UNIVERSITI PUTRA MALAYSIA

FACTORS ASSOCIATED WITH BODY WEIGHT STATUS AMONG STUDENTS IN A MALAYSIAN PRIVATE UNIVERSITY

SALMA KAMALELDIEN ALI MAHGOUB

FPSK(M) 2016 12

FACTORS ASSOCIATED WITH BODY WEIGHT STATUS AMONG STUDENTS IN A MALAYSIAN PRIVATE UNIVERSITY

By

SALMA KAMALELDIEN ALI MAHGOUB

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements for the Degree of Master of Science

May 2016

Abstract of thesis is presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the Degree of Master of Science

FACTORS ASSOCIATED WITH BODY WEIGHT STATUS AMONG STUDENTS IN A MALAYSIAN PRIVATE UNIVERSITY

By

SALMA KAMALELDIEN ALI MAHGOUB

May 2016

Chairman : Associate Professor Hazizi Abu Saad, PhD
Faculty : Medicine and Health Sciences

Ranking the highest for prevalence of overweight and obesity in South East Asia, Malaysia has a great urgency in responding to the obesity epidemic. This study aimed to determine the predictors of body weight status among students in one of the private university in Malaysia. This was a cross-sectional study conducted among students in Infrastructure University Kuala Lumpur (IUKL) (N=281), between February to April 2015. Data was gathered using questionnaire consisted of seven sections: socio-demographic characteristics, physical activity, environmental factors, emotional eating factors, sleeping quality, weight-control behaviors and a 24-hours recall dietary intake. Weight, height, body mass index (BMI), and waist circumference were measured to determine the body weight status. Chi-square and independent t-test as well as logistic regression were used to determine the predictors of body weight status. It was found that 28.1% of the respondents were overweight and 7.5% were obese while 32.0% at risk of abdominal obesity, making the overall obesity in the range of 32.0% – 35.6%. The prevalence of both overweight/obese significantly differed with transports related (p=0.029) and recreational related PA (p=0.010), easy access to transit (0.013), eating less carbohydrate food (p=0.027) and fat adequacy (p=0.040). Abdominal obesity on the other hand, significantly differed with transports related PA (p=0.029), safety to walk at night (p=0.044), change in type of food eaten (p=0.028), intake of appetite suppressants (p=0.021) and liquid diets (p=0.014), increased cigarette smoked (p=0.007) as well as use of laxatives or enemas (p=0.045). Both the overweight/obesity and abdominal obesity status also differed significantly with problems to control eating certain food (p=0.026 vs p=0.047), fasting (p=0.032 vs 0.032) and energy under-reporting (p=0.030 vs p=0.003). Multiple logistic regression analysis showed that the risk of being overweight/obese was significantly higher among respondents who were of older age (AOR=5.66), did not perform vigorous recreational related PA (AOR=1.94), live in neighborhood that did not maintain sidewalks (AOR=2.97), had moderately worse sleep efficiency (AOR=2.51), always could not control their diet after night work (AOR=2.69) and sometimes as well as generally give up diet and eat again without control, especially fattening food (AOR=3.05 vs 3.14). However, the risk was reduced about 50% among respondents

who sometimes eat less carbohydrate food (AOR=0.56). Meanwhile, the risk of abdominal obesity was significantly higher among respondents from lowest income group (AOR=4.71), those who did not perform vigorous recreational related PA (AOR=2.00), under-report energy (AOR=2.80), always reduce the amount of food (AOR=3.81) and sometimes as well as always on liquid diets (AOR= 3.47 vs 9.70). In contrast, the risk was lower about 86-87% among those who always perform fasting and consume appetite suppressants (AOR=0.14 vs 0.13). Overweight/obese status model explained 23.3% of the variation while that of abdominal obesity was 37.2%. This study provides evidence supporting the significant relationship between several environmental factors, emotional eating factor, sleep quality, weight control behavior and energy intake with overweight/obese and abdominal obesity risk. Vigorous recreational related PA was negatively associated with overweight/obesity as well as abdominal obesity which reiterate previously published information.

Key words: Obesity, Overweight, Physical Activity, Environment Factors, Emotional Eating, Weight Control Behavior, Sleep Quality, Energy Intake

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Sarjana Sains

FAKTOR-FAKTOR YANG BERKAITAN DENGAN STATUS BERAT BADAN DI KALANGAN PELAJAR DI UNIVERSITI SWASTA MALAYSIA

Oleh

SALMA KAMALELDIEN ALI MAHGOUB

Mei 2016

Pengerusi : Profesor Madya Hazizi Abu Saad, PhD
Fakulti : Perubatan dan Sains Kesihatan

Sebagai sebuah negara yang mempunyai kadar berat badan berlebihan dan obesiti yang tertinggi di Asia Tenggara, Malaysia mempunyai desakan yang besar untuk bertindak balas terhadap epidemik obesiti tersebut. Kajian ini telah dijalankan untuk menentukan peramal status berat badan dalam kalangan pelajar di salah sebuah universiti swasta di Malaysia. Ini adalah satu kajian keratan rentas yang dijalankan dalam kalangan pelajar Universiti Infrastruktur Kuala Lumpur (IUKL) (N=281), dari tempoh Februari hingga April 2015. Data telah diperoleh dengan menggunakan borang soal selidik yang terdiri daripada tujuh bahagian: ciri-ciri sosio-demografi, aktiviti fizikal, faktor persekitaran, faktor pemakanan beremosi, kualiti tidur, tingkah laku megawal berat badan dan pengambilan makanan ingatan 24-jam. Berat badan, ketinggian, indeks jisim badan (IJB), dan lilitan pinggang telah diukur untuk menentukan status berat badan. Ujian khi kuasa dua dan ujian-t tak bersandar serta regresi logistik telah digunakan untuk mengenalpasti peramal status berat badan. Kajian ini telah mendapati bahawa sejumlah 28.1% responden mempunyai berat badan berlebihan dan 7.5% adalah obes serta 32.0% mempunyai risiko obesiti abdomen, menjadikan obesiti keseluruhan antara 32.0% – 35.6%. Status berat badan berlebihan/obesiti berbeza dengan signifikan antara aktiviti fizikal berkaitan dengan pengangkutan (p=0.029) serta rekreasi (p=0.010), akses mudah ke transit (p=0.013), kurang memakan makanan berkarbohidrat (p=0.027) dan kecukupan lemak (0.040). Obesiti abdomen pula berbeza dengan aktiviti fizikal berkaitan dengan pengangkutan (p=0.010), persepsi terhadap keselamatan untuk berjalan pada waktu malam (p=0.044), mengubah jenis makanan yang dimakan (p=0.028), pengambilan penahan selera (p=0.021) dan diet cecair (p=0.014), peningkatan kadar merokok (p=0.007) serta penggunaan julap atau enema (p=0.045). Kedua-dua status berat badan berlebihan/obesiti dan obesiti abdomen juga berbeza dengan masalah untuk mengawal makan makanan tertentu (p=0.026 vs p=0.047), tabiat berpuasa (p=0.032 vs 0.032) and kurang melapor tenaga (p=0.030 vs p=0.003). Analisis regresi logistik pelbagai menunjukkan bahawa risiko berat badan berlebihan/obesiti adalah tinggi dalam kalangan responden yang beumur lebih 28 tahun (AOR=5.66), tidak melakukan aktiviti fizikal berekreasi cergas (AOR=1.94), tinggal di kejiranan yang tidak

menyelenggara lorong pejalan kaki (AOR=2.97), mempunyai keberkesanan tidur yang sederhana teruk (AOR=2.51), selalu tidak dapat mengawal diet selepas kerja malam (AOR=2.69) dan kadang-kadang serta umumnya menyerah diet dan memakan semula tanpa kawalan, terutamanya makanan berlemak (AOR = 3.05 vs 3.14). Namun, risiko adalah rendah sebanyak 50% dikalangan responden yang kadang-kadang mengurangkan makanan yang tinggi karbohidrat (AOR=0.56). Sementara itu, risiko obesiti abdomen adalah tinggi dikalangan mereka yang berasal dari keluarga berpendapatan rendah, < RM2000 (AOR=4.71), tidak melakukan aktiviti fizikal berekreasi cergas (AOR=2.00), kurang melapor tenaga (AOR=2.80), selalu mengurangkan jumlah makanan (AOR=3.81) dan kadang-kadang serta selalu mengambil diet cecair (AOR= 3.47 vs 9.70). Sebaliknya, risiko adalah lebih rendah kira-kira 86-87% dalam kalangan mereka yang sentiasa berpuasa dan mengambil penahan selera (AOR=0.14 vs 0.13). Model status berat badan berlebihan/obesiti menjelaskan 23.3% daripada variasi manakala bagi obesiti abdomen adalah 37.2%. Kajian ini memberikan bukti yang menyokong hubungan signifikan antara beberapa faktor persekitaran, pemakanan beremosi, kualiti tidur, tingkah laku mengawal berat badan dan pengambilan tenaga dengan risiko berat badan berlebihan/obesiti dan obesiti abdomen. Aktiviti fizikal berekreasi cergas berhubungkait secara negatif dengan berat badan berlebihan/obesiti dan juga obesiti abdomen, mengulangi maklumat yang diterbitkan sebelum ini.

Kata kunci: Obesiti, Berat Badan Berlebihan, Aktiviti Fizikal, Faktor Persekitaran, Pemakanan Beremosi, Kelakuan Mengawal Berat, Kualiti Tidur, Diet, Pengambilan Tenaga

ACKNOWLEDGEMENTS

I would like to gratefully acknowledge the supervision of Associate Professor Dr. Hazizi Abu Saad during the duration of this project. I thank Prof. Amin Ismail and Associate Professor Dr. Rosita Jamaluddin for the help they offered this research and I would also like to thank and acknowledge the help of Ms. Selvi Salome, and the management of IUKL for their support and the arrangement of the data collection for this research. In addition, I would like to thank and acknowledge the help of Salami Oladeji Dikko for their assistance during the data collection - at all times. I am grateful to everyone who helped me from Infrastructure University from the first day to the last day during my data collection.

Finally, I am forever indebted to my parents and my brother for the support they gave me and for being my inspiration to continue during my difficult times. I am also grateful to the ethics committee of Universiti Putra Malaysia for the flexibility and the help they gave me during my study.

This thesis was submitted to the Senate of the Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follow:

Hazizi Abu Saad, PhD
Associate Professor
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Chairman)

Rosita Jamaluddin, PhD
Associate Professor
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Member)

BUJANG BIN KIM HUAT, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

Declaration by graduate student

I hereby confirm that:

- this thesis is my original work;
- quotations, illustrations and citations have been duly referenced;
- this thesis has not been submitted previously or concurrently for any other degree at any institutions;
- intellectual property from the thesis and copyright of thesis are fully-owned by Universiti Putra Malaysia, as according to the Universiti Putra Malaysia (Research) Rules 2012;
- written permission must be obtained from supervisor and the office of Deputy Vice-Chancellor (Research and innovation) before thesis is published (in the form of written, printed or in electronic form) including books, journals, modules, proceedings, popular writings, seminar papers, manuscripts, posters, reports, lecture notes, learning modules or any other materials as stated in the Universiti Putra Malaysia (Research) Rules 2012;
- there is no plagiarism or data falsification/fabrication in the thesis, and scholarly integrity is upheld as according to the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) and the Universiti Putra Malaysia (Research) Rules 2012. The thesis has undergone plagiarism detection software

Signature: _____ Date: _____

Name and Matric No: Salma Kamaleldien Ali Mahgoub, GS36358

Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) were adhered to.

Signature: _____
Name of Chairman of Supervisory Committee: Associate Professor Dr. Hazizi Abu Saad

Signature: _____
Name of Member of Supervisory Committee: Associate Professor Dr. Rosita Jamaluddin

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

BMI	Body Mass Index
BMR	Basal Metabolic Rate
BRFSS	Behavioral Risk Factor Surveillance System
CDCP	Centers for Disease Control and Prevention
CI	Confidence Interval
EEQ	Emotional Eating Questionnaire
EI	Energy Intake
IDF	International Diabetes Federation
IUKL	Infrastructure University of Kuala Lumpur
LTPA	leisure-time Physical Activity
MET	Metabolic Equivalent
NHIS	National Health Interview Survey
NHMS	National Health and Morbidity Survey
OECD	Organization for Economic Co-operation and Development
OR	Odds Ratio
RNI	Recommended Nutrient intake
VLED	Very Low Energy Diet
WC	Waist Circumference
WCBS	Weight- control Behavior Survey
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

1.1 Background

The occurrence of obesity and overweight status in the population has caught public attention. This is in line with the World Health Organization's concern. According to the World Health Organization (WHO), overweight and obesity status are defined as the abnormal or excessive fat accumulation that can be a risk factor for many diseases. Worldwide, a minimum of 2.8 million people die every year as a consequence of being obese or overweight such as cardiovascular disease and diabetes (World Health Organization, 2013).

Body Mass Index (BMI) is an index of weight for height. It is a simple measurement that is commonly used to classify whether an adult is normal in weight, underweight, overweight, or obese. BMI can be calculated by the weight in kilograms (kg) divided by the square of the height in meters (kg/m^2). WHO defines an adult with BMI of 25 kg/m^2 or above as overweight and obese if the BMI is 30 kg/m^2 or above. Adults with BMI of 40 kg/m^2 or more are considered to be extremely obese. In 2014, 39% of adults, 18 years and older were overweight (38% of men and 40% of women), and 13% were obese (11% of men and 15% of women). This shows that almost 2000 million adults worldwide are overweight and out of these over 600 million were obese (WHO, 2015).

In 2008, 35% of adults of age 20 years old and above were overweight; out of that, 34% were men and 35% were women. Prevalence of obesity had almost doubled between 1980 and 2008. Thirty five percent of adults aged 20 and over were overweight in 2008, and 11% were obese (World Health Organization, 2013). In 2007-2008 in the United States, the prevalence of obesity was 32.2% among adult men (20 years and older) and 35.5% among adult women (Flega, Carroll & Ogden, 2010).

In Lebanon, the prevalence of overweight was stable from 1997 to 2009 for adults (20 years and above; it was 37% in 1997 versus 36.8% in 2009. However, the same study showed that obesity was increased in 2009 at 28.2% versus 17.4% in 1997 (Nassreddin, Naja, Chamieh, Adra, Sibai, and Hwallah, 2012). Kuwait has the highest level of obesity in the world. With a population of 2.5 million; 75% of Kuwait population is obese. In a study conducted in Kuwait University among youth, the prevalence of obesity and overweight was estimated to be 93.4%. Increasing consumption of fast foods and candy and decrease in the consumption of fruits and vegetables were shown to be some of the main factors leading to obesity (El-Ghazali, Ibrahim, Kandari & Ismail, 2010). Overweight and obesity prevalence had increased rapidly in the last few years in Asian countries (Aekplakorn et al., 2014).

The Western Pacific and East Asia region are facing epidemic diseases associated with overweight and obesity status such as CVD and diabetes; India has the highest rate of diabetes followed by China (Yoon et al., 2006). Several factors may influence weight gain and cause obesity and overweight status. The basic cause of obesity is energy imbalance between calories consumed and calories expended; this can be categorized under behavioral factors such as eating habits and physical inactivity. Eating food with high fat content, energy dense food and physical inactivity can cause weight gain and therefore contribute to obesity and overweight condition. Understanding of the relative importance of over consumption along with physical inactivity may help to prevent and reduce the prevalence of obesity and overweight condition among the population.

In a study conducted in five different regions in Peninsular and East Malaysia, the prevalence of obesity was found to be 19.5% (95% CI= 18.3, 20.7) and that of overweight status was 33.6% (95% CI= 32.2, 35.0); the prevalence of obesity were found to be higher among female (22.5%, 95% CI=20.9, 24.0) than male (14.1%, 95% CI=12.3, 15.9). In addition, it was found that the prevalence of obesity was highest among ethnic Indians (24.6%, 95% CI=20.3, 29.3), followed by the Malays (23.2%, 95% CI=21.6, 24.8%) and lowest among the Chinese (8.2%, 95% CI=6.2, 10.6) (Mohamud et al., 2011). In a cross sectional study aimed at determining the prevalence and factors associated with overweight and obesity status among 945 post-graduate Malaysian students in a public university, information such as socio-demographic, smoking, level of physical activity, drug history, and alcohol intakes were obtained using self-administered questionnaires. The prevalence was 23.1% (95% CI: 20.4%, 25.8%) for overweight and 23.1% (95% CI: 20.4%, 25.8%) for obesity status (Kabir, Md Said, & Ismail, 2014).

Genetic makeup factors have been shown to play an important role in developing obesity. Ball, Lamb, Travaglini & Ellaway (2012) in their study reported that 34% of their study respondents develop obesity due to genetic makeup. Examples of such cases are Bradet-Biedl Syndrome and Prader-Willi Syndrome. In some cases, multiple genes may increase one's susceptibility for developing severe obesity by showing a complex pattern of segregation. This condition may result due to polymorphisms in obesity related genes such as Leptin or Adiponectin where these changes might be involved in obesity development and its related complications. Leptin and Adiponectin act as inflammatory markers that are mainly secreted by adipose tissues, involved in energy balance and suspected to play a role in the pathways linking adiposity to impaired glucose and insulin homeostasis. Decreased Leptin and increased Adiponectin in adipose tissue could lead to higher degree of obesity and pro-inflammatory state. Other than that outside factors such as abundant food supply or little physical activity make the situation worse. Obesity is highly influenced by genetics, available data suggest that 40% to 77% of the observed variance in human body weight can be accounted for by inherited factors (Farooqi, 2005; O'Rahilly and Farooqi, 2008; Llewellyn et al., 2008). Obesity also has environmental causes, our genetic endowments have changed minimally during the last 40 years, yet the prevalence of childhood obesity has tripled in US (Ogden et al., 2008), and significantly increased world- wide (Onis et al., 2004). Human obesity gene map in the latest update reported 127 candidate genes for obesity related traits. Results of large-scale studies suggest that obesity is strongly associated with genetic variants in

the melanocortin-4 receptor (MC4R) gene, adrenergic β3 receptor (ADRB3) gene, leptin gene, brain-derived neurotro- phic factor (BDNF) gene, prohormone convertase 1 (PCSK1) gene, and endocannabinoid receptor 1 (CNR1) gene (Bochukova et al., 2010; Perrone et al., 2010). A combination of gene mutations, deletions and single nucleotide polymorphisms are all known to contribute to obesity. Most cases are polygenic, the result of multiple genes interacting with a shifting environment. Each "obesity gene" only makes a small contribution to phenotype, but collectively, inherited genetic variations play a major role in determining BMI and how the body maintains a balance between nutrition and physical activity. While obesity is most commonly associated with polygenic inheritance, there are other instances in which the cause is monogenic or syndromic. Monogenic obesity typically is caused by a single gene mutation with severe obesity as the main symptom. Syndromic obesity, on the other hand, has many characteris- tics, of which obesity is one symptom (Stein et al., 2011).

Environmental factors or what can be called 'Obesogenic environment' which is defined in general as the sum of influences that the surroundings have on promoting obesity in populations, such as availability of junk food, restaurants, side walk stalls, role of media in food advertisement, and the usage of cars or public transportation over walking or cycling. Environmental factors were shown to be the main reason that leads to the obesity epidemic. Obesity develops when there is a positive imbalance between energy intake and energy expenditure, but the relative contributions of these factors are poorly understood. A research has suggested that when environmental factors are modified to support healthy behaviors in individuals, more individuals engage in those behaviors (Townshend, 2009).

Some other factors such as socio-demographic factors (age, marital status, income, and educational level), diseases such as Cushing's disease and polycystic ovary syndrome, and drugs like steroids and some antidepressants may also cause weight gain and contribute to obesity and overweight status (Center for Disease Control and Prevention, 2001). Overweight and obesity status are risk factors for developing type-2 diabetes, heart diseases, high blood pressure, stroke, non-alcoholic fatty liver disease (excess of fats and inflammation in the liver of people who drink little or no alcohol), osteoarthritis (a health problem causing pain, swelling, and stiffness in one or more joints), and some types of cancers like breast, colon, endometrial and kidney cancers.

Excess body fat increases the risk of death and major comorbidities such as type-2 diabetes, hypertension, dyslipidemia, cardiovascular disease, osteoarthritis of the knee, sleep apnea, and some cancers (Swinburn, Caterson, SeideII & James, 2004).

An increase in the level of visceral or intra-abdominal fat independent of BMI, can lead to metabolic derangements and cardiovascular diseases (Janssen, Katzmarzyk & Ross, 2004). Prevention of weight gain had been suggested to be an important strategy in the prevention of obesity and overweight status in people. It was found that online computer-tailored weight management intervention was effective in the stabilization of weight and improvement in dietary intake, but not effective in preventing weight

gain or modifying dietary and physical activity behaviour (Genugten, Empelen, Boon, Borsboom, Visscher & Oenema, 2012).

The simple understanding of achieving and maintaining a healthy weight is not about short-term diet changes but is a life-style modification that includes healthy eating, regular physical activity, and balancing the intake of calories a person consumes with the number of calories that the body uses. Maintaining healthy weight will lead to better health now for the person for the present and future as he or she is getting older in age (CDC, 2011). Modification in lifestyle such as changing eating habits, dietary intake, exercising regularly and other behaviors is a great weight-loss strategy not only for short- term weight loss, but also long-term benefit; developing a healthy weight can greatly improve the health status. Lifestyle modifications are generally the recommended first approach to weight loss, as recommended by The National Institutes of Health (NIH) weight loss guidelines for obese people with a BMI of ≥ 30 kg/m^2 and for overweight people with (BMI 25-29.9 kg/m^2) with two or more obesity-related comorbidities (National Institutes of Health, 2010).

The National Weight Control Registry provides information about strategies that can be used successfully for long-term weight-loss maintenance. Members in National Weight Control Registry lost an average of 33 kg and successfully maintain this loss for five years. It was mentioned that they used high-level of physical activity (approximately 1 hour per day), eating low calories, low fat diet, eating breakfast regularly, self-monitoring weight, and maintaining a consistent eating pattern across the week. Those strategies were successful not only for maintaining healthy weight but also as interventions for weight loss (Wing & Phelan, 2005).

1.2 Statement of the problem

Obesity and overweight status have reached an epidemic proportion throughout the globe where the incidence of obesity accelerate from 200 million to 300 million in just 5 years, and this is found in populations in many Asian countries. Although Asian countries have the lower obesity and overweight prevalence worldwide compared to Western countries, they are facing an alarming increase in the rate of obesity and overweight status in recent years. The boom in cultural factors and economic development are commonly cited. Knowledge about the shift in obesity and overweight pattern is important for supporting this increasingly common risk group.

Malaysia has been experiencing a rapid level of urbanization and industrialization in recent decades. This growth has often been recognized as a role model for developing economies. In the last two decades, statistics available from several Ministries have suggested that as the population achieves affluence, there were surges in sugar and fat energy intake, as reflected in the rising and now substantial food importation bills. Global eating habits of the 'westernization' associated with economic growth brought about an increase in the number of fast-food outlets in Malaysia during the 1990s (Ismail, 2002).

The prevalence of obesity has reached epidemic level in Malaysia. Among South East Asian countries, Malaysia was reported with highest prevalence of both obesity and overweight. Meanwhile Malaysia was at 6th rank of underweight/obesity incidence among Asian countries in 2015. According to the Malaysian National Health and Morbidity Survey (NHMS), the number of obese and overweight adult males increased from 20.1% and 4.0% respectively in 1996 to 29.7% and 10.0% respectively in 2011. In 2006, prevalence of obesity was found to be higher among adult females, from 7.6% in 1996 increasing to 17.4% in 2006 (IPH and NHMS III, 2006). A very recent report from NHMS in 2015, revealed that the prevalence of obesity increased dramatically within few years in Malaysia, where 33.4% (5.6 million) where diagnosed as pre-obese and 30.6% (5.7 millions) was obese. Furthermore, in Malaysia, 47.9% of both sexes were overweight or obese, with around 51.2% being females (WHO, 2012). Obesity is growing globally as a health concern in poor countries as well as the rich ones, carrying numerous health impacts behind it, such as increasing risk of cardiovascular diseases, mainly heart diseases and stroke (world's number one cause of death that kills 17 million people each year), type-2 diabetes, which still is a global epidemic, some cancers (such as endometrial, breast, and colon), and musculoskeletal disorders especially osteoarthritis. In estimation, 2.6 million people die each year as a consequence of being overweight or obese (Center for Disease Control and Prevention, 2012). Therefore it is recommended to the national obesity prevention program (at the community level) that it should find new strategies to prevent obesity occurrence from growing into a larger risk. Obesity has become a main health concern in Malaysia affecting all age groups and both sexes. Prevalence of overweight and obesity status in Malaysia (14%) is nearly triple that of China (5.7%), Japan (5%), and the Philippines (6.3%) and double that of Singapore (7.1%). This alarming increase in obesity rate in Malaysia cannot be ignored (WHO, NCD Country profile, 2011).

There are many factors associated with body weight status such as socio-demographic characteristics, physical activity level, environmental condition, psychosocial, sleeping pattern, dietary intake, and weight-control behaviors. Speedy development in Malaysia brought easier lifestyle in terms of having easier access to western fast food, transportation, and availability of cheap migrant labor. Westernization in food style, which most notably involves increase in the greater availability of food that is high in fats, sugar, and carbohydrates contribute to developing obesity and overweight status among population of Malaysia. Rapid development in the country increased the availability of cars, and greater use of mechanized home and farm appliances, widespread use of computers, televisions, and electronic gaming devices have encouraged a more sedentary lifestyle. These factors lead to greater accumulation of body fat. Food industries in Malaysia have been shown to carry part of the responsibility for the increasing rate of obesity and overweight status in Malaysia, and must start an intervention program by contributing and producing healthier food.

Malaysians themselves need to change their eating behavior and practices and learn to make healthy eating choices a way of life (Mohamud et al, 2011). Social Cognitive Theory (SCT) which developed by Albert Bandura from Health Belief Models is an interpersonal level theory that focuses on three basic points: personal factors, environmental factors, and behaviors factors. Albert Bandura developed the Social

Cognitive Theory based on the concept of learning is affected by cognitive, behavioral, and environmental factors (Bandura, 1991). In contrast to the traditional psychological theories that emphasized learning through direct experience, Bandura suggested that virtually all learning phenomena can occur by observing other people's behavior and consequence of it (Bandura, 1986), and he suggested that the process of observational learning was governed by four key aspects: attention, retention, reproduction, and motivation. Attention is a process in which people will selectively observe and extract information from the ongoing modeled activities (Wood & Bandura, 1989). Retention involves a process of "transforming and restructuring information in the form of rules and conceptions" and store the information into memory. Reproduction is the act of performing the actual behavior that was observed. The fourth aspect concerns motivation which propels the learner to attention, practice and retention. SCT suggests that human behavior is the product of a dynamic interplay between personal, behavioral, and environmental influences. Although it recognizes how environments shape behavior, this theory focuses on the potential or abilities of individuals to alter and construct environments to suit purposes they devise for themselves (Tan, 2009). In addition to an individual's capacity to interact with their environment, SCT emphasizes the human capacity for collective action. This study attempts to find out factors contributing to overweight and obesity status among youths so that it will not be carried over to adulthood and consequently to their future generation. Preventing youths from overweight and obesity status will help them to be more health conscious when they get older and to prevent their children from having the same problem. In addition, the attempt to find out obesity predictors among socio-demographic, environmental, dietary intake, physical activity, weight-control behaviors, sleeping, and contributing emotional factors may prevent the community from devolving overweight and obesity issues. Knowing the prevalence of obesity among the population will help us to know the severity of the problem, and to reduce health costs associated with the overweight and obesity problems.

1.3 Importance of the study

This study aimed to determine and observe the prevalence of obesity and overweight status, and factors associated with body weight status among students in IUKL. Association between body weight and socio-demographic, environmental factors, dietary intake, physical activity level, weight-control behavior, sleeping quality, and emotional eating factors among students can contribute toward furthering important researches to evaluate which factor has the most impact on body weight status among adults. Moreover, throughout this study, we can validate the meaningful results and findings on factors associated with body-weight status. We can see the differences in the effects of how each factor can influence body-weight status. Furthermore, by discussing the findings and reviewing other researches on factors associated with body weight status, significant intervention can be made to lower the risk of the population getting obese or overweight.

Results in this study can help to improve health of the population by health and lifestyle modification awareness. In addition, the findings of this study may support recommendation to the Ministry of Health and Community Health Programs in Malaysia to develop more weight control and loss behaviors programs among all age

groups in Malaysia, and to prevent the prevalence of obesity and overweight status and their health consequences.

1.4 Research questions

The following research questions guided the investigation made in this study:

1. What is the body weight status (overweight/ obesity and abdominal obesity) of students in Infrastructure University Kuala Lumpur (IUKL), Kuala Lumpur, Malaysia?

2. What is the association between socio-demographic, environmental conditions, dietary (energy and macronutrients intake), physical activity, weight control behaviors, sleeping quality, emotional eating factors and body weight status among the students?

3. What are the main predictors among socio-demographic, environmental condition, dietary intake, physical activity, weight control behaviors, sleeping quality, emotional eating factors associated body weight status among the students?

1.5 Objectives of the study

1.5.1 General objective:

To determine factors associated with body weight status among students in Infrastructure University Kuala Lumpur (IUKL), Kuala Lumpur, Malaysia.

1.5.2 Specific objectives:

1. To determine the body weight status (overweight/ obesity and abdominal obesity) of students in Infrastructure University Kuala Lumpur (IUKL).

2. To determine the association between socio-demographic, environmental, dietary (energy and macronutrients intakes), physical activity, weight control behaviors, sleeping quality, emotional eating factors and body-weight status among students in Infrastructure University Kuala Lumpur (IUKL).

3. To determine main predictors among socio-demographic, environmental condition, dietary intake, physical activity, weight control behaviors, sleeping quality, emotional eating factors associated with body-weight status among students in Infrastructure University Kuala Lumpur (IUKL).

1.6 Research hypotheses:

1. There is significant association between socio-demographic, environmental factors, dietary intake, physical activity level, weight control behaviors, sleeping quality and patterns, and emotional eating factor and body-weight status among students in Infrastructure University Kuala Lumpur (IUKL).

2. There are predictors among socio-demographic, environmental condition, dietary intake, physical activity, weight control behaviors, sleeping quality, emotional eating factors associated with body-weight status among students in Infrastructure University Kuala Lumpur (IUKL)

1.7 Conceptual framework

Figure 1.1 shows the conceptual framework of this study. This study covers two dependent variables related to body-weight status which are body mass index and waist circumference. In addition to that, it covers seven independent variables which consist of factors associated with body-weight status: socio-demographic, environmental factors, dietary intake, physical activity, weight control behaviors, sleeping quality, and emotional eating factors.

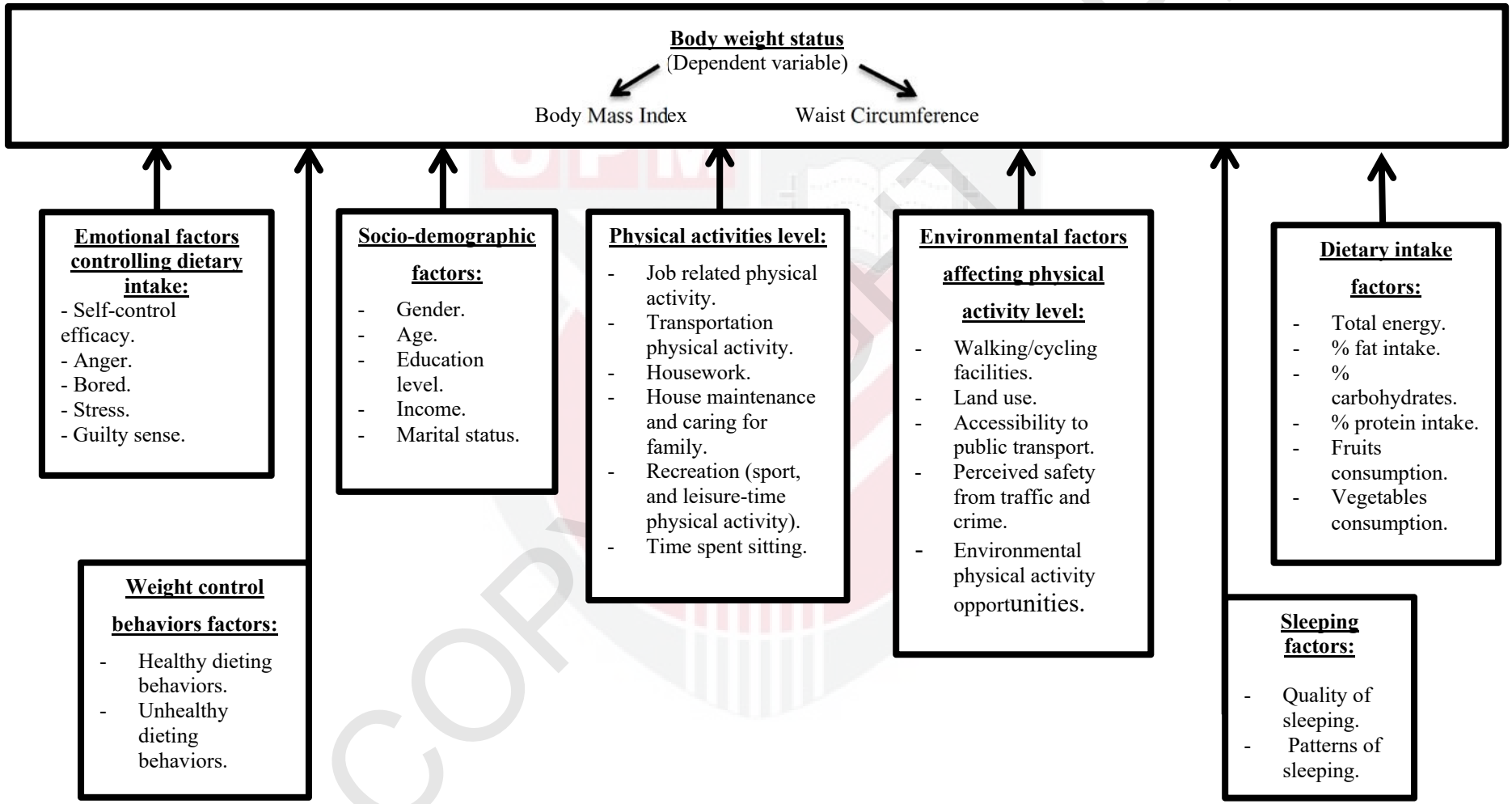

Figure 1.1 : Factors Associated with Body Weight Status among Students in Infrastructure University Kuala Lumpur (IUKL)

REFERENCES

Aekplakorn, W., Inthawong, R., Kessomboon, P., Sangthong, R., Chariyalertsak, S., Putwatana, P. and Taneepanichskul, S. (2014). Prevalence and Trends of Obesity and Association with Socioeconomic Status in Thai Adults: National Health Examination Surveys, 1991–2009. *Journal of Obesity* 2014(0): 1-8. doi:10.1155/2014/410259

Ahmed, F. and Siwar, C. (2013). Food Intake and Nutritional Status among Adults: Sharing the Malaysian Experience. *Pakistan J. of Nutrition Pakistan Journal of Nutrition* 12(11): 1008-1012. Retrieved from http://www.pjbs.org/pjnonline/ab2721.htm

Al-, S., Gha, H., Isa, Z. and Karim, N. (2014). Dietary Weight Loss Practice among Government Working Women Who Successfully Lose Weight in Malaysia. *Malaysian Journal of Public Health Medicine* 14(3): 81-87. Retrieved from http://www.mjphm.org.my/mjphm/journals/2014 - Volume 14 (3)/

Al-Baghli, N. A., Al-Ghamdi, A. J., Al-Turki, K. A., El-Zubaier, A. G., Al-Ameer, M. M. and Al-Baghli, F. A. (2008). Overweight and obesity in the eastern province of Saudi Arabia. *Saudi Medical Journal* 29(9): 1319-1325.

Alexander, A., Bergman, P., Hagströmer, M. and Sjöström, M. (2006). IPAQ environmental module; reliability testing. *Journal of Public Health* 14(2): 76-80.

Amiri, N., Talaei, M., Rabiei, K., Talaei, Z., Zolfaghari, B., Kabiri, P. and Sarrafzadegan, N. (2013). Physical activity, sex, and socioeconomic status: A population based study. *ARYA Atherosclerosis* 9(1): 51.

Armstrong, T. and Bull, F. (2006). Development of the world health organization global physical activity questionnaire (GPAQ). *Journal of Public Health* 14(2): 66-70.

Ashley, L., Jones, H., Velikova, G. and Wright, P. (2012). Cancer patients' and clinicians' opinions on the best time in secondary care to approach patients for recruitment to longitudinal questionnaire-based research. *Supportive Care in Cancer* 20(12): 3365-3372. DOI 10.1007/s00520-012-1518-4

Asuncion, K. (2012). The four steps to building an exercise habit. Retrieved from: http://www.pickthebrain.com/blog/the-4-steps-to-building-an-exercise-habit/

Atlantis, E., Barnes, E. and Ball, K. (2008). Weight status and perception barriers to healthy physical activity and diet behavior. 32(2), Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/17684508

Aziz, T., Finnegan, P. M., Lambers, H. and Jost, R. (2014). Organ-specific phosphorus-allocation patterns and transcript profiles linked to phosphorus efficiency in two contrasting wheat genotypes. *Plant, Cell & Environment* 37(4): 943-960.

Ball, K., Lamb, K., Travaglini, N. and Ellaway, A. (2012). Street connectivity and obesity in Glasgow, Scotland: impact of age, sex and socioeconomic position. *Health and Place* 18(6): 1307-1313.

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice-Hall

Bandura, A. (1991). Social cognitive theory of self-regulation. Organizational Behavior and Human Decision Processes. 50: 248--287. 10.1016/0749-5978(91)90022-L

Bauman, A. E., Reis, R. S., Sallis, J. F., Wells, J. C., Loos, R. J., Martin, B. W. and Lancet Physical Activity Series Working Group. (2012). Correlates of physical activity: why are some people physically active and others not? *The Lancet* 380(9838): 258-271.

Beccuti, G. And Pannain, S. (2011). Sleep and obesity. *Current Opinion in Clinical Nutrition & Metabolic Care* 14(4): 402–412. http://dx.doi.org/:10.1097/MCO.0b013e3283479109

Bellows, L. and Moore, R. (2013). Weight-Loss Products, Programs, and Diets. *Food and Nutrition Series Health.* Retrieved from http://extension.colostate.edu/docs/pubs/foodnut/09363.pdf

Berghöfer, A., Pischon, T., Reinhold, T., Apovian, C. M., Sharma, A. M. and Willich, S. N. (2007). Obesity prevalence from a European perspective: a systematic review. *BMC Public Health* doi: 10.1186/1471-2458-8-200

Bilsborough, S. and Mann, N. (2006). A review of issues of dietary protein intake in humans. *International Journal of Sport Nutrition and Exercise Metabolism 16*(2): 129.

Bochukova, E. G., Huang, N., Keogh, J., Henning, E., Purmann, C. and Blaszczyk, K. (2010). Large, rare chromosomal deletions associated with severe early-onset obe- sity. *Nature* 463(7281): 666-70

Bull, F. C., Maslin, T. S. and Armstrong, T. (2009). Global physical activity questionnaire (GPAQ): nine country reliability and validity study. *Journal of physical activity and health* 6(6): 790.

Cani, P. D., Osto, M., Geurts, L. and Everard, A. (2012). Involvement of gut microbiota in the development of low-grade inflammation and type 2 diabetes associated with obesity. *Gut Microbes* 3(4): 279-288. DOI:10.4161/gmic.19625

Carroll-Scott, A., Gilstad-Hayden, K., Rosenthal, L., Peters, S. M., McCaslin, C., Joyce, R. and Ickovics, J. R. (2013). Disentangling neighborhood contextual associations with child body mass index, diet, and physical activity: the role of built, socioeconomic, and social environments. *Social Science & Medicine* 95: 106-114.doi:10.1016/j.socscimed.2013.04.003

Center of Disease Control and Prevention (CDCP) (2015, May 15). *About Adult BMI*. Rerieved from https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/

Centers for Disease Control and Prevention. (2001). The Surgeon General's call to action to prevent and decrease overweight and obesity 2001. Retrieved from http://www.cdc.gov/nccdphp/dnpa/pdf/CalltoAction.pdf

Centers for Disease Control and Prevention. (2011, March). Adult overweight and obesity. Retrieved from http://www.cdc.gov/obesity/data/adult.html

Centers for Disease Control and Prevention. (2012, March). Adult overweight and obesity. Retrieved from http://www.cdc.gov/obesity/data/adult.html

Centers for Disease Control and Prevention. (2014, January 30). National health and nutrition examination survey. Retrieved from http://www.cdc.gov/nchs/nhanes.htm

Chair, J., Clark, K., Coleman, E., Donnelly, J., Foreyt, J., Melanson, E. and Volpe, S. (2001). Appropriate Intervention Strategies for Weight Loss and Prevention of Weight Regain for Adults. *Medicine and Science in Sports and Exercise* 2145-2156. Retrieved February 3, 2015, from http://www.iidca.net/descargas/articulos/13_Mantenimiento_y_perdida_de_peso.pdf

Chau, J. Y., van der Ploeg, H. P., Merom, D., Chey, T. and Bauman, A. E. (2012). Cross-sectional associations between occupational and leisure-time sitting, physical activity and obesity in working adults. *Preventive Medicine* 54(3): 195-200.

Chen, S. M., Creedy, D., Lin, H. S.and Wollin, J. (2012). Effects of motivational interviewing intervention on self-management, psychological and glycemic outcomes in type 2 diabetes: a randomized controlled trial. *International Journal of Nursing Studies 49*(6): 637-644.

Cheong, S. M., Kandiah, M., Chinna, K., Chan, Y. M. and Saad, H. A. (2010). Prevalence of Obesity and Factors Associated with it in a Worksite Setting in Malaysia. *Journal of Community Health* 35(6): 698-705. doi: 10.1007/s10900-010-9274-1.

Chew, W. F., Masyita, M., Leong, P. P., Boo, N. Y., Zin, T., Choo, K. B. and Yap, S. F. (2014). Prevalence of obesity and its associated risk factors among Chinese adults in a Malaysian suburban village. *Singapore Medical Journal* 55(2): 84. doi:10.11622/smedj.2014020

Cho K.C., Kolovou, G. D., Kolovou, V., Kostakou, P. M. And Mavrogeni, S. (2014). Body mass index, lipid metabolism and estrogens: their impact on coronary heart disease. *Current Medicinal Chemistry* 21(30): 3455-3465.

Cornelis, M. C., Rimm, E. B., Curhan, G. C., Kraft, P., Hunter, D. J., Hu, F. B. and Dam, R. M. (2014). Obesity susceptibility loci and uncontrolled eating, emotional eating and cognitive restraint behaviors in men and women. *Obesity* 22(5): e173-e182. DOI: 10.1111/j.1467-789X.2010.00826.x

Dwyer-Lindgren, L., Freedman, G., Engell, R. E., Fleming, T. D., Lim, S. S., Murray, C. J. and Mokdad, A. H. (2013). Prevalence of physical activity and obesity in US counties, 2001–2011: a road map for action. *Populion Health M*etr 11(1): 7.

El-Ghazali, S., Ibrahim, J. M., Kanari, B. M. and Ismail, N. A. (2010). The relationship between lifestyle and body mass index among university students in Kuwait. *Egyptian Journal of Community Medicine* 28(1).

Farooqi, I. S. (2005). Genetic and hereditary aspects of childhood obesity. *Best Practical Research Clinical Endocrinol Metabolic* 19(3): 359-74.

Feisul M.I, Azmi S. (Eds). National Diabetes Registry Report, Volume 1, 2009-2012. Kuala Lumpur; Ministry of Health Malaysia; 2013 Jul.

Fernández, J. R., Redden, D. T., Pietrobelli, A. and Allison, D. B. (2004). Waist circumference percentiles in nationally representative samples of African-American, European-American, and Mexican-American children and adolescents. *The Journal of Pediatrics 145*(4): 439-444.

Fight The Obesity Epidemic. (2013). Obesity ion new zeland. Retrieved from http://foe.org.nz/category/nz-news/

Flegal, K.M., Margaret D., Carroll, C. L. Ogden, and Lester, R. C. (2010). Prevalence and trends in obesity among US adults 1999-2008. *Jama* 303(3): (2010): 235-241.

Frank, L.D, Schmid, T.L, Sallis, J.F, Chapman, J, and Saelens, B.E. (2005). Linking Objectively Measured Physical Activity with Objectively Measured Urban Form. Findings from SMARTRAQ. *American Journal of Preventive Medicine* 28(2S2): 117–25.

Gan, W. Y., Nasir, M. T. M., Zalilah, M. S. and Hazizi, A. S. (2012). Psychological distress as a mediator in the relationships between biopsychosocial factors and disordered eating among Malaysian university students. *Appetite* 59(3): 679-687. doi:10.1016/j.appet.2012.08.002

Gangwisch, J. E., Malaspina, D., Boden-Albala, B. and Heymsfield, S. B. (2005). Inadequate sleep as a risk factor for obesity: analyses of the NHANES I. *Sleep-New York Then Westchester 28*(10): 1289.

Garaulet, M., Canteras, M., Morales, E., López-Guimera, G., Sánchez-Carracedo, D. and Corbalán-Tutau, M. D. (2012). Validation of a questionnaire on emotional eating for use in cases of obesity: the Emotional Eater Questionnaire (EEQ). *Nutrion Hosp*ital *27*(2): 645-51. doi: 10.1590/S0212-16112012000200043

Gebel, K., Bauman, A. E., Sugiyama, T. and Owen, N. (2011). Mismatch between perceived and objectively assessed neighborhood walkability attributes: prospective relationships with walking and weight gain. *Health and Place 17*(2): 519-524.doi:10.1016/j.healthplace.2010.12.008

Ghazali, S. M., Seman, Z., Cheong, K. C., Hock, L. K., Manickam, M., Kuay, L. K. And Mustafa, A. N. (2015). Sociodemographic factors associated with multiple cardiovascular risk factors among Malaysian adults. *BMC public health* 15(1): 68. doi:10.1186/s12889-015-1432-z

Giacco, R., Pepa, G., Luongo, D. and Riccardi, G. (2011). Whole grain intake in relation to body weight: From epidemiological evidence to clinical trials. *Nutrition, Metabolism and Cardiovascular Diseases* 21(12): 901-908. doi:1210.1016/j.numecd.2011.07.003

Giskes, K., van Lenthe, F., Avendano-Pabon, M. and Brug, J. (2011). A systematic review of environmental factors and obesogenic dietary intakes among adults: are we getting closer to understanding obesogenic environments?.*Obesity Reviews 12*(5): e95-e106.

Gögebakan, Ö., Kohl, A., Osterhoff, M. A., van Baak, M. A., Jebb, S. A., Papadaki, A. and Pfeiffer, A. F. (2011). Effects of Weight Loss and Long-Term Weight Maintenance With Diets Varying in Protein and Glycemic Index on Cardiovascular Risk Factors The Diet, Obesity, and Genes (DiOGenes) Study: A Randomized, Controlled Trial. *Circulation* 124(25): 2829-2838. doi: 10.1161/CIRCULATIONAHA.111.033274

Gopalakrishnan, S., Ganeshkumar, P., Prakash, M. V. S. and Amalraj, V. (2012). Prevalence of overweight/obesity among the medical students, Malaysia. *The Medical Journal of Malaysia* (67): 442-4.

Griesemer, Rebecca Lynn, "Index of Central Obesity as a Parameter to Evaluate Metabolic Syndrome for White, Black, and Hispanic Adults in the United States." Thesis, Georgia State University, 2008. http://scholarworks.gsu.edu/iph_theses/42

Grimes, C. A., Riddell, L. J., Campbell, K. J. and Nowson, C. A. (2013). Dietary salt intake, sugar-sweetened beverage consumption, and obesity risk. *Pediatrics* 131(1): 14-21. doi: 10.1542/peds.2012-1628

Hairi, N. N., Bulgiba, A., Cumming, R. G., Naganathan, V. and Mudla, I. (2010). Prevalence and correlates of physical disability and functional limitation among community dwelling older people in rural Malaysia, a middle income country. *BMC Public Health 10*(1): 1.

Hajian-Tilaki, K., Heidari, B., Firouzjahi, A., Bagherzadeh, M., Hajian-Tilaki, A. and Halalkhor, S. (2014). Prevalence of metabolic syndrome and the association with socio-demographic characteristics and physical activity in urban population of Iranian adults: A population-based study. Diabetes & Metabolic Syndrome*: Clinical Research & Reviews* 8(3): 170-176.

Hartmann-Boyce, J., Johns, D. J., Jebb, S. A. and Aveyard, P. (2014). Effect of behavioural techniques and delivery mode on effectiveness of weight management: systematic review, meta-analysis and meta-regression. *Obesity Reviews* 15(7): 598-609. DOI: 10.1111/obr.12165

Henderson, V. and Kelly, B. (2005). Food advertising in the age of obesity: content analysis of food advertising on general market and African American television. 37(4), Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/16029689

Hirsch K., Petersen, L., Schnohr, P. and Sørensen, T. I. A. (2014). Longitudinal study of the long-term relation between physical activity and obesity in adults. *International Journal of Obesity* 28(1): 105-112.

Horikawa, C., Kodama, S., Yachi, Y., Heianza, Y., Hirasawa, R., Ibe, Y. and Sone, H. (2011). Skipping breakfast and prevalence of overweight and obesity in Asian and Pacific regions: a meta-analysis. *Preventive Medicine 53*(4): 260-267.

Ibrahim, S., Karim, N. A., Oon, N. L. and Ngah, W. Z. W. (2013). Perceived physical activity barriers related to body weight status and sociodemographic factors among Malaysian men in Klang Valley. *BMC Public Health* 13(1): 275. doi:10.1186/1471-2458-13-275

Institute for Public Health (IPH). The Third National Health and Morbidity Survey (NHMS III) 2006, Nutritional Status. Ministry of Health, Malaysia; 2008.

International Diabetes Federation. (2012). The IDF consensus worldwide definition of the metabolic syndrome. Retrieved from http://www.idf.org/webdata/docs/MetS_def_update2006.pdf

Isabelle K., Johansson, G., Wikman, Å., Åhrén, A. M., Hallmans, G. and Johansson, I. (2014). Underreporting of energy intake in repeated 24-hour recalls related to gender, age, weight status, day of interview, educational level, reported food intake, smoking habits and area of living. *Public Health Nutrition* 4(04): 919-927.

Ismail, M., Chee, S., Nawawi, H., Yusoff, K., Lim, T. and James, W. (2002). Obesity in Malaysia. *Obesity Reviews* 203-208.

Ismail, M., Zawiah, H., Chee, S.S. and Ng, K.K. (1995). Prevalence of obesity and chronic energy deficiency (CED) in adult Malaysians. *Malaysian Journal of Nutrition* 1: 1–9.

Janghorbani, M., Amini, M., Rezvanian, H., Gouya, M., Delavari, A., Alikhani, S. and Mahdavi, A. (2008). Association of Body Mass Index and Abdominal Obesity with Marital Status in Adults. *Archives of Iranian Medicine* 11(3): 274-281.

Janssen, I., Katzmarzyk, P. T. and Ross, R. (2004). Waist circumference and not body mass index explains obesity-related health risk. *The American Journal of Clinical Nutrition 79*(3): 379-384.

Jenkins, J. S. (2001). The Mozart effect. *Journal of The Royal Society of Medicine 94*(4): 170-172.

Jiang, Y., King, J. M. and Prinyawiwatkul, W. (2014). A review of measurement and relationships between food, eating behavior and emotion. *Trends in Food Science & Technology 36*(1): 15-28. doi:10.1016/j.tifs.2013.12.005

Kandiah, M., Ramadas, A., Shariff, Z. M., Mohd, R. and Yusof, Y. G. A. G. (2005). Diet and lifestyle intervention among patients with colorectal adenomas: rationale and design of a Malaysian study. *Asian Pacific Journal of Cancer Prevention* 6(4): 553.

Keeley, L. L. (2013). 6 Physiology and Biochemistry of the Fat Body. *Integument, Respiration and Circulation* 3: 211.

Khoe, K. A. and Brownson, R. C. (2010). Sleep duration and obesity-related risk factors in the rural Midwest. *Preventive Medicine* 46(5): 439-444.

Khor, G. L., Yusof, A. M., Tee, E. S., Kandiah, M. and Huang, M. S. L. (1999). Prevalence of overweight among Malaysian adults from rural communities. *Asia Pacific Journal of Clinical Nutrition 8*(4): 272-279.

King A.C., Nelson, M. E., Rejeski, W. J., Blair, S. N., Duncan, P. W., Judge, J. O. and Castaneda-Sceppa, C. (2014). Physical activity and public health in older adults: recommendation from the American College of Sports Medicine and the American Heart Association. *Circulation* 116(9): 1094.

Kuczmarski, M. F., Kuczmarski, R. J. and Najjar, M. (2001). Effects of age on validity of self-reported height, weight, and body mass index: findings from the Third National Health and Nutrition Examination Survey, 1988–1994.*Journal of the American Dietetic Association 101*(1): 28-34.

Kullah, A. N. (2015). *Nutrition and other Lifestyle Factors Associated with Obesity and Hypertension Among Adolescents in The Wa Municipality of Ghana* (Doctoral dissertation).

Kumanan, J., Yaworski, J., Weber, R. M. And Ibrahim, N. (2013). What makes students succeed or fail?: The voices of developmental college students. *Journal of College Reading and Learning* 30(2): 195-221.

Kutty, N., Ru, T., Qi Chiang, V. And Zhi, W. (2015). Association of Physical Activity and Body Mass Index among University Students: A Cross-Sectional Study. *Scholars Journal Of Arts, Humanities And Social Sciences* 3(1): 195-202.

Lachapelle U. and Frank L. D, (2009). Transit and health: mode of transport, employer-sponsored public transit pass programs, and physical activity. *journal of Public Health Policy* 30(1): 73-94.

Lagiou, P., Sandin, S., Lof, M., Trichopoulos, D., Adami, H. O. and Weiderpass, E. (2012). Low carbohydrate-high protein diet and incidence of cardiovascular diseases in Swedish women: prospective cohort study. *BMJ* 344. e4026. doi: http://dx.doi.org/10.1136/bmj.e4026

Lai, P. P. and Say, Y. H. (2013). Associated factors of sleep quality and behavior among students of two tertiary institutions in northern Malaysia. *Medical Journal of Malaysia* 68(3): 195-203.

Layman, D. K. (2014). Eating patterns, diet quality and energy balance: A perspective about applications and future directions for the food industry. *Physiology & Behavior* 134: 126-130.

Lazarevich, I., Irigoyen-Camacho, M. E., del Consuelo Velázquez-Alva, M. and Salinas-Ávila, J. (2015). Psychometric characteristics of the Eating and Appraisal Due to Emotions and Stress Questionnaire and obesity in Mexican university students. *Nutrition Hosp*ital 31(6): 2437-2444.

Lear, S. A., Humphries, K. H., Kohli, S., Chockalingam, A., Frohlich, J. J. and Birmingham, C. L. (2007). Visceral adipose tissue accumulation differs according to ethnic background: results of the multicultural community health assessment trial (m-chat)1,2,3. *American Society for Clinical Nutrition* 86(2): 353-359.

Lee G. H., Bowman, S. A. and Vinyard, B. T. (2013). Fast food consumption of US adults: impact on energy and nutrient intakes and overweight status. *Journal of the American College of Nutrition* 23(2): 163-168.

Lee, C., Norimah, A. and Ismail, M. (2010). Association of energy intake and macronutrient composition with overweight and obesity in Malay women from Klang Valley. *Malayasian Journal of Nutrion 16*: 251-260.

Lin, J., Yen, C. and Chi-Wei , L. (2005). Patterns of obesity among children and adolescents with intellectual disabilities in Taiwan. *Journal of Applied Research and Intellectual Disabilities* 18(2): 123–129. doi: 10.1111/j.1468-3148.2005.00241.x

Llewellyn, C. H., van Jaarsveld, C. H. M., Boniface, D., Carnell, S. and Wardle, J. (2008). Eating rate is a heritable phenotype related to weight in children. Am. *Journal of Clinical Nutrition* 88(6): 1560-6.

Lund, H. G., Reider, B. D., Whiting, A. B. and Prichard, J. R. (2010). Sleep patterns and predictors of disturbed sleep in a large population of college students. *Journal of Adolescent Health* 46(2): 124-132.

Ma, Y., Bertone, E. R., Stanek, E. J., Reed, G. W., Hebert, J. R., Cohen, N. L. and Ockene, I. S. (2003). Association between eating patterns and obesity in a free-living US adult population. *American Journal of Epidemiology 158*(1): 85-92.

Mahathevan, R. (2007). Obesity epidemic in Malaysia: Seeking solutions through public health interventions and polices. *Malaysian Journal of Public Health Medicine* 7(2): 2-3.

Malaysian Association for the Study of Obesity (MASO) (2014). Retrieved from http://www.maso.org.com

Markey, C. N., Gomel, J. N. and Markey, P. M. (2008). Romantic Relationships and Eating Regulation An Investigation of Partners' Attempts to Control Each Other's Eating Behaviors. *Journal of Health Psychology* 13(3): 422-432.

Markey, C. N., Markey, P. M. and Birch, L. L. (2001). Interpersonal predictors of dieting practices among married couples. *Journal of Family Psychology 15*(3): 464. doi: 10.1037//0893-3200.15.3.464

Martin, L. E., Holsen, L. M., Chambers, R. J., Bruce, A. S., Brooks, W. M., Zarcone, J. R. and Savage, C. R. (2010). Neural mechanisms associated with food motivation in obese and healthy weight adults. *Obesity* 18(2): 254-260. doi: 10.1038/oby.2009.220

Mesirow, M. S. and Welsh, J. A. (2015). Changing beverage consumption patterns have resulted in fewer liquid calories in the diets of US Children: National Health and Nutrition Examination Survey 2001-2010. *Journal of the Academy of Nutrition and Dietetics* 115(4): 559-566.

Mikuska, L., Vrabcova, M., Lackovicova, L., Ukropec, J., Hegedusova, N., Slavkovsky, P. and Mravec, B. (2013). Long-term liquid nutrition intake and development of obesity: differences between young and adult rats. *Endocrine Regulations* 47(2): 85-92.

Ministry of Education (2013): Malaysia Education Blueprint 2013 - 2025 | Ministry of Education Malaysia [Online]. Assessed fromhttp://www.moe.gov.my/en/pelan-pembangunan-pendidikan-malaysia-2013-2025.

Mohamud, W. N., Musa, K. I., Md Khir, A. S., Ismail, A. A. S., Ismail, I. S., Kadir, K. A. and Wan Bebakar, W. M. (2011). Prevalence of overweight and obesity among adult Malaysians: an update. *Asia Pacific Journal of Clinical Nutrition* 20(1): 35.

Mohd Zaher, Z. M., Zambari, R., Chan, S. P., Muruga, V., Ng, B., Appannah, G. and Lim, T. O. (2009). Optimal cut-off levels to define obesity: body mass index and waist circumference, and their relationship to cardiovascular disease, dyslipidaemia, hypertension and diabetes in Malaysia. *Asia Pacific Journal of Clinical Nutrition 18*(2): 209.

Moy, F. M. and Bulgiba, A. (2011). High prevalence of vitamin D insufficiency and its association with obesity and metabolic syndrome among Malay adults in Kuala Lumpur, Malaysia. *BMC Public Health 11*(1): 735. doi: 10.1186/1471-2458-11-735

Nasreddine, L., Naja, F., Chamieh, M. C., Adra, N., Sibai, A. M. and Hwalla, N. (2012). Trends in overweight and obesity in Lebanon: evidence from two national cross-sectional surveys (1997 and 2009). *BMC Public Health 12*(1): 1.

National Center for Health Statistics (NCHS). Health, United States, 2010: With Special Feature on Death and Dying. Hyattsville, MD. 2011.

National Coordinating Committee on Food and Nutrition (NCCFN). Ministry of Health Malaysia. Recommended Nutrient Intakes for Malaysia. (2005). Retrieved from http://www.moh.gov.my/images/gallery/rni/front_pages.pdf

National Institutes of Health (NIH). (2010). Overweight and obesity statistics. Retrieved from http://win.niddk.nih.gov/publications/PDFs/stat904z.pdf

National Institutes Of Health. (2013.). The practical guide identification, evaluation, and treatment of overweight and obesity in adults. Retrieved from http://www.nhlbi.nih.gov/guidelines/obesity/prctgd_c.pdf

Neto, A. S., de Campos, W., dos Santos, G. C. and Junior, O. M. (2014). Metabolic syndrome risk score and time expended in moderate to vigorous physical activity in adolescents. *BMC Pediatrics* 14(1): 42.

New Zealand Medical Association. (2006). Obesity. Retrieved from http://www.nzma.org.nz/sites/all/files/pos_obesity.pdf

Nguyen, D. And El-Serag, H. (2010). The Epidemiology of Obesity. *Gastroenterology Clinics of North America* 39(1): 1-7. http://dx.doi.org/10.1016/j.gtc.2009.12.014

Nishiura, C. and Hashimoto, H. (2010). A 4-year study of the association between short sleep duration and change in body mass index in Japanese male workers. *Journal of Epidemiology 20*(5): 385-390.

Nor Afiah J., Jaarsveld, C. H., Fidler, J. A., Steptoe, A., Boniface, D. and Wardle, J. (2014). Perceived stress and weight gain in adolescence: a longitudinal analysis. *Obesity* 17(12): 2155-2161.

OCED. (2012). Health at a glance Europe 2012. Retrieved from http://www.oecd.org/health/health-systems/HealthAtAGlanceEurope2012.pdf

Office of the Surgeon General (US, & National Institutes of Health. (2001). The Surgeon General's call to action to prevent and decrease overweight and obesity.

Ogden, C. L., Carroll, M. D. and Flegal, K. M. (2008). High body mass index for age among US children and adolescents, 2003-2006. *JAMA* 299(20): 2401-5.

Oireachtas Library and research service. (2011, November). Obesity – a growing problem?. Retrieved from http://www.oireachtas.ie/parliament/media/housesoftheoireachtas/libraryresearch/spotlights/spotObesity071111_150658.pdf

O'Reilly, G. A., Cook, L., Spruijt-Metz, D. and Black, D. S. (2014). Mindfulness-based interventions for obesity-related eating behaviors: a literature review. *Obesity Reviews* 15(6): 453-461.

O'Rahilly, S. and Farooqi, I. S. (2008). Human obesity as a heritable disorder of the cen- tral control of energy balance. *International Journal of Obesity (Lond)* 32(7): 55-61.

Ortega, F. B., Ruiz, J. R. and Castillo, M. J. (2013). Physical activity, physical fitness, and overweight in children and adolescents: evidence from epidemiologic studies. *Endocrinología y Nutrición (English Edition) 60*(8): 458-469.

Parsa, P., Kandiah, M., Mohd Nasir, M. T., Hejar, A. R. and Nor Afiah, M. Z. (2008). Reliability and validity of Champion's Health Belief Model Scale for breast cancer screening among Malaysian women. *Singapore Medical Journal 49*(11): 897.

Punyadeera, C., Van der Merwe, M. T., Crowther, N. J., Toman, M., Schlaphoff, G. P. and Gray, I. P. (2001). Ethnic differences in lipid metabolism in two groups of obese South African women. *Journal of Lipid Research 42*(5): 760-767.

Quick, V., Larson, N., Eisenberg, M. E., Hannan, P. J. and Neumark-Sztainer, D. (2012). Self-weighing behaviors in young adults: tipping the scale toward unhealthy eating behaviors? *Journal of Adolescent Health* 51(5): 468-474.

Rampal, S., Mahadeva, S., Guallar, E., Bulgiba, A., Mohamed, R., Rahmat, R. and Rampal, L. (2012). Ethnic differences in the prevalence of metabolic syndrome: results from a multi-ethnic population-based survey in Malaysia. *PLoS One 7*(9)L: 46365. DOI: 10.1371/journal.pone.0046365

Ranchod, Y. K., Roux, A. V. D., Evenson, K. R., Sánchez, B. N. and Moore, K. (2014). Longitudinal associations between neighborhood recreational facilities and change in recreational physical activity in the multi-ethnic study of Atherosclerosis, 2000–2007. *American Journal of Epidemiology* 179(3): 335-343. doi: 10.1093/aje/kwt263

Rosenblum, J. L., Castro, V. M., Moore, C. E. and Kaplan, L. M. (2012). Calcium and vitamin D supplementation is associated with decreased abdominal visceral adipose tissue in overweight and obese adults. *The American Journal of Clinical Nutrition 95*(1): 101-108.

Sabki R., Harrison, A., Sullivan, S., Tchanturia, K. and Treasure, J. (2014). Emotional functioning in eating disorders: attentional bias, emotion recognition and emotion regulation. *Psychological Medicine* 40(11): 1887-1897.

Said, S. M. And Ismail, S. (2014). Prevalence and Factors associated with Overweight and Obesity among Malaysian Post Graduate Students in a Public University. *International Journal of Public Health and Clinical Sciences 1*(1): 131-140.

Sakinah, Ha., Seong-Ting, Ca., Rosniza, Rb., and Jayah, KP. (2012). Socio-Demographic, Dietary and Physical Activity Determinants of Adolescents Overweight and Obesity in Kelantan. *Health and the Environment Journal* 3(1): 44-53.

Sallis, J. F., Floyd, M. F., Rodríguez, D. A. and Saelens, B. E. (2012). Role of built environments in physical activity, obesity, and cardiovascular disease. *Circulation* 125(5): 729-737

Sallis, J. F., Bowles, H. R., Bauman, A., Ainsworth, B. E., Bull, F. C., Craig, C. L. and Matsudo, S. (2009). Neighborhood environments and physical activity among adults in 11 countries. *American journal of preventive medicine* 36(6): 484-490.

Sharman , M., Gómez , A., Kraemer , W. and Volek , J. (2004). Very low-carbohydrate and low-fat diets affect fasting lipids and postprandial lipemia differently in overweight men. *Journal of Nutr*ion 134(3).

Sidik, S. M. and Rampal, L. (2009). The prevalence and factors associated with obesity among adult women in Selangor, Malaysia. *Asia Pacific Family Medicine 8*(1): 1. doi:10.1186/1447-056X-8-2.

Skarnulis, L. (2012). 10 easy ways to make exercise a habit. Retrieved from: http://women.webmd.com/features/exercise-habits

Smith, J. C. (1999). *Understanding Childhood Obesity*. Univ. Press of Mississippi.

Smyth , C. (2012). The pittsburgh sleep quality index (psqi). (6.1), Retrieved from http://consultgerirn.org/uploads/File/trythis/try_this_6_1.pdf

Sonmez, A., Bayram, F., Barcin, C., Ozsan, M., Kaya, A. and Gedik, V. (2013). Waist Circumference Cutoff Points to Predict Obesity, Metabolic Syndrome, and Cardiovascular Risk in Turkish Adults. *International Journal of Endocrinology* 2013: 1-7. doi:10.1155/2013/767202

Statistics of Higher Education Malaysia (2011). Retrieved from http://www.mohe.gov.my/web_statistik/perangkaan_2010.pdf

Stein, Q. P., Mroch, A. R., De Berg, K. L. and Flanagan, J. D. (2011). The influential role of genes in obesity. *S D Med* 12(5): 12-5.

Stuckler, D. and Nestle, M. (2012). Manufacturing epidemics: the role of global producers in increased consumption of unhealthy commodities including processed foods, alcohol, and tobacco. *PLoS Medicine* 9(6): 695.

Sugathan, S. and Bagh, D. S. (2014). Prevalence and Correlates of Overweight and Obesity among Medical Students in Ipoh, Malaysia. *Academic Medical Journal of India 2*(1): 22-24.

Suraya, H. S. and Nawi, A. M. (2014). Use of nonprescription substances among University students in Malaysia. *Malaysian Journal of Public Health Medicine 14*(2): 86-98.

Suzana, S., Kee, C. C., Jamaludin, A. R., Safiza, M. N., Khor, G. L., Jamaiyah, H. and Fauzi, Y. A. (2012). The Third National Health and Morbidity Survey prevalence of obesity, and abdominal obesity among the Malaysian elderly population. *Asia-Pacific Journal of Public Health* 24(2): 318-329.

Swinburn, B. and Shelly, A. (2008). Effects of TV time and other sedentary pursuits. International *Journal of Obesity* 31: 132–136. http://dx.doi.org/10.1038/ijo.2008.249

Swinburn, B., Caterson, I., SeideII, J. and James, W. (2004). Diet, nutrition and the prevention of excess weight gain and obesity. *Public Health Nutrition* 7(1A): 123–146. doi: 10.1079/PHN2003585

Tan, A., Dunn, R., Samad, M. and Feisul, M. (2010). Sociodemographic and Health-Lifestyle Determinants of Obesity Risks in Malaysia. *Asia-Pacific Journal of Public Health* 23(2): 192-202. doi:10.1177/1010539509359535

Tan, M. Y. (2009). Self-care practices of adults with poorly controlled Diabetes Mellitus in Malaysia.

Taylor, D. J. and Bramoweth, A. D. (2010). Patterns and consequences of inadequate sleep in college students: substance use and motor vehicle accidents. *Journal of Adolescent Health* 46(6): 610-612. doi:10.1016/j.jadohealth.2009.12.010

The Forth National Health and Morbidity Survey 2011 Fact Sheet (2011). Ministry of Health

The NHS Information Centre. (2012). Statistics on obesity, physical activity and diet: england, 2012. Retrieved from http://www.aso.org.uk/wp-content/uploads/downloads/2012/03/2012-Statistics-on-Obesity-Physical-Activity-and-Diet-England.pdf

The Third National Health and Morbidity Survey Fact Sheet (2011). Ministry of Health

Theorell-Haglow, J., Berne, C. and Janson, C. (2010). Associations between short sleep duration and central obesity in women. *Sleep* 33:593–598.

Townshend, T. and Lake, A. A. (2009). Obesogenic urban form: theory, policy and practice. *Health & Place 15*(4): 909-916.

Ulaganathan, V., Kandiah, M., Zalilah, M. S., Faizal, J. A., Fijeraid, H., Normayah, K. and Othman, R. (2012). Colorectal cancer and its association with the metabolic syndrome: a Malaysian multi-centric case-control study. *Asian Pacific Journal of Cancer Prevention* 13(8): 3873-3877. DOI : 10.7314/APJCP.2012.13.8.3873

van Genugten, L., van Empelen, P., Boon, B., Borsboom, G., Visscher, T. and Oenema, A. (2012). Results from an online computer-tailored weight management intervention for overweight adults: randomized controlled trial. *Journal of Medical Internet Research 14*(2): e44., doi: 10.2196/jmir.1901

Wales, Kathleen R. and Brissette, Ian. (2010). Adult overweight and obesity in New York. Bureau of Chronic Disease Evaluation and Research, New York State Department of Health. Retrieved from http://https://www.health.ny.gov/prevention/obesity/statistics_and_impact/docs/2000-2010_adult_obesity.pdf

Wan Mohamud, W. N., Musa, K. I., Md Khir, A. S., Ismail, A. A. S., Ismail, I. S., Kadir, K. A. and Md Isa, S. H. (2011). Prevalence of overweight and obesity among adult Malaysians: an update. *Asia Pacific Journal of Clinical Nutrition 20*(1): 35.

Wang, F., Wen, M. and Xu, Y. (2013). Population-adjusted street connectivity, urbanicity and risk of obesity in the US. *Applied Geography* 41: 1-14.

Wing, R. R. and Phelan, S. (2005). Long-term weight loss maintenance1,2,3,4. *American Society for Clinical Nutrition* 82(1): 222S-225S.

Wood, R. and Bandura, A. (1989). Social Cognitive Theory of Organizational Management. *The Academy of Management Review* 14(3): 361-384.

World Health Organisation: Energy Intake (2014)[Online]. Retrieved From : www.who.org.com

World Health Organization. (2004, April). Obesity and overweight. Retrieved from http://www.who.int/mediacentre/factsheets/fs311/en/

World Health Organization. (2006). Global strategy on diet, physical activity and health: a framework to monitor and evaluate implementation. Retrieved from http://www.who.int/dietphysicalactivity/strategy/eb11344/strategy_english_web.pdf

World Health Organization. (2008). Waist circumference and waist-hip ratio report of a WHO expert consultation Geneva.

World Health Organization. (2013, March). Obesity and overweight. Retrieved from http://www.who.int/mediacentre/factsheets/fs311/en/

World Health Organization. Non Communicable Disease Profile: Malaysia. Geneva.2012.

World Health Organizaton. World Health Organization - NCD Country Profiles, 2011. Geneva: WHO.2011.

Yoon, K., Lee, J., Kim, J., Cho, J., Choi, Y., Ko, S. and Son, H. (2006). Epidemic obesity and type 2 diabetes in Asia. *Epidemic Obesity and Type 2 Diabetes in Asia* 368: 1681-1688.

Yuan (2014). 75% University Students Women in Malaysia & a pan-Asia Women's College [Blog post]. Retrieved from https://edblogs.columbia.edu/inafu6653-001-2014-1/2014/04/15/75-university-students-women-in-malaysia-a-pan-asia-womens-college/.

Zhu J.H., Wise, F. M., Harris, D. W. and Olver, J. H. (2014). Attitudes to obesity among rehabilitation health professionals in Australia. *Journal of Allied Health* 43(3): 162-168.