.52,2.64)	2.60 (2.53,2.65)	2.92 (2.86,2.98)		2.41 (2.31,2.50)	3.62 (3.53,3.72)	2.84 (2.75,2.92)
	315	[p:0.16]	[p:0.047*]	[p:0.052]	[p:0.17]	[p:0.03*]		[p:0.87]	[p:0.11]	[p:0.17]
Ethnicities										
Malay	597	2.42 (2.35,2.48)	2.71 (2.65,2.77)	2.66 (2.62,2.71)	2.61 (2.57,2.66)	2.99 (2.94,3.03)		2.46 (2.39,2.53)	3.72 (3.66,3.79)	2.95 (2.89,3.02)
Chinese	93	2.20 (2.05,2.36)	2.63 (2.47,2.78)	2.51 (2.41,2.60)	2.55 (2.44,2.66)	2.92 (2.83,3.01)		2.08 (1.92,2.24)	3.72 (3.56,3.87)	2.75 (2.60,2.91)
Indians	69	1.98 (1.80,2.15)	2.55 (2.34,2.75)	2.46 (2.31,2.62)	2.69 (2.55,2.84)	2.96 (2.79,3.12)		2.35 (2.13,2.57)	3.33 (3.09,3.57)	2.51 (2.34,2.68)
Others	38	2.11 (1.88,2.35)	2.74 (2.51,2.96)	2.62 (2.42,2.80)	2.89 (2.71,3.08)	2.86 (2.68,3.03)		2.30 (2.06,2.53)	3.61 (3.29,3.92)	2.85 (2.65,3.05)
		[p:<0.01*]	[p:0.29]	[p:<0.01*]	[p:<0.01*]	[p:0.36]		[p:<0.01*]	[p:<0.01*]	[p:<0.01*]
				*Malay-Chinese	*Malay-Others			*Malay-Chinese	*Malay-Indian	*Malay-Indian
		*Malay-Indian		*Malay-Indian	*Chinese-Others				*Chinese-Indian	
BMI Category										
Obese & OW	210	2.24 (2.13,2.35)	2.65 (2.55,2.76)	2.63 (2.56,2.71)	2.60 (2.53,2.67)	2.92 (2.84,3.00)		2.32 (2.21,2.43)	3.39 (3.28,3.51)	2.70 (2.60,2.80)
Normal Weight	355	2.34 (2.26,2.42)	2.70 (2.63,2.77)	2.65 (2.59,2.70)	2.61 (2.55,2.67)	2.99 (2.94,3.05)		2.41 (2.32,2.50)	3.78 (3.69,3.86)	2.91 (2.83,2.99)
Underweight	232	2.43 (2.31,2.54)	2.69 (2.59,2.79)	2.58 (2.50,2.66)	2.68 (2.60,2.75)	2.98 (2.91,3.05)		2.46 (2.34,2.58)	3.80 (3.69,3.91)	3.02 (2.91,3.13)
		[p:0.06]	[p:0.77]	[p:0.33]	[p:0.26]	[p:0.26]		[p:0.24]	[p:<0.01*]	[p:<0.01*]
									*UW-OW&Ob	*UW-OW&Ob
									* <i>NW-OW&amp;Ob</i>	*NW-OW&Ob
Stress Category	222	2 (0 (2 40 2 71)	0.02 (0.74.0.00)		0.71 (0.64.0.70)	2.01 (2.04.2.00)		2 49 (2 26 2 60)	2 70 (2 69 2 01)	2.00 (2.00.2.20)
High Mala i	232	2.60 (2.49,2.71)	2.83 (2.74,2.92)	2.73 (2.66,2.80)	2.71 (2.64,2.78)	3.01 (2.94, 3.08)		2.48 (2.36,2.60)	3. /9 (3.68,3.91)	3.09 (2.99, 3.20)
Moderate	493	2.20(2.19,2.33)	2.00(2.39,2.72)	2.01(2.30,2.00)	2.00(2.55,2.05)	2.95(2.91, 5.00)		2.39(2.31,2.40)	3.04(3.57, 3.72)	2.82 (2.70,2.89)
LOW	12	2.02(1.85, 2.22)	2.43(2.23,2.01)	2.41(2.29,2.34)	2.33(2.43,2.07)	2.94(2.82, 3.07)		2.24(2.03, 2.43)	5.00(5.40, 5.61)	2.00(2.47,2.83)
		[p:<0.01] *High Low	[p:<0.01] *High Mod	[p:<0.01] *High Mod	[p:0.02] *High Mod	[p:0.59]		[p:0.10]	[p:0.06]	[p:<0.01] *High Mod
		*High-LOW	*High-Low	*High-Low	"Ingn-Mou					*High-Low
		111511-11100	*Mod-Low	*Mod-Low						Ingn-LOw

# Table 4.14: Baseline Eating Behaviour Patterns of the Adolescents

Variation within group tested with Independent t-test and ANOVA.

<sup>12</sup> \* *The difference is significant at the 0.05 level (2-tailed)* 

# 4.5.2 Eating behaviour pattern of Malaysian adolescents at baseline (T<sub>0</sub>) and follow up (T<sub>1</sub>)

The complete cohort of the two visits involving only 592 students were analyzed and depicted in Table 4.15. In general, significant increment from baseline to follow up were observed in EOE item (p < 0.01) but not in EUE item. Significant reduction (p < 0.05) were observed in all three items of the externally induced eating pattern which include DD, EOF and FR items. Restrained eating pattern demonstrated significant reduction between visits in SR and FF items (p < 0.01) but SE demonstrated a significant increment (p < 0.01) from baseline to follow up.

	Eating Behavior Score           Items         Baseline (Ta)         Follow Un (Ti)								
Items	<b>Baseline</b> (T <sub>0</sub> )	Follow Up (T1)	p-value	Remarks					
<b>(n)</b>	(592)	(592)							
Emotional Eating									
Emotional Overeating	2.34(2.27,2.40)	2.47(2.40,2.53)	< 0.01*	1					
Emotional Undereating	2.67(2.61,2.73)	2.69(2.63,2.75)	0.47	1					
Restrained Eating									
Satiety Responsiveness	2.62 (2.57,2.66)	2.50(2.45,2.54)	< 0.01*	$\downarrow$					
Slowness in Eating	2.62 (2.57,2.66)	2.71(2.64,2.78)	< 0.01*	1					
Food Fussiness	2.95(2.91,3.00)	2.70(2.65,2.74)	< 0.01*	$\downarrow$					
Externally Induced Eating									
Desire to Drink	2.36(2.29,2.43)	2.24(2.17,2.31)	< 0.01*	$\downarrow$					
Food Responsiveness	2.89(2.83,2.96)	2.84(2.77,2.90)	$0.048^{*}$	$\downarrow$					
Enjoyment of Food	3.71(3.64,3.77)	3.55(3.47,3.62)*	< 0.01*	$\downarrow$					

Table 4.15 : Eating Behaviour Score at baseline and follow up

Variation between the visits were tested with Paired t-test.

\* The difference is significant at the 0.05 level (2-tailed)

# 4.5.2.1 Trend of eating behaviour pattern according to socio-demographic characteristics

This section describes on the eating behaviour pattern of the adolescents according to the socio-demographic characteristics.

### Gender

The trend of eating behaviour among adolescents according to gender is shown in Table 4.16. Female students were observed to have higher score in emotional eating pattern (EOE and EUE) than the male at both time points. The mean score was significantly higher during follow up (p<0.01). The EOE score showed significant increment from baseline to follow up in both genders (p<0.01).

In restrained eating pattern, SR was significantly higher among females at both time points (p<0.01). No significant difference was observed between genders in both FF and SE items. FF showed significant reduction from baseline to follow up in both genders (p<0.01). Female students also demonstrated significant reduction from baseline to follow up in SR (p<0.01) but a significant increment in SE (p<0.01).

Analyzing the externally induced eating pattern, female students showed high score in EOF and FR item than the male at both time points. This difference however was significant at both time points only in EOF item. Significant difference between genders in FR score was observed only at baseline (p=0.04). EOF also showed significant reduction from baseline to follow up in both genders (p<0.01). FR and DD showed significant reduction from baseline to follow up only among the female students (p<0.01).

			Mean Score	e (95%CI)		$- \frac{P}{(T_0/T_1)}$
	<b>n=592</b> (200/392)	Baseline (T <sub>0</sub> )	p-value	Follow Up (T1)	p-value	- (T <sub>0</sub> /T <sub>1</sub> )
Emotion	al Eating					
EOE	Male Female	2.21(2.10,2.31) 2.41(2.32,2.49)	<0.01*	2.37(2.27,2.47) 2.51(2.43,2.60)	0.051	${<}0.01^{*} \ {<}0.01^{*}$
EUE	Male Female	2.54(2.44,2.64) 2.73(2.66,2.81)	<0.01*	2.65(2.55,2.74) 2.71(2.64,2.78)	0.27	$0.048^{*}$ 0.60
Restrain	ed Eating					
SR	Male Female	2.50(2.42,2.57) 2.68(2.62,2.73)	<0.01*	2.42(2.35,2.49) 2.54(2.49,2.59)	<0.01*	$0.08 \\ < 0.01^{*}$
SE	Male Female	2.62(2.54,2.70) 2.61(2.56,2.67)	0.88	2.63(2.53,2.73) 2.75(2.67,2.84)	0.07	0.93 <0.01*
FF	Male Female	2.91(2.84,2.98) 2.98(2.92,3.03)	0.13	2.72(2.65,2.80) 2.68(2.62,2.74)	0.38	${<}0.01^{*} \ {<}0.01^{*}$
External	lly Induced Eating					
DD	Male Female	2.41(2.29,2.53) 2.33(2.25,2.41)	0.26	2.44(2.32,2.55) 2.14(2.06,2.22)	<0.01*	$0.71 < 0.01^{*}$
FR	Male Female	2.80(2.70,2.90) 2.94(2.86,3.02)	0.04*	2.82(2.73,2.92) 2.85(2.76,2.93)	0.74	$0.65 < 0.01^{*}$
EOF	Male Female	3.56(3.45,3.67) 3.78(3.69,3.87)	<0.01*	3.43(3.31,3.54) 3.61(3.52,3.70)	0.02*	${<}0.01^{*} \ {<}0.01^{*}$

# Table 4.16: Eating Behaviour Patterns of the Adolescents at baseline and follow up according to Gender

Variations within category was tested with Independent t-test. Variation between the visits were tested with Paired ttest. \* The difference is significant at the 0.05 level (2-tailed)

#### School location

The eating behavior pattern of the adolescents according to school locations were shown in Table 4.17. The EOF score was highest at both time points compared to other items. The EOF was observed higher among the urban students at both time points; significantly high during follow up (p=0.04). The EOF score demonstrated significant reduction from baseline to follow up in both urban and rural students (p<0.01). The FR demonstrated higher score among the urban students at both time points with reduction from baseline to follow-up but the differences were not significant. In emotional eating, urban students demonstrated higher score in EOE at both time points but the differences were not significant. Significant increment of score in EOE from baseline to follow up was observed among both urban and rural students (p<0.01).

Restrained eating pattern demonstrated significant difference in SR between the urban and rural students at both time points. At baseline, SR was higher among the urban but during follow up, the score was higher among the rural students. Significant reduction of SR score was observed among the urban students from baseline to follow up. Significant reductions were also observed in FF item from baseline to follow up both among the urban and rural students (p<0.01). Urban students also showed significantly higher score of FF at baseline (p<0.01). Both urban and rural students demonstrated an increment in SE item from baseline to follow-up but the difference was significant only among the rural students (p<0.01).

Table 4.17: Eating Behaviour	Patterns of the adolescents a	at baseline and follow up
according to School Location		

			Mean Score	e (95%CI)		Р
	<b>n=592</b> (200/392)	Baseline (T <sub>0</sub> )	p-value	Follow Up (T1)	p-value	- (T <sub>0</sub> /T <sub>1</sub> )
Emotion	al Eating					
EOE	Urban	2.36(2.28,2.45)	0.41	2.47(2.38,2.56)	0.91	< 0.01*
	Rural	2.31(2.20,2.41)		2.46(2.36,2.57)		< 0.01*
EUE	Urban	2.70(2.62,2.78)	0.18	2.68(2.60,2.76)	0.76	0.62
	Rural	2.62(2.53,2.71)		2.70(2.62,2.78)		0.10
Restrain	ed Eating					
SR	Urban	2.66(2.60,2.72)	0.03*	2.46(2.40,2.51)	$0.04^{*}$	< 0.01*
	Rural	2.56(2.50,2.62)		2.55(2.48,2.61)		0.71
SE	Urban	2.64(2.58,2.70)	0.20	2.70(2.61,2.80)	0.84	0.16
	Rural	2.58(2.52,2.65)		2.72(2.63,2.81)		$< 0.01^{*}$
FF	Urban	2.99(2.94,3.05)	$0.04^{*}$	2.67(2.61,2.74)	0.27	< 0.01*
	Rural	2.90(2.84,2.97)		2.73(2.66,2.79)		$<\!0.01^*$
External	lly Induced Eating					
DD	Urban	2.38(2.28,2.47)	0.59	2.21(2.12,2.30)	0.29	< 0.01*
	Rural	2.34(2.24,2.44)		2.28(2.18,2.38)		0.23
FR	Urban	2.91(2.82,3.00)	0.56	2.86(2.78,2.95)	0.35	0.23
	Rural	2.87(2.78,2.97)		2.80(2.71,2.90)		0.10
EOF	Urban	3.75(3.66,3.84)	0.14	3.61(3.52,3.71)	$0.04^{*}$	< 0.01*
	Rural	3.65(3.54,3.75)		3.46(3.35,3.57)		$< 0.01^{*}$

Variations within category was tested with Independent t-test. Variation between the visits were tested with Paired t-test. \* The difference is significant at the 0.05 level (2-tailed).

### **Ethnicity**

Across the ethnicities, the EOF score was again significantly highest compared to other eating behavior items at both time points (Table 4.18). EOF score was higher among the Malay students at both time points; significantly higher compared to the Indian students at baseline. The Malay and Chinese students showed significant reduction in EOF from baseline to follow up with p-value of <0.01 and 0.02 respectively. Significant difference was observed between ethnicities in FR item at both time points (p<0.01). Malay students had significantly higher score at both time points compared to the Chinese and Indian students (p<0.01). A reduction of score from baseline to follow up were observed among the Malays, Chinese and other ethnicities but an increment was observed only among the Indian students. These changes however were not significant. The Malay students had significantly higher DD score compared to the Chinese students at baseline (p<0.01).

Emotional eating analysis revealed significant difference in EOE score between the ethnicities at both time points. Malay students had significantly higher EOE score than the Indians at both time points and higher than the Chinese students at follow up (p<0.01). The Malay students also demonstrated a significant increment in EOE from baseline to follow up (p<0.01). EUE scores was observed highest among the other ethnicities in both visits. EUE score was significantly higher (p<0.01) among other ethnicities and Malays students compared to the Indian students during follow up. No significant changes were observed in EUE score across the ethnicities between the two visits.

Restrained eating pattern analysis revealed significant reduction from baseline to follow up in FF among the Malay (p<0.01) and the Chinese (p=0.048) students. FF score was observed to be highest among the Indian students both at baseline and follow up. The

difference however was not significant. Significant reduction from baseline to follow up was also observed in SR item among the Malays (p<0.01). The SE score revealed significant difference between the ethnicities at baseline (p=0.04); highest among other ethnicity compared to the Malay and Chinese students. No significant changes were observed in SE score across the ethnicities between the two visits.

			Mean Score (95%CI)								
	n=592	Baseline (T <sub>0</sub> )	p-value	Follow Up (T1)	p-value	- (T <sub>0</sub> /T <sub>1</sub> )					
Emotion	al Eating										
EOE	Malay	2.42(2.34,2.50)	<0.01*	2.57(2.49,2.65)	< 0.01*	<0.01*					
	Chinese	2.22(2.04,2.40)	*Mal -Ind	2.22(2.05,2.39)	*Mal-Chi	1.00					
	Indian	1.98(1.79,2.18)		2.03(1.82,2.25)	*Mal-Ind	0.61					
	Others	2.08(1.81,2.35)		2.30(2.03,2.56)		0.21					
EUE	Malay	2.70(2.63,2.76)	0.22	2.74(2.68,2.81)	< 0.01*	0.20					
	Chinese	2.60(2.41,2.77)		2.52(2.35,2.68)	*Mal- Ind	0.40					
	Indian	2.50(2.26,2.74)		2.42(2.19,2.64)	*Ind-Oth	0.54					
	Others	2.71(2.42,3.00)		2.84(2.60,3.08)		0.48					
Restrain	ed Eating										
SR	Malay	2.65(2.60,2.70)	0.06	2.49(2.44,2.54)	0.53	<0.01*					
	Chinese	2.49(2.37,2.61)		2.46(2.33,2.58)		0.60					
	Indian	2.51(2.34,2.69)		2.56(2.41,2.70)		0.66					
	Others	2.59(2.36,2.83)		2.59(2.37,2.82)		1.00					
SE	Malay	2.60(2.55,2.65)	0.04*	2.69(2.61,2.76)	0.21	0.19					
	Chinese	2.55(2.41,2.70)	*Mal-Oth	2.66(2.44,2.87)		0.30					
	Indian	2.67(2.51,2.83)	*Chi-Oth	2.88(2.65,3.11)		0.11					
	Others	2.88(2.68,3.09)		2.89(2.55,3.24)		0.95					
FF	Malay	2.97(2.92,3.02)	0.35	2.69(2.64,2.75)	0.99	<0.01*					
	Chinese	2.89(2.78,3.00)		2.70(2.57,2.83)		$0.048^{*}$					
	Indian	2.98(2.79,3.17)		2.71(2.53,2.89)		0.08					
	Others	2.82(2.61,3.04)		2.67(2.40,2.93)		0.44					
External	lly Induced Eating										
DD	Malay	2.42(2.34,2.50)	$<\!0.01^{*}$	2.23(2.15,2.31)	0.42	$< 0.01^{*}$					
	Chinese	2.07(1.89,2.26)	*Mal-Chi	2.14(1.96,2.32)		0.52					
	Indian	2.28(2.06,2.50)		2.35(2.10,2.59)		0.65					
	Others	2.27(1.99,2.56)		2.38(2.09,2.67)		0.48					
FR	Malay	2.97(2.90,3.05)	$<\!0.01^{*}$	2.91(2.84,2.99)	<0.01*	0.06					
	Chinese	2.70(2.51,2.89)	*Mal-Chi	2.65(2.48,2.82)	*Mal-Chi	0.49					
	Indian	2.51(2.31,2.71)	*Mal-Ind	2.54(2.34,2.74)	*Mal-Ind	0.71					
	Others	2.87(2.64,3.10)		2.71(2.43,3.00)		0.31					
EOF	Malay	3.76(3.68,3.83)	<0.01*	3.60(3.52,3.68)	0.052	<0.01*					
	Chinese	3.68(3.50,3.86)	*Mal-Ind	3.45(3.25,3.65)		$0.02^{*}$					
	Indian	3.32(3.05,3.60)		3.27(2.96,3.58)		0.66					
	Others	3.75(3.39,4.11)		3.47(3.03,3.92)		0.05					

 

 Table 4.18: Eating Behaviour Patterns of the Adolescents at baseline and follow up according to Ethnicity

Variations within category was tested with ANOVA. Variation between the visits were tested with Paired t-test. \* The difference is significant at the 0.05 level (2-tailed)

### 4.5.2.2 Trend of eating behaviour pattern according to BMI category

Significant difference between obesity categories were observed in EOE score both at baseline (p=0.03) and follow up (p=0.02) (Table 4.19). The overweight and obese students had significantly lower EOE score than the underweight students at both time points. Significant increment of EOE score from baseline to follow up were demonstrated among the normal weight (p<0.01) and the underweight students (p=0.02).

The EOF score was significantly highest compared to other eating behavior items at both time points. There was significant difference between the BMI Categories in both EOF and FR scores both at baseline and follow up (p<0.01). The overweight and obese category had significantly lower EOF score and FR score than both the normal weight and underweight categories at both time points. All categories showed reduction of EOF score and FR score from baseline to follow up; but significant EOF reduction was observed only among the normal weight (p<0.01) and the underweight (p=0.03). Significant reduction of FR score from baseline to follow up was only observed among the obese and overweight category (p<0.01). DD item also showed reduction in all categories but significant reduction was only observed among the normal weight (p=0.03).

Restrained eating demonstrated significant reduction in SR and FF items score in all BMI categories (p<0.01) except for one which was SR score among the underweight students. Significant difference between categories was only observed in SE score during follow up; in which the underweight students demonstrated higher SE score than the overweight and the obese (p<0.01).

			Mean Score	e (95%CI)		Р
	n=592	Baseline (T <sub>0</sub> )	p-value	Follow Up (T1)	p-value	- (T <sub>0</sub> /T <sub>1</sub> )
Emotion	nal Eating					,
EOE	Overweight & Obese	2.20(2.07,2.32)	0.03*	2.31(2.17,2.45)	0.02*	0.054
	Normal Weight	2.35(2.25,2.44)	*OW-UW	2.49(2.40,2.59)	*OW-UW	< 0.01*
	Underweight	2.45(2.31,2.59)		2.56(2.43,2.69)		$0.02^{*}$
EUE	Overweight & Obese	2.68(2.55,2.81)	0.98	2.66(2.55,2.78)	0.62	0.84
	Normal Weight	2.67(2.58,2.75)		2.72(2.63,2.81)		0.27
	Underweight	2.66(2.54,2.78)		2.67(2.57,2.76)		0.91
Restrain	ned Eating				U	
SR	Overweight & Obese	2.63(2.54,2.71)	0.27	2.48(2.41,2.56)	0.80	< 0.01*
	Normal Weight	2.64(2.58,2.71)		2.49(2.43,2.55)		< 0.01*
	Underweight	2.56(2.48,2.65)		2.52(2.43,2.60)		0.41
SE	Overweight & Obese	2.60(2.51,2.69)	0.87	2.60(2.48,2.72)	< 0.01*	0.98
	Normal Weight	2.62(2.55,2.68)		2.66(2.56,2.76)	*OW-UW	0.29
	Underweight	2.63(2.55,2.71)		2.88(2.75,3.00)		< 0.01*
FF	Overweight & Obese	2.91(2.82,3.00)	0.40	2.70(2.61,2.80)	0.84	< 0.01*
	Normal Weight	2.98(2.92,3.04)		2.68(2.61,2.75)		< 0.01
	Underweight	2.95(2.87,3.03)		2.71(2.63,2.79)		< 0.01*
Externa	Illy Induced Eating					
DD	Overweight &Obese	2.28(2.15,2.40)	0.35	2.14(2.01,2.27)	0.23	0.07
	Normal Weight	2.38(2.28,2.48)		2.27(2.18,2.37)		0.045*
	Underweight	2.40(2.27,2.53)		2.27(2.14,2.40)		0.03*
FR	Overweight &Obese	2.72(2.60,2.83)	< 0.01*	2.56(2.45,2.67)	< 0.01*	< 0.01*
	Normal Weight	2.93(2.84,3.02)	*OW-NW	2.88(2.78,2.98)	*OW-NW	0.22
	Underweight	2.99(2.86,3.12)	*OW-UW	3.02(2.90,3.13)	*OW-UW	0.59
EOF	Overweight & Obese	3.43(3.29,3.57)	< 0.01*	3.34(3.20,3.48)	< 0.01*	0.16
	Normal Weight	3.80(3.70,3.90)	*OW-NW	3.58(3.46,3.69)	*OW-NW	< 0.01
	Underweight	3.79(3.67,3.92)	*OW-UW	3.68(3.55,3.82)	*OW-UW	0.03*

# Table 4.19: Eating Behaviour Patterns of the Adolescents according to BMI Categories at baseline and follow up

Variations within category was tested with ANOVA. Variation between the visits were tested with Paired t-test. \* The difference is significant at the 0.05 level (2-tailed)

# 4.5.2.3 Trend of eating behaviour patterns among Malaysian adolescents according to baseline stress level

The trend of eating behavior was further analyzed according to baseline stress level of the participants. Baseline stress level of the adolescents were categorized into three categories as follow: (1) high, (2) moderate and (3) low stress level. The trend of eating behavior between the two time points according to baseline stress level category were shown in Table 4.20.

During the near exam period, the emotional eating pattern of participants revealed significantly higher score among the high stress level participants in both EOE and EUE items. The high stress level participants also demonstrated strong externally induced eating pattern significantly only through a higher FR score and restrained eating pattern only through the SR score. During the normal school days, high stress level participants demonstrated significantly stronger emotional eating pattern only through a higher EOE score and externally induced eating pattern only through the FR score.

The high stress level category demonstrated significantly higher EOE score than both the moderate and low stress level category at both time points (p>0.01). The EOE score also showed increment in all stress level categories, significantly demonstrated (p<0.01) among the moderate and low stress categories. EUE score showed significant difference between the category at baseline (p<0.01) but not during follow up (p=0.08). EUE score was significantly highest among the high stress level compared to the low stress level group at baseline. No significant difference in EUE score was demonstrated between the two visits (p>0.05).

A significant difference between the stress level categories was only observed in SR score at baseline. SR Score was demonstrated to be significantly higher in the high stress level category than the low stress level category (p < 0.01). Significant reduction in SR score were observed from baseline to follow up among both the high stress and moderate stress level categories (p < 0.01). The FF score also demonstrated significant reduction from baseline to follow up in all stress level categories.

Externally induced eating pattern analysis revealed significant difference between stress level categories in FR both at baseline (p < 0.01) and follow up (0.04). At baseline, FR score was significantly higher in high stress level category than both the moderate and low stress level categories. Significant reduction in FR Score from baseline to follow up was observed only among the high stress level category (p=0.03). Significant reduction from baseline to follow up were also demonstrated in both EOF and DD score among both the moderate and high stress level category.

	500		Mean Score	e (95%CI)		P - (T <sub>0</sub> /T <sub>1</sub> )
	<b>n=592</b> (167/374/51)	<b>Baseline</b> (T <sub>0</sub> )	p-value	Follow Up (T1)	p-value	- (T <sub>0</sub> /T <sub>1</sub> )
Emotion	al Eating					
EOE	High	2.61(2.49,2.74)	<0.01*	2.68(2.54,2.82)	<0.01*	0.29
	Moderate	2.26(2.18,2.34)	*High-Mod	2.39(2.31,2.47)	*High-Mod	<0.01*
	Low	1.99(1.75,2.24)	*High-Low	2.33(2.09,2.56)	*High-Low	<0.01*
EUE	High	2.78(2.68,2.88)	<0.01*	2.79(2.68,2.90)	0.08	0.88
	Moderate	2.65(2.57,2.73)	*High-Low	2.66(2.59,2.73)		0.80
	Low	2.42(2.21,2,64)		2.58(2.34,2.82)		0.14
Restrain	ed Eating					
SR	High	2.71(2.63,2.79)	<0.01*	2.55(2.46,2.63)	0.21	<0.01*
	Moderate	2.60(2.54,2.65)	*High-Low	2.49(2.43,2.54)		< 0.01*
	Low	2.43(2.27,2.58)		2.41(2.25,2.58)		0.87
SE	High	2.69(2.60,2.77)	0.14	2.71(2.58,3.85)	0.99	0.68
	Moderate	2.59(2.54,2.65)		2.71(2.63,2.79)		$< 0.01^{*}$
	Low	2.57(2.42,2.72)		2.71(2.48,2.94)		0.20
FF	High	2.98(2.90,3.06)	0.77	2.75(2.66,2.84)	0.09	<0.01*
	Moderate	2.94(2.89,3.00)		2.69(2.63,2.74)		$<\!0.01^{*}$
	Low	2.94(2.78,3.11)		2.55(2.36,2.75)		0.02*
External	ly Induced Eating					
DD	High	2.42(2.29,2.55)	0.39	2.25(2.12,2.38)	0.79	$0.02^{*}$
	Moderate	2.35(2.27,2.43)		2.23(2.14,2.31)		< 0.01*
	Low	2.24(2.02,2.46)		2.31(2.04,2.57)		0.63
EOF	High	3.82(3.68,3.96)	0.13	3.61(3.46,3.76)	0.40	$< 0.01^{*}$
	Moderate	3.67(3.59,3.75)		3.51(3.42,3.60)		$< 0.01^{*}$
	Low	3.61(3.37,3.86)		3.63(3.40,3.86)		0.87
FR	High	3.09(2.97,3.22)	<0.01*	2.96(2.83,3.09)	$0.04^*$	$0.03^{*}$
	Moderate	2.83(2.75,2.90)	*High-Mod	2.78(2.71,2.86)	*High-Mod	0.15
	Low	2.71(2.48,2.94)	*High-Low	2.85(2.61,3.09)		0.07

 Table 4.20: The Trend of Eating Behaviour among Malaysian Adolescents according to Baseline Stress Level

Variations within category was tested with ANOVA. Variation between the visits were tested with Paired t-test.

\* The difference is significant at the 0.05 level (2-tailed)

#### 4.5.3 Correlation between stress and eating behaviour among the adolescents

The correlation between stress and eating behavior items on the complete cohort at both time points are shown in Table 4.21. Correlation between CPSS score and eating behavior items involved the complete cohort of 592 participants whereas correlation between saliva cortisol level and eating behavior items involved the complete subsample participants of 228 students.

# 4.5.3.1 Correlation between CPSS score and eating behaviour items

At baseline, strong positive significant correlation was observed between CPSS score and EOE ( $T_0$ : r = 0.30; p < 0.01). This correlation remained significantly positive during follow up but weaker ( $T_1$ : r = 0.27; p < 0.01). A positive significant correlation was also observed between CPSS score and FR scale at both baseline ( $T_0$ : r = 0.22; p < 0.01) and follow up ( $T_1$ : r = 0.21; p < 0.01). At baseline, weak significant positive correlation was also observed between CPSS score and SR ( $T_0$ : r = 0.19, p < 0.01) and between CPSS score and SR ( $T_0$ : r = 0.19, p < 0.01) and between CPSS score and EUE ( $T_0$ : r = 0.16, p < 0.01). The correlation between CPSS score and EUE persisted during follow up ( $T_1$ : r = 0.14, p < 0.01) but not between CPSS score and SR. During follow up, weak positive significant correlations were observed between CPSS score and FF ( $T_1$ : r = 0.16, p < 0.01) and between CPSS score and DD ( $T_1$ : r = 0.15, p < 0.01).

#### 4.5.3.2 Correlation between saliva cortisol level and eating behaviour

At baseline, no significant correlation was observed between saliva cortisol level and all eating behaviour items. During follow up, a weak positive significant correlation was demonstrated only between saliva cortisol level and SR item (T<sub>1:</sub> r = 0.16; p < 0.05).

Stress				]	Eating <b>B</b>	ehavior Sc	ore					
		Emo Ea	otional Iting	R	estrained	l Eating	Exte	Externally Induced Eating				
Baseline	n	EOE	EUE	SR	SE	FF	DD	EOF	FR			
Perceived Stress	592	0.30	0.16	0.19	** 0.12	* 0.07	0.09	0.12***	0.22***			
Cortisol Level	228	-0.06	-0.01	-0.03	3 0.01	-0.02	0.03	-0.06	-0.04			
Follow Up	n											
Perceived Stress	592	$0.27^{**}$	0.14**	0.07	0.05	0.16***	0.15	0.05	0.21**			
Cortisol Level	228	0.03	0.05	0.16	* 0.08	0.10	0.08	-0.06	0.04			

 Table 4.21: Correlation between Stress and Eating Behaviour among the

 Adolescents

\* The correlation is significant at the 0.05 level (2-tailed)

\*\*The correlation is significant at the 0.01 level (2-tailed)

# 4.5.3.3 Correlation between stress and eating behaviour among the adolescents according to socio-demographic characteristics

Since no correlation was observed between saliva cortisol and eating behavior items, only the correlation between CPSS score and eating behavior items were further analyzed across gender, location, ethnicity, BMI category and stress level category. The results were as in Table 4.22.

				Eating B	ehavior	Score at	Baseline	( <b>T</b> <sub>0</sub> )		Eating Behavior Score at Follow Up (T <sub>1</sub> )							
Perceived Stress (CPSS Score)		Emotic <u>Eating</u>	onal	Restra	Restrained Eating		Extern Eating	Externally Induced Eating		Emotic <u>Eating</u>	onal	Restrained Eating		ing	Externally Induced Eating		iced
	n	EOE	EUE	SR	SE	FF	DD	EOF	FR	EOE	EUE	SR	SE	FF	DD	EOF	FR
Overall	592	0.30***	0.16	0.19**	0.12**	0.07	0.09*	0.12***	0.22***	0.27**	0.14**	0.07	0.05	0.16***	0.15	0.05	0.21**
Gender																	
Male Female	200 392	$0.22^{**}$ $0.31^{**}$	$0.27^{**}$ 0.08	$0.21^{**}$ $0.15^{**}$	$0.17^{*} \\ 0.10^{*}$	$0.07 \\ 0.05$	0.08 0.10 <sup>*</sup>	0.08 0.10 <sup>*</sup>	0.24 0.20**	$0.22^{**}$ $0.28^{**}$	0.13 0.14	0.00 0.07	-0.03 0.06	$0.17^{*} \\ 0.16^{**}$	0.12 0.21 <sup>***</sup>	-0.02 0.08	$0.18^{*}$ $0.23^{**}$
Location																	
Urban Rural	334 258	$0.32^{**}_{**}$	$0.12^{*}$	$0.20^{**}_{0.17}$	0.09 0.15 <sup>*</sup>	0.10 0.01	0.11 <sup>*</sup> 0.05	0.17 0.05	0.21	$0.33^{**}$ $0.19^{**}$	0.11 0.20 <sup>***</sup>	0.05 0.09	0.09 -0.02	0.19 <sup>***</sup> 0.12	$0.13^{*}$ $0.20^{**}$	0.10 -0.01	$0.24^{**}$ $0.17^{**}$
Ethnicity		0.20	0.20	0.17					0.23								
Malay Chinese Indian Others	439 69 56 28	0.29 <sup>***</sup> 0.31 0.28 <sup>*</sup> 0.10	0.17 0.14 0.09 -0.02	0.18 0.13 0.33 0.15	0.11 0.22 0.09 0.38	0.07 -0.08 0.15 0.16	** -0.09 -0.05 -0.15	** 0.13 -0.01 0.09 -0.07	0.23 0.08 0.10 0.26	0.28 0.19 0.27* -0.17	$0.10^{*}$ $0.24^{*}$ 0.24 0.03	0.03 0.06 0.36 0.04	0.05 0.18 0.16 -0.26	0.12 <sup>*</sup> 0.28 <sup>*</sup> 0.27 <sup>*</sup> 0.28	0.17 <sup>**</sup> 0.21 0.14 0.13	* -0.06 -0.15 -0.07	0.21 0.16 0.22 0.01
BMI category Obese &OW Normal Weight Underweight	151 267 174	0.31 *** 0.28 0.34**	0.16 0.06 0.28	0.28 0.13 0.19*	-0.00 *** 0.21 0.10	0.09 0.08 0.04	-0.01 0.08 0.17	0.09 0.13 0.16*	0.17 <sup>*</sup> 0.20 0.30 <sup>**</sup>	0.34 0.20** 0.32**	0.19 <sup>*</sup> 0.11 0.14	0.20 -0.02 0.07	0.11 0.06 -0.02	0.18 0.20** 0.07	0.11 0.13 ** 0.23	0.11 0.02 0.08	0.38 0.13* 0.26**
Stress level category																	
High Moderate Low	167 374 51	0.18 <sup>**</sup> 0.24 0.09	0.05 0.11 0.20	0.13 0.13* 0.24	0.06 0.14 0.16	-0.01 0.16 <sup>**</sup> 0.00	0.03 0.10 0.07	0.10 * 0.12 -0.03	0.24 <sup>***</sup> 0.11 0.15	0.21** 0.23** 0.32*	0.04 0.13* 0.24	0.02 0.07 0.01	-0.08 0.10* 0.20	0.09 0.12* 0.30*	0.14 0.18 <sup>**</sup> 0.16	0.09 0.08 -0.18	0.25** 0.20** 0.09

Table 4.22: Correlation between Stress and Eating Behaviour of the Adolescents according to gender, location, ethnicities, BMI Category and stress level category at baseline (T<sub>0</sub>) and follow up (T<sub>1</sub>)

\* The correlation is significant at the 0.05 level (2-tailed). \*The correlation is significant at the 0.01 level (2-tailed)

# 4.6 The Effect of Change in Stress Level on Transition of Eating Behaviour among Malaysian Adolescents

In this study, eating behaviour is the main outcome and stress is the predictor investigated. Stress coping strategy is the main mediator of interest to the researcher. Being a cohort study, the researcher had the advantage to analyze the effect of change in stress level from baseline to follow up within the six months duration. Change in stress level was analyzed by following the change in CPSS score and categorized into three categories as follow: (1) increase stress level, (2) no change in stress level and (3) decrease stress level. An increment of CPSS score defined an increase in stress level and a decrease in the CPSS score defined a decrease in stress level. Similar CPSS score at both time points was defined as no change in stress level.

The final outcome investigated was transition of the eating behavior of the adolescents following the changes in their stress level. The transition of eating behavior was categorized into three categories as follow: (1) improved (positive transition), (2) no change (no transition) or (3) worsened (negative transition). An increment of score in both emotional eating and externally induced eating pattern was defined as a negative transition or worsening of behavior. A decrement in these two patterns was defined as a positive transition or improvement of behavior. Restrained eating pattern reflected the braking system of eating behavior. Thus, an increment of score in restrained eating pattern was defined as a positive transition or improvement of score in restrained eating pattern in restrained eating pattern was defined as a negative transition or worsening of behavior. Thus, an increment of score in restrained eating pattern in restrained eating pattern was defined as a negative transition or worsening of behavior. Thus, an increment of behavior. A decrement in restrained eating pattern was defined as a negative transition or worsening of behavior. Thus, the relationship of the variables of interest were shown in Figure 4.1.



Figure 4.1: The Effect of Stress on Transition of Eating Behavior

In general, majority of participants experienced an increase in stress level (46.6%, n=276). 43.6% (n=258) of participants experienced a decrease in stress level and 9.8% (n=58) of participants experienced no change in stress level. A significant association was demonstrated only between the change in stress level and transition of EOE score  $[\chi^2=20.1, p<0.01]$ . No significant association were observed between changes in stress level and transition of other eating behaviour items (p>0.05).

# Emotional eating

A negative transition or worsening of EOE behaviour was predominated by participants with increased stress level (58.3%, n=161). An improvement of EOE behavior was observed predominantly among participants with no change in stress level (43.1%, n=25). Majority of participants with increase stress level (49.6%, n=137) also demonstrated a negative transition in EUE score. Majority of participants with decreased

stress level (49.2%, n=127) demonstrated a positive transition of EUE score from baseline to follow up.

#### Externally induced eating

All stress level categories demonstrated a positive transition in EOF score; highest among the no change in stress level (55.2%, n=32) and decrease stress level (51.6%, n=133) participants. Similar pattern was observed in transition of DD behavior, also highest among the no change in stress level participants (50.0%, n=29). Majority of decrease stress level participants demonstrated an improvement in FR behavior (50.0%, n=129).

### Restrained eating

Restrained eating pattern analysis revealed that majority of participants demonstrated a negative transition in both SR and FF behavior across all stress level categories; highest among the no change in stress level participants in both items at 60.3% (n=35) and 58.6% (n=34) respectively. SE score however demonstrated an improvement of behavior in all stress level categories; predominantly among the participants with increase stress level category at 50.7% (n=140).

The effect of change in stress level on transition of eating behaviour among the adolescents was shown in Table 4.23.

A. Emotiona	l Eating					
	Stress Level	Overall	Worsened	No Change	Improved	$\gamma^2$
Transition	Overall	592 (100)	292(49.3)	90 (15.2)	210 (35.5)	ĸ
of EOE	Increase	276 (46.6)	161 (58.3)	35 (12.7)	80 (29.0)	
	No Change	58 (9.8)	19 (32.8)	14(24.1)	25 (43.1)	20.1
	Decrease	258 (43.6)	112 (43.4)	41 (15.9)	105 (40.7)	(p = < 0.01*)
Transition	Overall	592 (100)	259(43.8)	74 (12.5)	259 (43.8)	
of EUE	Increase	276 (46.6)	137 (49.6)	32 (11.6)	107 (38.8)	
	No Change	58 (9.8)	24 (41.4)	9 (15.5)	25 (43.1)	8.18
	Decrease	258 (43.6)	98 (38.0)	33 (12.8)	127 (49.2)	( <i>p</i> =0.09)
B. Externally	y Induced Eating					
	Stress Level	Overall	Worsened	No Change	Improved	$\chi^2$
Transition	Overall	592 (100)	202 (34.1)	101(17.1)	289 (48.8)	
of EOF	Increase	276 (46.6)	104 (37.7)	48 (17.4)	124 (44.9)	
	No Change	58 (9.8)	19 (32.8)	7 (12.1)	32 (55.2)	4.67
	Decrease	258 (43.6)	79 (30.6)	46 (17.8)	133 (51.6)	(p=0.32)
Transition	Overall	592 (100)	233 (39.4)	89 (15.0)	270 (45.6)	
of FR	Increase	276 (46.6)	115 (41.7)	47 (17.0)	114 (41.3)	
	No Change	58 (9.8)	26 (44.8)	5 (8.6)	27 (46.6)	6.34
	Decrease	258 (43.6)	92 (35.7)	37 (14.3)	129 (50.0)	(p=0.18)
Transition	Overall	592 (100)	204 (34.5)	114(19.3)	274(46.3)	
of DD	Increase	276 (46.6)	103 (37.3)	49 (17.8)	124 (44.9)	
	No Change	58 (9.8)	16 (27.6)	13 (22.4)	29 (50.0)	2.66
	Decrease	258 (43.6)	85 (32.9)	52 (20.2)	121 (46.9)	(p=0.62)
C. Restraine	d Eating					
	Stress Level	Overall	Worsened	No Change	Improved	$\chi^2$
Transition	Overall	592 (100)	302 (51.0)	87(14.7)	203 (34.3)	
of SR	Increase	276 (46.6)	134 (48.6)	46 (16.7)	96 (34.8)	
	No Change	58 (9.8)	35 (60.3)	6 (10.3)	17 (29.3)	3.50
	Decrease	258 (43.6)	133 (51.6)	35 (13.6)	90 (34.9)	(p=0.48)
Transition	Overall	592 (100)	235 (39.7)	68 (11.5)	289 (48.8)	
of SE	Increase	276 (46.6)	107 (38.8)	29 (10.5)	140 (50.7)	
	No Change	58 (9.8)	19 (32.8)	11 (19.0)	28 (48.3)	4.74
	Decrease	258 (43.6)	109 (42.2)	28 (10.9)	121 (46.9)	( <i>p</i> =0.32)
Transition	Overall	592 (100)	322 (54.4)	50 (8.4)	220 (37.2)	
of FF	Increase	276 (46.6)	141 (51.1)	20 (7.2)	115 (41.7)	
	No Change	58 (9.8)	34 (58.6)	6 (10.3)	18 (31.0)	4.92
	Decrease	258 (43.6)	147 (57.0)	24 (9.3)	87 (33.7)	( <i>p</i> =0.30)

# Table 4.23 : Transition in in Eating Behaviour Pattern following changes in<br/>stress level from baseline to follow up.

Variations between categories were tested with Pearson Chi Square test.

\* The difference is significant at the 0.05 level (2-tailed)

# 4.6.1 Correlation between change in stress level and transition of eating behavior among the adolescents

The Pearson correlation between the change in stress level and the transition in eating behavior was tested and depicted in Table 4.24. The results revealed significant weak positive correlation between change in CPSS score and transition of some eating behavior items. The correlation was strongest between change in CPSS score and transition in EOE behavior (r = 0.18, p < 0.01) followed by change in CPSS score and transition in FR behavior (r = 0.14, p < 0.01). No significant correlation was demonstrated between change in saliva cortisol level and transition of any of the eating behavior items.

 Table 4.24: Correlation between Change in Stress Level and Transition of Eating Behaviour of the Adolescents.

					Transi	tion of E	ating Beh	avior	•		
Mean Change		Emotional Eating		_	Restr	ained E	ating	Externally Induced Eating			
	n	EOE	EUE		SR	SE	FF		DD	EOF	FR
Change in Perceived Stress Level	592	0.18**	0.12***		0.08	0.03	0.09*	(	0.09 <sup>*</sup>	0.07	0.14**
Change in Cortisol Level	228	-0.08	-0.05		0.04	-0.06	-0.01	-	-0.02	-0.05	-0.09

\*Correlation is significant at the 0.01 level (2-tailed)

\*\* Correlation is significant at the 0.05 level (2-tailed)

# 4.6.1.1 Correlation between change in stress level and transition of eating behaviour among the adolescents according to socio-demographic characteristics

The correlation between the change in CPSS score and the transition in eating behavior across gender, school location, ethnicity and BMI category were further tested and depicted in Table 4.21. No significant correlation was demonstrated between change in saliva cortisol level and transition of any of the eating behavior items thus further analysis across the socio-demographic characteristics were not conducted.

		Transition of Eating Behavior									
Change in Perceived Stress Level		Emotional Eating			Restrained Eating			Externally Induced Eating			
(CF55 Score)	n	EOE	EUE		SR	SE	FF		DD	EOF	FR
Overall	592	0.18**	0.12***		0.08	0.03	0.09*	-	0.09*	0.07	0.14
Gender											
Male	200	0.11	0.14*		0.03	-0.01	0.12		0.06	0.06	0.25
Female	392	0.22**	$0.14^{\circ}$ $0.11^{*}$		0.10*	0.07	0.07		0.09	0.07	0.25
Location											
Urban	334	0.20**	0.13		0.09	0.05	0.11*		0.10	0.05	0.11*
Rural	258	$0.20^{\circ}$ $0.15^{*}$	0.13		0.06	0.01	0.05		0.07	0.09	0.18**
Ethnicity											
Malay	439	0.20**	0.16		0.08	0.03	0.06		0.08	0.05	0.13
Chinese	69	0.20	0.10		0.03	0.15	0.08		0.21	0.22	0.15
Indian	56	0.10	0.07		0.26	0.09	0.26		0.25	-0.03	0.17
Others	28	0.20	-0.18		-0.12	-0.24	0.11		-0.37	0.26	0.13
BMI Category											
Obese & OW	151	0.25	0.21*		0.12	0.01	0.15		0.14	0.17	0.19
Normal Weight	267	0.17	0.05		0.05	0.07	0.13		0.13	0.01	0.11
Underweight	174	0.17	0.16		0.09	0.00	-0.03		-0.03	0.05	0.11

# Table 4.25: Correlation between change in stress level and transition of eatingbehaviour according to Gender, Locations, Ethnicity and BMI Categories

\*\*Correlation is significant at the 0.01 level (2-tailed)

\* Correlation is significant at the 0.05 level (2-tailed)

# 4.7 Coping Strategies when Dealing with Stress Adopted by Malaysian Adolescents

The data of coping strategies when dealing with stress adopted by the adolescents were collected only at baseline. This was the time when the students were hypothesized to potentially experience higher stress level than normal school days as this period of time was within the two weeks duration prior to the final year national school examinations.

# 4.7.1 Coping strategies adopted by Malaysian adolescents according to sociodemographic characteristics

Overall, the most frequently adopted coping strategies by the adolescents were turning to religion ( $6.18 \pm 1.7$ ) followed by positive reinterpretation ( $5.78 \pm 1.5$ ) and active coping ( $5.65 \pm 1.4$ ). The least popular choice of strategies adopted by the adolescents were behavioral disengagement ( $3.86 \pm 1.5$ ), using food ( $4.23 \pm 1.6$ ) and denial ( $4.29 \pm 1.5$ ). The result of coping strategies score adapted by the adolescents according to gender and school locations were shown in Table 4.26.

### Gender

Overall, the female students had significantly higher score than the male in eight items which were turning to religion, positive reinterpretation, acceptance, self-distraction, use of instrumental support, use of emotional support, using food and venting of emotion (p < 0.01).

### School locations

The urban students showed higher score in all coping strategies items except for turning to religion which was higher among the rural students. The score was significantly higher in six strategies which are acceptance, self-distraction, humor, self-blame, behavioral disengagement and venting of emotion (p < 0.05).

	Overall n(%)	Gender			School I		
Coping Strategies		Male	Female	p-value	Urban	Rural	p-value
	797(100)	317(46.8)	480 (10.1)		482(60.5)	315(39.5)	
Self-Distraction	$5.54 \hspace{0.1cm} \pm \hspace{0.1cm} 1.5$	$5.24 \pm 1.5$	$5.73 \ \pm 1.4$	< 0.01**	$5.64 \pm 1.4$	$5.38 \pm 1.6$	0.01*
Active Coping	$5.65 \pm 1.4$	$5.56 \pm 1.4$	$5.71 \pm 1.3$	0.12	$5.70\ \pm 1.3$	$5.57 \pm 1.5$	0.19
Denial	$4.29 \pm 1.5$	$4.18 \pm 1.4$	$4.37 \pm 1.5$	0.07	$4.36 \pm 1.5$	$4.19 \pm 1.5$	0.12
Food	$4.23 \pm 1.6$	$4.04 \pm 1.5$	$4.35\pm1.7$	<0.01**	$4.27 \pm 1.6$	$4.16\pm1.7$	0.31
Use of Emotional Support	$5.25 \pm 1.6$	$5.01 \pm 1.6$	$5.41 \pm 1.5$	< 0.01**	$5.30\pm1.6$	$5.17 \pm 1.6$	0.25
Use of Instrumental Support	$5.48 \pm 1.6$	$5.24 \pm 1.6$	$5.64 \pm 1.6$	< 0.01**	$5.51 \pm 1.5$	$5.44 \pm 1.7$	0.53
Behavioral Disengagement	$3.86 \pm 1.5$	$3.78 \pm 1.6$	$3.92\pm1.5$	0.21	$3.96 \pm 1.5$	$3.72\pm1.6$	0.03*
Venting of Emotion	$4.90 \pm 1.5$	$4.59 \pm 1.5$	$5.11 \pm 1.5$	<0.01**	$5.00\pm1.5$	$4.74 \pm 1.6$	$0.02^{*}$
Positive Reinterpretation	$5.78 \pm 1.5$	$5.51 \pm 1.6$	$5.96 \pm 1.5$	<0.01**	$5.80 \pm 1.5$	$5.76 \pm 1.7$	0.76
Planning	$5.48 \pm 1.5$	$5.42 \pm 1.6$	$5.53 \pm 1.5$	0.35	$5.51 \pm 1.4$	$5.45 \pm 1.6$	0.58
Humor	$4.49 \pm 1.7$	$4.60\pm1.7$	$4.43 \pm 1.7$	0.16	$4.68 \pm 1.7$	$4.21 \pm 1.6$	<0.01**
Acceptance	$5.60 \pm 1.5$	$5.40 \pm 1.6$	$5.74 \pm 1.4$	< 0.01**	$5.78 \pm 1.4$	$5.34 \pm 1.6$	<0.01**
Religion	$6.18 \pm 1.7$	5.73 ± 1.7	$6.48 \pm 1.6$	<0.01**	$6.14 \pm 1.7$	$6.24 \pm 1.8$	0.43
Self-Blame	$5.00 \pm 1.7$	$4.89 \pm 1.7$	$5.08 \pm 1.8$	0.14	$5.18 \pm 1.7$	$4.73 \pm 1.7$	<0.01**

Table 4.26: Coping Strategies S	Scores at Baselir	ne according to (	Gender and S	chool Locations

Variations between categories were tested with Independent t- test.

\* The difference is significant at the 0.05 level (2-tailed)

\*\* The difference is significant at the 0.01 level (2-tailed)

### Ethnicity

The result of coping strategies score adopted by the adolescents according to ethnicity was shown in Table 4.27. Malay and Other ethnicity students preferred using religion as coping strategies method the most with the score of  $6.42 \pm 1.6$  and  $6.50 \pm 1.6$  respectively. Chinese students were observed to score highest in acceptance technique  $(5.42 \pm 1.3)$  whereas most Indians adapted active coping  $(5.67 \pm 1.7)$ .

Malay and Other ethnicity students demonstrated significant higher scores in using religion, planning and positive reinterpretation compared to the Chinese (p < 0.01). Malay and Other ethnicity students were also observed to significantly and strongly preferred adapting venting of emotion compared to the Indians (p < 0.01).

Malay students had significantly higher score than the Chinese students in using self-distraction technique (p < 0.01) and instrumental support (p=0.02) in coping with stress. Malay students also demonstrated significantly higher score than the Indian students in using self-distraction technique (p>0.01), using humor (p=0.03) and using emotional support (p<0.01).

<b>Coping Strategies</b>	Overall					
	n(%)	Malay	Chinese	Indians	Other	p-value
	797(100)	597(74.9)	93 (11.7)	69(8.7)	38(4.8)	
Self-Distraction	5.54 ±1.5	5.71 ±1.4	5.09 ±1.4	4.84 ±1.5	5.24 ±1.6	<0.01* *Malay-Chinese *Malay-Indian*
Active Coping	$5.65 \pm 1.4$	$5.67 \pm 1.3$	$5.38 \pm 1.3$	5.67 ±1.7	$5.97 \pm 1.4$	0.11
Denial	$4.29 \pm 1.5$	4.31 ±1.5	$4.02\pm1.3$	$4.52\pm1.5$	4.24 ±1.5	0.16
Food	$4.23 \pm 1.6$	4.31 ±1.7	$4.04\pm1.4$	$4.10\pm1.5$	3.61 ±1.6	0.03* *Malay-Others
Emotional Support	$5.25 \pm 1.6$	$5.37 \pm 1.6$	$4.92 \pm 1.4$	$4.62\pm1.6$	5.29 ±1.7	<0.01** *Malay-Indian
Instrumental Support	$5.48 \pm 1.6$	5.56 ±1.6	5.11 ± 1.3	5.17 ± 1.5	5.68 ±1.6	0.02* *Malay-Chinese
Behavioral Disengagement	3.86 ± 1.5	$3.83 \pm 1.5$	4.15 ± 1.2	$3.86 \pm 1.6$	3.68 ±1.8	0.24
Venting of Emotion	$4.90 \pm 1.5$	5.01 ±1.5	4.67 ± 1.3	4.20 ± 1.5	5.08 ±1.7	<0.01 <sup>**</sup> *Malay-Indian *Others-Indian
Positive Reinterpretation	$5.78 \pm 1.5$	5.84 ±1.5	5.40 ± 1.3	5.61 ± 1.9	6.16 ±1.2	0.02* *Malay-Chinese *Others-Chinese
Planning	$5.48 \pm 1.5$	5.57 ±1.5	5.02 ± 1.3	$5.20\pm1.9$	5.79 ±1.6	<0.01 <sup>**</sup> *Malay-Chinese *Others-Chinese
Humor	$4.49 \pm 1.7$	4.40 ±1.7	4.75 ± 1.4	$4.94 \pm 1.9$	4.47 ±1.8	0.03* *Malay-Indian
Acceptance	$5.60 \pm 1.5$	5.64 ±1.5	$5.42 \pm 1.3$	$5.39 \pm 1.7$	$5.87 \pm 1.6$	0.24
Religion	6.18 ± 1.7	6.42 ±1.6	4.97 ± 1.6	$5.52\pm2.0$	$6.50 \pm 1.6$	<0.01** *Malay-Chinese *Others-Chinese
Self-Blame	$5.00 \pm 1.7$	$4.93 \pm 1.7$	$4.82 \pm 1.4$	$4.61 \pm 1.9$	5.08 ±1.7	0.12

 Table 4.27: Coping Strategies Scores according to Ethnicity

Variations between categories were tested with Independent t- test.

\* The difference is significant at the 0.05 level (2-tailed)

\*\* The difference is significant at the 0.01 level (2-tailed)

# **BMI** Category

The result of coping strategies score adopted by the adolescents according to BMI category was shown in Table 4.28. Interestingly, a significant difference in COPE score between the BMI categories was observed only in 'utilization of food' item. Significantly lower 'utilization of food' score was observed among the overweight and obese students  $(3.92 \pm 1.5)$  compared to both the normal weight  $(4.31 \pm 1.7)$  and the underweight (4.38  $\pm 1.6$ ) students. No significant difference was observed in other coping strategies items across the BMI categories.

	]			
Coping Strategies	<b>Overweight</b> & Obese 232(29.1)	Normal Weight 355(44.5)	<b>Under</b> <b>weight</b> 210(26.3)	p-value
Self-Distraction	$5.46 \pm 1.6$	5.65 ± 1.4	5.43 ± 1.4	0.13
Active Coping	$5.59 \pm 1.4$	5.65 ± 1.4	5.72 ± 1.4	0.59
Denial	$4.35\pm1.5$	$4.22 \pm 1.4$	4.35 ± 1.5	0.44
Food	3.92 ± 1.5	4.31 ± 1.7	$4.38 \pm 1.6$	<0.01* *OW-NW *OW-UW
Emotional Support	$5.19 \pm 1.6$	$5.16 \pm 1.6$	$5.44 \pm 1.6$	0.10
Instrumental Support	$5.45 \pm 1.6$	$5.48 \pm 1.6$	$5.52 \pm 1.6$	0.89
Behavioral Disengagement	$4.03 \pm 1.5$	$3.79 \pm 1.5$	3.83 ± 1.5	0.18
Venting of Emotion	$4.85 \pm 1.5$	$5.00 \pm 1.5$	$4.79 \pm 1.6$	0.22
Positive Reinterpretation	$5.64 \pm 1.5$	$5.79 \pm 1.5$	5.89 ± 1.6	0.23
Planning	$5.43 \pm 1.6$	5.41 ± 1.5	5.64 ± 1.6	0.17
Humor	$4.55 \pm 1.7$	$4.50 \pm 1.7$	4.44 ± 1.7	0.76
Acceptance	$5.62 \pm 1.5$	5.58 ± 1.6	5.63 ± 1.5	0.90
Religion	6.15 ± 1.8	6.21 ± 1.7	6.16 ± 1.7	0.88
Self-Blame	$5.09 \pm 1.7$	$5.03 \pm 1.7$	$4.88 \pm 1.7$	0.42

Table 4.28: Mean Coping Strategies score according to BMI Category

Variations between categories were tested with ANOVA

\* The difference is significant at the 0.05 level (2-tailed)

# 4.7.2 Coping strategies adopted by adolescents according to baseline stress level category

Analyzing according to baseline stress level category (Table 4.29), significant difference in COPE score between the stress level categories were observed in all stress coping items except three item which were instrumental support, humor and religion. Students who perceived high stress level demonstrated significantly higher coping score in self distraction ( $6.00 \pm 1.4$ ), denial ( $4.76 \pm 1.5$ ), utilization of food ( $4.56 \pm 1.8$ ), emotional support ( $5.51 \pm 1.5$ ), behavioral disengagement ( $4.40 \pm 1.5$ ), venting of emotion ( $5.45 \pm 1.5$ ) and self-blame ( $5.70 \pm 1.8$ ) than students who perceived low or moderate stress level.

Students who perceived low stress level demonstrated significantly higher score in active coping  $(6.31 \pm 1.5)$  than both the high and moderate stress level categories. They also had significantly higher score in positive reinterpretation  $(6.25 \pm 1.7)$ , planning  $(5.94 \pm 1.6)$  and acceptance  $(6.04 \pm 1.6)$  than students who perceived moderate stress level.

~ . ~		St	ress Categorio	es	р-		
Coping Strategies	-	High	Moderate	Low	value		
	n(%)	232(29.1)	493(61.9)	72(9.0)	<u>VU</u>		
Self-Distraction		$6.00 \pm 1.4$	5.33 ±1.4	5.44 ± 1.7	<0.01*	*High-Low *High-Mod	
Active Coping		$5.66 \pm 1.3$	5.55 ± 1.4	6.31 ± 1.5	<0.0**	*High-Low *Mod-Low	
Denial		4.76 ± 1.5	4.19 ± 1.4	3.49 ± 1.2	<0.01*	*High-Low *High-Mod *Mod-Low	
Food		$4.56 \pm 1.8$	4.14 ± 1.5	3.76 ± 1.6	<0.01*	*High-Low *High-Mod	
Emotional Support		5.51 ± 1.5	5.17 ± 1.5	$5.00 \pm 2.0$	<0.01*	*High-Low *High-Mod	
Instrumental Support		5.63 ± 1.5	5.43 ± 1.6	$5.39 \pm 1.7$	0.27		
Behavioral Disengagement		4.40 ± 1.5	3.72 ± 1.4	3.13 ± 1.4	<0.01*	*High-Low *High-Mod *Mod-Low	
Venting of Emotion		5.45 ± 1.5	$4.72\pm1.4$	$4.38 \pm 1.5$	<0.01*	*High-Low *High-Mod	
Positive Reinterpretation		$5.93 \pm 1.4$	$5.65 \pm 1.6$	$6.25\pm1.7$	$<\!0.01^{*}$	*Mod-High *Mod-Low	
Planning		$5.52 \pm 1.5$	$5.40 \pm 1.5$	$5.94 \pm 1.6$	$0.02^{*}$	*Mod-Low	
Humor		$4.43 \pm 1.7$	$4.50\pm1.6$	$4.64 \pm 1.8$	0.64		
Acceptance		$5.67 \pm 1.5$	$5.51 \pm \ 1.6$	$6.04 \pm 1.6$	$0.02^{*}$	*Mod-Low	
Religion		$6.20\pm1.7$	$6.12 \pm 1.7$	$6.50\pm1.7$	0.21		
Self-Blame		$5.70\pm1.8$	4.77 ± 1.6	4.32 ± 1.5	<0.01*	*High-Low *High-Mod	

 Table 4.29: Mean Coping Strategies score according to Baseline Stress Level

 Category

Variations between categories were tested with ANOVA

\* The difference is significant at the 0.05 level (2-tailed)

# 4.8 The effect of coping strategies adopted by Malaysian adolescents on stress and eating behaviour.

Stress coping strategies adapted by the adolescents may potentially affect both the change in adolescents' stress level and the eating behavior of the adolescents directly or as mediator between the two variables. This section analyzed on the effect of the coping strategies adopted by the adolescents on the change in their stress level and the eating behavior patterns.

# 4.8.1 Change in stress level of the adolescents according to coping strategies adopted at baseline

The coping strategies score of the adolescents were categorized into three categories which were (1) has been doing this a lot, (2) medium amount and (3) doing it a little bit or not at all. The stress reaction of the adolescents were analyzed following the frequency of the coping strategies adopted. The results were shown in Table 4.30. No significant association was observed between all stress coping strategies adopted and stress change of the adolescents. (p > 0.05).

Majority of the adolescents practiced these following eight coping strategies at medium frequency: self-distraction (50.3%), active coping (51.2%), use of emotional support (46.1%), use of instrumental support (45.9%), venting of emotion (47.1%), positive reinterpretation (51.2%), active coping (56.1%) and planning (50.0%). Majority of adolescents were found to practice these following five strategies with little bit of frequency or not at all: denial (58.8%), using food (62.8%), behavioral disengagement (75.0%), humor (54.6%) and self-blame (45.1%). The only coping strategy that was adopted a lot by the adolescents was religion at 47.1%.

It was however demonstrated that majority of participants who adopted a lot of using religion strategy (49.1%) experienced an increase in stress level rather than a decrease (43.7%). Participants who demonstrated a decreased in stress level were observed to predominantly adapted a lot of self-distraction (45.0%), active coping (45.1%), using food (50.0%), using emotional support (49.1%), behavioral disengagement (54.2%), acceptance (45.7%) and self-blame (44.8%). Participants who demonstrated an increment in stress level were observed to predominantly practiced only a little bit or not at all self-distraction (49.7%), denial (48.6%), using food (48.1%), behavioral disengagement (48.4%) and venting of emotion (49.4%).

Coping Strategy	Coping		Changes	in Stress Le	evel	~ <sup>2</sup>
	Frequency	Overall	Increased	No Change	Decreased	χ
	Overall	592 (100)	276(46.6)	58(9.8)	258(43.6)	
I. Self-Distraction	A lot	149(25.2)	71(47.7)	11(7.4)	67(45.0)	
	Medium	298(50.3)	133(44.6)	32(10.7)	133(44.6)	2.34
	Little Bit or	145(24.5)	72(49.7)	15(10.3)	58(40.0)	(p=0.67)
	Not at All					
II. Active Coping	A lot	164(27.7)	77(47.0)	13(7.9)	74(45.1)	
	Medium	303(51.2)	141(46.5)	30(9.9)	132(43.6)	1.42
	Little Bit or	125(21.1)	58(46.4)	15(12.0)	52(41.6)	(p=0.84)
	Not at All	15(7 ()	21(46.7)	$2(C, \overline{T})$	21(46.7)	
III. Denial	A lot	45(7.6)	21(46.7)	3(0.7)	21(46.7)	2.00
	Medium Little Dit on	199(33.6)	86(43.2)	18(9.0)	95(47.7)	3.09
	Not at All	346(38.8)	109(48.0)	37(10.0)	142(40.8)	(p=0.54)
IV Using Food	A lot	50(8.4)	22(44.0)	3(6.0)	25(50.0)	
TV. Using Poou	Medium	170(28.7)	75(44.1)	22(12.9)	73(42.9)	3 77
	Little Bit or	372(62.8)	179(48.1)	33(8.9)	160(43.0)	(p=0.44)
	Not at All	0/2(0210)	1,5(1011)	22(01))	100(1210)	(P 0111)
V. Use of Emotional	A lot	116(19.6)	52(44.8)	7(6.0)	57(49.1)	
Support	Medium	273(46.1)	131(48.0)	28(10.3)	114(41.8)	3.49
	Little Bit or	203(34.3)	93(45.8)	23(11.3)	87(42.9)	(p=0.48)
	Not at All					-
VI. Use of	A lot	148(25.0)	81(54.7)	12(8.1)	55(37.2)	
Instrumental Support	Medium	272(45.9)	121(44.5)	30(11.0)	121(44.5)	5.84
	Little Bit	172(29.1)	74(43.0)	16(9.3)	82(47.7)	(p=0.21)
	Not at All					
VII. Behavioural	A lot	24(4.1)	11(45.8)	0(0)	13(54.2)	
Disengagement	Medium	124(20.9)	50(40.3)	13(10.5)	61(49.2)	5.81
	Little Bit	444(75.0)	215(48.4)	45(10.1)	184(41.4)	(p=0.21)
	Not at All					
VIII. Venting of	A lot	82(13.9)	36(43.9)	10(12.2)	36(43.9)	
Emotion	Medium	279(47.1)	126(45.2)	23(8.2)	130(46.6)	3.37
	Little Bit or	231(39.0)	114(49.4)	25(10.8)	92(39.8)	(p=0.50)
	Not at All		00(160)			
IX. Positive	A lot	1/5(29.6)	82(46.9)	1/(9.7)	/6(43.4)	2.50
Reinterpretation	Medium	303(51.2)	146(48.2)	25(8.3)	132(43.6)	3.50
	Not at All	114(19.5)	48(42.1)	16(14.0)	50(43.9)	(p=0.48)
V. Planning	A lot	136(23.0)	67(49.3)	12(8.8)	57(41.9)	
A. Flamming	Medium	296(50.0)	138(46.6)	12(0.0) 23(7.8)	135(45.6)	5 74
	Little Bit or	160(27.0)	71(44.4)	23(14.4)	66(41.3)	(n=0.22)
	Not at All	100(27.0)	, ((1.1)	25(11.1)	00(11.5)	(p=0.22)
XI. Humor	A lot	58(9.8)	31(53.4)	5(8.6)	22(37.9)	
	Medium	211(35.6)	89(42.2)	20(9.5)	102(48.3)	3.68
	Little Bit or	323(54.6)	156(48.3)	33(10.2)	134(41.5)	(p=0.45)
	Not at All					•
XII. Active Coping	A lot	140(23.6)	69(49.3)	7(5.0)	64(45.7)	
• •	Medium	332(56.1)	154(46.4)	35(10.5)	143(43.1)	5.58
	Little Bit or	120(20.3)	53(44.2)	16(13.3)	51(42.5)	(p=0.23)
	Not at All					
XIII. Religion	A lot	279(47.1)	137(49.1)	20(7.2)	122(43.7)	
	Medium	216(36.5)	101(46.8)	22(10.2)	93(43.1)	7.99
	Little Bit or	97(16.4)	38(39.2)	16(16.5)	43(44.3)	(p=0.09)
	Not at All					
XIV. Self-Blame	A lot	105(17.7)	48(45.7)	10(9.5)	47(44.8)	0.74
	Medium	220(37.2)	105(47.7)	19(8.6)	96(43.6)	0.76
	Little Bit or	20/(43.1)	123(46.1)	29(10.9)	115(43.1)	(p=0.94)
	not at All					

# Table 4.30: Frequency of Coping Strategies adopted by Adolescents and Changes in Stress Level at Baseline

## 4.8.2 Correlation between stress level and coping strategies score

The correlation between stress level and coping strategy score helped reflects the most preferred strategies adolescents adopted as the stress level increased or decreased.

### 4.8.2.1 Correlation between CPSS score and COPE score

Strongest significant positive correlation was observed between CPSS score and behavioral disengagement (r = 0.33, p < 0.01). Strong significant positive correlation were also observed between CPSS score and self-blame (r = 0.30), denial (r = 0.29), venting of emotion (r = 0.28) and self -distraction (r = 0.20). Weaker significant positive correlation were demonstrated between CPSS score and utilization of food (r = 0.17) and between CPSS score and seeking emotional support (r = 0.13). Negative significant weak correlation (p < 0.05) was observed between CPSS score and active coping (r = -0.10). . The results were shown in Table 4.31.

<b>Coping Strategies</b>	Stress	Cortisol
	n=797	n=261
Self-Distraction	0.20**	-0.04
Active Coping	$-0.10^{*}$	-0.09
Denial	$0.29^{**}$	-0.06
Food	$0.17^{**}$	-0.04
Emotional Support	0.13**	-0.13*
Instrumental Support	0.06	-0.08
Behavioral Disengagement	0.33**	-0.04
Venting of Emotion	$0.28^{**}$	-0.18**
Positive Reinterpretation	-0.04	-0.10
Planning	-0.05	-0.09
Humor	0.03	0.03
Acceptance	-0.02	-0.11
Religion	-0.03	-0.11
Self-Blame	$0.30^{**}$	-0.08

Table 4.31: Pearson Correlation between Stress and Coping Strategies

\*Correlation is significant at the 0.01 level (2-tailed)

\*\* Correlation is significant at the 0.05 level (2-tailed)

### 4.8.2.2 Correlation between saliva cortisol level and COPE score

Analyzing the correlation between saliva cortisol level and coping strategies items, negative weak significant correlation was observed only between saliva cortisol level and venting of emotion (r = -0.18, p < 0.01) and between saliva cortisol level and using emotional support (r = -0.13, p < 0.05).

## 4.8.3 Correlation between coping strategies and eating behaviour

The correlation between coping strategies and eating behaviour scores on all 797 participants at baseline were shown in Table 4.32. This correlation helped reflects the eating behavior pattern of the adolescents as they adopted the most preferred stress coping strategies.

Overall, the strongest significant positive correlation was observed between utilization of food strategy and EOE score (r = 0.55, p < 0.01) followed by FR score (r = 0.46, p < 0.01) and EOF score (r = 0.41, p < 0.01). Other strongest significant positive correlation between stress coping strategies and FR score were observed in venting of emotion (r = 0.27), self-distraction (r = 0.24) and self-blame (r = 0.22). These were the negative outcome found following the coping strategies adapted.

Analyzing the positive side of adapting these strategies, stronger significant positive correlation between stress coping strategies and FF score were observed in planning (r = 0.24), active coping (r = 0.24), positive reinterpretation (r = 0.23), seeking emotional support (r = 0.22), acceptance (r = 0.22), humor (r = 0.22) and instrumental support (r = 0.20).

Coping strategies that did not show a fairly strong correlation (r<0.20) with any of the eating behavior items include behavioral disengagement, religion and denial.

			Eating	Behavio	our Patt	ern			
	Emotional Eating		Restrained Eating				Externally Induced Eating		
Coping Strategy	EOE	EUE	SR	SE	FF		DD	EOF	FR
Self-Distraction	0.19**	$0.22^{**}$	$0.18^{**}$	0.11**	$0.22^{**}$		0.003	0.21**	0.24**
Active Coping	0.04	0.13**	0.07	0.06	0.24**		-0.04	$0.17^{**}$	0.12**
Denial	0.13**	0.13**	$0.11^{**}$	0.11**	0.15**		0.15**	0.07	0.14**
Food	$0.55^{**}$	$0.20^{**}$	$0.10^{**}$	$0.18^{**}$	0.23**		$0.18^{**}$	0.41**	$0.46^{**}$
Emotional Support	0.11**	0.15**	$0.17^{**}$	0.11**	$0.22^{**}$		-0.04	-0.17**	0.19**
Instrumental Support	0.10**	0.16**	0.14**	$0.08^*$	0.20**		-0.01	0.15**	0.19**
Behavioral Disengagement	0.14**	0.09**	0.14**	0.12**	0.07		0.15**	0.06	0.15**
Venting of Emotion	0.19**	0.21**	0.21**	$0.17^{**}$	0.24**		0.03	$0.20^{**}$	$0.27^{**}$
Positive Reinterpretation	0.06	0.16**	0.12**	$0.08^*$	0.23**		-0.01	0.16**	0.17**
Planning	$0.08^{*}$	$0.17^{**}$	0.15**	0.12**	0.24**		-0.02	0.11**	0.15**
Humor	$0.14^{**}$	$0.09^{*}$	$0.12^{**}$	$0.08^{*}$	0.22**		$0.10^{**}$	$0.14^{**}$	0.19**
Acceptance	$0.08^{*}$	0.19**	0.16**	0.11**	0.22**		-0.03	0.21**	0.21**
Religion	0.06	0.13**	0.13**	0.07	0.19**		-0.01	0.16**	0.17**
Self-Blame	0.19**	0.12**	0.20**	0.16**	0.16**		0.10**	0.15**	0.22**

# Table 4.32: Pearson Correlation between Coping Strategies and EatingBehaviour Scores at Baseline

\*Correlation is significant at the 0.01 level (2-tailed)

\*\* Correlation is significant at the 0.05 level (2-tailed)

# 4.9 Regression Analysis and Modelling

General linear model was further conducted to determine factors associated with the main outcome investigated which was the transition of eating behavior among the adolescents. Multinomial logistic regression using complex sampling analysis was then performed to investigate the relationship between stress, stress coping strategies adapted and all confounding factors of individual, family and environmental factors with the main outcome which was transition of eating behavior.

### 4.9.1 Multiple linear regression analysis

Analyzing the relationship between the adolescents' stress reaction and eating behavior patterns with coping strategies as the mediators, multiple linear regression analysis of the quantitative variables involved were performed. The outcome of interest (dependent variable) was the eating behavior; the predictor investigated (independent variable) was the stress level and possible mediator of interest was the coping strategy (COPE) adopted. Stepwise regression analysis was performed to build the model.

#### 4.9.1.1 Correlation between variables

Correlation between the variables was initially performed to measure the strength of association between the variables. Pearson correlation test between the variables were conducted in the previous sections which include:

- (i) Subjective and objective measurement of stress
- (ii) Stress and eating behaviour
- (iii) Stress and stress coping strategies
- (iv) Stress coping strategies and eating behaviour
### 4.9.1.2 Linear regression analysis

The objective of the analysis was to test the association between the four main predictor variables which are: (1) baseline CPSS Score [baseline stress level], (2) change in CPSS Score [stress change], (3) baseline saliva cortisol level [baseline saliva], (4) change in saliva cortisol level [saliva change] and the main outcome which was transition of eating behaviour.

In performing the linear regression analysis, the eight eating behavior patterns items being the outcome of interest were analyzed individually. Only significant outcome variables identified in relation to stress were selected for further analysis. Three outcome were selected as follow: (1) transition of EOE behaviour, (2) transition of FR behaviour and (3) transition of EUE behaviour.

### a. Outcome of Interest I: Transition of EOE behaviour

Stepwise regression analysis was performed and the only variable entered was stress change. Equation 1 was obtained. Stress change was a significant predictor of transition in EOE behaviour (p < 0.05).

### **Equation 1**

Transition of EOE Behaviour = 0.102 + 0.035 (Stress Change)

For every unit increase in stress change the transition of EOE behavior will increase by 0.035 units; meaning that an increase in CPSS score or perceived stress level will be followed by increasing or worsening of emotional overeating behaviour.

### b. Outcome of Interest II: Transition of FR behaviour

Following stepwise regression analysis, the only variable entered was also stress change. Equation 2 was obtained. Stress change was also a significant predictor of transition in FR behaviour (p < 0.01).

### **Equation 2**

*Transition of FR Behaviour* = -0.107 + 0.035 (*Stress Change*)

For every unit increase in stress change the transition of FR behavior will increase by 0.035 units; meaning that an increase in CPSS score or perceived stress level will be followed by increasing or worsening of food responsiveness behaviour.

#### c. <u>Outcome of Interest III</u>: Transition of EUE behaviour

Following stepwise regression analysis, the only variable entered was also stress change. Equation 3 was obtained. Stress change was a significant predictor of transition in EUE behaviour (p < 0.05).

### **Equation 3**

*Transition of EUE Behaviour* = 0.021 + 0.026 (*Stress Change*)

For every unit increase in stress change the transition of EUE behaviour will increase by 0.026 units; meaning that an increase in CPSS score or perceived stress level will be followed by increasing or worsening of emotional undereating behaviour.

No variables were entered for other transition eating behaviour items.

### 4.9.2 General linear model

This analysis was conducted to determine factors associated with the main outcome which were the transition of eating behaviour among the adolescents. Following linear regression analysis conducted earlier, the significant predictor identified was stress change which represents the change in CPSS score. As in previous analysis, the eating behavior items analyzed will include only items which have been identified to have significant association with the main predictor. The three eating behaviour items analyzed included were: (1) transition of EOE behaviour, (2) transition of FR behaviour and (3) transition of EUE behavior. The objective of this analysis was to test if there was a difference in transition of the eating behaviour score between participants according to stress change category from baseline to follow up.

# **4.9.2.1** To test the difference in transition of eating behaviour between participants according to stress change category from baseline (T<sub>0</sub>) to follow up (T<sub>1</sub>).

ANOVA was obtained using GLM Univariate. Descriptive statistic as in Table 4.33 revealed that participants with increase stress level had highest mean of transition in EOE score (0.25  $\pm$  0.71), highest mean of transition in FR score (0.0007  $\pm$  0.64) and highest mean of transition in EUE behaviour score (0.0797  $\pm$  0.79).

### Table 4.33: Mean Change of Transition in Eating BehaviourScore according to Stress Change Category

Category	Mean	Std. Deviation	Ν
Increase	.2464	.71062	276
No Change	0172	.55382	58
Decrease	.0349	.71173	258
Total	.1284	.70515	592
Dependent Varia	ble: FR Trans	ition	
Category	Mean	Std. Deviation	N
Increase	.0007	.64148	276
No Change	0448	.67957	58
Decrease	1163	.69783	258
Total	0547	.67147	592
Dependent Var	iable: EUE 7	Fransition	
Category	Mean	Std. Deviation	Ν
Increase	.0797	.79085	276
No Change	0302	.70723	58
Decrease	0262	.76049	258
Total	.0228	.77045	592

Tests of between subject effects for EOE transition (Appendix D1) revealed the stress change p-value of 0.001(<0.01). Thus at least one pair of mean score change of EOE transition differs significantly. However, test of between subject effects for FR and EUE transition revealed the stress change p-value of 0.131 and 0.244 (p>0.05). The analysis

thus revealed that there was no difference in mean transition of FR and EUE behaviour between the stress change categories.

Based on Bonferroni pairwise comparisons (Table 4.34) and the plot derived (Figure 4.2), mean transition of EOE behaviour among participants with increased stress level was significantly higher compared to mean transition of EOE behaviour among the participants with no change in stress level (p=0.027) or with a decrease in stress level (p=0.001).

Table 4.34: Pairwise Comparisons on Transition of EOE Behavior

Dependent Variable:	EOE Transition
---------------------	----------------

	Mean Difference				95% CI for Difference <sup>b</sup>		
(I) Category	(J) Category	(I-J)	Std. Error	Sig. <sup>b</sup>	Lower Bound	Upper Bound	
Increase	No Change	.264*	.101	.027	.022	.505	
	Decrease	.211*	.060	.001	.066	.357	
No Change	Increase	264*	.101	.027	505	022	
	Decrease	052	.101	1.000	295	.191	
Decrease	Increase	211*	.060	.001	357	066	
	No Change	.052	.101	1.000	191	.295	

Based on estimated marginal means

\*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.



Figure 4.2: Estimated Marginal Means of Transition in EOE Score

# 4.9.2.2 To test the difference in transition of eating behaviour between participants according to stress change category when controlled for coping strategies.

The analysis was further conducted to test if there was a difference in transition of the behaviour score between participants according to stress change from baseline ( $T_0$ ) to follow up ( $T_1$ ) when controlled for coping strategies. ANCOVA was obtained using GLM Univariate. When controlled for coping strategies, the p-value of stress change for EOE transition was 0.001 (p<0.01). Thus at least one pair of the category means differ significantly when controlled for all the 14 coping strategy items. The coping strategies thus was not confounders for the transition in EOE behaviour.

However, the p-value of stress change for FR and EUE transition was 0.081 and 0.229 (p>0.05) respectively. Thus, there was no significance difference in the mean change of the transition of the FR and EUE behaviour when controlled for all the stress coping strategy items.

The new estimated marginal means (Table 4.35) for the eating behavior transition persisted almost as similar as in the earlier descriptive statistics after adjusting for all coping strategies scores.

## Table 4.35: Estimated Marginal Means of Eating Behaviour Transition according to Stress Change Category

Dependent Variable:	EOE Transition						
		95% CI					
Category	Mean	Std. Error	Lower Bound	Upper Bound			
Increase	.248ª	.042	.165	.330			
No Change	.014ª	.092	167	.195			
Decrease	.027ª	.044	059	.112			
Dependent Variable:	FR Transition						
			95% Confidence Interval				
Category	Mean	Std. Error	Lower Bound	Upper Bound			
Increase	.006ª	.040	073	.085			
No Change	037 <sup>a</sup>	.088	210	.136			
Decrease	124 <sup>a</sup>	.042	206	042			
Dependent Variable:	EUE Transition						
			95% CI				
Category	Mean	Std. Error	Lower Bound	Upper Bound			
Increase	.082ª	.047	010	.175			
No Change	022 <sup>a</sup>	.103	224	.181			
Decrease	031ª	.049	127	.065			

a. Covariates appearing in the model are evaluated at the following values: Self Distraction = 5.52, Active Coping = 5.65, Denial = 4.29, Substance Abuse = 4.21, Emotional Support = 5.27, Instrumental Support = 5.53, Behavioral Disengagement = 3.83, Venting = 4.89, Positive Reintep = 5.83, Planning = 5.48, Humor = 4.46, Acceptance = 5.61, Religion = 6.24, Self-Blame = 4.95.

Based on Bonferroni pairwise comparisons (Table 4.36) and the plot (Figure 4.3), mean transition of EOE behaviour score among participants with increased stress was significantly higher compared to mean transition of EOE behavior among the participants with decrease stress level (p=0.001) when controlled for coping strategies.

### Table 4.36: Pairwise Comparisons on Transition of EOE Behaviour when controlled for Coping Strategies

	Mean Difference					95% CI for Difference <sup>b</sup>			
(I) Category	(J) Category	(I-J)	Std. Error	Sig. <sup>b</sup>	Lower Bound	Upper Bound			
Increase	No Change	.234	.102	.066	010	.478			
	Decrease	.221*	.061	.001	.074	.368			
No Change	Increase	234	.102	.066	478	.010			
	Decrease	013	.102	1.000	258	.233			
Decrease	Increase	221*	.061	.001	368	074			
	No Change	.013	.102	1.000	233	.258			

Dependent Variable: EOE Transition

Based on estimated marginal means

\*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.



Figure 4.3: Estimated Marginal Means of Transition in EOE Score when controlled for Coping Strategies

### 4.9.3 Multinomial Logistic Regression

Multinomial logistic regression analysis was performed to investigate the relationship between the participants' baseline stress level, participants' change in stress level, stress coping strategies adapted and all confounding factors of individual, family and environmental factors investigated with the transition of eating behaviour. The analysis includes the complete cohort of 592 participants. The eating behaviour items investigated included only the most significant identified in previous analysis which were the EOE, FR and EUE behavior.

Specifically, for multivariate logistic regression which aim to show association of all independent variables with eating behavior transition, the p-value of less than 0.25 was preset as the cut off value to choose independent variables from the univariate analysis be entered into the multivariate logistic regression model. The independent variables were taken as control. The cut off value of p<0.25 was chosen so as not to miss significant independent variables which may have been confounded during the univariate analysis (Hosmer et al.). Predictors of p-value less than 0.25 from the univariate analysis thus were fitted jointly into multivariate logistic model.

## 4.9.3.1 To investigate the factors affecting the transition of emotional overeating behaviour among the participants.

A main effect model with transition in EOE behaviour as dependent variable was initially produced containing all the covariate and factor main effects but with no interaction effects. All the variables tested were listed in Table 4.37.

The likelihood ratio tests table showed that the significant p-value (p<0.05) were observed only for stress change (p=0.01) and eat to cope (p=0.03) indicating that both stress change and eat to cope variables were significant predictors of transition in the EOE behaviour. Higher significant p-value of p<0.25 will include ethnicity (p=0.22), parent's marital status (p=0.246), parent's as role model (p=0.10), meal with family (p=0.21), bought junk food (p=0.22), emotional support (p=0.11) and planning (p=0.10).

	Model Fitting		
	Criteria	Likelihoo	d Ratio Tests
	-2 Log Likelihood of		
Effect	Reduced Model	Chi-Square	Sig.
Waist	1019.60	.61	.74
Hip	1021.00	2.02	.37
Stress Change	1033.34	14.35	.01
Baseline Stress Level	1022.58	3.59	.46
Gender	1019.06	.07	.97
School Type	1021.64	2.65	.27
Ethnicity	1027.26	8.27	.22
Academic Achievement	1019.66	.67	.96
Pocket Money	1023.41	4.42	.35
Attempts to reduce weight	1019.28	.29	.86
Eat to Cope	1026.11	7.13	.03
BMI Category	1020.21	1.23	.87
Father's Education	1021.81	2.83	.83
Mother's Education	1024.55	5.56	.47
Marital	1021.79	2.80	.25
Parents as Role	1023.67	4.68	.10
Meal with Family	1024.88	5.89	.21
Canteen Food	1020.32	1.33	.86
Junk Food Vendor	1020.27	1.29	.86
Bought Junk Food	1024.67	5.68	.22
Fast Food Consumption	1020.27	1.29	.86
Cope1_SelfDistract	1019.44	.45	.98
Cope2_ActiveCoping	1021.08	2.10	.72
Cope3_Denial	1024.27	5.29	.26
Cope4_Food	1021.34	2.35	.67
Cope5_Emotional	1026.55	7.56	.11
Cope6_Instrumental	1020.26	1.27	.87
Cope7_BehavDiseng	1023.76	4.77	.31
Cope8_Venting	1021.37	2.38	.67
Cope9_PositiveReinterp	1022.19	3.20	.53
Cope10_Planning	1026.80	7.81	.10
Cope11_Humor	1019.88	.89	.93
Cope12_Acceptance	1022.40	3.41	.49
Cope13_Religion	1023.81	4.83	.31
Cope14_SelfBlame	1022.46	3.47	.48

Table 4.37: Likelihood Ratio Tests of EOE Transition

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

Considering p-value of <0.05 as significant, logistic regression analysis of all factors investigated (Appendix D2) indicated that students who experienced an increase in stress level compared to a decrease (OR = 1.84, 95% CI: 1.15, 2.94), denies to eat when coping with stress (OR = 1.92, 95% CI: 1.18, 3.12), admit to purchasing junk food habit sometimes compared to never (OR: 1.64, 95% CI: 1.04, 2.59) and doing a little bit of

planning or not at all when coping with stress compared to doing a lot of it (OR: 2.72, 95% CI: 1.24, 5.99) were more likely to have a negative transition of emotional overeating behavior than a positive transition.

By increasing the significant p-value to <0.25, the analysis also indicated that students who had low stress level at baseline compared to high stress level (OR = 2.36, 95% CI: 0.92, 6.10), had low stress level at baseline compared to moderate stress level (OR = 1.96, 95% CI: 0.87, 4.44), mother with primary education compared to secondary education (OR = 1.59, 95% CI: 0.76, 3.33), students who consider parents as role model (OR = 1.71, 95% CI: 0.90, 3.25), frequently purchased junk food habit (OR = 2.72, 95% CI: 0.71, 10.5), practicing denial a lot compared to a little or not at all (OR = 2.22, 95% CI: 0.90, 5.48), using food a little or not at all compared to using a lot (OR = 1.85, 95% CI: 0.79, 4.29), using emotional support a lot compared to a little or not at all (OR = 1.81, 95% CI: 0.83, 3.92) were more likely to have a negative transition of emotional overeating behaviour than a positive transition (Appendix D2).

Forward entry of stepwise method was applied. Stress change was added into the model using forced entry terms as it was the main and most important predictor. The p-value of the analysis for model fitting on transition of EOE behavior was <0.01. Likelihood ratio tests revealed that the p-values for the six variables listed variables were <0.25. Thus, these variables were significant predictors of transition of EOE behaviour among the participants. The goodness of fit table showed a p-value of >0.05, thus the chi-square value is small indicating adequate model fit.

### Generating the equation

The equation was obtained based on the parameter estimates table of EOE behaviour transition (Table 4.38). The reference category used was 'positive transition'

EOE behaviour or improved EOE behaviour. Non-significant variables were removed from the equation to create the model.

Category <sup>a</sup>		В	Std Error	Wald	Sig	$Evp(\mathbf{R})$	95% CI fo	or Exp(B)
		D	Stu. Elloi	vv alu	Sig.	Exp(D)_	Lower	Upper
Worsened (Negative Tra	nsition)							
Stress Change	Increase	.661	.206	10.347	.001	1.938	1.295	2.899
	No Change	313	.351	.799	.372	.731	.368	1.453
	Decrease (ref)	0 <sup>b</sup>						
Eat to Cope	Yes	722	.204	12.556	.000	.486	.326	.724
	No	0 <sup>b</sup>						
Parents as Role Model	Yes	.496	.275	3.263	.071	1.643	.959	2.815
	No	0 <sup>b</sup>						
Bought Junk Food	Frequent	.615	.609	1.020	.312	1.850	.561	6.101
	Sometimes	.446	.203	4.831	.028	1.562	1.049	2.324
	Never	0 <sup>b</sup>						
CO5: Emotional	A lot	.521	.303	2.951	.086	1.683	.929	3.050
	Medium	223	.226	.981	.322	.800	.514	1.245
	Little/None	0 <sup>b</sup>						
CO10: Planning	A lot	687	.294	5.460	.019	.503	.283	.895
	Medium	094	.240	.153	.695	.910	.569	1.457
	Little/None	$0^{b}$						
No Change (No Transitio	on)							
Stress Change	Increase	.180	.284	.402	.526	1.197	.686	2.090
	No Change	.518	.399	1.686	.194	1.679	.768	3.668
	Decrease (ref)	0 <sup>b</sup>						
Eat to Cope	Yes	530	.276	3.680	.055	.588	.342	1.012
	No	0 <sup>b</sup>						
Parents as Role Model	Yes	311	.327	.903	.342	.733	.386	1.392
	No	0 <sup>b</sup>						
Bought Junk Food	Frequent	015	.884	.000	.986	.985	.174	5.566
	Sometimes	.192	.270	.504	.478	1.211	.713	2.057
	Never	0 <sup>b</sup>						
COPE 5: Emotional	A lot	.315	.399	.622	.430	1.370	.626	2.998
	Medium	314	.303	1.073	.300	.731	.404	1.323
	Little/None	0 <sup>b</sup>						
COPE10: Planning	A lot	174	.408	.182	.670	.840	.378	1.869
	Medium	.345	.332	1.079	.299	1.411	.737	2.705
	Little/None	$0^{b}$						

 Table 4.38: Parameter Estimates on EOE Behaviour Transition

The reference category is: Improved (Positive Transition)

### **Equation Z1**=

Probability of students to experience negative transition of EOE behaviour compared to positive transition

Z1 = 0.326 + 0.661 (Stress Change) - 0.72 (Eat to Cope)

+ 0.5 (Consider Parents as Role Model) + 0.45 (Bought Junk Food Habit)

+ 0.52 (Use Emotional Support) – 0.69 (Planning)

Stress Change: [Increase =1, No Change or Decrease = 0] Eat to Cope: [Yes=1, No=0] Parents as Role Model [Yes=1, No=0] Bought Junk Food [Sometimes=1, Never=0] Use Emotional Support to cope [A lot=1, Medium, A little or None = 0] Planning to cope [A lot=1, Medium, A little or None=0]

### Interpretation of the Odds Ratio

#### (i) Stress change

The OR for stress change in Z1 = 1.94 (95%CI: 1.30, 2.90). The odds of students who had an increase stress level compared to a decrease experiencing a negative transition of EOE behaviour rather than a positive transition is nearly 2 times more.

### (ii) Eat to cope with stress

The OR for eat to cope with stress in Z1 = 0.49 (95% CI: 0.33, 0.72). If we reciprocate this, OR = 2.0 (95% CI: 1.4, 3.1). The odds of students who deny to eat to cope with stress experiencing a negative transition in EOE behaviour is 2 times more compared to those who admit to practicing this.

### (iii) Considering parents as role model

The OR for parents as role model in Z1 = 1.64 (95% CI: 0.96, 2.82). The odds of students who regards their parents as role model compared to those who does not experiencing a negative transition of EOE behaviour rather than a positive transition is 1.6 times more.

### (iv)Bought junk food

The OR for bought junk food habit in Z1 = 1.56 (95% CI: 1.05, 2.32). The odds of students who sometimes bought junk food compared to those never bought junk food

experiencing a negative transition of EOE behaviour rather than a positive transition is nearly 1.6 times more.

### (v) Use of emotional support

The OR for use of emotional support in Z1 = 1.68 (95% CI: 0.93, 3.05). The odds of students who use a lot of emotional support to cope with stress compared to those who use it a little or none experiencing a negative transition of EOE behaviour rather than a positive transition is 1.7 times more.

### (vi)Planning to cope

The OR for planning in Z1 = 0.50 (95% CI: 0.28, 0.90). If we reciprocate this, OR = 1.99 (95% CI: 1.12, 3.53). The odds of students who plan a little or none to cope with stress experiencing a negative transition in EOE behaviour is 2 times more compared to students who plan a lot when coping with stress.

# 4.9.3.2 To investigate the factors affecting the food responsiveness behaviour among the participants.

A main effect model with transition in FR behavior as dependent variable was produced containing all the covariate and factor main effects but with no interaction effects. All the variables tested were listed in Table 4.39. The likelihood ratio tests showed that the significant p-value (p<0.05) were observed only for Cope\_9: Positive Reinterpretation (p=0.04) and Cope\_10: Planning (p=0.03). Higher significant p-value of p<0.25 will include stress change (p=0.22), baseline stress level (p=0.14), school location (p=0.16), eat to cope (p=0.22), BMI category (p=0.18), mother's education (p=0.17), bought junk food (p=0.05), fast food consumption (p=0.08), use of instrumental support (p=0.13) and religion (p=0.18). These variables were thus significant predictors of transition in FR behaviour.

	Model Fitting Criteria	Likelihoo	d Ratio Tests
-	-2 Log Likelihood of		
Effect	Reduced Model	Chi-Square	Sig.
Waist	1015.17	.91	.64
Hip	1014.78	.51	.77
Stress Change	1020.02	5.76	.22
Baseline Stress Level	1021.17	6.90	.14
Gender	1014.91	.65	.72
School Type	1017.98	3.72	.16
Ethnicity	1017.30	3.04	.80
Academic Achievement	1018.80	4.54	.34
Pocket Money	1015.02	.75	.95
Attempts to reduce weight	1015.66	1.40	.50
Eat to Cope	1017.31	3.05	.22
BMI Category	1020.54	6.28	.18
Father's Education	1020.08	5.82	.44
Mother's Education	1023.41	9.15	.17
Marital	1016.58	2.31	.32
Parents as Role	1014.36	.09	.96
Meal with Family	1016.79	2.53	.64
Canteen Food	1016.80	2.53	.64
Junk Food Vendor	1015.32	1.05	.90
Bought Junk Food	1023.71	9.44	.05
Fast Food Consumption	1022.52	8.25	.08
Cope1_SelfDistract	1019.09	4.83	.31
Cope2_ActiveCoping	1014.53	.27	.99
Cope3_Denial	1017.22	2.96	.57
Cope4_Food	1016.83	2.57	.63
Cope5_Emotional	1015.99	1.73	.79
Cope6_Instrumental	1021.45	7.19	.13
Cope7_BehavDiseng	1017.34	3.08	.55
Cope8_Venting	1016.80	2.54	.64
Cope9_PositiveReinterp	1024.45	10.19	.04
Cope10_Planning	1024.86	10.60	.03
Cope11_Humor	1018.89	4.62	.33
Cope12_Acceptance	1016.52	2.26	.69
Cope13_Religion	1020.55	6.28	.18
Cope14_SelfBlame	1017.81	3.55	.47

Table 4.39: Likelihood Ratio Tests on FR Behaviour Transition

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

Considering the significant p-value of <0.25, logistic regression analysis on all factors investigated (Appendix D2) indicated that students who had an increase in stress level compared to a decrease in stress level (OR = 1.36, 95% CI: 0.88, 2.10), students with low baseline stress level compared to moderate stress level (OR = 2.51, 95% CI: 0.71, 8.84), average academic achievement compared to below average (OR = 1.63, 95%

CI: 0.99, 2.68), denies eating to cope with stress (OR = 1.51, 95% CI: 0.93, 2.45), underweight compared to overweight and obese (OR = 3.14, 95% CI: 1.0, 9.9), underweight compared to normal weight (OR = 1.87, 95% CI: 1.02, 3.44), had single parents than married parents (OR = 1.48, 95% CI: 0.79, 5.3), using a little of humor or none compared to medium amount of usage (OR = 1.36, 95% CI: 0.86, 2.15) and using a lot of religion to cope with stress compared to a little or none (OR = 1.74, 95% CI: 0.84, 3.61) were more likely to have a negative transition of FR behaviour than a positive transition (Appendix D2).

Stress change was added into the model using forced entry terms. Forward entry of stepwise method was applied. The p-value of the analysis for model fitting was 0.003 (<0.05). Likelihood ratio tests revealed that the p-value for stress change and all of the five listed variables were significant (p<0.25). Thus, the variables were significant predictor of transition of FR behaviour among the participants. The goodness of fit table depicted a p-value of >0.05, thus the chi-square value is small indicating adequate model fit.

### Generating the equation

The equation was obtained based on the parameter estimates table of FR behavior transition (Table 4.40). The reference category used was 'positive transition' of FR behaviour or improved FR behaviour. Unexpected singularities in the Hessian matrix were encountered during analysis indicating some predictor variables should be excluded. Fast food consumption was the variable identified and thus removed prior to generating the equation. All non-significant variables were also removed from the equation to create the model.

Category <sup>a</sup>		D	Std.	Std. Wold	C:-	Eve(D)	95% CI for Exp(B)	
		В	Error	wald	51g.	Exp(B)	Lower	Upper
Worsened (Negative Tra	nsition)							
Stress Change	Increase	.354	.198	3.210	.073	1.425	.967	2.099
	No Change	.225	.317	.501	.479	1.252	.672	2.332
	Decrease (ref)	$0^{b}$						
Eat to Cope	Yes	455	.196	5.388	.020	.634	.432	.932
	No	$0^{b}$						
Bought Junk Food	Frequent	.793	.674	1.382	.240	2.210	.589	8.287
	Sometimes	.328	.194	2.869	.090	1.389	.950	2.031
	Never	$0^{b}$						
COPE 11: Humor	A lot	.126	.321	.153	.695	1.134	.605	2.125
	Medium	306	.209	2.142	.143	.737	.489	1.109
	Little/None	$0^{b}$						
COPE14: Self-Blame	A lot	452	.277	2.665	.103	.636	.370	1.095
	Medium	117	.210	.309	.578	.890	.590	1.343
	Little/None	$0^{b}$						
No Change (No Transiti	on)							
Stress Change	Increase	.365	.266	1.881	.170	1.441	.855	2.427
	No Change	578	.533	1.179	.278	.561	.197	1.593
	Decrease (ref)	$0^{b}$						
Eat to Cope	Yes	209	.266	.614	.433	.812	.482	1.368
	No	$0^{b}$						
Bought Junk Food	Frequent	2.136	.703	9.224	.002	8.462	2.133	33.573
	Sometimes	.400	.273	2.139	.144	1.492	.873	2.550
	Never	$0^{b}$						
COPE 11: Humor	A lot	771	.590	1.707	.191	.463	.146	1.470
	Medium	.061	.275	.050	.824	1.063	.620	1.823
	Little/None	0 <sup>b</sup>						
COPE14: Self-Blame	A lot	498	.371	1.808	.179	.607	.294	1.256
	Medium	632	.298	4.501	.034	.531	.296	.953
	Little/None	0 <sup>b</sup>						

### Table 4.40: Parameter Estimates on FR Behaviour Transition

The reference category is: Improved (Positive Transition)

### **Equation Z2**:

Probability of students to experience negative transition of FR behaviour compared to positive transition

Z1 = -0.15 + 0.35 (Stress Change) - 0.46 (Eat to Cope)

+ 0.79 (Frequently Bought Junk Food Habit)

- + 0.33 (Sometimes Bought Junk Food Habit)
- 0.31 (Utilizing humor medium amount)
- -0.45 (Practicing self blame a lot)

Stress Change: [Increase =1, No Change or Decrease = 0] Eat to Cope: [Yes=1, No=0] Frequently Bought Junk Food [Yes=1, No=0]

Sometimes Bought Junk Food [Yes=1, No=0]

Use humor to cope [Medium=1, A little or None = 0]

Self-blame to cope [A lot=1, Medium, A little or None=0]

### Interpretation of the Odds Ratio

### (i) Stress change

The OR for stress change in Z2 = 1.43 (95% CI: 0.97, 2.10). Despite the OR include 1 and interpreted as not significant, stress change is an important factor that needs to be included as one of the main predictor investigated. The odds of students who had an increase stress level compared to a decrease experiencing a negative transition of FR behaviour rather than a positive transition is thus nearly 1.4 times more.

### (ii) Eat to cope with stress

The OR for eat to cope in Z2= 0.63 (0.43, 0.93). If we reciprocate this, OR = 1.6 (95% CI: 1.07, 2.31). The odds of students who deny to practice eating to cope with stress experiencing a negative transition in FR behaviour is 1.6 times more compared to those who admit to practicing this.

### (iii) Bought junk food habit

The OR for frequently bought junk food habit in Z2 = 8.46 (95% CI: 2.13, 33.6). The odds of students who frequently bought junk food compared to those who never bought junk food experiencing a negative transition of FR behaviour rather than a positive transition is nearly 8.5 times more.

The OR for sometimes bought junk food habit in Z1 = 1.49 (95% CI: 0.87, 2.55). The odds of students who sometimes bought junk food compared to those who never bought junk food experiencing a negative transition of FR behaviour rather than a positive transition is nearly 1.5 times more

### (iv)Use humor to cope with stress

The OR for using humor in Z2 = 0.74 (95% CI: 0.49, 1.11). If we reciprocate this, OR = 1.36 (95% CI: 0.90, 2.04). The odds of students who practice humor a little or none experiencing a negative transition in FR behaviour is 1.4 times more compared to students who practice it in medium amount.

### (v) Use self-blame to cope with stress

The OR for using self-blame in Z2 = 0.64 (95% CI: 0.37, 1.10). If we reciprocate this, OR = 1.57 (95% CI: 0.91, 2.70). The odds of students who practice self-blame a little or none to cope with stress experiencing a negative transition in FR behaviour is 1.6 times more compared to students who practice it a lot.

# 4.9.3.3 To investigate the factors affecting the transition of emotional undereating behaviour among the participants.

A main effect model with transition in EUE behaviour as dependent variable was produced containing all the covariate and factor main effects but with no interaction effects. All the variables tested were listed in Table 4.41. The likelihood ratio tests table showed that the significant p-value (p<0.05) were observed only for Cope\_6: Instrumental support (p=0.04). Higher significant value of p<0.25 will include these variable: stress change (p=0.22), gender (p=0.11), pocket money (p=0.17), parents as role model (p=0.12), meal with family (p=0.20), bought junk food habit (p=0.08), Cope\_11:Self distract (p=0.14), Cope\_2:Active coping (p=0.21), Cope\_13:Religion (p=0.06) and Cope\_14: Self-blame (p=0.06). These variables were thus significant predictors of the transition in EUE behaviour.

	Model Fitting		
	Criteria	Likelihood Rati	o Tests
	-2 Log Likelihood		
Effect	of Reduced Model	Chi-Square	Sig.
Waist	991.98	2.04	.36
Hip	990.05	.11	.95
Stress Change	995.71	5.77	.22
Baseline Stress Level	995.10	5.16	.27
Gender	994.29	4.35	.11
School Type	992.55	2.61	.27
Ethnicity	996.57	6.63	.36
Academic Achievement	994.46	4.52	.34
Pocket Money	996.41	6.47	.17
Attempts to reduce weight	991.44	1.50	.47
Eat to Cope	990.08	.14	.94
BMI Category	990.76	.82	.94
Father's Education	992.60	2.66	.85
Mother's Education	994.38	4.44	.62
Marital	990.46	.52	.77
Parents as Role	994.26	4.32	.12
Meal with Family	995.88	5.93	.20
Canteen Food	991.77	1.83	.77
Junk Food Vendor	991.47	1.53	.82
Bought Junk Food	998.28	8.34	.08
Fast Food Consumption	992.22	2.28	.69
Cope1_SelfDistract	996.91	6.97	.14
Cope2_ActiveCope	995.78	5.84	.21
Cope3_Denial	991.49	1.54	.82
Cope4_Food	994.11	4.17	.38
Cope5_Emotional	992.95	3.01	.56
Cope6_Instrumental	1000.15	10.21	.04
Cope7_BehavDisengagement	993.02	3.07	.55
Cope8_Venting	992.25	2.31	.68
Cope9_PositiveReinterp	994.49	4.55	.34
Cope10_Planning	990.68	.74	.95
Cope11_Humor	990.67	.73	.95
Cope12_Acceptance	993.65	3.71	.45
Cope13 Religion	999.13	9.18	.06
Cope14_SelfBlame	998.90	8.96	.06
School Type Ethnicity Academic Achievement Pocket Money Attempts to reduce weight Eat to Cope BMI Category Father's Education Mother's Education Mother's Education Marital Parents as Role Meal with Family Canteen Food Junk Food Vendor Bought Junk Food Fast Food Consumption Cope1_SelfDistract Cope2_ActiveCope Cope3_Denial Cope4_Food Cope5_Emotional Cope6_Instrumental Cope6_Instrumental Cope7_BehavDisengagement Cope1_Planning Cope11_Humor Cope12_Acceptance Cope13_Religion Cope14_SelfBlame	994.29 992.55 996.57 994.46 996.41 990.08 990.76 992.60 994.38 990.46 994.26 995.88 991.77 991.47 998.28 992.22 996.91 995.78 991.49 995.78 991.49 992.95 1000.15 993.02 992.25 994.49 990.68 990.67 993.65 999.13 998.90	$\begin{array}{c} 4.35\\ 2.61\\ 6.63\\ 4.52\\ 6.47\\ 1.50\\ .14\\ .82\\ 2.66\\ 4.44\\ .52\\ 4.32\\ 5.93\\ 1.83\\ 1.53\\ 8.34\\ 2.28\\ 6.97\\ 5.84\\ 1.54\\ 4.17\\ 3.01\\ 10.21\\ 3.07\\ 2.31\\ 4.55\\ .74\\ .73\\ 3.71\\ 9.18\\ 8.96\end{array}$	.1 .2 .3 .3 .3 .1 .4 .9 .9 .9 .9 .8 .6 .7 .1 .2 .7 .8 .0 .0 .6 .1 .2 .8 .3 .5 .00 .5 .6 .3 .9 .9 .9 .4 .0 .0 .0

Table 4.41: Likelihood Ratio Tests on EUE Transition

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

Considering the significant p-value of <0.05, logistic regression analysis conducted on all the investigated factors (Appendix D2) indicated that male students compared to female (OR = 1.68, 95% CI: 1.03, 2.74), students who did not regard parents as role model (OR: 1.92, 95% CI: 1.02, 3.58), students who never purchased junk food compared to sometimes (OR: 1.81, 95% CI: 1.16, 2.82) and those who never practice or

practice self-blame a little when coping with stress compared to students who practice it in medium amount (OR: 1.62, 95% CI: 1.02, 2.60) were more likely to have a negative transition of EUE behavior than a positive transition.

Increasing the significant value to p<0.25 will include these variables: students who had an increase in stress level compared to a decrease (OR = 1.53, 95% CI: 0.97, 2.42), students with low baseline stress level compared to high stress level (OR = 2.07, 95% CI: 0.84, 5.15), students who never consume fast food compared to frequently (OR = 3.12, 95% CI: 0.53, 18.2), students who practice active coping a little or none than medium amount (OR = 1.78, 95% CI: 0.97, 3.27), students who practice coping with instrumental support a lot compared to a little or none (OR = 1.53, 95% CI: 0.76, 3.08) and students who use religion to cope with stress in medium amount compared to a little or none (OR = 2.12, 95% CI: 0.98, 4.16) were more likely to have a negative transition of EUE behavior than a positive transition (Appendix D2).

Stress change was added into the model using forced entry terms. Forward entry of stepwise method was applied. The p-value of the analysis for model fitting was 0.01 (<0.05). Likelihood ratio tests revealed that the p-value for stress change and all the seven listed variables were <0.25. Thus, stress change and these variables were significant predictors of transition in EUE behaviour among the participants. The goodness of fit table depicted a p-value of >0.05, thus the chi-square value is small indicating adequate model fit.

### Generating the equation

The equation thus was obtained based on the parameter estimates table (Table 4.42). The reference category used was 'positive transition' of EUE behavior or improvement of the EUE behaviour. Non-significant variables were removed from the equation to create the model.

$D_{T}$ wald Sig. $EXP(D)$	A 1 1
Error Lower	Upper
Worsened (Negative Transition)	
Stress Change         Increase         .459         .199         5.293         .021         1.582         1.07	0 2.338
No Change .399 .336 1.413 .234 1.491 .77	2 2.881
Decrease (ref) 0 <sup>b</sup>	
Gender Male .538 .206 6.812 .009 1.713 1.14	3 2.566
Female(ref) 0 <sup>b</sup>	
Bought Junk Food Frequent638 .573 1.240 .265 .528 .17	2 1.624
Sometimes614 .200 9.442 .002 .541 .36	6 .801
Never(ref) $0^{b}$	
Academic Good096 .543 .031 .860 .909 .31	4 2.632
Achievement Average004 .231 .000 .985 .996 .63	3 1.567
Below Average(ref) $0^{b}$	
CO1: Self Distract A lot .089 .307 .084 .772 1.093 .59	9 1.994
Medium260 .251 1.074 .300 .771 .47	1 1.261
Little/None(ref) $0^{b}$	
CO6: Instrumental A lot .184 .288 .410 .522 1.203 .68	4 2.114
Medium522 .234 4.966 .026 .593 .37	5.939
Little/None(ref) $0^{b}$	
CO9: Positive A lot348 .316 1.213 .271 .706 .38	0 1.312
Reinterpretation Medium .124 .274 .203 .653 1.131 .66	1 1.937
Little/None(ref) 0 <sup>b</sup>	
CO13: Religion A lot 352 333 1.118 290 1.422 74	1 2.731
Medium 611 323 3.584 058 1.843 97	9 3.471
Little/None(ref)	
CO14: Self-Blame A lot 246 288 733 392 1 279 72	8 2.248
Medium - 482, 214, 5,045, 025, 618, 40	6 .940
Little/None(ref)	
No Change (No Transition)	<u> </u>
Stress Change Increase .054 .296 .034 .854 1.056 .59	1 1.885
No Change	4 3.505
Decrease (ref) $0^{b}$	
Gender Male .219 .308 .505 .477 1.245 .68	1 2.276
Female(ref)    0b   .   .   .	
Bought Junk Food Frequent -1.142 1.131 1.020 .312 .319 .03	5 2.927
Sometimes096 .295 .106 .745 .908 .50	9 1.621
Never(ref) $0^{\circ}$	
Academic Good 1.000 .626 2.550 .110 2.719 .79	6 9.281
Achievement Average .585 .319 3.370 .066 1.795 .96	1 3.353
Below Average (ref) $0^{\circ}$	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4 2.118
I = 1.08 = 0.09 = 0.048 = 0.493 = 0.24	+ .774
CO6: Instrumental A lot 352 441 637 425 1 422 59	 9 3 379
Medium076 .356 .045 .831 .927 .46	2 1.862
Little/None(ref) $0^{b}$	
CO9: Positive A lot .199 .454 .191 .662 1.220 .50	1 2.971
Reinterpretation Medium019 .414 .002 .963 .981 .43	6 2.209
Little/None(ref) $0^{b}$	
CO13: Religion A lot194 .495 .153 .695 .824 .31	3 2.172
Medium .681 .459 2.203 .138 1.977 .80	4 4.861
Little/None(ref) $0^{b}$	
CU14: Self-Blame A lot .336 .420 .640 .424 1.399 .61	5 3.183
0 <sup>b</sup> .34	0 1.212

### Table 4.42: Parameter Estimates of EUE Behaviour Transition

The reference category is: Improved (Positive Transition)

### **Equation Z3**:

Probability of students to experience negative transition of EUE behaviour compared to positive transition

Z3 = -0.04 + 0.46 (Stress Change) + 0.54 (Gender) - 0.61 (Sometimes Bought Junk Food Habit) - 0.52 (Utilizing instrumental support medium amount) + 0.61 (Using religion medium amount) - 0.48 (Using self blame medium amount)

> Stress Change: [Increase =1, No Change or Decrease = 0] Gender: [Male=1, Female=0] Sometimes Bought Junk Food [Yes=1, No=0] Use instrumental support to cope [Medium=1, A little or None = 0] Use religion to cope[Medium=1, A little or None = 0] Use self-blame to cope [Medium=1, A little or None = 0]

### Interpretation of the Odds Ratio

### (i) Stress change

The OR for stress change in Z3 = 1.58 (95% CI: 1.07, 2.34). The odds of students who had an increase stress level compared to a decrease experiencing a negative transition of EUE behaviour rather than a positive transition is 1.6 times more.

### (ii) Gender

The OR for gender in Z3= 1.71 (95% CI: 1.14, 2.57). The odds of male students experiencing a negative transition of EUE behaviour rather than a positive transition is 1.7 times more compared to the female students.

### (iii) Bought junk food habit

The OR for bought junk food habit in Z3 = 0.54 (95% CI: 0.37, 0.80). If we reciprocate this, OR = 1.84 (95% CI: 1.25, 2.73). The odds of students who sometimes bought junk food experiencing a negative transition of EUE behaviour rather than a positive transition is 1.7 times more compared to students who never does this.

### (iv) Use instrumental support to cope in medium amount

The OR for instrumental support in Z3= 0.59 (95% CI: 0.38, 0.94). If we reciprocate this, OR = 1.69 (95% CI: 1.06, 2.67). The odds of students who use instrumental support a little or none experiencing a negative transition of EUE behaviour rather than a positive transition is 1.7 times more compared to students who use this strategy in medium amount.

### (v) Use religion to cope in medium amount

The OR for religion in Z3= 1.84 (0.98, 3.47). The odds of students who use religion in medium amount to cope with stress experiencing a negative transition of EUE behaviour rather than a positive transition is 1.7 times more compared to students who use this strategy a little or none.

### (vi) Use self-blame to cope in medium amount

The OR for self-blame in Z3= 0.62 (95% CI: 0.41, 0.94). If we reciprocate this, OR = 1.62 (95% CI: 1.06, 2.46). The odds of students who use self-blame a little or none to cope with stress experiencing a negative transition of EUE behaviour rather than a positive transition is 1.6 times more compared to students who use this strategy in medium amount.

### 4.10 Modelling

A model was created following the analysis to demonstrate the relationship and significance of stress on transition of eating behaviour among Malaysian adolescents corrected for potential individual, family and environmental confounding factors and stress coping strategies adapted. Only strong significant variables were included in the model except for stress change as it was the main predictor investigated. The significant relation of the variables investigated were demonstrated in Figure 4.4.

The model demonstrated the association of increase stress level and potential factors that may significantly affect unhealthy transition of eating behavior. The odds ratio of each factor demonstrated the strength of the effect on the transition. Most significant transition of eating behavior that could be caused by an increase in stress level is EOE (p=0.01) followed by EUE (p=0.02) and FR (p=0.07).

Interestingly, denying to consume food when coping with stress actually increase the odds of both unhealthy eating of emotional overeat (OR = 2.06) and food responsiveness (OR = 1.58). The habits of buying junk food despite sometimes also increase the odds of both unhealthy eating of emotional overeat (OR=1.56) and food responsiveness (OR=1.39). Unable to plan when coping with stress increase the odds of emotional overeating by two times. However, adapting emotional support could actually increase the odds of emotional overeating by 1.7 times. If it is noted that, self-blaming when coping with stress will decrease the odds of both unhealthy eating of emotional undereating and food responsiveness. Unable to adapt humor when coping with stress increase the odds of food responsiveness by 1.4 times.



Figure 4.4: Association of Increase Stress and Factors Affecting Unhealthy Transition of Eating Behaviour

### 4.11 Mediation Analysis

A mediation analysis was further conducted to test if the coping strategies found to be significant predictors during earlier analysis mediates the relationship between stress change and transition of the eating behaviours. As in previous sections, the eating behaviour items investigated included only the most significant identified in previous analysis which were the EOE, FR and EUE behavior. The comparison was conducted using Sobel's Method.

### 4.11.1 To test if coping strategies mediates the relationship between stress change and the transition of EOE behavior.

Only two coping strategies were found to be significant predictors for the transition of EOE behavior which are (1) Planning and (2) Emotional Support.

Regression analysis were conducted which include regression of Transition of EOE behavior upon the coping strategies (Table 4.43) and regression of the coping strategies upon Stress Change (Table 4.44).

	Unstandardized Coefficients		Standardized Coefficients		
Model	В	Std. Error	Beta	t	Sig.
Stress Change	.030	.007	.1	.80 4.443	.000
Planning	019	.019	(	.964964	.336
<b>Emotional Support</b>	.015	.019	).	.797	.426

 Table 4.43: Regression of Transition of EOE behaviour upon Stress Change and

 Planning and Emotional Support

a. Dependent Variable: EOE Transition

		Unstand	lardized	Standardized		
		Coefficients		Coefficients	_	
Dependent						
Variable	Model	В	Std. Error	Beta	Т	Sig.
Planning	Stress Change	.000	.014	.00	.027	.979
Emotional Support	Stress Change	012	.015	033	791	.429

### Table 4.44: Regression of the Coping Strategies upon Stress Change

Partitioning the effect of Stress Change on the transition of EOE behavior,

the Direct Effect (DE) is 0.180;

(i) <u>Testing if Planning mediates the relationship between Stress Change on Transition of</u>

EOE Behaviour

The Indirect Effect (IE) is 0.001 \* -0.039 = -0.000039

Total Effect (TE) is DE + IE = 0.180039

Since IE is <0.08, planning does not mediate the relationship between stress change and the transition of EOE behavior.

(ii) Testing if Emotional Support mediates the relationship between Stress Change on

Transition of EOE Behaviour

The Indirect Effect (IE) is -0.033 \* 0.032 = 0.00096

Total Effect (TE) is DE + IE = 0.18196.

Since IE is <0.08, emotional support does not mediate the relationship between stress change and the transition of EOE behavior.

### 4.11.2 To test if coping strategies mediates the relationship between stress change and the transition of EUE behaviour.

Only three coping strategies were found to be significant predictors for the transition of EUE behavior which are (1) Instrumental, (2) Self-blame and (3) Religion.

Regression analysis were conducted which include regression of Transition of EUE behavior upon Stress Change and the coping strategies (Table 4.45) and regression of the coping strategies upon Stress Change (Table 4.46).

Table 4.45: Regression of Transition of EUE behaviour upon Stress Change andInstrumental Support, Self-blame and Religion

	Unstandardized Coefficients		Standardize Coefficient	Standardized Coefficients		
Model	В	Std. Error	Beta		Т	Sig.
Stress Change	.022	.007		.123	3.019	.003
Instrumental Support	003	.020		006	138	.890
Self-Blame	.011	.018		.025	.610	.542
Religion	.003	.019		.008	.184	.854

a. Dependent Variable: EUE Transition

		Unstandardized Coefficients Std.		Standardized Coefficients		
Dependent Variable						
	Model	В	Error	Beta	Т	Sig.
Instrumental	Stress Change	.010	.015	.028	.677	.499
Support						
Self-blame	Stress Change	012	.016	031	745	.457
Religion	Stress Change	.019	.016	.049	1.186	.236

Partitioning the effect of Stress Change on Transition of EUE Behaviour,

the Direct Effect (DE) is 0.123.

(i) Testing if Instrumental Support mediates the relationship between Stress Change on

Transition of EUE Behaviour

The Indirect Effect (IE) is 0.028 \* -0.006 = -0.000168

Total Effect (TE) is DE + IE = 0.123168.

Since IE is <0.08, instrumental support does not mediate the relationship between stress

change and the transition of EUE behavior.

(ii) Testing if Self-blame mediates the relationship between Stress Change on Transition

of EUE Behaviour

The Indirect Effect (IE) is -0.031 \* 0.025 = 0.000775

Total Effect (TE) is DE + IE = 0.124775.

Since IE is <0.08, self-blame does not mediate the relationship between stress change and the transition of EUE behavior.

(iii)<u>Testing if Religion mediates the relationship between Stress Change on Transition of</u> <u>EUE Behaviour</u>

The Indirect Effect (IE) is 0.049 \* 0.008 = 0.000392

Total Effect (TE) is DE + IE = 0.124392.

Since IE is <0.08, religion does not mediate the relationship between stress change and the transition of EUE behavior.

### 4.11.3 To test if coping strategies mediates the relationship between stress change and the transition of FR behavior.

Only two coping strategies were found to be significant predictors for the transition of FR behavior which are (1) Humor and (2) Self-blame.

Regression analysis were conducted which include regression of Transition of FR behavior upon Stress Change and the coping strategies (Table 4.47) and regression of the coping strategies upon Stress Change (Table 4.48).

	Unstand Coeffi	lardized cients	Standardized Coefficients		
Model	В	Std. Error	Beta	t	Sig.
Stress Change	.022	.006	.140	3.440	.001
Humor	010	.017	023	562	.574
Self-Blame	012	.016	031	764	.445

## Table 4.47: Regression of Transition of FR behaviour upon Stress Change and Humor and Self-blame

a. Dependent Variable: FR Transition

		Unstanda	Unstandardized Standardized			
		Coefficients		Coefficients		
Dependent Variable			Std.			
	Model	В	Error	Beta	t	Sig.
Humor	Stress Change	004	.015	011	269	.788
Self-blame	Stress Change	012	.016	031	- 745	.457

### Table 4.48: Regression of the Coping Strategies upon Stress Change

Partitioning the effect of Stress Change on Transition of FR Behaviour,

the Direct Effect (DE) is 0.140.

(i) <u>Testing if Humor mediates the relationship between Stress Change on Transition of</u>

### FR Behaviour

The Indirect Effect (IE) is -0.011 \* -0.023 = 0.000253

Total Effect (TE) is DE + IE = 0.140253

Since IE is <0.08, instrumental support does not mediate the relationship between stress

change and the transition of EUE behavior.

(ii) Testing if Self-blame mediates the relationship between Stress Change on Transition

### of FR Behaviour

The Indirect Effect (IE) is -0.031 \* -0.031 = 0.000961

Total Effect (TE) is DE + IE = 0.140961

Since IE is <0.08, self-blame does not mediate the relationship between stress change and the transition of FR behavior.

### **CHAPTER 5: DISCUSSION**

### 5.1 About this Chapter

This chapter discusses the findings of this study within the theoretical framework and also relates them to results presented in previous research. The first section of this chapter (section 5.2) describes the background characteristics of the participants. The flow of the discussion in the subsequent sections is based on the objectives of the study. Section 5.3 and section 5.4 discuss the prevalence and distribution of stress and eating behaviour among Malaysian adolescents, respectively. The findings are related to the stress that is potentially caused by preparing for final-year school examinations. Section 5.5 discusses the effect of stress on the transition in eating behaviour among adolescents. Section 5.6 focuses on the coping strategies adopted by Malaysian adolescents when dealing with stress. The section also discusses the effect of the stress coping strategies adopted by the adolescents on their stress level and their eating behaviour pattern. Section 5.7 discusses all the factors associated with the final outcome of this study, which is the transition in eating behavior of the adolescents.

### 5.2 Background Characteristics of Participants

Malaysia is a federation of 13 states located in Southeast Asia. It is a middleincome country consisting of two regions separated by the South China Sea. As of 2016, Malaysia has a population of 31.6 million. It is a multi-ethnic and multi-religious country in which the majority of the population are Malay (68.6%) followed by Chinese (23.4%), Indian (7.0%) and Other (1.0%) (Department of Statistics, 2016). Thus, the background characteristics of the adolescents participating in this research are crucial because inappropriate selection may confound the outcome and affect the generalization of the study findings. The sample in this study is acceptably proportionate to the general population because 74.9% of the participants were Malay followed by Chinese (11.7%), Indian (8.7%) and Other (4.8%) ethnicities. The Other category consisted mainly of Malaysian aborigines who are also known as Orang Asli. Female participants accounted for 60.2% of the sample. Majority of the participants were from the urban population (60.5%).

Generally, a large proportion (44.5%) of the participants in this study had a normal BMI, while the prevalence of obesity and overweight was 11.7% and 14.7%, respectively. This finding is almost similar to the prevalence in Malaysia where NHMS 2015 reported that the national prevalence of obesity among children and adolescents aged below 18 years old is 11.9%. According to NHMS 2015, Perak, one of the states included in this study had the highest prevalence of obesity at 14.1%.

The obesity and overweight participants in this study were also proportionately higher among the urban (27.6%) adolescents compared to their counterparts, the rural (24.4%) adolescents. The prevalence of obesity among the urban students was 12.4% compared to the rural students at 10.5%. Again, this is coherent with NHMS (2015) findings which reported that the prevalence of obesity in Malaysia was higher among children in urban areas (12.1%) than rural areas (11.2%) (Institute for Public Health, 2015). A higher prevalence of overweight among the urban than the rural adolescent population was also reported in a previous study by Dev et al, 2009 in Malaysia (Dev, Dev, Permal, Fauzee, & Sofian, 2009). In another study that was based on a bigger sample size (n = 1361), Malaysian adolescents from rural areas were reported to be at higher risk of developing non-communicable diseases compared to their urban counterparts (Hazreen et al., 2014). The study by Hazreen et al, 2014 however did not report on the prevalence of obesity and overweight of the participants. Hazreen et al. (2014) recruited participants from three different states and had a larger sample size compared to the study by Dev (2009) that was based on only 200 respondents from two districts within one state.

This study also found that the prevalence of obesity and overweight was higher among male students (28.7%: obesity [11.7%]; overweight [17.0%]) compared to the female (24.8%: obesity [11.7%]; overweight [13.1%]). This is also coherent with the findings in NHMS (2015), which reported a significantly higher prevalence of obesity among boys (13.6%) compared to girls (10.0%) (Institute for Public Health, 2015). Among the ethnic groups, NHMS (2015) reported that Chinese had the highest prevalence of obesity (13.0%) followed by Indians (12.6%) and Malays (11.8%). These figures contradict those in this study because this study found that Malay students had the highest prevalence of obesity (13.1%) followed by Other (7.9%), Chinese (7.5%) and Indian (7.2%) ethnicities. In this study, the awareness of the overweight and obese students about their nutritional status was good because 87% of the participants in this category admitted attempting to reduce their weight.

As regards on academic performance, the majority of the participants in this study had below average academic achievement (72.5%). A higher percentage of urban students had a good level of academic achievement compared to the rural participants. An analysis of the academic background of the participants' parents in this study also revealed that the urban students had parents with higher level of education (Father: 24.9%, Mother: 22.6%) compared to the rural students (Father: 10.5%, Mother: 7.3%). However, rural students showed closer family bonding with 83.1% regarding their parents as role models. Yet, ironically, more urban students (43.2%) reported that they frequently had meals with family members compared to the rural students (36.5%).

### 5.3 Prevalence and Distribution of Stress among Malaysian Adolescents

This study investigated the stress level experienced by Malaysian adolescents and its impact on the eating behaviour of the adolescents. The stress experienced by the participants in this study was analysed subjectively using the CPSS score and objectively by the saliva cortisol biomarker. Both measurements were conducted at baseline prior to the final-year school examinations and at follow-up during normal school days. The findings will be discussed in two parts as follows:

(1) The first part (section 5.3.1 to 5.3.3) discusses the prevalence and distribution of stress among the participants both subjectively and objectively.

(2) The second part (section 5.3.4 to 5.3.5) discusses the transition in stress level within the 6-month period from baseline to follow-up; in relation to the scheduled school examinations.

### 5.3.1 Perceived stress among adolescents based on subjective stress measurement using CPSS self-report questionnaire

The CPSS score reflects the stress level perceived by the participants. The CPSS self-report questionnaire used was designed to measure the degree to which students appraised the situations in their life as stressful. The initial CPSS score had no diagnostic cut-offs. In this study, the cut-off points that were used were based on the study by Khalili et al, 2017 which categorizes stress as follows: a score of 13 and below indicates a low level, 14 to 20 a moderate and 20 and above a high level of level of stress (Khalili, Sirati Nir, Ebadi, Tavallai, & Habibi, 2017).

Generally, this study found that the majority of the adolescents were moderately stressed with approximately one third perceiving a high stress level both at baseline (29.1%) and follow-up (30.9%). At both time points, the majority of the participants perceived a moderate stress level, with a higher percentage at baseline ( $T_0$ : 61.9%) than at follow-up ( $T_1$ : 60.5%). The mean CPSS score of the participants was 18.7 (95% CI: 18.4, 19.0) both during near school examination and during normal school days. The scores were in the moderate stress level category, but with close proximity to the high stress level category.

This finding was in line with previous studies conducted in Malaysia such as the study by Hashim, 2007 which reported that form four students generally considered their life stressful (Hashim, 2007). Another study by Yusoff et al, 2011 reported a higher prevalence of distressed among secondary school students (32.8%) with major stressor identified being academic related issues (M. S. B. Yusoff et al., 2011). A more recent study reported 38.5% of adolescents from six schools in south part of Malaysia had stress symptoms (Tajik et al., 2016). The rising trend was alarming and correlate with the Malaysia National Health Morbidity Survey findings that reported the rising psychiatric morbidity prevalence in the general population among children and adolescents 15 years and below from 13% in 1996 to 19.3% in 2006 and 20% in 2011 (Institute for Public Health, 2011). This is an alarming situation as this study point out that approximately one third of the adolescents are experiencing high stress level and only one out of ten had low stress level, regardless of whether it is near examination or normal school days.

### Socio-demographic characteristics and its influence on stress

With respect to the demographic characteristics of gender, school location, ethnicity and BMI category, the findings of this study will help identify the group with highest stress level. This is the group who is the most in need of an intervention. In this study, the proportion of adolescents who perceived a high stress level was highest among the female students (T<sub>0</sub>: 34.4%, T<sub>1</sub>: 33.4%), urban schools (T<sub>0</sub>: 32.6%, T<sub>1</sub>: 31.4%), Chinese (T<sub>0</sub>: 34.4%, T<sub>1</sub>: 33.3%) and the obese and overweight category (T<sub>0</sub>: 33.8%, T<sub>1</sub>: 33.1%). All these categories demonstrated a higher prevalence of high stress perceived during the near-exam period compared to normal school days.

### (i) <u>Gender influences on stress</u>

Across genders, the perceived stress level was significantly higher among female students at both time points and was perceived to be higher during the near-exam period (19.3; 95% CI: 18.9, 19.6) than normal days (19.0; 95% CI: 18.6, 19.4). This is coherent with some earlier psychological findings in some Malaysian studies that reported stress and suicidal ideation as significantly higher among females (Ahmad et al., 2014; Yaacob, Juhari, Abu Talib, & Uba, 2009). Worldwide, sex differences in the incidence and severity of stress have also been reported to favour men, which suggests that women are more vulnerable in their responses to stress (Paris et al., 2010).

### (ii) Urbanization and stress

The proportion of adolescents who perceived a high stress level was also observed to be higher among urban compared to rural students both at baseline and follow-up (T<sub>0</sub>: 19.1 [95% CI: 18.7, 19.5]; T<sub>1</sub>: 19.0 [95% CI: 18.5, 19.4]). Both individual and family factors such as participants' academic achievement and parents' education level may have influenced these figures. In terms of academic achievement, more of the urban students who participated in this study had good academic achievement (6.5%) compared to rural students (3.2%). The rural student category contained a higher percentage of below average academic achievers (76.9%) than the urban student category (69.6%). If a child is an academic achiever, this normally exerts more pressure on them to perform well in examinations. A study among Malaysia boarding school students reported a stress prevalence of 44.9% and a significant association with learning/teaching-related stressors (Wahab et al., 2013). The prevalence of stress reported by Wahab et al., 2013 is higher than that reported by studies in public schools in Malaysia (Hashim, 2007; Tajik et al., 2016; Yusoff et al., 2011). In Malaysia, boarding schools are generally high-performing schools with better facilities and infrastructure to prepare students for a pre-university education. Enrolment into these schools requires excellent results in the national PT3 examination. With the high magnitude of stress level identified in this study involving students only from public school, the estimate on the actual magnitude of stress among
the adolescents nationwide involving the high-performance schools thus should rise more concern among the healthcare professionals.

The analysis of the background characteristics of the participants also revealed that more urban parents had a higher tertiary level of education than rural parents, among both fathers (urban: 24.9%; rural 10.5%) and mothers (urban: 22.6%, rural: 7.3%). If parents are highly educated and more aware of the importance of education this is generally seen as a good thing, but the downside is that it may cause such parents to have higher expectations about their children's academic achievement. In this study, this seems to have been the reason why urban students perceived a higher stress level than rural students, especially during the near-exam period. The Healthy Mind Programme Survey conducted in Malaysia in 2013, identified the high expectations of parents regarding their children achieving academic excellence as among the significant stress risk factors in Malaysian adolescents (Ahmad et al., 2014). A Malaysian study conducted in 2007 also identified academic expectation as an important stressor with 77% out of 209 Form 4 students experiencing some level of stress (Hashim, 2007). Furthermore, another study in Malaysia also reported a high prevalence of distress among secondary school students (32.8%) with the major stressor identified as being academic-related issues (M. S. B. Yusoff et al., 2011). Moreover, the extra tuition classes that are often forced onto students by parents with high expectations may potentially add to the stress experienced by urban adolescents.

# (iii) Ethnicity influences on stress

As regards to the level of perceived stress by ethnicity, this study found that the prevalence of high stress was highest among the Chinese students (T<sub>0</sub>: 34.4%; T<sub>1</sub>: 33.3%). Studies in Malaysia have shown that Bumiputeras and Malaysian Chinese have different academic achievement with Malaysian Bumiputeras not performing as well in their

university education compared to those from Chinese ancestry (Alfan & Othman, 2005; Che Azmi & Mustapha, 2014)]. According to Article 160 (2) and (6) of the Federal Constitution of Malaysia, the title of Bumiputera in Peninsular Malaysia is granted to a child if one of their parents is a Muslim Malay or Orang Asli. In Sabah, it is granted to a child whose father is a Muslim Malay or indigenous native of Sabah and in Sarawak it is granted to a child if both parents are indigenous natives of Sarawak.

In this study, the participants in the Other ethnicity category were comprised mainly of Malaysian aborigines who are best known as Orang Asli. This category was found to have a lower perceived stress level at both time points ( $T_0$ : 18.3 [95% CI: 17.1, 19.5];  $T_1$ : 18.2 [95% CI: 16.6, 19.8]). Orang Asli in Malaysia are minorities and are the most under-privileged in the country with 76.9% living below the poverty line (M. A. Mohd Noor, 2012). As they are from the group that this the most under-privileged in the reason why the students in the Other ethnicity category and their parents do not consider academic achievement as the most important issue in daily life. As for Indian students, they were found to have the lowest perceived stress level at both time points. This finding contradicts that in Ahmad et al. (2014), which reported that suicidal ideation was positively associated with stress and was significantly higher among Indians adolescents in Malaysia. Future study to focus on this group of adolescents is needed to identify underlying issues and appropriate intervention specifically for them.

## (iv) BMI influences on stress

As regards to the BMI categories, this study found that the prevalence of high perceived stress was highest among the obese and overweight category both at baseline ( $T_0$ : 33.8%) and follow-up ( $T_1$ : 33.1%). The perceived stress level was also higher during the near-exam period ( $T_0$ : 19.0 [95% CI: 18.4, 19.5]) compared to during normal school days ( $T_1$ : 18.7 [95% CI: 18.0, 19.3]). The above findings could relate to the findings

reported by (van Jaarsveld, Fidler, Steptoe, Boniface, & Wardle, 2009), who found that adolescents under moderate or severe stress levels have significantly higher BMI and consume more sweet and high-fat foods compared to adolescents with a mild stress level. Another study reported that there is a higher prevalence of overweight, obesity and abdominal obesity among stress-driven eaters as compared to non-stress-driven eaters (Jaaskelainen et al., 2014). This is also another group that needs to be targeted and intervened with specifically designed intervention programs.

Despite no significant difference being observed in the perceived stress level at baseline and follow-up, this study demonstrated that both the perceived stress level and the prevalence of adolescents with a high stress level was higher during the near-exam period compared to normal school days and that the adolescent populations with a high stress level were the female, the urban, the Chinese and the obese and overweight. This study thus shows that school examinations and expectations about achieving academic excellence are important stressors among Malaysian adolescents. The groups identified to have higher stress level compared to their counterparts thus need to be focused on and intervened with specifically designed intervention programs as different groups had different underlying issues.

# 5.3.2 'True stress' among adolescents based on objective stress measurement using saliva cortisol biomarker

In this study, saliva cortisol was used as an objective measurement of the stress level of selected subsample adolescents participating in this study who completed the CPSS questionnaire. Cortisol production has a circadian rhythm (Lorah, Joseph, Tammy, & Sarah, 2007) with the level peaking in the early morning and dropping to its lowest concentration at night (Hucklebridge et al., 2005; Knutsson et al., 1997). Pennsylvania State University Behavioural Endocrinology Laboratory reported that the normal morning reading of the saliva cortisol level among European adolescents aged 12 to 18 years old ranges between 0.58 nmol/L and 24.4 nmol/L, whereas the evening reading range is lower; from not detected to 7.1 nmol/L (Salimetrics, 2016). The level rises independently of the circadian rhythm in response to stress (Miller et al., 2007). The current range available for comparison is very wide, thus the findings in this study is hope to provide information and help guide on establishing a more comparable and reliable normal level among the adolescents worldwide.

In Malaysia, the number of studies on the cortisol hormone in relation to stress is very limited. Moreover, to the best of the researcher's knowledge, this study is the first study in Malaysia to analyse the saliva cortisol level among adolescents. Thus, it is hope that the level of saliva cortisol in this study could be a reference for comparison in future studies in the same region, and further guide on the establishment of a normal saliva cortisol level in the future. In this study, the saliva sample was collected from the participants between 9.00 am and 11.00 am. At baseline, the mean saliva cortisol level was 3.8 nmol/L (95% CI: 3.4, 4.3). This level decreased significantly at follow-up (3.0 nmol/L; 95% CI: 2.6, 3.4). Thus, the level was proven to be significantly higher during the near-exam period when students were presumed to be under more stressful conditions compared to normal school days that were presumed to be less stressful. The finding of a study on graduate students in Singapore, a neighbouring country, correlates with this finding; in which the Singaporean study reported that students rate a higher stress level before examinations and this rating is associated with increased salivary cortisol (V. Ng, Koh, & Chia, 2003). However, it should be noted that the result in the above study was based on only 11 saliva samples taken on the day of the examination.

A study conducted in the USA (Sladek, Doane, Luecken, & Eisenberg, 2016) among college students with a mean age of 18.9 years old reported a mean level of cortisol of 6.69 nmol/L for early morning after bed. However, the study was conducted in a different region with an earlier collection time of 1 hour after waking up from sleep, and also had a much smaller sample size (n = 70) (Sladek et al., 2016) compared to this study. In Malaysia, a study on an adult cohort that was conducted on assistant medical officers in Ministry of Health hospitals reported significantly higher cortisol among stressed (21.5 nmol/L) compared to non-stressed officers (18.5 nmol/L) (N. Mohd Noor, Yacob, Zahiruddin, & Mohammad, 2011). However, saliva cortisol readings between adults and adolescents are not comparable.

# Socio-demographic characteristics influences on saliva cortisol level

In this study, at baseline, the saliva cortisol level was observed to be higher among the male (4.3 nmol/L; 95% CI: 3.5, 5.1), the urban (3.9 nmol/L; 95% CI: 3.3, 4.4) and the Indian adolescents (5.7 nmol/L; 95% CI: 3.4, 8.0). This finding correlates with the high perceived stress observed in this study among the urban adolescents, but it does not correlate well with the higher perceived stress among the female and the Chinese adolescents during the near-exam period. At follow-up, the saliva cortisol level was again higher among the male (3.2 nmol/L; 95% CI: 2.6, 3.8) and the urban students (3.3 nmol/L; 95% CI: 2.8, 3.9), but not among the Indian students. As regards the saliva cortisol level by ethnicity, it was highest among the adolescents in the Other category (3.7 nmol/L; 95% CI: 3.4, 8.0). Overall, the saliva cortisol level was observed to be higher during the nearexam period than in during normal school days.

### (i) Gender influences on saliva cortisol level

A previous study on healthy participants reported that men tend to have a higher basal cortisol level than women (Paris et al., 2010). However, in response to acute stressors, the cortisol level is comparable to or higher than that of women (Paris et al., 2010). In addition, a study on men reported that cigarette smoking is associated with an elevated cortisol level, which is probably due to nicotine exposure (Steptoe & Ussher, 2006). This factor could be the most plausible explanation for the higher cortisol level observed among the male adolescents because studies in Malaysia have reported that the prevalence of smoking among secondary school students in Malaysia, specifically in Selangor and its neighbouring state, Negeri Sembilan, is 8.6% and 14%, respectively, with the majority of smokers being male (Maher, Fairuz, Balsam, Ibraheem, & Ayob, 2014). The authors also reported a significant association between the male gender and smoking. This could also be the reason for the higher cortisol level among male students compared to female students (Maher et al., 2014). The smoking status of adolescents in this study was not investigated so a comparison of the findings of this study and those of previous studies is somewhat limited. Also, other factors such as dehydration and caffeine intake, which can affect the cortisol level, were also not taken into account by this study or previous studies.

Another factor to consider in relation to the difference between male and female students is the distinction between true and perceived stress. Male students could be experiencing true stress as reflected by an increased cortisol level, but they may actually deny perceiving it. It has been argued that even when men realize that they are depressed or have some other problem, they are still less likely than women to see a psychologist or other mental health professional due to reluctance caused by masculine role socialization (Addis & Mahalik, 2003). In addition, a study by (Levant, 2011) reported that men with a higher level of traditional masculinity ideology also tend to have a more negative opinion of seeking psychological help. Levant (2011) also states that the social norms in some societies deem that seeking or even needing help is not a normal male behaviour, thus some men may worry that society will look down on a man who admits to having problems and seeks help. Perhaps, Malaysian adolescents are experiencing a similar

situation and thus the saliva biomarker is a more reliable indicator than a questionnaire in identifying extremely stressed adolescents who may be in need of an intervention.

### (ii) Ethnicity influences on saliva cortisol level

Across ethnicities, the Indian students had the highest mean cortisol level at the baseline (5.7 nmol/L; 95% CI: 3.4, 8.0) compared to the other categories. This contradicts this study's own findings that showed that Indian students had the lowest perceived stress both in terms of prevalence and mean stress score at both time points. Factors such as smoking, dehydration and caffeine intake could be the reason for this variation. No studies on the cortisol level among Malaysian adolescents were found for the purpose of comparison.

# (iii) BMI influences on saliva cortisol level

A similar pattern was observed across the BMI categories at baseline where despite the perceived stress level being higher among the obese and underweight students, the mean saliva cortisol level was highest among the underweight students (4.5; 95% CI: 3.4, 5.6). However, during the near-exam period the obese and overweight students had the highest saliva cortisol level (3.3; 95% CI: 2.4, 4.1). No similar studies were available to support an explanation of this finding.

As regards academic achievement, students with below average academic attainment reported the highest level of perceived stress during the near-exam period, but ironically the highest saliva cortisol level was observed among the students with good academic achievement. Also, during normal school days, students with good achievement perceived the highest stress level but their cortisol level was significantly lower (1.9; 95% CI: 0.6, 3.1). Interestingly, during normal days, the below average academic achievers also had the highest mean saliva cortisol. Again, no similar studies were available to explain these findings. Nevertheless, the findings of saliva cortisol level in this study is

thus novel and valuable to be used as reference in future studies. It is also valuable to be used in the establishment of a reference range for adolescents, as until today, no formally established guidelines are available.

#### 5.3.3 Correlation between perceived stress and saliva cortisol

Cortisol has been demonstrated to correlate with stress level in previous studies. However, the findings in this study showed no correlation between the two measurements at both time points. The non-significant correlation was probably due to the variation in the students' perception of stress and the 'true stress' they were actually experiencing as reflected by a raised saliva cortisol level. A study on perceived stress among patients attending a breast cancer clinic in Bristol, UK was also unable to show a correlation between stress and saliva cortisol level (Vedhara et al., 2003). Similar findings have been reported in some studies that were conducted in Asia/Southeast Asia. For instance, nurses in an emergency department of a hospital in Singapore revealed that they perceive their job as more stressful compared to general ward nurses, but their salivary cortisol was lower than that of the latter (Yang et al., 2001).

The identification of stress among adolescents may be difficult because they are in a complex transitional period of their life and are often not able to express themselves fully and sometimes tend not to tell the truth. This may sometimes cause even health professionals to miss the early signs of psychological illnesses that warrant intervention. Thus using the cortisol level as an indicator of stress could be very helpful. However, despite the apparent ability of the cortisol biomarker in helping to identify stress among adolescents, it cannot be used as the sole measuring tool of stress because cortisol can be influenced by numerous other factors such as smoking, caffeine intake, alcohol consumption and glycaemic load. Stress is only one of the possible contributors to a raised cortisol level. Cortisol production also varies throughout the day and an individual's sleeping and awakening pattern influences its production (Kudielka, Federenko, Hellhammer, & Wust, 2006).

A previous study in USA among adolescents with mean age of 15.9 has reported situational elevations in cortisol in adolescents that differs from the level seen in their typical diurnal rhythm and it has been linked to experiencing more true stress than usual (Adam, 2006). The strength of Adam, 2006 study is that salivary cortisol levels were measured seven times a day and analysed in conjunction with diary report of adolescent mood states. In another study conducted in Netherlands among 771 university students with mean age of 20.3 year old, their cortisol level has also been reported to be higher on the day of an examination compared to a control day (Verschoor & Markus, 2011). The examination stressor thus has been linked to changes in cortisol level among the Western population, but it has not yet been demonstrated in Asia, specifically in Malaysia.

# 5.3.4 Transition in stress level

As this study is a cohort study, the analysis of the data was conducted longitudinally. This is a novel aspect of this study as to date, there is no study that have analysed the change in stress level between time points as conducted in this study. The change in the stress level of the adolescents from baseline to follow-up was also investigated in relation to the approach of important school examinations. It was hypothesized that the majority of students would experience a decrease in stress level, whether it is perceived or true stress over the period of the study because baseline data was collected during the near-exam period and the follow-up data was collected during normal school days. However, the findings of this study revealed that slightly more participants perceived an increase in stress level (46.6%, n = 276) compared to a decrease in stress level (43.6%, n = 258). Only 9.8% (n = 58) of the participants experienced no change in stress level. However, the analysis revealed no significant association between

any of the sociodemographic characteristics or the individual factors and the transition in the stress level.

The finding thus imply that the expectation of academic excellence was not the only significant stressor in an adolescent life. The stress experienced by the adolescents in this study may have been influenced by numerous other factors. Hashim (2007), who investigated the sources and levels of stress related to everyday life, concluded that the biggest problems identified by the respondents are those related to academic related issues (77%). The other significant stressors that were identified are problems related to relationships at home (34.9%), problems related to relationships at school (31.5%), problems related to money (25.8%), problems related to co-curricular activities (23.4%) and problems related to romantic relationships (18.1%). There could be a possible sampling bias in this study because the participants were predominantly in the below average academic achievement category (72.5%, n = 572), thus they may not see academic excellence as the most important achievement to strive for in life. Further exploration in future studies, perhaps involving a qualitative design would help to identify significant stressors experienced by the adolescents.

From the analysis of the transition of stress based on change in the saliva cortisol level, a significant association was observed only for the BMI category. The normal weight and the underweight categories predominantly demonstrated a decrease in saliva cortisol level. This contradicted the findings of this study that were based on the CPSS score that revealed a higher prevalence of obese and overweight adolescents in the decreased stress level group, even though the obese and overweight category were predominant in the increased saliva cortisol level group (51.5%). Again, this potential inverse correlation between stress change and saliva cortisol change was as observed in the earlier analysis of the stress score and saliva cortisol level across the demographic

characteristics and the factors investigated. A future study on this area which include repeated measurement of saliva cortisol in a day would be more informative compared to once per visit as conducted in this study.

#### 5.3.5 Correlation between perceived stress and change in saliva cortisol level

The analysis revealed a significant weak negative correlation between the transition in the CPSS score and the change in the saliva cortisol level from baseline to follow-up. Again, the inverse correlation that was observed in the earlier analysis and the significant negative correlation demonstrated could be due to variation between the students' perception of stress and the 'true stress' they were actually experiencing. Nevertheless, the concern is that the adolescents may actually have denied perceiving that they were feeling stressed; or worse they did not realize that they were experiencing stress. The inability to identify this internal problem may lead to adolescents not receiving appropriate intervention, the lack of which could be harmful to them in the long run.

# 5.4 Eating Behaviour Patterns among Malaysian Adolescents

This section discusses the eating behaviour patterns of the adolescents who participated in this study. The discussion will directly compare the eating behaviour patterns between baseline and follow-up, which reflect the difference in the eating behaviour patterns of adolescents during the near-exam period and during normal school days, respectively.

Generally, the eating behaviour pattern at baseline among the adolescents in this study can be summed up as follows: they enjoyed food and they tended to be impulsive and responsive with regards to eating when in the presence of food. However, they still had a high tendency to be highly selective about which foods they were willing to eat. This was reflected by the highest mean score of EOF, FR and FF score compared to all the other eating behaviour items investigated. The EOF and FR scores reflect the adolescents' habits with regards to how they approach to food, i.e. the factors that drive them to eat, while the FF score reflects their food avoidance habit, i.e. the factors that actually 'put a brake on' their drive to eat.

The eating behaviour, being a component of a behavioural act thus is expected to be a factor that is modifiable. However, enjoyment of food is a factor that despite should be modifiable, may strongly be considered 'unattainable'. Food responsiveness on the other hand is a behavioural factor that may be changed by an individual empowerment through education and awareness. As discovered in this study, the intervention programs targeted on rural students whom knowledge and awareness are much inferior compared to the urban adolescents, thus should focus on educating and knowledge empowerment on healthy choices of food. This will in turn influence their eating behavior by restraining themselves from overeating and despite of their high enjoyment of food and food responsiveness behaviour, they will tend to make healthy choices on their food selection. Being more aware and more knowledgeable on healthy food choices and healthy eating habits would also increase the food fussiness of an individual which is reflected especially by the urban adolescents who were found to be more selective in their food choices compared to rural adolescents. The TPB theory states that behavioral achievement depends on both motivation (intention) and ability (behavioural control). Information will thus influence and individual's motivation leading to ability to exert self-control.

# 5.4.1 Eating behaviour patterns among Malaysian adolescents according to sociodemographic characteristics

This study found that female and Malay students demonstrated highest emotional eating, food responsiveness and enjoyment of food behaviour compared to their counterparts which are the male and other ethnicities. The urban adolescents on the other hand demonstrated higher food fussiness compared to the rural adolescents. Relating to the findings in the previous section on stress, the female adolescent is the group that are most likely experiencing the issue of stress-related eating.

### (i) Gender influences on eating behaviour

During the near-exam period, gender differences in emotion-driven eating behaviour were observed with a significantly higher prevalence of an emotional eating pattern, both in overeating and undereating, observed among female adolescents. The female students also demonstrated significantly higher enjoyment of food and were more responsive to food than their male counterparts. However, these differences between genders in the EOE, EUE and FR scores were significant only during the near-exam period. This would relate with the findings in the earlier section which demonstrated the emotional aspect of female; with higher stress level perceived by the female adolescents compared to the male adolescents. Other psychological findings in earlier studies had also reported stress as significantly higher among females and that women are more vulnerable in their responses to stress (Ahmad et al., 2014; Paris et al., 2010; Yaacob et al., 2009). This fact would predisposes female students at a higher risk of practicing stress-related eating than the male students.

However, the study by Nguyen et al, 2009 which was conducted among 666 seventh and eighth grade school students in Los Angeles, USA, reported that perceived stress and worries were related to emotional eating in adolescents, but there were no gender differences in the proportion of emotional eaters and the level of emotional eating between boys and girls (Nguyen-Rodriguez, Unger, & Spruijt-Metz, 2009). The findings reported by Nguyen-Rodriguez et al., 2009 are also coherent with those of a study in Malaysia which reported that eating behaviour did not differ between genders (Loh et al., 2013). However, both of these studies were conducted during normal school days and not

near to or at the time of major school examinations. This study is thus the first to explore the eating behaviour of adolescents from a different dimension; which are during the near examination period.

## (ii) Urbanization influences on eating behaviour

As regards to differences between school locations, this study found that during the near-exam period, the scores for all eating behaviour items were higher among the urban students. However, during normal school days, rural students had higher scores in EUE, DD and all the restrained eating items (SR, SE and FF). Again, this reflected the significance of the emotional aspect on eating behaviour. As described in the previous section, urban adolescents had superior knowledge on healthy food choices than their rural counterparts. However, when encountered by examination stressor, the urban adolescents tend to emotionally overeat and being more responsive to food. These findings imply on the need for an effective coping strategy to be adopted by adolescents when dealing with stress.

The earlier analysis of the data in chapter 4 (section 4.4.1.1 [Table 4.8]) on participants' individual factors also revealed that a higher percentage of urban compared to rural adolescents were concerned about their body image as shown by their admission that they were making attempts to reduce their weight (59.2%). More rural students also admitted to eating when coping with stress (37.9%) compared to urban students (33.6%). This could be due to lack of awareness and poor knowledge about body image and healthy eating among rural compared to urban students. More urban students (58.5%) also noted the wholesomeness of the food served in their school canteen, whereas a higher percentage of rural students were not sure about this aspect of their school meals (51.7%); again, this may reflect a lower level of knowledge and awareness among the rural as compared to the urban adolescents about what constitutes a healthy nutritious meal. This

finding is in line with an earlier research findings on diet intake using the same cohort by Hazreen et al. (2014) which reported that the rural students are taking more sugar compared to the urban students (Hazreen et al., 2014).

Greater awareness of the importance of a healthy diet could be the reason that the urban students in this study were able to put a significantly better brake on their drive to eat compared to the rural adolescents during the near-exam period, as reflected by their significantly higher SR and FF scores. This finding showed that the urban adolescents were more able to stop eating when they reached a feeling of fullness and were more selective in their choices of food during the near-exam period, but during normal school days rural students had better control of this 'braking mechanism' as indicated by their higher scores in SR, SE and FF. Nevertheless, urban students still showed higher EOE and EUE scores, and higher DD, FR and EOF scores. Despite there being no significant difference between the urban and rural students, these scores suggest that the urban adolescents had a greater tendency to eat unhealthily than the rural students during the near-exam period.

The majority of urban parents in this study had a higher educational status compared to rural parents. According to Rayhan and Khan (2006), if a mother has a low education level this could affect their children's food intake and thus determine their BMI status. However, this finding is contradicted by another study that shows that children whose parents have a higher educational level parents do not necessarily have a healthy diet (Adnan, 2012). This is supported by another study that reported a high intake of fast food among children with higher educational level mothers (Adnan & Muniandy, 2012). Higher education also may open opportunity to an individual to have a higher paid occupation. This assumption is supported by this study in which the urban population, which overall had a higher educational status, reported significantly higher pocket money

(60.5%) than the rural population (21.8%). In light of the above, amount of pocket money accompanied by food availability could further increase the consumption of unhealthy foods.

Indeed, in this study, while more urban students (70.1%) reported that they were aware about and acknowledged the presence of junk food vendors outside the school compound compared to rural students (45.0%), more urban students (2.7%) also reported that they purchased junk food more frequently compared to rural students (1.3%). Fast food consumption was also found to be significantly higher among the urban (7.3%) than the rural students (2.5%). These findings strengthen the postulation that pocket money and greater availability of unhealthy foods could be the factors that influence urban students to eat unhealthily compared to rural students, despite the former being aware of the importance of a healthy diet. As for the rural population, irrespective of their low level of awareness about the need to eat a healthy diet, the eating pattern of the rural adolescents could be influenced more by the lower pocket money provided by their parents and the lower availability of such food items. These findings thus suggest for a different approach to be implemented when dealing with the urban and rural adolescents as these two groups despite having similar age, they had a totally different underlying issues to be addressed.

# (iii) Ethnicity influence on eating behaviour

Across ethnicities, Malay adolescents had significantly higher scores in externally induced eating behaviour items (EOF, FR and EOF) than other ethnicities; with all these scores being at their highest during the near-exam period. Malay adolescents thus demonstrated the unhealthiest eating habits during the near-exam period and sadly these habits persisted during normal school days

These findings correlate with a study also conducted among 13 year old secondary school students in Kuala Lumpur, Malaysia in which Malay adolescents reported higher

FR, EOF and EOE compared to Chinese and Indian adolescents (Loh et al., 2013). However, another study in Kuala Lumpur that was conducted among undergraduate university students contradicts this finding because it found no difference in eating behaviours among Malay and non-Malay participants (Saat et al., 2013). However, the results reported in the study by Saat et al. (2013) cannot be directly compared with those of this study because the background characteristics of school and university students may vary. Another study conducted by Sarina and Lai (2015) on 221 adolescents in Klang, a district in Selangor, Malaysia reported that ethnicity is associated with emotional eating. The authors found that Chinese students are slightly more inclined to experience emotional eating than non-Chinese students (Sarina & Lai, 2015), which was not the finding of this study. It should be noted that the study by Sarina and Lai (2015) was conducted in only one urban district. Thus, the opportunity for generalization to the Malaysian population would not be as good as that offered by this study which covered three states and both the urban and rural populations.

With regards to the influence of ethnicity, Ahmad et al. (2014) reported that Indians usually demonstrate more emotions in most situations. That finding is not in line with the results of this study which showed that Indian adolescents had the lowest EOE and EUE scores at both time points. The EOE score was significantly lower at both time points while that for EUE was significantly lower during normal school days. However, a similar result was not observed for the restrained eating components; the FF score was the highest among the Indian students at both time points. Gibson (2006) argues that emotional response could increase or decrease eating responses where emotional eaters escape negative emotions by overeating often sweet, high-fat and energy-dense foods, which increases the risk of adiposity. The author also states that intense emotional arousal may reduce gut activity, as observed in emotional undereating (Gibson, 2006). Thus, the emotions experienced by Indian adolescents could be too intense and thereby lead to reduced gut activity, as described by Gibson (2006).

The findings in this study suggested that Malay and Indian adolescents are the two groups of ethnicities that are the most in need of the empowerment to adopt a healthier eating behaviour compared to the Chinese and Other ethnicities. The two groups however had different underlying issues thus the programs developed need to carefully consider the different needs of the two groups.

# 5.4.2 Eating behaviour patterns among Malaysian adolescents according to BMI category

This study found that at both time points, the obese and the underweight category had significantly lower FR, EOF and EOE scores. The FR score reduced significantly among the obese and overweight participants from the time point near the examinations to the time point during a normal school day. The findings in this study contradicted those in some earlier studies that reported BMI is positively associated with FR, EOF and EOE and that it is inversely associated with SR and SE scores (Sleddens, Kremers, & Thijs, 2008; Viana, Sinde, & Saxton, 2008). This variation in the findings needs to be explored further not least because the use of a self-administered questionnaire may have increased the possibility of underreporting among obese and overweight students about their eating habits; due to the fear of stigmatization and to denial. This could correlate with another finding in this study, that a higher percentage of the obese and overweight category (67.6%) denied themselves food when coping with stress compared to the normal weight and the underweight students. This fact may need further exploration for a better understanding with a qualitative study rather than a self-administered questionnaire.

# 5.4.3 Eating behaviour patterns among Malaysian adolescents according to baseline stress level category

This study found that during both the near-exam period and normal school days, the EOE score was significantly higher among the high stress level category compared to both the moderate and low stress level categories. A similar pattern was observed in the FR score with highest score observed among the high stress level category at both time points. However, responsiveness to food significantly reduced during normal school days compared to during the near-exam period among the high stress level students. This implies the negative effects of emotion on eating behavior of the adolescents, thus strengthen the need to address stress with appropriate coping strategy.

There was no significant difference in the FF score between the three stress level categories at both time points. However, the SR and FF score among the high stress level and moderate stress level category were higher during near examination period. This indicates that the 'braking system' in the drive to eat behaviour were stronger with the presence of examination stress. A similar pattern was observed for the EOF score, suggesting that enjoyment of food among the high stress level and moderate stress level categories was lower during normal school days compared to during the near-exam period. These findings could not be compared with other previous study as no exploration of eating behavior comparing eating behavior scores during examination period and normal school days has ever been conducted in this region. These findings would thus be a baseline and future reference for future studies.

# 5.4.4 Correlation between stress and eating behaviour at baseline and follow-up

The correlation between stress and eating behaviour are discussed in two sections. First, section 5.4.4.1 discusses the correlation between perceived stress and eating behaviour scores. Section 5.4.4.2 discusses the correlation between saliva cortisol and eating behaviour scores. As no remarkable correlation was observed between the saliva cortisol and eating behaviour items, only the correlation between perceived stress level and eating behaviour items are discussed further in terms of gender, location, ethnicity, BMI category and stress level category.

#### 5.4.4.1 Correlation between perceived stress level and eating behaviour

Overall, a strong positive significant correlation was observed between perceived stress level and EOE at both time points ( $T_{0:}$  r = 0.30,  $T_{1:}$  r = 0.27). The correlation was higher during the near-exam period and lower during normal school days. This finding is coherent with some previous studies conducted in USA among adolescents which reported that perceived stress is associated with and may contribute to emotional eating (Nguyen-Rodriguez et al., 2009; Wilson, Darling, Fahrenkamp, D'Auria, & Sato, 2015).

A search for research on this issue among adolescents in Asia resulted in a very limited number of comparable studies. Among those, a study on the relationship between stress and eating behaviour among university graduates in Kuala Lumpur, Malaysia reported contradictory findings with this study, stating that the majority of students have low emotional eating scores and that stress does not affect uncontrolled eating and emotional eating (Saat et al., 2013). Another study in Malaysia, also conducted on university students, which used the Eating Attitude Test-26 as the data collection instrument, reported positive correlations between stress and disordered eating (Gan, Mohd Nasir, Zalilah, & Hazizi, 2011). However, the results of their study are not comparable with the findings of this study because the former focused more on eating disorders such as bulimia and anorexia nervosa rather than on overeating behaviour, and in addition, different instruments were used to collect the data. The findings of this study is hope to add to the body of knowledge as the association between stress and eating behaviour and eating behaviour in this region are still not well established.

# Gender

Based on an analysis of the results across gender, this study found that at both time points, an increase in stress level was associated with a higher tendency to emotionally overeat as demonstrated by the strong positive significant correlation between perceived stress level and EOE among both the male and female students. The correlation was however stronger among the female students and during the near-exam period. This finding is coherent with Jaaskelainen et al. (2014) who reported that stressrelated eating behaviour is more common in girls than in boys. This study also discovered that at both time points, an increase in stress level was associated with a higher responsiveness to food in both genders. These findings address the significance of stressrelated eating especially among the female adolescents.

During the near-exam period, there was a significant correlation between perceived stress level and EUE score only among the male students. The male students also had a better braking system during the near-exam period as demonstrated by the significant stronger correlation between perceived stress level and SR score and between perceived stress level and SE score. The approach for intervention on stress-related eating for both genders thus should be specifically designed as both groups had different behavioural issues to be addressed. Overeating appeared to be more of an issue to the female adolescents whereas the male adolescents are the groups who tend to experience more undereating behavioural problems than their counterparts.

# School location

Among the urban population, there was an almost similar strength of association between the increase in stress level and emotional overeating at both time points. However, the urban adolescents also practised better food restraint during the near-exam period as indicated by a stronger significant positive correlation between perceived stress and SR score than the rural adolescents. This reflects that urban adolescents despite being more knowledgeable and aware on healthy food choices still had higher tendency to overeat, probably following the higher stress level perceived. Nevertheless, they are still aware of the unhealthy practice reflected by the application of the 'braking system' of the unhealthy eating behavior.

Rural adolescents on the other hand demonstrated a stronger significant correlation between perceived stress level and food responsiveness score during the nearexam period compared to during normal school days. These findings suggest that the examination stress perceived by the rural adolescents overruled the limitation of financial autonomy or food availability in determining their eating behaviour. Poor knowledge and awareness of healthy eating were shown to have a stronger influence on the rural adolescents' eating behaviour when dealing with stressful situations.

## Ethnicity

The strongest significant association between perceived stress and emotional overeating was found among the Chinese students; but only during the near-exam period and not during normal school days. This correlates with the finding of this study that the highest prevalence of high stress was among the Chinese, especially during the near-exam period. Malay and Indian students however indicate more need for an intervention on their eating behaviour because both of these ethnicities demonstrated a significant and almost similar strength positive correlation between perceived stress and emotional overeating at both time points, regardless of the presence of the examination stressor. Malay students demonstrated the poorest eating behaviour at both time points because they also demonstrated a significant correlation between perceived stress and food responsiveness at both time points.

### BMI Category

During the near-exam period, a strong significant positive correlation was demonstrated across all the BMI categories between perceived stress and emotional overeating behaviour. During normal school days, this correlation was strongest among the overweight and obese. During normal school days, the correlation between perceived stress and food responsiveness was also strongest among the overweight and obese category. This study showed that during normal school days, the obese and overweight adolescents' eating behaviour was more affected by stress, thus further exploration on this group of adolescents is required to identify significant stressors among them. This will provide guide on the development of a more effective preventive programs on this group of students.

# Baseline stress level

Among the students in the high stress level category, the strongest significant correlation was observed between perceived stress and food responsiveness, at both time points. The restrained eating system was better manifested among the moderate stress level category during the near-exam period with a significant positive correlation between perceived stress and all the restrained eating pattern items; satiety responsiveness, slowness in eating and food fussiness. This correlation was not significant among the high stress level category, reflecting the poorest eating habits of this category; thus, this is the group to be prioritize most in developing an appropriate intervention programs to combat stress and unhealthy eating practices.

#### 5.4.4.2 Correlation between saliva cortisol and eating behaviour

Based on the objective measurement of stress, no significant correlations were observed between saliva cortisol level and eating behaviour scores during the near-exam period. During normal school days, a weak significant positive correlation was only observed between saliva cortisol level and SR. This findings could correlate with a study that reported that high cortisol among girls predicts the likelihood of being overweight and is mediated through SR (Lumeng et al., 2014). However, the findings for the male students in this study are not coherent with those in Lumeng et al. (2014), which reported that high cortisol among boys is associated with being overweight and is mediated through emotional overeating.

In this study, it was not possible to test for an immediate acute response because saliva samples were taken approximately two weeks prior to the actual examination. It was reported in previous study that acute stress, which occurs almost immediately after a stressful event is experienced, releases hormones that mediate the suppression of food intake (Sominsky & Spencer, 2014). In the case of ongoing chronic stress, chronically elevated glucocorticoids can lead to chronically stimulated eating behaviour and excessive weight gain (Sominsky & Spencer, 2014). Epel et al., 2001 conducted a study specifically on women and reported that high cortisol reactors consume more calories on a stressful day compared to low reactors. Moreover, high cortisol reactors also ate significantly a greater quantity of sweet food across days (Epel et al., 2001). The findings of this study however could be used as a benchmark as it adds to the limited information on the association between saliva cortisol and eating behaviour among adolescents especially in the Asia region.

Overall, this study demonstrated that perceived stress significantly affected emotional eating during the near-exam period, especially in the case of the female, urban and Chinese students. Overweight and obese students experienced an increase in emotional eating with an increase in stress level; more during normal school days. Food responsiveness was experienced most strongly among the high stress level category but this result did not have a significant relationship with school examinations. The findings

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of this study that are contradictory to those of studies in different regions may be due to the cultural differences in a multi-ethnic Asian setting because the influence of culture is complex and mediated by biological, demographic, psychosocial and environmental factors (T. P. Ng, Lim, Jin, & Shinfuku, 2005).

# 5.5 Effect of Change in Stress Level on the Transition in Eating Behaviour among Adolescents

As this study was a cohort study, the change in perceived stress level from baseline to follow-up was analysed to determine whether it increased, showed no change or decreased. This study looked specifically into transitions in eating behaviours following a change in the stress level, and whether the transitions were positive or negative. A significant association was found only between the change in stress level and the transition in the emotional overeating score. No significant associations were observed between changes in stress level and transitions in the other eating behaviour items. A Pearson's correlation between the change in stress level and the transition in eating behaviour items also revealed a significant weak positive correlation between the change in perceived stress level and the transition in some other eating behaviour items other than emotional overeating; which are the food responsiveness and emotional undereating behaviour. To the best of the researcher's knowledge and based on an in-depth search of the literature, it seems that no study has been conducted to analyse the association between these two variables in a longitudinal manner.

This study also found that more participants experienced a negative transition of emotional overeating (49.3%) or worsening of emotional overeating behaviour rather than a positive transition (35.5%) or an improvement from baseline to follow up. The prevalence of participants who had an increased stress level and also experienced a negative transition in their emotional overeating behaviour was 58.3%, a higher

proportion compared to those who had a decrease in their stress level (43.4%). The findings of this study is thus novel as it demonstrated that changes in stress level is an important factor to be addressed. It is impossible to eliminate stress as stress is needed in life as part of the 'flight and fight' response, but the most important aspect here is to manage stress. The change in stress level influence the transition of emotional overeating towards becoming better or worse; thus, this is one of the aspect to carefully consider while developing the intervention programs to combat obesity.

The overall findings of this study also showed that more students experienced an increase in stress level despite the follow up visits were conducted during normal school days. The reason behind this could be that during follow up, the students were in the final year of their secondary school years and despite the data were collected at least three months away from any scheduled major school examinations, they may have already started to chronically perceive the stress of the final year of school assignments and exams to come in the near future.

A previous study reported that BMI moderates the relationship between perceived stress and emotional eating and that higher stress can predict greater emotional eating for the lower BMI groups but not the higher group (Wilson et al., 2015). The findings in this study contradict those in Wilson et al. (2015) because a positive significant correlation between changes in perceived stress and a negative transition in EOE was observed to be the strongest among the overweight and obese participants (r = 0.25) in this study. The obese and overweight participants also showed a stronger significant correlation between changes in perceived stress and transitions in EUE (r = 0.21), FR (r = 0.19) and EOF (r = 0.17) behaviour compared to other BMI categories.

A comparison of the results of this study and those of previous studies on the transition in eating behaviours following a stress reaction was not possible because the design of most of the earlier studies on eating behaviour was cross-sectional rather than longitudinal. The previous longitudinal studies that were found in this field did not analyse their findings by using the same comprehensive approach that was adopted by this study. Thus, the findings presented by this study may better reflect the significance of the influence of the emotional components in the eating behaviour of adolescents that are aggravated by external stimuli such as food availability which triggers food responsiveness.

## 5.6 Coping Strategies to Deal with Stress Adopted by Malaysian Adolescents

The Brief COPE questionnaire was used in this study to measure the frequency at which an individual adopts the stated items to cope with stressful situations in daily life. It was found in this study that the coping strategies that were most frequently adopted by the adolescents when dealing with stress were turning to religion followed by positive reinterpretation and active coping. The least adopted strategies were behavioural disengagement, using food and denial or refusing to acknowledge that something is wrong.

A study on 505 adolescents in Kota Bharu (M. S. B. Yusoff et al., 2011) reported an almost similar trend with religion being the main coping strategy adopted by adolescents followed by positive reinterpretation, use of instrumental support, active coping and planning. The three least popular strategies identified by Yusoff et al. (2011) were substance abuse, denial and behavioural engagement, which represents an almost similar trend to that observed in this study. However, the limitation of the study by Yusoff et al. (2011) is that it cannot be generalized to multi-ethnic Malaysian adolescents as the participants of their study were predominantly Malay (99%) and Muslim (98.8%) as it was conducted in a state in Malaysia that is populated mostly by Muslims. The findings of this study thus is more able to be generalized as it represents three large states in Malaysia; despite approximately three quarter of the participants are Malays.

## (i) <u>Gender influences on coping strategies</u>

Overall, this study also found that the female students had a higher score in all coping strategy items except for humour, suggesting that the female adolescents were more aware of the need to cope compared to their male counterparts. A previous study on university students that investigated gender differences in the coping strategies adopted, reported that male students exhibit a greater ability to detach themselves from the emotions of a situation and demonstrate emotional inhibition or 'bottle up' their feelings more compared to female students (Lawrence, 2006). Indeed, in some cultures, focusing on emotions also could constitute a lesser accepted behaviour for men. It has been stated that even when men realize that they are depressed or have some other problem, they are still less likely than women to see a psychologist or other mental health professional; the reluctance being caused by masculine role socialization (Addis & Mahalik, 2003).

Another previous study surmised that due to the social norms in some societies, the seeking of or even needing help is not seen as a normal male behaviour, thus some men may worry that society will look down on a man who admits to having a problem and seeking help (Levant, 2011). Despite the rapid development and urbanization that has taken place in Malaysia in recent years, the gender issue could still be the underlying problem that is deterring male adolescents from seeking help because traditional Malaysian values could still be strongly inculcated in the Malaysian population and its younger generations, especially in the rural population.

## (ii) Urbanization influence on coping strategies

Another finding that could support this supposition is that the urban adolescents had a higher score compared to the rural adolescents in all coping strategy items except for turning to religion. This study also found that the urban students had a higher level of knowledge and awareness about healthy eating. Thus, perhaps it could be inferred that more urban males are also more aware of the importance of mental stress and coping and thus they are more receptive to adopting some of the stress coping strategies. This study highlighted that the rural adolescents despite do not demonstrated as higher stress level as the urban adolescents are still in need of more awareness and information on not just healthy eating, but on appropriate coping strategies to deal with challenges they faced in life.

#### (iii)Ethnicity influence on coping strategies

The religion-based coping strategy was adopted mostly by Malay students and those in the Other ethnicities category. The choices of this two groups could be based on the background the students are being brought up in and the cultural value and beliefs that they have been inculcated since birth. Chinese students on the other hand preferred adopting acceptance as a way to cope with stress. The choice adopted by the Chinese adolescents could be advised to be adopted by other ethnicities as the Chinese students demonstrated better coping as a whole in terms of both dealing with stress and practicing a healthier eating behaviour. Indian students mostly preferred using an active coping technique. Active coping involves having awareness of the stressor and making attempts to reduce the negative outcome. This strategy should also be taken into consideration as Indian adolescents demonstrated fairly low perceived stress level both during near examination period and during normal school days compared to the Malays and Chinese adolescents.

# (iv) BMI influence on coping strategies

A significantly lower score in food utilization was observed among the overweight and obese students compared to both the normal weight and the underweight students. This showed that they were aware of the risk to their health posed by overeating, which thus prevented them from adopting food utilization as the most preferred choice of coping strategy when dealing with stress. However, the obese and overweight participants may also not admit to utilizing food when dealing with stress; which could be due to fear of stigmatization or denial of their health condition. This should be taken into careful consideration when interpreting the data. The overweight and obese students also had higher scores in behavioural disengagement, humour and self-blame. The normal weight students had higher scores in self-distraction, venting of emotion and using religion, whereas the underweight students had higher scores in active coping, emotional support, instrumental support, positive reinterpretation, planning and acceptance. It is demonstrated that the underweight students adopted a more proactive and positive coping strategy as compared to the other two groups, thus this could be the reason of them practicing a healthier eating behavior as demonstrated in the previous sections.

# (v) Stress level influence on coping strategies

A significant difference in the COPE score between the stress level categories was observed in all stress coping items except for instrumental support, humour and religion. The high stress level students had a significantly higher coping score in self-distraction, denial, utilization of food, emotional support, behavioural disengagement, venting of emotion and self-blame than both the low and moderate stress level students. The findings of this study is almost similar to the earlier study conducted by Yusoff et al. (2011) in Malaysia which reported that denial, behavioural disengagement, venting of emotion, planning, acceptance and self-blame are significantly more common coping strategies used by distressed students compared to non-distressed students (M. S. B. Yusoff et al., 2011). Both of the above-mentioned studies found that distressed or high stress level students prefer negative coping strategies such as denial, behavioural disengagement and self-blame rather than positive ones.

A previous study by Macneil (2012) in USA on undergraduate students with mean age of 20.4 year old and their daily stressors, coping style and eating behaviours reported that students who lack confidence in their coping abilities are more likely to have problematic eating attitudes regardless of their daily level of stress. Macneil (2012) also reported that students with an avoidance coping style with poor coping self-efficacy may be at risk of disordered eating particularly with the onset of associated stress (Macneil, Esposito-Smythers, Mehlenbeck, & Weismoore, 2012). Another more recent previous study has reported that perceiving greater stress than usual in the last hour before bed is significantly associated with elevations in cortisol, but only during situations characterized by greater than usual engagement coping (Sladek et al., 2016). Thus, cortisol elevation occurred only among adolescents below average on trait measures of engagement coping or belief in their ability to handle stress. However, in this study, the low stress level students had a significantly higher score in active coping than both the high and moderate stress level categories. They also had a significantly higher score in positive reinterpretation, planning and acceptance than the moderate stress level categories students.

Based on a longitudinal analysis of the cohort of this study, a significant difference in the COPE score between the stress change categories was only observed in the religionbased coping item, which was manifested more among the increased stress level category as compared to the no change in stress level category. Furthermore, this study found no association between coping frequency and change in stress level in all 14 coping strategy items investigated. However, there was a higher prevalence of increased stress level among students who practised a lot of instrumental support, positive reinterpretation, planning, humour, acceptance, and religion-based coping strategies compared to those who practised these coping strategies a little bit or not at all. Students who predominantly adopted self-distraction, active coping, denial, use of emotional support, behavioural disengagement and venting of emotion demonstrated a decrease in stress level.

Another interesting finding of this study is that the majority of students who adopted food utilization a lot in coping with stress actually experienced a decrease in stress level (50.0%), whereas the majority of students who adopted this practice a little bit or not at all experienced an increase in stress level (48.1%). Further analysis revealed that the strongest significant positive correlation was between utilization of food items and EOE (r = 0.55), between utilization of food items and FR (r = 0.46) and between utilization of food items and EOE (r = 0.41). Other strategies that correlated positively with FR were self-distraction, venting of emotion and acceptance and self-blame. Students who practised these stress coping strategies could thus be at risk of practising unhealthy eating behaviour when experiencing stressful situations. It was observed that despite students using positive coping strategies, the prevalence of stress among the students was still high. The above findings thus show that this study has gone some way to bridging the research gap that existed due to the limited data on stress, stressors and coping strategies among secondary school students in Malaysia.

# 5.7 Factors Affecting the Transition of Eating Behaviour among Malaysian Adolescents

A linear regression analysis revealed that stress change was a significant predictor of transition in EOE, FR and EUE behaviours. When controlled for coping strategies, it was also found that the mean transition in EOE behaviour among participants with increased stress was significantly higher compared to the mean transition of EOE behaviour among the participants with decreased stress level. No significant difference was demonstrated in the mean transition in FR and EUE behaviours between the stress change categories when controlled for coping strategies. The transition of emotional overeating following change in stress level is thus the major issue significantly demonstrated by this study; which could be an important underlying factor contributing to obesity and overweight among the adolescents.

A multinomial logistic regression analysis further revealed that the students who were more likely to have a negative transition in emotional overeating behaviour were those who experienced an increase in stress level (OR = 1.94 [95% CI: 1.30, 2.94]), denied themselves food when coping with stress (OR = 2.0 [95% CI: 1.4, 3.1]), admitted to purchasing junk food (OR = 1.56 [95% CI: 1.54, 2.32]), using a lot of emotional support (OR = 1.68 [95% CI: 0.93, 3.05]) and doing a little bit of planning when coping with stress (OR = 1.99 [95% CI: 1.12, 3.53]). On the other hand, the students who were more likely to demonstrate a negative transition in FR behaviour were those who had an increased stress level (OR = 1.6 [95% CI: 0.97, 2.1]), denied themselves food when coping with stress (OR = 1.6 [95% CI: 2.13, 33.6]) and do not adopt self-blame strategy when coping with stress (OR = 1.57 [95% CI: 0.91, 2.70]).

A logistic regression analysis on the transition in emotional undereating behaviour indicated that the odds of students who had an increased stress level experiencing a negative transition in EUE behaviour was approximately 1.6 times more than for students with a decreased stress level (OR = 1.58, [95% CI: 1.07, 2.34]). The students who were more likely to have a negative transition in emotional undereating behaviour were male (OR = 1.71 [95% CI: 1.14, 2.57]), students who never purchased junk food (OR = 1.84[95% CI: 1.25, 2.73]), those who did not use instrumental support (OR = 1.69 [95% CI: 1.06, 2.67]), those that adopted religion (OR = 1.84 [95% CI: 0.98, 3.47]) and those who did not adopt self-blame when coping with stress (OR = 1.62 [95% CI: 1.02, 2.46]). The findings of this study had a very strong implication on highlighting the importance of adopting an appropriate coping strategy when dealing with stress. Mediation analysis conducted to test the mediation effect of coping strategies on the transition of emotional overeating, food responsiveness and emotional undereating showed that the coping strategies do not mediate the effect of stress change on the transition of the eating behaviours. Nevertheless, it was demonstrated in the logistic regression analysis that these coping strategies were significant predictors of the transition of eating behaviours.

The findings of this study need to be communicated to healthcare professionals; with a strong message that the objective of the coping strategies adopted by the adolescents were not to be targeted only to reduce the stress level. Some of the coping strategies adopted when dealing with stress significantly influence the direction of the eating behaviour transition, into improving or worsening it. Thus, adopting an appropriate coping strategy is vital to ensure the overall well-being of the adolescents, mentally and physically. This study may help to guide the mental health professionals such as the clinical psychologist to advise their clients on the most suitable coping strategies to adopt when dealing with stress; a strategy that would help reduce the stress level and at the same time do not adversely affect the eating behaviour pattern of the adolescents.

An individual's stress level and mental health affect well-being, but stress is unavoidable. To the best of the researcher's knowledge and based on a search of the available literatures, no longitudinal research on the association between stress change and transition in eating behaviour has been conducted in Malaysia, even in Southeast Asia. In this regard, it is believed that the findings of this research will provide a basis and strong implication for future research and practice in terms of mental health services in Malaysia. The role of parents in the development of coping skills from an early age has been reported in a number of studies (Compas, Phares, Banez, & Howell, 1991), thus preventive programmes should also be provided as early as possible in childhood with parents involvement; guided by healthcare professionals. Professionals may be able to help stressed adolescents by providing counselling interventions as well as suggesting the most suitable coping strategies to adopt when dealing with stress; such as planning and instrumental coping which focused on problem-solving in order to bolster their resilience as well as enhance their mental health and ability to cope with stressful events. These findings may help to guide in the development of intervention programs that will facilitate a healthy transition from childhood to adulthood and ensure an overall well-being of the adolescents.

# 5.8 Strength and Limitations of the Study

# 5.8.1 Strengths

This study has several strengths. First, it is a cohort study, which means that the stress level could be assessed for the same cohort at two different time points with different levels of exposure. Thus, the transition in the eating behaviour pattern that occurred following the adolescents' stress reaction could be observed, unlike in a cross-sectional study. Second, the comparability and perception of perceived stress was also more reliable rather than that which could be derived from comparing the perceived stress level between two groups of totally different populations. Also, despite the participants being from the same country, the environmental factors affecting the populations, whether the stressor or the support system, were definitely not similar.

A further strength of this study lies in the fact that the sample was extracted from an ongoing cohort study. Thus, previous data on the cohort can be revisited and related accordingly and this may allow the problem to be studied from a wider perspective by investigating for example data on the dietary pattern and body composition collected when the cohort was 13 and 15 years of age. The confounding factors that may affect eating behaviour such as demographic characteristics were also being considered. The study also had a fairly large sample size which gives power to the study. Weightage was also performed to allow better generalization of the study findings to the wider population. Another strength of this was the study instrument because the stress level was measured both subjectively and objectively by using questionnaires and saliva cortisol analysis, respectively. Lastly, a longitudinal cohort study such as this study has never been conducted in Malaysia specifically or in Southeast Asia more generally, and thus this study makes an important contribution to knowledge in this field in this region.

### 5.8.2 Limitations

The main limitation of this study lies in the fact that it was not possible to perform the objective measurement of stress in all participants due to cost constraints. Thus, the saliva cortisol analysis was conducted only among the subsamples; however, there was still sufficient power. Another limitation of this study was that it was not possible to identify anorexic or bulimic participants because diagnosis requires special tools and professional assessment by a psychiatrist. The researcher attempted to mitigate this limitation by using restrained eating indices to help to identify students with eating disorders. If the presence of a disorder was suspected, students were referred accordingly for further assessment and intervention as necessary.

The study was also limited to only three states in Malaysia. Furthermore, the sample size was not representative of the actual distribution of the student population in terms of school type because only government schools were selected. Students in these schools are predominantly below average academic achievers, thus their perception and awareness of the importance of academic achievement may not be as high as among those in boarding schools. This limits the generalizability of the findings. Furthermore, the
study relied on participants' self-reports, thus there is a possibility of respondent bias and students may have underreported some items when answering the questionnaires. This study was also only able to capture data on the school-going adolescents. The study duration also was fairly short to observe more significant effects among the adolescents. Thus a longer study on such a cohort would be better able to assess the effect of stress on eating behaviour and body composition.

Another limitation is identified in the developed socio-demographic questionnaire. The variables eating as coping strategy when dealing with stress and parents as role model were considered suggestive in nature. The parents as role mode variable were meant to gather information on the possibility of significant family influence on the eating habits of the adolescents. These variables however will be carefully reconsidered and rephrased in future studies.

## **CHAPTER 6: CONCLUSION**

#### 6.1 About this Chapter

To the best of the researcher's knowledge, this is the first study conducted in Malaysia, and perhaps worldwide, to identify stress and eating behaviour issues among adolescents by using a different approach and interpreting it in a new dimension. This study looked into the association longitudinally, between the change in stress level and its association with transition in eating behaviour among adolescents. It identified the importance of focusing on influencing the change in stress level and thus the transition in eating behaviour through time rather than intervening at a single time point. Most of the findings are in line with previous literature and the instrument used in this study was robust.

## 6.2 Summary of Main Findings

This study covered a wide perspective and a unique dimension that has never been explored in previously conducted studies. The findings of the study are summarized here based on the specific objectives of the research. Then, a final overall conclusion is made at the end of the chapter.

#### 6.2.1 Stress among Malaysian adolescents

This study identified that the majority of Malaysian adolescents perceived moderate stress irrespective of whether they were in a near-exam period or going to school on a normal school day. In general, stress was perceived as higher among female and urban adolescents. However, Chinese students and below average students perceived the highest stress during the near-exam period. The prevalence of a high perceived stress level among national secondary school students in Malaysia was high at approximately 30%, with 29.1% perceiving this level of stress during the near-exam period and 30.9% during normal school days. This study found that while the academic stressor, specifically

final-year examinations, is an important stressor, it is not the only stressor faced by adolescents.

In addition, this study found that the saliva cortisol level was higher during the near-exam period, but there was no significant correlation between perceived stress and saliva cortisol. Thus, saliva cortisol was more sensitive and reliable in detecting acute stress such as that actually experienced in relation to school examinations. On the other hand, the perceived stress questionnaire was more useful in determining chronic stress. The study findings highlight the significance of the problem of stress in the adolescent population. It is hoped that the information on the distribution of stress among adolescents obtained by this study will help to identify the specific needs of every target groups. The information gathered thus will assist in designing effective prevention programmes for each and every group. For example, the urban and rural adolescents were identified to have different underlying issues that influences their stress level thus these two groups need to be approach in two different ways.

## 6.2.2 Eating behaviours among Malaysian adolescents

Generally, this study found that Malaysian adolescents enjoyed food and had a higher tendency to eat in the presence of food. This externally induced eating behaviour was found to be more predominant among the Malay, the female and the underweight adolescents. Emotional overeating was also predominant among the female and the Malay students; as well as the high stress level adolescents. Externally induced eating was stronger during the near-exam period, whereas emotional overeating was stronger during normal school days. High stress level students had a higher tendency to emotionally overeat especially in the presence of food. The academic stressor is thus an important factor that affects adolescents' eating behaviour. The majority of urban students, despite having more extensive knowledge about healthy eating, had poorer healthy eating habits. The eating out phenomenon in urban Malaysians is influenced by higher financial autonomy and food availability and these external forces in the urban environment seem to have aggravated the unhealthy behaviours in food uptake. Hence solely educating the public about healthy eating is inadequate. Social responsibility among food entrepreneurs and good governance by local authorities also need to be incorporated into strategies developed to ensure quality of life in urban communities.

# 6.2.3 The effect of change in stress level on the transition in eating behaviour among Malaysian adolescents

This study discovered that stress change was a significant predictor of the transition in emotional overeating and food responsiveness behaviour. An increasing stress level will increase the tendency of adolescents to emotionally overeat, especially in the case of the female, the urban and the obese and overweight adolescents. An increasing stress level will also increase the tendency of adolescents to eat when they are in the presence of food, especially in the case of the male, the rural and the obese and overweight adolescents. This is the first study to investigate the association between change in stress level and transition in eating behaviour. The findings of this study is thus novel as it demonstrated the importance to manage changes in stress level as the change in stress level rather than the stress level itself influence the transition of emotional overeating. This is one of the aspects to carefully consider while developing the intervention programs to combat obesity.

#### 6.2.4 Stress coping strategies adopted by Malaysian adolescents

This study found that the eating behaviour of adolescents was influenced by a change in their stress level and that their coping skills mediated the transition in eating behaviour either negatively or positively. Generally, turning to religion was the coping strategy that was mostly adopted by the adolescents, especially the Malay students and those in the other ethnicity categories. Chinese students preferred to use the acceptance technique while Indian students mostly adopted active coping as a strategy. Most of the underweight students adopted using food to cope with stress. Higher perceived stress influenced students to use more of the negative coping strategies, such as behavioural disengagement, self-blame, denial and venting of emotion. Thus, intervention programmes should consider training students to have a healthy mindset and positive coping strategies that have been proven to be more beneficial, rather than purely focusing on educating students on the importance of eating healthily. Professionals may be able to help stressed adolescents by providing counselling interventions and coping strategies to improve their resilience as well as enhance their mental health and their ability to cope with stressful events. This may facilitate a healthy transition from childhood to adulthood and thus protect adolescents' mental health and further protect against a negative transition in eating behaviour among adolescents.

## 6.2.5 Factors affecting the transition in eating behaviour among Malaysian adolescents

This study revealed that those students who experienced an increase in stress level (OR = 1.9, 95% CI: 1.3, 2.9), did a little bit of planning or not at all when coping with stress (OR = 2.0, 95% CI: 1.1, 3.5) and used a lot of emotional support to cope with stress (OR = 1.7, 95% CI: 0.9, 3.1) were more likely to have a negative transition in emotional overeating behaviour. Also, students who experienced an increase in stress level (OR = 1.4, 95% CI: 1.0, 2.1), used humour (OR = 1.4, 95% CI: 0.9, 2.0) and self-blamed (OR = 1.6, 95% CI: 0.9, 2.7) a little or not at all when coping with stress were more likely to experience a negative transition in food responsiveness behaviour. Moreover, students who experienced an increase in stress level (OR = 1.7, 95% CI: 1.1, 2.6), used instrumental support (OR = 1.7, 95% CI: 1.1, 2.7) and self-

blamed (OR = 1.6, 95% CI: 1.1, 2.5) a little or not at all when coping with stress were more likely to experience a negative transition in emotional undereating behaviour.

In light of the above, this study has revealed the importance of managing stress to prevent increments in stress level and the important role that coping strategies play in eating behaviour transition among adolescents. The adoption of an appropriate stress coping strategy when experiencing an increase in stress level is crucial because the strategy adopted mediates the transition in an individual's eating behaviour either positively or negatively.

## 6.3 Recommendations for Future Research

- A study of a longer prospective cohort is required to monitor the long-term effect of stress on eating behaviour and its effect on body composition among adolescents. Such a study may capture the prolonged effect of stress on an individual and would also be a good platform from which to assess mental health more comprehensively.
- 2. To address the diurnal variation of cortisol level throughout the day, an objective stress measurement using multiple readings of the saliva biomarker in a day and involving the whole sample rather than a subsample would give much more valuable input to the body of knowledge on the physiological aspect of stress and its effect on general health.
- 3. To strengthen the findings, the sample size could be increased and research could be conducted in multiple settings such as schools other than government-funded schools, religious schools or single-ethnicity schools. A comparison of these schools may reveal differences in the academic or support system that may be used as a basis for intervention strategies.

- 4. A study of the support system for adolescents could be a next step in research in this area, the findings of which may complement those on the effect of the coping strategies adopted by the adolescents.
- 5. Further study as such should be conducted in schools that have higher academic achievement, such as boarding schools, to compare the stress and eating behaviour trend among higher academic achievers and further explore the reasons for distress among adolescents.
- 6. The effectiveness of government policy on stress prevention, mental health and obesity prevention, especially among adolescents, needs further study and re-evaluation. The intervention developed should carefully consider the eating behaviour factor as a possible contributor to the problem of overweight and obesity among Malaysian adolescents. As regards to the current intervention which focus on promoting towards mental health and eating healthily as a separate entity, promotion towards mental health considering its relation to eating behavior, coping strategy and adiposity as one connecting entity is hope to result in a better outcome of adolescent well-being.

## 6.4 Summary

This study highlighted that stress is a significant mental health problem among Malaysian adolescents. Majority of the adolescents are experiencing moderate stress with at least one third perceiving a high stress level. The Cohen perceived stress questionnaire is a good tool to identify chronic stress while the detection of acute stress among adolescents is better detected by measuring saliva cortisol level. The expectation of achieving academic excellence in school examinations is a significant stressor. The change in stress level is a significant predictor of the transition in emotional overeating and food responsiveness behaviours. The adoption of an appropriate coping strategy when experiencing an increase in stress level is crucial because the strategy adopted influence the transition of eating behaviour towards a positive or negative direction. The findings thus need to be communicated to health professionals such as the clinical psychologist to advise clients on the most suitable coping strategies to adopt when dealing with stress; a strategy that would help reduce the stress level and at the same time do not adversely affect the eating behaviour pattern of the adolescents. The novelty of the findings of this research provide a strong basis and a benchmark for future research, in terms of establishing an objective measurement for stress level among the adolescents in Malaysia and assisting in developing an effective obesity preventative programmes which carefully consider the role of stress and coping strategy in the interventions. The commitment of policy makers to ensure involvement of food entrepreneurs and local authorities in providing the optimum environment to promote healthy eating is also important to ensure the health and well-being of future generations.

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