

ASSOCIATION BETWEEN BREAKFAST  
CONSUMPTION WITH OBESITY AND PHYSICAL  
ACTIVITY LEVEL AMONG ADOLESCENTS IN  
URBAN SCHOOLS OF KOTA BHARU, KELANTAN

by

MACKENDY MANGGIS

Thesis submitted in partial fulfillment of the  
requirements for the degree of  
Bachelor of Health Sciences (Nutrition)

June 2013

PERKAITAN ANTARA PENGAMBILAN SARAPAN PAGI DENGAN OBESITI  
DAN TAHAP AKTIVITI FIZIKAL DALAM KALANGAN REMAJA DI  
SEKOLAH BANDAR DI KOTA BHARU, KELANTAN

Abstrak

Berat badan berlebihan atau obesiti adalah risiko kematian kelima paling utama di dunia, dengan tahap dan kelaziman mereka meningkat di kalangan kanak-kanak dan remaja. Oleh itu, kajian keratan rentas ini bertujuan untuk menentukan perkaitan antara tabiat pengambilan sarapan pagi dengan obesiti dan tahap aktiviti fizikal dalam kalangan remaja di sekolah bandar di Kota Bharu, Kelantan. Borang Soal-Selidik Aktiviti Fizikal bagi Kanak-Kanak Lebih Tua (Physical Activity Questionnaire for Older Children, PAQ-C) dan soal selidik pengambilan sarapan pagi telah digunakan untuk menemubual 200 pelajar-pelajar Tingkatan 1 dan Tingkatan 4 di dua buah sekolah yang dipilih secara rawak. Ukuran antropometri telah diambil untuk klasifikasi berat badan. Kajian ini mendapati kelaziman untuk berat badan berlebihan dan obesiti adalah 20.5%, di mana peratusan adalah lebih tinggi dalam kalangan perempuan (23.1%). Ia juga mendapati bahawa 76.5% daripada responden tidak mengambil sarapan pagi sekurang-kurangnya sekali dalam seminggu, dan lebih ramai lelaki (78.3%) tidak mengambil sarapan berbanding perempuan (75.2%). Hanya 3% daripada responden sangat aktif secara fizikal, 40% daripada responden adalah sederhana aktif dan 57% adalah yang tidak aktif. Skor min aktiviti fizikal adalah lebih tinggi dalam kalangan lelaki ( $t = 6.58$ ,  $p = 0.02$ ). Kajian ini mendedahkan bahawa tiada perkaitan yang signifikan antara pengambilan sarapan pagi dan status indeks jisim badan, BMI dan tiada perbezaan yang signifikan dalam median BMI antara golongan pengambil sarapan pagi dan bukan pengambil sarapan pagi ( $Z = -0.17$ ,  $p = 0.87$ ). Hasil yang sama juga mendapati tiada perkaitan

yang signifikan antara pengambilan sarapan pagi dan tahap aktiviti fizikal. Skor min aktiviti fizikal juga didapati tidak mempunyai perbezaan yang signifikan antara pengambil sarapan pagi dan bukan pengambil sarapan pagi. Kesimpulannya, kesedaran tentang kepentingan pengambilan sarapan pagi dan aktiviti fizikal perlu disebarkan di kalangan kumpulan umur ini untuk mencegah beberapa penyakit kronik yang berkaitan di kemudian hari.

ASSOCIATION BETWEEN BREAKFAST CONSUMPTION WITH OBESITY  
AND PHYSICAL ACTIVITY LEVEL AMONG ADOLESCENTS IN URBAN  
SCHOOLS OF KOTA BHARU, KELANTAN


Abstract

Overweight or obesity is the fifth leading risk of death in the world, with their severity and prevalence increases among children and adolescents. This cross-sectional study aimed to determine the association between breakfast consumption habit with obesity and physical activity level among adolescents in urban schools of Kota Bharu, Kelantan. The Physical Activity Questionnaire for Older Children (PAQ-C) and a breakfast consumption questionnaire were administered on 200 students of Form 1 and Form 4 in two randomly selected schools. Anthropometric measurements were taken for body weight classification. This study found prevalence for overweight and obesity was 20.5%, where the percentage was higher among females (23.1%). It was also found that 76.5% of the respondent skipped breakfast at least once in a week, and more males (78.3%) skipped breakfast compared to females (75.2%). Only 3% of the respondents were highly active physically, 40% of the respondents were moderately active and 57% were the least active. Mean physical activity score was significantly higher among males ( $t = 6.58$ ,  $p = 0.02$ ). This study found no significant association between breakfast consumption and body mass index status and no significant difference of median BMI between breakfast skippers and non-skippers ( $Z = -0.17$ ,  $p = 0.87$ ). Similarly, no significant association was found between breakfast consumption and physical activity level. Mean physical activity score was not significantly different between breakfast skippers and non-skippers. In conclusion, awareness about the essential of

breakfast eating and physical activity should be disseminated among this age group to prevent some related chronic diseases later in life.

## DECLARATION

I, hereby declare that this thesis is my original work, except for all the quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently submitted for any other degree or purposes in Universiti Sains Malaysia or any other institutions



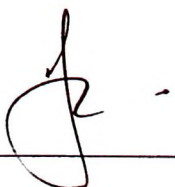
---

MACKENDY MANGGIS

Date: 4 JULY 2013

I, hereby certify that Mr. Mackendy Manggis has carried out her study entitled “Association Between Breakfast Consumption With Obesity And Physical Activity Level Among Adolescents In Urban Schools Of Kota Bharu, Kelantan” as a final year research project in Nutrition under my supervision. He has complied with the ethical standard and regulations in conducting his study and has completed his thesis. I am satisfied with her work and have no objection for the thesis to be examined by the appointed examiners by the School of Health Sciences, Universiti Sains Malaysia.

Thank you.



---

DR SOO KAH LENG

Nutrition Programs, School of Health Sciences, Universiti Sains Malaysia

## ACKNOWLEDGEMENT

First of all, thanks be to God Almighty for His great grace and mercy, I was finally able to complete my final year research project successfully. I would like to express my gratitude to my research project supervisor, DR Soo Kah Leng, for all her inspirational guidance and thoughts throughout the course of this final year. She has been exceptionally patient guiding my ways in completing this research project. Thanks for the non-stop encouraging words and endless assistance whenever I need them. Without her sincere assistance in guiding me, it would be impossible for me to complete my final year research project.

I would also like to convey my gratitude to our Nutrition Programme Chairman, Prof Madya Dr Shariza Abdul Razak, and also the former chairman, Prof Wan Abdul Manan Wan Muda for their encouragement and guidance in completing this project. Not to forget, to all my lecturers who have equipped me with all the precious knowledge and wisdom to do my project, thank you so much. Only God is able to repay all the favors and endless knowledge that all the lecturers had given to me throughout my learning process in Universiti Sains Malaysia.

Next, I would like to say thank you to all the teachers and students of the schools that I have visited in doing my data collection. Special thanks to the principals of SMK Penampang and SMK Zainab II, Kota Bharu, Kelantan for allowing me to do my research in their schools. Also, without the willingness of the students involved to participate in the research, this thesis would be impossible to be completed. My sincere gratitude I forward to all the staffs of both schools, especially the schools' counseling teachers, who had arranged all the time slots and to be with us monitoring the students during the data collection.

I would also like to express my gratitude to all my course mates who had helped me in my research project. They were able to make some time to help me with my research although they have their own research projects to be completed. Special recognition to Miss Lim Yoke Har and Miss Nik Farhana Nik Khairu Zaman, for always helping and accompanying me during the data collection process.

Last but not least, to my family that never stops encouraging, all the persistent motivation and prayers for my success, my greatest appreciation to them. Thanks for all the moral and financial support they had provided to me. Special thanks goes to my mother, who always cheering me up and make me always believe that I can do my best for this project.

Thank you.

## TABLE OF CONTENTS

	Page
ABSTRAK	i
ABSTRACT	iii
DECLARATION	v
ACKNOWLEDGEMENT	vi
LIST OF TABLES	xi
LIST OF FIGURES	xii
CHAPTER	
1    INTRODUCTION	
1.1 Background of study	1
1.2 Research problem statement	4
1.3 Objectives	5
1.3.1 General objective	5
1.3.2 Specific objectives	5
1.4 Research question	6
1.5 Research hypothesis	6
1.5.1 Null hypothesis	6
1.5.2 Alternative hypothesis	6
1.6 Significance of study	7
1.7 Conceptual framework	8



4	RESULTS	
	4.1 Characteristic of the respondents	36
	4.2 Prevalence of obesity among respondents	38
	4.3 Breakfast consumption of respondents	40
	4.4 Physical activity level of respondents	42
	4.5 Academic performance of respondents	44
	4.6 Association between variables	47
5	DISCUSSION	
	5.1 Socio-demographic characteristics	48
	5.2 Breakfast consumption	49
	5.3 Body weight status	51
	5.4 Physical activity level	52
	5.5 Academic performance	53
	5.6 Limitations and recommendations	54
6	CONCLUSION	56
	REFERENCES	58
	APPENDICES	72

## LIST OF TABLES

	Page
2.1 Definition of breakfast skipping used in different literatures	14
2.2 Cross-sectional studies evaluating body weight characteristics in adolescents who consume or skip breakfast	17
3.1 Classification of body weight status according to BMI-for-age (z-score) for boys and girls age 5 – 19 years old	30
3.2 Classification of physical activity level scores	33
4.1 Body mass index (BMI) status of the respondents	38
4.2 BMI status of the respondents	39
4.3 Academic performance of the respondents	46
4.4 Association between breakfast consumption and independent variables	47

## LIST OF FIGURES

	Page
1.1 Conceptual framework	8
2.1 Consideration on how breakfast is defined	12
3.1 Flow chart of research	35
4.1 Distribution of gender in different forms of the respondents (n= 200)	36
4.2 Distribution of parents' income (n= 200)	37
4.3 Distribution of the BMI according to gender (n= 200)	39
4.4 Breakfast consumption among respondents (n=200)	40
4.5 Percentage of students according to physical activity level (n= 200)	42
4.6 Physical activity level according to gender (n= 200)	43
4.7 Mean academic score of the participants (n= 200)	44
4.8 Academic performance of the respondents, based on the academic mean score (n= 200)	45

## CHAPTER ONE: INTRODUCTION

### 1.1 Background of study

Obesity is defined as “abnormal or excessive fat accumulation that presents a risk to health” by the World Health Organization (WHO, 2012a). In this 21<sup>st</sup> century, obesity has become an epidemic problem globally and threatens to become one of the leading health problems. The alarming rise in the prevalence of overweight and obesity since the last decades also indicates that the severity of obesity problem has become much more worrying.

Overweight and obesity are the fifth leading risk for global deaths, where at least 2.8 million adults die of being overweight or obese each year. Overweight and obesity also attributes to 23% of the ischaemic heart disease burden, 44% of the diabetes burden and between 7% and 41% of certain cancer burdens (WHO, 2012b). Over the past decades, the prevalence of obesity in Western and other westernizing countries has doubled. In the United States alone, more than 100 million individuals are categorized as overweight or obese (Lopez & Knudson, 2012). The World Health Organization also found out that more than 40 million children under five were overweight in 2010. Most overweight and obesity cases are now from the low- and middle-income countries, particularly in urban settings (WHO, 2012b). Obesity is also one of the most common nutritional disorders with increasing prevalence in many Asian countries, including in Malaysia.

Over the past decades, many researches had been carried out in order to identify and determine the risk factors of obesity throughout the world. Obesity occurs as a result of the multifactor interrelation which favors an imbalance between energy intake and disbursement. This is also supported by a study of Tappy & Le

(2010), where they found that one of the causes of obesity is the continuing imbalance between energy intake and expenditure. In addition, environmental and behavioral (Morland et al., 2006), genetic predisposition (Herbert et al., 2006; Loo & Bouchard, 2003), engagement into physical activities (Phupakdi et al., 2005) and dietary patterns also been agreed by many to be common factors that may influence obesity in children and adolescents.

Breakfast consumption is also suggested to be important in the role of maintaining normal weight and providing good nutritional benefits in children and adolescents (Rampersaud et al., 2005). This earns breakfast to be the most important meal of the day, yet it is the meal that people are more likely to skip or neglect. Researches (Barba et al., 2006; Berg et al., 2009; Koplan et al., 2005) also found that skipping breakfast may play a role in obesity. This is explained by the study done by Sjorberg et al. (2003), where the practice of skipping breakfast habit among adolescents is associated with negative lifestyle factors and less healthy choices, which include a higher risk of snacking, skipping other meals, doing less physical activity (Rampersaud et al., 2005; Utter et al., 2007) and are prone to increase BMI (Affenito et al., 2005), which causes overweight and obesity. Review by Rampersaud et al. (2005) had examined the breakfast consumption literature and suggests that those who take breakfast had improved academic performance, better nutritional profiles and lower BMI compared to breakfast skippers. Although most but not all researches had established the relationship between skipping breakfast with overweight and obesity among children and adolescents globally, yet the trend towards a higher prevalence of breakfast skipping among adolescents has been reported in many countries. A study conducted by Moy et al. (2006) on the eating patterns among school children and adolescents in Kuala Lumpur, Malaysia had

reported that breakfast is the most frequently missed meal with prevalence of 12.6%, followed by lunch (6.7%) and dinner (4.4%). The study also suggested that the prevalence of skipping breakfast increases as the age increases.

Another factor that has always been link to the occurrence of obesity is physical activity. As suggested by Must & Tybor (2005) and Christodoulus et al. (2006), regular physical activity seems to offer protection against a wide variety of chronic disease-related risk factors during childhood and adolescence. The practice of physical activity has shown to be another key environmental factor influencing body fatness during adolescence. Previous studies also found out that the combination of adequate physical activity together with healthy dietary habits has also been shown to help prevent obesity and other nutrition-related alterations common in adolescence, such as poor bone mineralization (Moreno et al., 2010; Vincente-Rodriquez et al., 2008). It was shown that both dietary habits and physical activity independently affect the development of obesity. Interestingly, some studies also found out some possible interrelation between breakfast consumption and physical activity. Habitual breakfast eaters may also be more likely to exhibit higher levels of physical activity than breakfast skippers (Cohen et al., 2003; Keski-Rahkonen et al., 2003). Timlin et al. (2008) also suggested that daily breakfast eaters also seemed much more physically active than breakfast skippers.

## **1.2 Research problem statement**

The vast economic, technologies and industrial development in Malaysia had raised the living standard of people in this country. These changes and developments have contributed to the shift of Malaysian citizens towards a Westernised living pattern and sedentary lifestyle. This eventually affects the health behaviours of the people for all age groups, including adolescents. Economic affluence together with enormous exposure to mass media had affected the health attitudes, physical and social activities and dietary habits of adolescents and children.

The prevalence of overweight and obesity are also alarming, with the prevalence of 7.3% of overweight in a sample of urban adolescents (Moy et al., 2004), 7.2% prevalence of obesity in urban children and 7.0% prevalence of obesity in rural children (Sumarni et al., 2006). A systematic review by Whitlock et al. (2005) confirmed the persistence of obesity from childhood into adulthood. It was predicted that the higher the BMI is in childhood, the greater the probability of obesity is in adulthood. Many studies suggest that skipping breakfast plays an important role in the development of obesity (Berg et al., 2009; Koplan et al., 2005), together with other environment factors such as engagement in physical activities (Must & Tybor, 2005).

Therefore, this study was conducted to investigate the association of breakfast consumption habit with obesity and physical activity among adolescents in Kota Bharu, Kelantan.

## **1.3 Objectives**

### **1.3.1 General objective**

To investigate the association of breakfast consumption habit with obesity and physical activity level among adolescents.

### **1.3.2 Specific objectives**

- a. To study the prevalence of obesity among adolescents in urban schools of Kota Bharu, Kelantan
- b. To determine the prevalence of skipping breakfast habit among adolescents.
- c. To investigate the physical activity level of the adolescents.
- d. To study the association of breakfast consumption with body mass index.
- e. To study the association of breakfast consumption with physical activity.
- f. To study the association of parents presence at home with breakfast habit consumption.
- g. To investigate the association of breakfast consumption with academic performance.

## **1.4 Research questions**

1. Does breakfast consumption relate to the body mass index (BMI) of adolescents?
2. Does breakfast consumption relate to the physical activity level of adolescents?

## **1.5 Research hypothesis**

### **1.5.1 Null hypothesis**

- a. There is no association between the breakfast consumption habit with obesity.
- b. There is no association between the breakfast consumption habit with physical activity.

### **1.5.2 Alternative hypothesis**

- a. There is an association between the breakfast consumption habit with obesity.
- b. There is an association between breakfast consumption habit and physical activity level.

## **1.6 Significance of study**

Adolescence is the critical time to encourage the development of health promoting behaviors (Cohen et al., 2003). The transitional period between adolescence and adulthood is a period of increased risk for the development of obesity (Gordon-Larsen et al., 2004). Hence, this study on investigating the association of breakfast consumption with obesity and physical activity level is vital as one of the stepping stone in lowering the risk of obesity development among adolescents in Kota Bharu, Kelantan.

As not many studies have been done in our local setting, it is hope that this study may be able to investigate the prevalence of obesity among adolescents in Kota Bharu, Kelantan. It is also hoped that this study may able to help people to understand better on the possible relationship between breakfast consumption habit among Kelantanese adolescents and the BMI of the respective individuals. Moreover, this study investigates the possible relation between physical activity level and breakfast consumption habit among Kelantanese adolescents.

On the other hand, the factors that may influence the behavior of breakfast consumption were investigated in this study. This may help in understanding more deeply on the causes of breakfast skipping among the Kelantanese adolescents. The findings of this study can be beneficial in conducting more detail studies on the Kelantanese adolescent communities in near future. This study may also serve as guidance in any health promotion intervention programs which might be organized by different health institutions in our country.

## 1.8 Conceptual framework

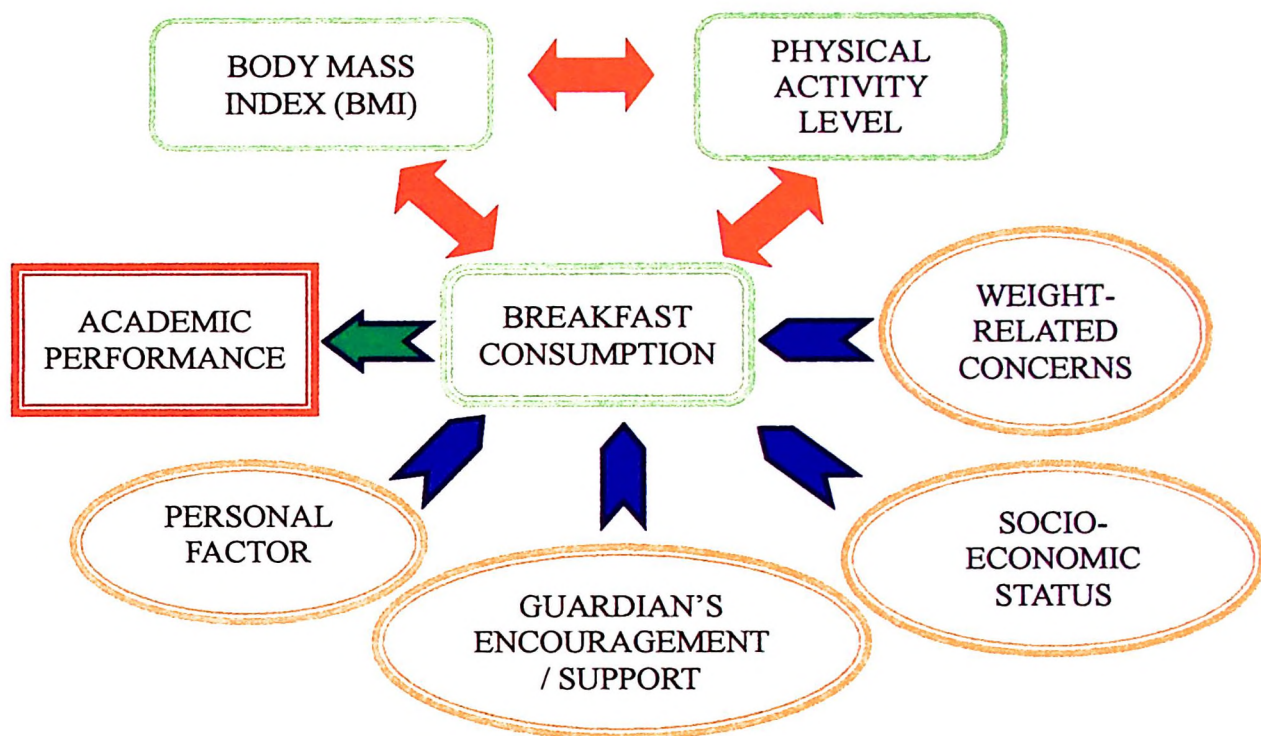


FIGURE 1.1: Conceptual framework

A conceptual framework was constructed as a general guideline on the main aspects that were investigated in this study. As illustrated in Figure 1.1, several factors were investigated. These factors were chosen and investigated based on the support of findings from several previous studies. One of the factors was the socioeconomic status. Studies by Delva et al. (2006) and Keski-Rahkonen et al. (2003) supported this theory, where they found that lower socioeconomic status has been associated with breakfast omission, which may also cause other unhealthy lifestyle later in life. Breakfast consumption has also been linked with the guardian's encouragement or supports. This may also be a factor which affected the breakfast consumption habit of the adolescents. Keski-Rahkonen et al. (2003) in their study

suggested that parental presence may play a role in breakfast consumption among the adolescents. This was also supported by the findings of other study which also suggested that the breakfast consumption habit was improved with the presence of at least one parent during breakfast period in the morning (Merten et al., 2009) and improved dietary profiles and practices (Woodruff & Hanning, 2009).

Other factors such as personal reasons may also affect the breakfast consumption. As proposed by Sweeney & Horishita (2005), breakfast skippers gave reason such as time constraint and rejection of eating breakfast in the morning as the reason why they missed breakfast. These reasons were also supported in a study by Vanelli et al. (2005). From the conceptual framework, it was also suggested that breakfast consumption may have effects on the body weight status and physical activity level among the adolescents. This has been proposed in accordance with several studies that found links between these variables. Rampersaud et al. (2005) found that breakfast eaters have better body weight status and academic performance compared to their counterparts. Breakfast consumption has also been associated with greater physical activity level in children and adolescents (Albertson et al., 2007; Cohen et al., 2003)

## CHAPTER TWO: LITERATURE REVIEW

### 2.1 Adolescents

Adolescent is defined by the World Health Organization as the young people between the age of 10 to 19 years old and youth as people in the age of range 15 to 24 years old. In South-East Asia alone, there are about 350 million adolescents, which comprising about 22% of the total population in countries of the south-east Asia region (WHO, 2013b). Adolescence and young adulthood are unique periods in the life stage, that present opportunities and challenges in improving health. This is also the period of life stage where they may learn the skills and attributes necessary in becoming productive and reproductive adults. Adolescence period is a transitional period between childhood and adulthood. According to Halfon & Hochstein (2002), transitional period is the time when individuals are more sensitive to the surrounding environment inputs, which may involve significant growth and development. Characteristics such as trying to be independent and taking greater responsibilities for habits in areas including in dietary intake, personal exercise behavior, substance use, sexual activity, and so on, are generally encountered by adolescents.

The statistics data source from WHO (2013d) stated that most of the young people are healthy. While most of the world's adolescents make it through the period with no major problems, however, it was found that more than 2.6 million young people aged between 10 to 24 years old died each year. Adolescents are at risk of having certain health issues such as early pregnancy and childbirth, HIV/AIDS, malnutrition, mental health, tobacco use, harmful use of alcohol, violence and injuries (WHO, 2013d), which may continue to the development of several non-communicable diseases such as cardiovascular disease, cancers, obesity, diabetes and

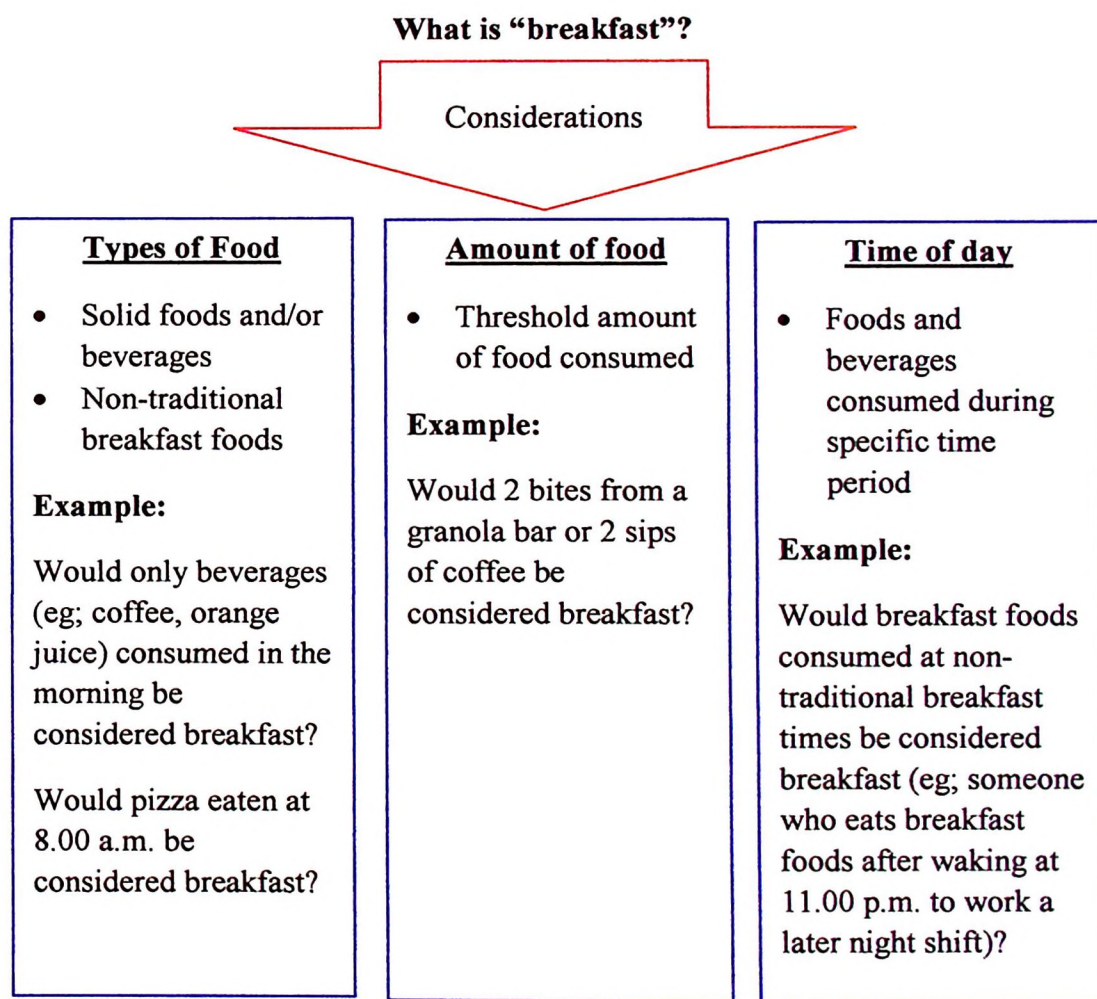
so on. Exposures to such risks may be because many initiate adult behaviors in areas such as substance use and sexual activity. Although these reflected normative development, the early onset of normative adult behavior and initiation of health-damaging behaviors is of concern, as it may influence health in the short and long term.

A review paper by Darnton-Hill et al. (2004) reported that there were three critical issues in adolescence that may impact on chronic diseases; (i) the development of risk factors during this period, (ii) tracking of risk factors throughout life; and in terms of prevention, (iii) the development of healthy or unhealthy habits that may tend to stay throughout life. One of the examples is the occurrence obesity that has been reported as a serious public health problem among the adolescents in developed and developing nations (Reilly, 2006). According to Gordon-Larsen (2001), the onset of overweight and obesity during adolescence tend to stay and persist into adulthood, and obese adolescents may remain obese during adulthood. Overweight and obesity was also found to be one of the risk factors for vast number of non-communicable diseases, as reported by a study by Swinburn et al. (2004).

Therefore, improvement in protection of young people from health risk is very critical, and steps must be taken in promoting healthy practices during adolescence period to ensure great future of countries' health and social infrastructure as well as to the prevention of health problems occurrence in adulthood (WHO, 2013d).

## 2.2 Breakfast consumption

Breakfast has been regarded as one of the most important meal in day by many nutritionists through various nutrition texts. Breakfast generally has been accepted as the first meal of the day, which is usually taken in the morning. However, there is no universal definition of breakfast has been establish for scientific research purpose, as proposed by Rampersaud (2009) in his review paper. Figure 2.1 below shows the conflicting considerations that must be taken for how breakfast eating occasion is defined.



Source: Rampersaud (2009)

FIGURE 2.1: Consideration on how breakfast is defined

According to Rampersaud (2009), there were many studies that investigated the importance of breakfast and their effects on various outcomes, however, various ways that breakfast and breakfast consumption frequency were defined had create difficulties and challenges in comparing the results among studies. Several ways have been used to assess breakfast intake frequency, such as using a 1-day dietary survey or 24-hour dietary recall. Through this method, breakfast skipping might be defined as not having breakfast on the day of the survey or recall. However, the inability to reflect the breakfast consumption habit overtime through this method is the major limitation. Other than that, the review also found that breakfast may be defined as in frequency basis (number of days per week or other defined time period), where breakfast skippers may be defined by missed or not consuming breakfast on majority of days or defined period of time.

Previous researches mainly on breakfast consumption habit has found a number of benefits of regular breakfast eating habit. For example, study by Rampersaud et al. (2005) had found out evidence that there was an increase in academic performance, improved cognitive function related to memory, better nutritional profiles and lower body mass index (BMI) among regular breakfast eaters compared to their breakfast skippers counterpart. It was also reported that the prevalence of breakfast skipping among female adolescent were apparently higher than male adolescents (Keski-Rahkonen et al., 2003). Another study by Pearson et al. (2009) interestingly found out that the likeliness to skipping breakfast is increasing during the transition from childhood through adolescence, where older children and adolescents do skip breakfast more.

As mentioned earlier, taking regular breakfast has been linked with lower BMI. This is supported by a longitudinal research to examine the breakfast skipping

and weight change in adolescents by Berkey et al. (2003) where the study cross-sectionally found out that breakfast skippers were more likely to be overweight. Keski-Rahkonen et al. (2003) also found a cross-sectional association between high BMI adolescents and breakfast skipping. Although many research have found association between breakfast consumption and BMI, the relationship is still not well established (Rampersaud et al., 2005).

As mentioned before, however, a major limitation of the previous literatures on breakfast skipping and its correlates, causes and consequences. This limitation was the absence of a commonly agreed upon definition of breakfast skipping. The following Table 2.1 shows the reviews publication that differently define breakfast skipping and non-breakfast skipping behavior.

Timeframe	Definitions	Studies using the definitions
7 days/ 1 week	<ul style="list-style-type: none"> <li data-bbox="437 1149 872 1253">▪ Missed breakfast at least 1x/week</li>   <li data-bbox="437 1357 872 1460">▪ Missed breakfast at least 6x/week</li> </ul>	<p data-bbox="897 1149 1179 1181">Sjorberg et al. (2003)</p> <p data-bbox="897 1212 1164 1243">Dubois et al. (2009)</p> <p data-bbox="897 1357 1291 1388">Keski-Rahkonen et al. (2003)</p> <p data-bbox="897 1419 1291 1450">Keski-Rahkonen et al. (2004)</p> <p data-bbox="897 1491 1157 1522">Timlin et al. (2008)</p> <p data-bbox="897 1564 1157 1595">Cheng et al. (2008)</p>

1 day/ 24 hour	▪ Missed breakfast on day of survey, 24-h food recall, or food record	Serra-Majem et al. (2002) Molcho et al. (2007)
“Usual breakfast habits”	▪ Usually skip breakfast, or never or almost never eat breakfast	Boutelle et al. (2002) Kovrova et al. (2002) Berkey et al. (2003) Videon & Manning (2003)

TABLE 2.1: Definition of breakfast skipping used in different literatures

The inconsistent definition of breakfast skipping in previous literatures has created a different understanding and incomparability among the studies. The different definition of breakfast skipping also creates a different meaning of the term “skippers” among the participants in those studies. Rampersaud et al. (2005), through a review on studies that were evaluating body weight characteristics in children and adolescents who consume or skip breakfast, has made a comparison on the results of those studies with different breakfast skipping operational definitions. Table 2.2 shows the different results obtained from various studies on the body weight characteristics in children and adolescents, using different operational definition on breakfast skipping.

There were several reasons why adolescents skip breakfast. Among common reasons why they skipped breakfast were lack of time to eat, did not like to eat early, no appetite to eat, or overslept (Chitra & Reddy CR, 2007; Moy et al., 2009). The

study by Keski-Rahkonen et al. (2003) also reported that the parental presence is an important factor in breakfast consumption among the adolescents. Lower socioeconomic status also has been associated with breakfast omission (Delva et al., 2006; Keski-Rahkonen et al., 2003), which later on has been related to other less healthful lifestyle habits, such as reduced levels of physical activity (Delva et al., 2006; Keski-Rahkonen et al., 2003; Miech et al., 2006)

Study description	Key measured variables	How breakfast consumption defined	Results	Reference
US Studies				
School based Kentucky n= 4049 Ages 11 – 14 years	<ul style="list-style-type: none"> <li>▪ Height and weight self-reported</li> <li>▪ Diet by Youth Risk Behavior Survey questionnaire</li> </ul>	<ul style="list-style-type: none"> <li>▪ Participants are asked how many days they ate breakfast during the past 7 days; 8 response options ranging from none to 7 days</li> </ul>	<ul style="list-style-type: none"> <li>▪ Weight status inversely associated with breakfast frequency (p&lt;.01)</li> <li>▪ Healthy weight students consumed breakfast more often than students overweight or at risk for overweight (p&lt;.013)</li> <li>▪ No adjustment for confounding factors</li> </ul>	<ul style="list-style-type: none"> <li>▪ Roseman et al. (2007)</li> </ul>
National survey NHANES III 1988 – 1994 n= 1890 Ages 12 – 16 years	<ul style="list-style-type: none"> <li>▪ Height and weight measured</li> <li>▪ Diet by 24-hour recall</li> </ul>	<ul style="list-style-type: none"> <li>▪ Participants asked how often they eat breakfast; responses coded as rarely or never, some days, or every day</li> </ul>	<ul style="list-style-type: none"> <li>▪ In adolescents with at least 1 obese parent, eating breakfast everyday was associated with an increased odds of having a healthful weight (based on BMI) compared with rarely/never eating breakfast</li> <li>▪ OR= 3.99, 95% CI; 1.87 – 8.56 (p&lt;.001)</li> <li>▪ No association between breakfast and weight in children with normal weight parents or 2 obese parents</li> <li>▪ Analysis adjusted for sex, age, race, SES, parental weight, asthma diagnosis, water consumption, TV viewing, exercise, and energy intake</li> </ul>	<ul style="list-style-type: none"> <li>▪ Fiore et al. (2006)</li> </ul>

TABLE 2.2, continued

Non-US Studies			
<p>School based United Kingdom n= 6599 Ages 11 -13 years</p>	<ul style="list-style-type: none"> <li>▪ Height and weight measured</li> <li>▪ Diet by health questionnaire</li> </ul>	<ul style="list-style-type: none"> <li>▪ Breakfast intake assessed with the question, “Before going school, how often do you breakfast at home or at school breakfast club?”</li> <li>▪ Responses include every day, 3-4 days a week, 1-2 days a week, never/hardly ever</li> </ul>	<ul style="list-style-type: none"> <li>▪ Skipping breakfast sometimes or always are associated with an increased odds for overweight and obesity in girls and boys</li> <li>▪ OR range= 1.53 – 2.06</li> <li>▪ Analysis adjusted for socioeconomic circumstances, family type, height, pubertal stage, and age.</li> </ul> <p style="text-align: right;">▪ Harding et al. (2008)</p>
<p>School based Netherlands n= 25176 Ages 13 – 16 years</p>	<ul style="list-style-type: none"> <li>▪ Height and weight self-reported</li> <li>▪ Diet by health survey</li> </ul>	<ul style="list-style-type: none"> <li>▪ Frequency of breakfast intake per week assessed using 8 response categories ranging from having breakfast 0 to 7 days per week</li> </ul>	<ul style="list-style-type: none"> <li>▪ Skipping breakfast &gt;2days per week associated with increased odds for overweight</li> <li>▪ OR = 1.68, 95% CI; 1.43 – 1.97 (age 13-14 years) and OR = 1.32, 95% CI; 1.14 – 1.54 (age 15-16 years)</li> <li>▪ Analysis adjusted for gender, family situation, ethnic background, education level, smoking, alcohol intake and physical activity.</li> </ul> <p style="text-align: right;">▪ Croezen et al. (2007)</p>

TABLE 2.2, continued

<p>School based Netherlands n= 9050 Ages 11- 16 years</p>	<ul style="list-style-type: none"> <li>▪ Height and weight self-reported</li> <li>▪ Diet by questionnaire</li> </ul>	<ul style="list-style-type: none"> <li>▪ Breakfast consumption defined by 3 groups; eat breakfast daily, eat breakfast 1-6 times per week, and never eat breakfast.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Adolescent boys who never consumed breakfast and adolescent girls who ate breakfast 1-6 times per week had increased odds for overweight compared with those who ate breakfast every day</li> <li>▪ OR= 1.82, 95% CI; 1.17 – 2.82 (boys)</li> <li>▪ OR= 1.39, 95% CI; 1.04 – 1.86 (girls)</li> <li>▪ Analysis adjusted for age, ethnicity, and educational level</li> </ul>	<ul style="list-style-type: none"> <li>▪ Snoek et al. (2007)</li> </ul>
<p>National survey Australia n= 3007 Ages 2 – 18 years</p>	<ul style="list-style-type: none"> <li>▪ Height and weight measured</li> <li>▪ Diet by 24-hour diet recall</li> </ul>	<ul style="list-style-type: none"> <li>▪ Participants asked, “How many days per week do you usually have something to eat at breakfast?”</li> <li>▪ Breakfast consumers defined as those eating breakfast ≥ 5 days per week</li> </ul>	<ul style="list-style-type: none"> <li>▪ No difference in BMI between skippers and consumers</li> <li>▪ No adjustment for confounding factors</li> </ul>	<ul style="list-style-type: none"> <li>▪ Williams (2007)</li> </ul>

TABLE 2.2, continued

<p>University hospital (obesity unit) Sweden n= 474 Ages 16 – 17 years</p>	<ul style="list-style-type: none"> <li>▪ Body fat percentage measured using BodPod Body Composition System</li> <li>▪ Diet by questionnaire</li> </ul>	<ul style="list-style-type: none"> <li>▪ Participants asked how many times per week they normally eat breakfast; responses included never, 1-4 times, 5-6 times, or daily</li> </ul>	<ul style="list-style-type: none"> <li>▪ Breakfast frequency was not associated with body fat percentage</li> </ul>	<ul style="list-style-type: none"> <li>▪ Vagstrand et al. (2007)</li> </ul>
<p>National survey New Zealand n= 3275 Ages 5 – 14 years</p>	<ul style="list-style-type: none"> <li>▪ Height and weight measured</li> <li>▪ Diet by interview</li> </ul>	<ul style="list-style-type: none"> <li>▪ Participants asked, “Over the past week, did you eat or drink something before you left home for school in the morning?”</li> <li>▪ Responses included yes, usually; yes, sometimes; and no</li> </ul>	<ul style="list-style-type: none"> <li>▪ Children usually eating breakfast at home has a lower mean BMI (p=.002)</li> <li>▪ Analysis adjusted for age, sex, ethnicity, SES, and physical activity</li> </ul>	<ul style="list-style-type: none"> <li>▪ Utter et al. (2007)</li> </ul>
<p>School based Taiwan n= 1609 Grades 7 - 12</p>	<ul style="list-style-type: none"> <li>▪ Height and weight self-reported</li> <li>▪ Diet by self-administered questionnaire</li> </ul>	<ul style="list-style-type: none"> <li>▪ Breakfast defined as mean taken before 9.00 a.m. each weekday; irregular breakfast consumption defined as having breakfast ≤ 3 days from Monday to Friday</li> </ul>	<ul style="list-style-type: none"> <li>▪ Irregular breakfast consumption associated with increased odds of being overweight</li> <li>▪ OR= 1.51, 95% CI; 1.12 – 2.04</li> <li>▪ Analysis adjusted for parents’ availability and education level, gender, perceived health status, school level and Gender × School level</li> </ul>	<ul style="list-style-type: none"> <li>▪ Yang et al. (2006)</li> </ul>

TABLE 2.2, continued

<p>National survey (enKid Study) Spain n= 3534 Ages 2 -24 years</p>	<ul style="list-style-type: none"> <li>▪ Height and weight measured</li> <li>▪ Diet by 24-hour recall and food frequency questionnaire</li> </ul>	<ul style="list-style-type: none"> <li>▪ Regular breakfast consumption categorized as no; sometimes; yes</li> </ul>	<ul style="list-style-type: none"> <li>▪ Regular breakfast consumption had a protective effect on obesity compared with no breakfast</li> <li>▪ OR= 0.73, 95% CI: 0.32 – 0.94 for ages 2 – 13 years; OR=0.64. 95% CI: 0.37 – 0.88 for ages 14 – 24 years</li> <li>▪ Analysis adjusted for age, gender, geographical region, mother’s education level, and family SES</li> </ul>	<ul style="list-style-type: none"> <li>▪ Serra-Majem et al. (2006)</li> </ul>
<p>Sports camp participants Italy n= 1202 Ages 6 – 14 years</p>	<ul style="list-style-type: none"> <li>▪ Height and weight measured</li> <li>▪ Diet by self-administered questionnaire</li> </ul>	<ul style="list-style-type: none"> <li>▪ Participants asked whether, when, where, how and with whom they consumed breakfast during weekdays and weekend</li> <li>▪ Skipping is defined as eating breakfast &lt;3 times per week</li> </ul>	<ul style="list-style-type: none"> <li>▪ A higher percentage of children who skipped breakfast were overweight or obese compared with children who ate breakfast (p&lt;.04)</li> <li>▪ No adjustment for confounding factors</li> </ul>	<ul style="list-style-type: none"> <li>▪ Vanelli et al. (2005)</li> </ul>
<p>School and community based Canada n= 180 (males) Ages 14 – 18</p>	<ul style="list-style-type: none"> <li>▪ Height and weight measured</li> <li>▪ Diet by 3-day food record</li> </ul>	<ul style="list-style-type: none"> <li>▪ Breakfast determined as a frequency of consuming breakfast over 3 days (ie, breakfast on none, 1, 2, or 3 days)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Adolescents consuming breakfast all 3 days of the survey had a lower BMI and were less frequently classified as overweight versus adolescents skipping breakfast at least 1 day (p&lt;.0008)</li> <li>▪ No adjustment for confounding factors</li> </ul>	<ul style="list-style-type: none"> <li>▪ Stockman et al. (2005)</li> </ul>

years				
<ul style="list-style-type: none"> <li>▪ Studies published between 2005 and 2008</li> <li>▪ BMI, body mass index</li> <li>▪ CI, confidence interval</li> <li>▪ NHANES, National Health and Nutrition Examination Survey</li> <li>▪ OR, odds ratio</li> <li>▪ SES, socioeconomic status</li> </ul>				

Source: Rampersaud (2009)

TABLE 2.2: Cross-sectional studies evaluating body weight characteristics in adolescents who consume or skip breakfast.

## 2.3 Obesity

Overweight and obesity are defined as abnormal or excessive fat accumulation that presents a risk to health (WHO, 2013a). The body mass index (BMI) is used as the crude population measurement of obesity. It is a simple index of weight-for-height that is commonly used to clarify overweight and obesity. BMI can be calculated by dividing a person's weight in kilograms with the square of his height in meters ( $\text{kg}/\text{m}^2$ ). WHO further defined a BMI greater than or equal to 25 as overweight and a BMI greater than or equal to 30 as obesity. The BMI has served as the most used measurement of overweight and obesity in population-level. However, BMI may not correspond to the same degree of fatness in different individual, and BMI should be considered as a rough guide. (WHO, 2013a).

Overweight and obesity has been an epidemic problem globally. As in 2011, overweight occurred in more than 40 million children under the age of five. Traditionally, overweight and obesity was thought to be a high-income country problem. However, this rapidly-increase problem has now on the rise in low- and middle- income countries, especially in urban setting areas. Being overweight and obesity has become a risk factors for development of non communicable diseases, such as cardiovascular diseases, diabetes, musculoskeletal disorders and some cancers (endometrial, breast, and colon) (WHO, 2013a). A study by Azmi et al. (2009) on a nationally representative sample involving 5000 adults in the Malaysian Adults Nutrition Survey (MANS) reported a 12.7% prevalence of obesity in Malaysia. On the other hand, the Third National Health and Morbidity Survey (NHMS III) conducted in 2006 also reported the prevalence of obesity of 14.0% in Malaysia. Both of the investigations indicate obesity prevalence has increased approximately three times the level of 4.4% found in 1996 Second National Health

and Morbidity Survey, NHMS II (Noor Safiza et al., 2008). Another study by Lekhraj Rampal et al. (2007) reported overall prevalence of obesity to be at 12.3%. This rate had increased when compared to the obesity prevalence in adults aged 18 years and above, reported in the NHMS II 1996 (4.4%). It was also found that the prevalence of obesity in Malaysia in 2004 was 280% higher than that in 1996. During that time, Malaysia's obesity prevalence was lower as compared to the United States (20.9%) but higher in France (7%) and United Kingdom (9%).

This staggering increase in the prevalence of obesity in Malaysia shows that this problem must be tackled from a younger age in children and adolescence. Obesity among adolescents were increasing rapidly across the global (Doll et al., 2002; Wang et al., 2002), which may persist into adulthood obesity as suggested by several studies previously (Singh et al., 2008). A study carried out by Moy et al. (2004) have found that the prevalence of overweight among the adolescents and school children in Kuala Lumpur was 7.3%, with the youngest group of 11 years old had the highest prevalence. It was further reported that 7.5% of the boys and 7.1% of the girls were overweight when the data was disaggregated by gender. Another study in Kuala Selangor also found that the overall prevalence of obesity among school children was 7.2%, with the highest among Malays (9.3%) followed by the Chinese (6.6%) and Indians (3.0%) (Sumarni et al., 2006).