UNIVERSITI PUTRA MALAYSIA

FACTORS ASSOCIATED WITH OVERWEIGHT AND OBESITY AMONG POSTGRADUATE AFRICAN STUDENTS IN UPM, 2017

NURA TUKUR

FPSK(M) 2017 34

FACTORS ASSOCIATED WITH OVERWEIGHT AND OBESITY AMONG POSTGRADUATE AFRICAN STUDENTS IN UPM, 2017

By

NURA TUKUR

Dissertation Submitted to the Department of Community Health , Faculty of Medicine and Health Sciences, Universiti Putra Malaysia in Fulfillment of the Requirements for the Degree of Master of Public Health

August 2017

COPYRIGHT

DEDICATION

This study is dedicated to Almighty Allah who gave me the wisdom and strength to go through the challenges of this study. This study is also dedicated to my parents, whose good examples have taught me to work hard for the things that I desire to accomplish.

Abstract of dissertation presented to the Department of Community Health, Universiti Putra Malaysia in fulfillment of the requirement for the Degree of Master of Public Health

FACTORS ASSOCIATED WITH OVERWEIGHT AND OBESITY AMONG POSTGRADUATE AFRICAN STUDENTS IN UPM, 2017

By

NURA TUKUR

August 2017

Chairman : Dr. Suriani Binti Ismail, MD, MPH, PhD
Faculty : Medicine and Health Sciences

Introduction: Globally, overweight and obesity are the major public health problem. World Health Organization (WHO) estimated about 1.9 billion adults were overweight out of which more than 600 million were obese in 2014. In a foreign country, student's lifestyle and behaviour including eating pattern changes very quickly leading to unhealthy habits, which may have negative effect on their health. The changes in the body mass index (BMI) of a foreign student is influenced by various complex factors involving exposure to more stress, sedentary lifestyle, accessibility and availability to familiar food, limited finances, irregular class schedules and overload, and spending more time on studying with less physical activities leading to increased or decreased intake of food or dependence of fast food with less nutritional value.

Objectives: The objective of the study was to determine the factors associated with overweight and obesity among postgraduate African students in UPM.

Method: A cross-sectional study was conducted among postgraduate African students in UPM. Data was collected using pre-tested self-administered structured questionnaire. The questionnaire consist of four sections, which include: a) socio-demographic, b) behavioural factors (International Physical Activity Questionnaire – IPAQ), c) eating pattern and d) psychological factors (The short version of the Depression, Anxiety and Stress Questionnaire – DASS). Weight and height was measured and converted to BMI. The study analysis was done using Statistical Package for Social Sciences (SPSS) version 23. Descriptive statistics (frequency and percentage) was used to summarise categorical data while continuous variables like age were converted into categorical. The association between two categorical variables was done using Chi square. At the end multiple logistic regression was used to determine predictors of overweight and obesity.

Results: Five hundred and fifty nine students participated in this study out of which 432 (77.3%) were males and 127 (22.7%) were females. The proportion of overweight and obesity were 30.4% and 6.1% respectively. In multiple logistic regression, the significant predictors were: advancing age, with age group of 30 – 39 years (AOR=2.209; 95%CI=1.048 – 4.657) and 40 – 49 age group (AOR=2.530; 95%CI=1.043 – 6.134), being male gender (AOR=2.037; 95%CI 1.130 – 3.672), being married (AOR=3.686; 95%CI=1.783 – 7.620), low physical activity level (AOR=2.478, 95%CI=1.191 – 5.157) and alcohol consumption (AOR=2.999, 95%CI=1.667 – 5.396).

Conclusion: The significant predictors of overweight and obesity were advancing age, being male gender, being married, low physical activity, and alcohol consumption. Campaigns to increase awareness about the importance of health as well as the danger of alcohol consumption among students. Physical activity exercises/competition among the students.

Keywords: Overweight, Obesity, Associated factors, African students, Malaysia.

Abstrak disertasi yang dikemukakan kepada Jabatan Kesihatan Komuniti,
Universiti Putra Malaysia sebagai memenuhi keperluan untuk
Ijazah Sarjana Kesihatan Awam

FAKTOR YANG BERKAITAN DENGAN BERLEBIHAN BERAT BADAN DAN OBESITI PELAJAR PASKASISWAZAH KETURUNAN AFRIKA DI UPM, 2017

Oleh

NURA TUKUR

Ogos 2017

Pengerusi : Dr. Suriani Binti Ismail, MD, MPH, PhD
Fakulti : Perubatan dan Sains Kesihatan

Pengenalan: Di peringkat global, berat badan berlebihan dan obesiti adalah antara masalah utama kesihatan awam. Pertubuhan Kesihatan Sedunia (WHO) menganggarkan kira-kira 1.9 bilion orang dewasa berlebihan berat badan, yang mana lebih daripada 600 juta adalah obes pada tahun 2014. Apabila di negara asing, gaya hidup dan tingkah laku pelajar termasuk corak pemakanan berubah dengan cepat dan membawa kepada tabiat yang tidak sihat, yang mungkin memberi kesan negatif terhadap kesihatan mereka. Corak pemakanan seorang pelajar asing dipengaruhi oleh pelbagai faktor yang kompleks yang melibatkan pendedahan kepada tekanan, gaya hidup yang tidak aktif, kebolehcapaian dan ketersediaan makanan biasa, kewangan terhad, jadual kelas yang tidak teratur dan beban yang banyak, dan menghabiskan lebih banyak masa untuk belajar dan kekurangan aktiviti fizikal membawa kepada peningkatan atau penurunan pengambilan makanan atau pergantungan kepada makanan segera dengan nilai nutrisi yang rendah.

Objektif: Objektif kajian ini adalah untuk menentukan faktor-faktor yang berkaitan dengan berlebihan berat badan dan obesiti di kalangan pelajar pascasiswazah di UPM.

Kaedah: Kajian keratan rentas telah dijalankan di kalangan pelajar Afrika pascasiswazah di UPM. Data dikumpul menggunakan borang soal selidik yang diisi oleh perserta sendiri yang terdiri daripada empat bahagian iaitu: sosio-demografi, faktor tingkah laku, corak pemakanan dan faktor psikologi. Boring tersebut ialah International Physical Activity Questionnaire – IPAQ, Dietary pattern was assessed using frequency of eating in 24 hours and of eating outside. The short version of the Depression, Anxiety and Stress Questionnaire – DASS. Borang pro-forma digunakan oleh penyelidik untuk mengukur berat dan ketinggian. Analisa kajian dilakukan dengan menggunakan *Statistical Package for Social Sciences* (SPSS) versi

23. Statistik deskriptif (kekerapan dan peratusan) digunakan untuk meringkaskan data kategori manakala pembolehubah yang berterusan seperti umur telah diubah menjadi kategori. Hubungan antara dua pembolehubah kategori dilakukan dengan menggunakan ujian *Chi square*. Akhirnya, regresi logistik berganda digunakan untuk menentukan faktor peramal berat badan berlebihan dan obesiti.

Keputusan: Lima ratus lima puluh sembilan pelajar mengambil bahagian dalam kajian ini yang mana 432 (77.3%) adalah lelaki dan 127 (22.7%) adalah perempuan. Kadar berat badan berlebihan dan obesiti masing-masing adalah 30.4% dan 6.1%. Dalam regresi logistik berganda, mendapati (faktor peramal yang penting ialah: umur, yang meninbat, tolah berkahwin, tahap aktiviti fizikal yang rendah, dan penggunaan alkohol.

Kesimpulan: faktor peramal yang penting ialah: umur, yang meninbat, tolah berkahwin, tahap aktiviti fizikal yang rendah, dan penggunaan alkohol.

Kata kunci: Berlebihan berat badan, Obesiti, Faktor, pelajar Afrika, Malaysia

ACKNOWLEDGEMENTS

I would like to acknowledge the contributors to this dissertation. A special thank goes to Dr. Suriani Binti Ismail, my knowledgeable, reliable, caring, inspiring and gracious supervisor. This thesis would not have been possible without her continuous support, helpful guidance as well as generous encouragement. I would like to acknowledge the immense contributions of my co-supervisor Dr. Rosliza Abdul manaf for her support and timely feedbacks throughout this study.

This study would not have been accomplishable without the prayers, love, support, and encouragement received from my parents, brothers, and sisters throughout the duration of this study. Thanks for listening to my problems and providing perspective. I would not be who am I today without you. I would like to acknowledge my wife and daughters. You have been constantly supportive throughout my studies. You have been patient with me when I am frustrated, you cheer with me when even the smallest things go right and you are there whenever I need you to just listen. Also, I would like to acknowledge my uncle and father-in-law, as well as all my relatives and friends for their support and prayers, without you all, this study would not have been possible.

I certify that the Dessertation Examination Committee has met on the 2nd August 2017 to conduct the final examination of Nura Tukur on his dessertation entitled "Factors Associated with Overweight and Obesity among Postgraduate African Students in UPM, 2017" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Public Health.

Members of the Dessertation Examination Committee were as follows:

Associate Professor Dr. Hejar Abd Rahman
Medical Lecturer
Department of Community Health
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Chairman)

Dr. Norliza Ahmad, MD (USM), MPH (UKM), PhD
Medical Lecturer
Department of Community Health
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Internal Examiner)

Associate Professor. Dr. Aniza Ismail
Medical Lecturer
Department of Community Health
Faculty of Medicine and Health Sciences
Universiti Kebangsaan Malaysia
(External Examiner)

_____
Professor Dato' Dr. Abdul Jalil Nordin, DSIS
MD, (UKM), MMed. (Radiology-UM)
Professor and Dean
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia

Date:

.

This dissertation was submitted to the Department of Community Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master of Public Health. The members of the Supervisory Committee were as follows:

Dr. Suriani Ismail, MD, MPH, PhD
Medical Lecturer
Department of Community Health
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Chairman)

Dr. Rosliza Abdul Manaf, MD, M COMMUNITY MED, PhD
Medical Lecturer
Department of Community Health
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Member)

Professor Dato' Dr. Abdul Jalil Nordin, DSIS
MD, (UKM), MMed. (Radiology-UM)
Professor and Dean
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia

Date:

Declaration by graduate student

I hereby confirm that:

- this dissertation is my original work;
- quotations, illustrations and citations have been duly referenced;
- this dissertation has not been submitted previously or concurrently for any other degree at any other institutions;
- intellectual property from the dissertation and copyright of desssertation 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 dissertation 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 dissertation has undergone plagiarism detection software.

Signature: _____ Date: _____

Name and Matric No.: Nura Tukur, GS47267

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AOR	Adjusted Odds Ratio
BAT	Brown Adipocytes
BIA	Bioelectric Impedance
BMI	Body mass index
CDC	Centre for Disease Control
CI	Confidence Interval
COPD	Chronic Obstructive Pulmonary Disease
COR	Crude Odd ratio
CT	Computerized Tomography
CVD	Cardiovascular disease
DASS	Depression, Anxiety, Stress Scale
DEXA	Dual Energy X-ray Absorptiometry
df	Degree of Freedom
DM	Diabetes Mellitus
EASO	European Association for the Study of Obesity
F	F-value
f	frequency
FAO	Food and Agriculture Organization of the United Nations
IPAQ	International Physical Activity Questionnaire
MET	Metabolic Equivalent of Task
MRI	Magnetic Resonance Imaging
N	Total number
n	number in the sub-group
NCD	Non-communicable disease

NIH	National Institute of Mental Health
OR	Odds Ratio
SD	Standard Deviation
SPSS	Statistical Package for Social Sciences
UK	United Kingdom
UPM	Universiti Putra Malaysia
US	United States
WAT	White Adipocytes
WC	Waist Circumference
WHO	World Health Organization
WHR	Waist – Hip Ratio

CHAPTER 1

INTRODUCTION

This chapter describes the background, reason, and significance of the study. In addition, the general and specific objectives, as well as the hypothesis of the study are presented.

1.1 Background of the Study

The World Health Organization (WHO) defines overweight and obesity as a condition in which there is an abnormal or excessive accumulation of fat in the body leading to impairment of health. Energy disproportion between calories consumed and expanded as a result of an increased intake of foods high in energy and fat, changes in diets and physical inactivity as well as a sedentary lifestyle is the cardinal cause of overweight and obesity (WHO, 2016). The individual choice of food is portrayed as a complex process involving a multiplicity of Influencing factors, such as socio – economic factors, cultural effects, accessibility and availability of food as well as educational level and age (Cheli Vettori, Covolo, Savegnago Mialich, & Jordao, 2014). It is well known that maintaining a normal body weight is of utmost importance of good health and reduces the chances of developing long-term health problems. Adverse nutritional outcomes, such as overweight and obesity are related to chronic heart diseases, stroke, diabetes (type 2), osteoarthritis and some cancers (Hovhannisyan, Pierce, & Amirkhanyan, 2009).

Overweight and obesity are considered as the fifth leading risk for deaths worldwide and not less than 2.8 million adults died every year (EASO, 2016). Also, the rates of obesity worldwide are predicted to rise and by 2025, 18% of men and 21% of women will be obese globally, according to the latest study by Non-Communicable Disease Risk Factor Collaboration (NCD-RisC). The study also reported an increase in the number of obese people from 105 million in 1975 to 641 million in 2014. The world has more overweight than underweight people, and latest remain serious public health problems in the poorest countries. In South Asia, almost a quarter of the population is underweight, in Central and East Africa about 12% of women and 15% of men are underweight. Also in India and Bangladesh, more than a fifth of men and quarter of women are underweight. (NCD-RisC) et al. 2016).

WHO defines Body Mass Index (BMI) as the body weight in kilogram (kg) divided by the square of height in meters (m^2). Underweight means BMI less than 18.5 kg/m^2, while a range of 18.5 kg/m^2 to less than 25kg/m^2 is considered as normal weight, BMI of 25kg/m^2 to less than 30kg/m^2 is overweight and the obesity range falls at or higher than 30kg/m^2 (WHO, 2015). The raised in BMI is considered as a major risk factor for developing non-communicable diseases (NCDs). Hence, the significant of NCDs is steadily increasing and by far the leading global cause of death. (WHO, 2009). The common risk factors, responsible for most of the major NCDs are unhealthy diets and

lifestyle. Based on present trends by the year 2020 NCDs are predicted to account for 73% of deaths and 60% of the disease burden. The report further stated that over the period of 30 years the burden of disease from NCDs for developing and newly industrialized countries was predicted to increase by more than 60% by 2020 (WHO, 2008). Hence, more than 190 countries agreed on global mechanisms to reduced avoidable NCDs burden in 2011, which include a global action plan for the prevalence and control of NCDs 2013 to 2020, the aim of this plan is to reduce the numbers of premature death from NCDs by 25% by 2025 (Vineis, Stringhini, & Porta, 2014).

In a foreign country, student's lifestyle and behaviour including eating pattern changes very quickly leading to unhealthy habits, which may have a negative effect on their health (Hovhannisyan et al., 2009). The eating pattern of a foreign student is influenced by a complex of factors involving exposure to more stress, sedentary lifestyle, accessibility and availability to familiar food, limited finances, irregular class schedules and overload, and spending more time on studying with less physical activities leading to increased or decreased intake of food or dependence of fast food with less nutritional value and high in sugar or fat (Mahfouz et al., 2016). In relation to this, the postgraduate African students in Universiti Putra Malaysia (UPM) faces similar circumstances.

In line with the above introduction, several studies have reported the association between many factors and unhealthy body weight status (overweight and obesity) for instance the socio-demographic factors (Kabir, Said, & Ismail, 2014, Peltzer et al., 2014, Nwachukwu et al., 2010, Adienbo et al. 2012, Zarei, Taib, & Zarei, 2013, etc.), behavioral factors such as physical activity level, smoking and alcohol consumption (Zarei et al., 2013, Teo, Nurul-Fadhilah, Aziz, Hills, & Foo, 2014, Sayon-Orea, Martinez-Gonzalez, & Bes-Rastrollo, 2011), eating pattern (Bezerra, Curioni, & Sichieri, 2012, Seguin, Aggarwal, Vermeylen, & Drewnowski, 2016, Perez-Cueto, Verbeke, Lachat, & Remaut-De Winter, 2009, and Yildiz et al., 2011 etc.) and psychological factors (Bodenlos, Lemon, Schneider, August, & Pagoto, 2011, Babazekri, Hanafiah Juni, Afiah M.Z., & Fattah Azman, 2014, Chen & Qian, 2012). Consequently, this study aims to further investigate the association between these factors and overweight and obesity among African postgraduate students in UPM.

1.2 Problems Statement

Overweight and obesity has a serious negative impact on health, which is associated with hypertension, coronary heart diseases, stroke, type 2 diabetes as well as some cancers of breast, colon, prostate, endometrium and gall bladder. Overweight and obesity are accounted for 5% of all death worldwide. Overweight and obesity can also lead to serious physical, behavioural, social, psychological, and economic consequences (WHO 2008 and 2015). Hence, as the body mass index of an individual increase so as the mortality rates (Flegal, Bk, Orpana, & Graubard, 2013). In a report by Mckinsey in 2014, it was estimated that the global economy loses 2 trillion USD per year due to obesity and this makes it almost as damaging as smoking or an armed conflict (McKinsey, 2014).

Obesity has virtually doubled since 1980 globally (WHO, 2016). Accordingly, in a research conducted to assess the prevalence of overweight/obesity and its associated factors among university students from 22 universities in 22 low, middle income and emerging economy countries, a high (18.95%) prevalence of overweight in male than in female (14.1%) was reported. While obesity was 5.8% in male and 5.2% in female, the overall overweight and obesity were 22% (Peltzer et al., 2014). Another study conducted among university students in Enugu, Nigeria noted a higher prevalence of underweight among female (9.4%) than male (4.7%) and lower prevalence of overweight (4%) and obesity (0.9%) in female than in male with 8% and 7% respectively (Nwachukwu et al., 2010). Whereas, in a study conducted among seven (7) African countries reported a higher prevalence of obesity in female among all age group in 5 countries: Benin, Djibouti, Ghana, Mauritania and Morocco (Manyanga, El-Sayed, Doku, & Randall, 2014).

Student's lifestyle adheres to irregular eating pattern and physical inactivity. Consequently, eating pattern and physical activity of students in a foreign country becomes their exclusive responsibility (Perez-Cueto et al. 2009 and Zarei, Taib, and Zarei 2013). In addition, the statements were supported in a study carried out among students in Jazan University, which revealed 80% of students reported changes in their eating habit, 8.6% improved, 71.6% worsened and almost 86.2% reported changes in their weight (Mahfouz et al., 2016). Again, about 85% of students reported changes in their diets in a study reported by (Perez-Cueto et al., 2009).

Since 2013 the numbers of foreign students in Malaysia are increasing dramatically (Zarei et al. 2013). In Universiti Putra Malaysia (UPM), there is a total of 815 postgraduate African students in the 2016/2017 academic year. The Previous study conducted on factors associated with weight status focused only on Iranian students in UPM. However, considering the high prevalence of overweight and obesity and its implications for health and economy now and future, there is need to assess the weight status and associated factors among postgraduate African students in UPM. Furthermore, the findings of this study can be used in producing more facts concerning the factors associated with overweight and obesity among African students in UPM.

1.3 Significance and Benefits of Study

A person has the ability to maintain or harm their own health, as they are responsible for what they eat and avoid. It is for this reason that a person needs to ensure they maintain a healthy eating pattern and lifestyle. The weight of a person affects their health, as overweight and obesity are associated with increased risk of many acute and chronic conditions like hypertension, stroke, coronary atherosclerosis, type 2 diabetes, cancer, chronic obstructive pulmonary disease (COPD), gall bladder disease etc (Singh, Bhsc, and Medicine 2008; Savegnago Mialich et al. 2014 and Mahfouz et al. 2016). Management of these diseases is associated with a high financial cost and is of great burden not only on the person but on the nation in general. A healthy lifestyle has become an important preventive measure against overweight and obesity (Samaranayake, Ong, Leung, & Cheung, 2012).

It is vital to study whether the overweight and obesity among postgraduate university students are as a result of the changes from high school to college lifestyle or other specific behaviours. Moving away from home, student's lifestyle and behaviour including eating pattern alter very quickly leading to unhealthy habits, which may have a negative effect on their health (Hovhannisyan et al., 2009). Therefore, this study aims to determine factors associated with weight status among postgraduate African students in UPM. The finding can be used to plan preventive measures, thereby, focusing on the significant factors of its predictors among postgraduate African students.

1.4 Research Question

a) What is the prevalence of overweight and obesity among postgraduate African students in UPM?
b) What are the factors that influence overweight and obesity of postgraduate African students in UPM?
c) What are the predictors of overweight and obesity among postgraduate African students in UPM?

1.5 Objectives

1.5.1 General objective

To determine factors associated with overweight and obesity among postgraduate African students in UPM.

1.5.2 Specific objectives

a) To measure the prevalence of overweight and obesity among postgraduate African students in UPM.
b) To identify the socio-demographic characteristics, behavioural factors, eating pattern, and psychological factors of the respondents.
c) To determine the association between socio-demographic factors, behavioural factors, eating pattern, and psychological factors with overweight and obesity among the respondents.
d) To determine the predictors of overweight and obesity among postgraduate African students.

1.6 Research Hypotheses

The alternate hypotheses of the study are:

a) There is a significant association between socio-demographic factors (age, gender, nationality, marital status and financial support) with overweight and obesity among the respondents.

b) There is a significant association between behavioural factors (level of physical activity, smoking, and alcohol consumption) with overweight and obesity among the respondents

c) There is a significant association between eating pattern (frequency of eating per day and of eating outside) with overweight and obesity among the respondents

d) There is a significant association between psychological factors (depression, anxiety, and stress) with overweight and obesity among the respondents.

REFERENCES

Adienbo, O. M., Hart, V. O., & Oyeyemi, W. A. (2012). High Prevalence of Obesity among Indigenous Residents of a Nigerian Ethnic Group: The Kalabaris in the Niger Delta Region of South-South Nigeria. *Greener Jounrnal of Medical Sciences, 2*(6), 152–6.

Al-Hazzaa, H. M., Abahussain, N. A., Al-Sobayel, H. I., Qahwaji, D. M., & Musaiger, A. O. (2012). Lifestyle factors associated with overweight and obesity among Saudi adolescents. *BMC Public Health*, *12*, 354. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/22591544%5Cnhttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC3433359

Anis, N., Pan, K., Huda, B., & Faisal, I. (2016). Stress and its associated factors among Medical students in a public medical faculty, Malaysia. *International Journal of Public Health and Clinical Sciences*, *3*(3), 71–80.

Audrain-McGover, J., & Benowitz, N. (2011). Cigarette Smoking, Nicotine, and Body Weight. *Clin Pharmacol Ther*, *90*(1), 164–168.

Babazekri, L., Hanafiah Juni, M., Afiah M.Z., N., & Fattah Azman, A. Z. (2014). Association between overweight and obesity with stress amongst Iranian adolescents living in Malaysia. *International Journal of Public Health and Clinical Services*, *1*(2), 80–90. Retrieved from http://publichealthmy.org/ejournal/ojs2/index.php/ijphcs/article/view/121/110

Baxter, A. J., Scott, K. M., Vos, T., & Whiteford, H. A. (2013). Global prevalence of anxiety disorders: a systematic review and meta-regression. *Psychological Medicine*. https://doi.org/10.1017/S003329171200147X

Bezerra, I. N., Curioni, C., & Sichieri, R. (2012, February). Association between eating out of home and body weight. *Nutrition Reviews*.

Bodenlos, J. S., Lemon, S. C., Schneider, K. L., August, M. A., & Pagoto, S. L. (2011). Associations of mood and anxiety disorders with obesity: Comparisons by ethnicity. *Journal of Psychosomatic Research*, *71*(5), 319–324. https://doi.org/10.1016/j.jpsychores.2011.03.004

Bowie, J. V, Juon, H.-S., Cho, J., & Rodriguez, E. M. (2007). Factors associated with overweight and obesity among Mexican Americans and Central Americans: results from the 20.01 California Health Interview Survey. *Preventing Chronic Disease, 4*(1), A10.

Brumpton, B., Langhammer, A., Romundstad, P., Chen, Y., & Mai, X.-M. (2013). The associations of anxiety and depression symptoms with weight change and incident obesity: The HUNT Study. *International Journal of Obesity*.

Bursac, Z., Gauss, C. H., Williams, D. K., & Hosmer, D. W. (2008). Purposeful selection of variables in logistic regression. *Source Code for Biology and Medicine*, *3*(1), 17. https://doi.org/10.1186/1751-0473-3-17

CDC. (2015). Health Statistics. Retrieved December 10, 2016, from https://www.cdc.gov/nchs/nhis/tobacco/tobacco_glossary.htm

CDC. (2016). Indicator Definitions - Alcohol. Retrieved December 1, 2016, from https://www.cdc.gov/cdi/definitions/alcohol.html

CDC-n.a.-2. (2012). Defining adult overweight and obesity. *Centers for Disease Control and Prevention*, 8–9. Retrieved from http://www.cdc.gov/obesity/adult/defining.html

Centers for Disease Control and Prevention. (2015). Adult Obesity Facts. *DNPAO Data & Statistics*. Retrieved from http://www.cdc.gov/obesity/data/adult.html

Centers for Disease Control and Prevention (CDC). (2016). Adult Obesity Causes & Consequences. Retrieved January 13, 2017, from https://www.cdc.gov/obesity/adult/causes.html

Cheli Vettori, J., Covolo, N., Savegnago Mialich, M., & Jordao, A. A. (2014). Nutritional status, weight evolution and eating behavior in university students of health careers in Ribeirao Preto, Sao Paulo, Brazil. *Nutricion Clinica Y Dietetica Hospitalaria*, *34*(2), 52–62. https://doi.org/10.12873/342cheli

Chen, Y., & Qian, L. (2012). Association between lifetime stress and obesity in Canadians. *Preventive Medicine*, *55*(5), 464–467.

Chu, A. H. Y., & Moy, F. M. (2012). Reliability and Validity of the Malay International Physical Activity Questionnaire (IPAQ-M) Among a Malay Population in Malaysia. *Asia-Pacific Journal of Public Health*, *XX*(X), 1–9. https://doi.org/10.1177/1010539512444120

Collins, J. C., & Bentz, J. E. (2009). Behavioral and Psychological Factors in Obesity. *The Journal of Lancaster General Hospital*, *4*(4), 124–126.

Dare, S., Mackay, D. F., & Pell, J. P. (2015). Relationship between smoking and obesity: A cross-sectional study of 499,504 middle-aged adults in the UK general population. *PLoS ONE*, *10*(4).

de Castro, J. M., King, G. A., Duarte-Gardea, M., Gonzalez-Ayala, S., & Kooshian, C. H. (2012). Overweight and obese humans overeat away from home. *Appetite*, *59*(2), 204–211.

Department of Health. (2012). *The Public Health Outcomes Framework for England, 2013-2016. Department of Health.*

Dupuy, M., Godeau, E., Vignes, C., & Ahluwalia, N. (2011). Socio demographic and life style factors associated with overweight in a representative sample of 11-15 years in France. *BMC Public Health*, *11*, 442. Retrieved from http://www.biomedcentral.com/1471-2458/11/442

Durnin, J. V. G. A., & Womersley, J. (1974). Body fat assessed from total body density and its estimation from skinfold thickness: measurements on 481 men and women aged from 16 to 72 Years. *British Journal of Nutrition*. https://doi.org/10.1079/BJN19740060

Edelman, A., Jensen, J. T., Bulechowsky, M., & Cameron, J. (2011). Combined oral contraceptives and body weight: Do oral contraceptives cause weight gain? A primate model. *Human Reproduction*, *26*(2), 330–336.

European association for the study of obesity (EASO). (2016). Obesity Facts & Figures. Retrieved May 25, 2017, from http://easo.org/education-portal/obesity-facts-figures/

Fields, D. A., Gunatilake, R., & Kalaitzoglou, E. (2015). Air Displacement Plethysmography. *Nutrition in Clinical Practice*. https://doi.org/10.1177/0884533615572443

Flegal, K., Bk, K., Orpana, H., & Graubard, B. (2013). Association of All-Cause Mortality With Overweight and Obesity Using Standard Body Mass Index Categories: A Systematic Review and Meta-analysis. *JAMA*, *309*(1), 71–82. Retrieved from http://jama.jamanetwork.com/article.aspx?articleid=1555137

Frederick, C. B., Snellman, K., & Putnam, R. D. (2014). Increasing socioeconomic disparities in adolescent obesity. *Proceedings of the National Academy of Sciences of the United States of America*, *111*(4), 1338–42. Retrieved from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3910644&tool=pmcentrez&rendertype=abstract

Freedman, D. S., Horlick, M., & Berenson, G. S. (2013). A comparison of the Slaughter skinfold-thickness equations and BMI in predicting body fatness and cardiovascular disease risk factor levels in children1-4. *American Journal of Clinical Nutrition*, *98*(6), 1417–1424.

French, M. T., Norton, E. C., Fang, H., & Maclean, J. C. (2010). Alcohol consumption and body weight. *Health Economics*, *19*(7), 814–832.

Gastelurrutia, P., Lupón, J., de Antonio, M., Zamora, E., Domingo, M., Urrutia, A., … Bayes-Genis, A. (2015). Body mass index, body fat, and nutritional status of patients with heart failure: The PLICA study. *Clinical Nutrition*, *34*(6), 1233–1238. https://doi.org/10.1016/j.clnu.2014.12.013

Gopalakrishnan, S., Ganeshkumar, P., Prakash, M. V. S., Christopher, & Amalraj, V. (2012). Prevalence of overweight/obesity among the medical students, Malaysia. *The Medical Journal of Malaysia*.

Guyenet, S. J., & Schwartz, M. W. (2012). Clinical review: Regulation of food intake, energy balance, and body fat mass: implications for the pathogenesis and treatment of obesity. *The Journal of Clinical Endocrinology and Metabolism*, *97*(3), 745–755. https://doi.org/10.1210/jc.2011-2525

Health, N. I. of M. (n.d.). Depression. Retrieved October 28, 2016, from https://www.nimh.nih.gov/health/topics/depression/index.shtml

Holmbäck, I., Ericson, U., Gullberg, B., & Wirfält, E. (2010). A high eating frequency is associated with an overall healthy lifestyle in middle-aged men and women and reduced likelihood of general and central obesity in men. *British Journal of Nutrition*. https://doi.org/10.1017/S0007114510001753

Hosmer Jr, DW; Lemeshow, S. (2004). Applied Logistic Regression. In *John Wiley and Sons*.

Hovhannisyan, M. G., Pierce, M., & Amirkhanyan, Y. (2009). Hygienic characteristics of nutrition among first-year foreign students studying at the yerevan state medical university. *New Armenian Medical Journal*, *3*(1 (2009)), 68–76.

Kabir, S., Said, S. M., & 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.

Kader Maideen, S. F., Mohd Sidik, S., Rampal, L., & Mukhtar, F. (2014). Prevalence, associated factors and predictors of depression among adults in the community of Selangor, Malaysia. *PLoS ONE*. https://doi.org/10.1371/journal.pone.0095395

Kaminsky, C. K., Yuh, B., & Koh, C. J. (2014). *Principles of computerized tomography (CT)*. *Pediatric and Adolescent Urologic Imaging*. https://doi.org/10.1007/978-1-4614-8654-1_3

Koh, D., & Zawi, M. K. (2014). Statistics anxiety among postgraduate students. *International Education Studies*, *7*(13), 166–174. https://doi.org/10.5539/ies.v7n13p166

Kypreos, K. E., Karagiannides, I., Fotiadou, E. H., Karavia, E. A., Brinkmeier, M. S., Giakoumi, S. M., & Tsompanidi, E. M. (2009). Mechanisms of obesity and related pathologies: Role of apolipoprotein e in the development of obesity. *FEBS Journal*, *276*(20), 5720–5728. https://doi.org/10.1111/j.1742-4658.2009.07301.x

Larson, N., Neumark-Sztainer, D., Laska, M. N., & Story, M. (2011). Young adults and eating away from home: Associations with dietary intake patterns and weight status differ by choice of restaurant. *Journal of the American Dietetic Association*. https://doi.org/10.1016/j.jada.2011.08.007

Lee, Y. H., Mottillo, E. P., & Granneman, J. G. (2014). Adipose tissue plasticity from WAT to BAT and in between. *Biochimica et Biophysica Acta - Molecular Basis of Disease*, *1842*(3), 358–369. https://doi.org/10.1016/j.bbadis.2013.05.011

Leppik, A., Jürimäe, T., & Jürimäe, J. (2004). Reproducibility of anthropometric measurements in children: a longitudinal study. *Anthropologischer Anzeiger; Bericht Über Die Biologisch-Anthropologische Literatur*.

Little, M., Humphries, S., Patel, K., & Dewey, C. (2016). Factors associated with BMI , underweight , overweight , and obesity among adults in a population of rural south India : a cross- sectional study. *BMC Obesity*, 1–13. https://doi.org/10.1186/s40608-016-0091-7

Lorenzo, A. D., & Andreoli, A. (2003). Segmental bioelectrical impedance analysis. *Curr.Opin.Clin.Nutr.Metab Care*.

Lovibond, S., & Lovibond, P. (1995). Depression Anxiety and Stress Scale. *Manual for the Depression Anxiety Stress Scales*.

Mahfouz, M. S., Makeen, A. M., Akour, A. Y., Madkhly, T. M., Hakami, H. M., Shaabi, W. M., … Al-Ali, M. A. (2016). Nutritional habits and weight status among Jazan university students: Eating patterns and healthy lifestyle assessment. *Epidemiology Biostatistics and Public Health*, *13*(2), 1–7. https://doi.org/10.2427/11658

Mahmood, S., Perveen, T., Najjad, M., Yousuf, N., &, & Ahmed, F. (2013). Overweight and Obesity among Medical Students of public sector's institutes in Karachi, Pakistan. *Journal of Obesity and Weight Loss*, *3*, 157.

Manyanga, T., El-Sayed, H., Doku, D. T., & Randall, J. R. (2014). The prevalence of underweight, overweight, obesity and associated risk factors among school-going adolescents in seven African countries. *BMC Public Health*, *14*, 887. https://doi.org/10.1186/1471-2458-14-887

Marmorstein, N. R., Iacono, W. G., & Legrand, L. (2014). Obesity and depression in adolescence and beyond: Reciprocal risks. *International Journal of Obesity*, *38*(7), 906–911. Retrieved from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4098649&tool=pmcentrez&rendertype=abstract

Martyn-Nemeth, A., P., & Penckofer, S. (2012). Psychological Vulnerability Among Overweight/Obese Minority Adolescents. *The Journal of School Nursing*, *28*(4), 291–301. https://doi.org/10.1177/1059840511430508

McKinsey. (2014). Overcoming obesity : An initial economic analysis Executive summary Discussion paper, (November).

Mogre, V., Nyaba, R., & Aleyira, S. (2014). Lifestyle Risk Factors of General and Abdominal Obesity in Students of the School of Medicine and Health Science of the University of Development Studies, Tamale, Ghana. *ISRN Obesity*, *2014*, 1–10. https://doi.org/10.1155/2014/508382

Murakami, K., & Livingstone, M. B. (2015). Eating Frequency Is Positively Associated with Overweight and Central Obesity in US Adults. *J Nutr*. https://doi.org/10.3945/jn.115.219808

Murakami, K., & Livingstone, M. B. E. (2014). ★★Eating frequency in relation to body mass index and waist circumference in British adults. *International Journal of Obesity (2005)*. https://doi.org/10.1038/ijo.2014.1

Musa, R., Fadzil, M. A., & Zain, Z. (2007). Translation , validation and psychometric properties of Bahasa Malaysia version of the Depression Anxiety and Stress Scales (DASS). *Asean Journal of Psychiatry*, *8*(2), 82–89.

Musaiger, A. O. (2011). Overweight and obesity in Eastern Mediterranean Region: Prevalence and possible causes. *Journal of Obesity*, *2011*(January 1990). https://doi.org/10.1155/2011/407237

Nazaimoon, W., Mohamud, W., & Musa, K. I. (2011). Prevalence of overweight and obesity among adult Malaysians : an update Short Communication Prevalence of overweight and obesity among adult Malaysians : an update. *Asia Pacific Journal of Clinical Nutrition*, (September 2015).

NCD Risk Factor Collaboration (NCD-RisC), Di Cesare, M., Bentham, J., Stevens, G. A., Zhou, B., Danaei, G., … Ezzati, M. (2016). Trends in adult body-mass index in 200 countries from 1975 to 2014: a pooled analysis of 1698 population-based measurement studies with 19·2 million participants. *Lancet (London, England)*, *387*(10026), 1377–96. https://doi.org/10.1016/S0140-6736(16)30054-X

Nwachukwu, D., Nwagha, U., Obikili, E., Ejezie, F., Okwuosa, C., Nweke, M., & Ezeh, C. (2010). Assessment of Body Mass Index and Blood Pressure among University Students in, Enugu, South East, Nigeria. *Nigerian Journal of Medicine*, *19*(2). https://doi.org/10.4314/njm.v19i2.56503

Okafor, C. I., Anyaehie, U. S. B., & Ofoegbu, E. N. (2014). The magnitude of obesity and its relationship to blood pressure among the residents of enugu metropolis in South East Nigeria. *Annals of Medical and Health Sciences Research*, *4*(4), 624–9. https://doi.org/10.4103/2141-9248.139351

Peltzer, K., & Pengpid, S. (2011). Overweight and obesity and associated factors among school-aged adolescents in ghana and Uganda. *International Journal of Environmental Research and Public Health*, *8*(10), 3859–3870.

Peltzer, K., Pengpid, S., Alafia Samuels, T., Özcan, N. K., Mantilla, C., Rahamefy, O. H., … Gasparishvili, A. (2014). Prevalence of overweight/obesity and its associated factors among university students from 22 countries. *International Journal of Environmental Research and Public Health*, *11*(7), 7425–7441.

Perez-Cueto, F., Verbeke, W., Lachat, C., & Remaut-De Winter, A. M. (2009). Changes in dietary habits following temporal migration. The case of international students in Belgium. *Appetite*, *52*(1), 83–88. https://doi.org/10.1016/j.appet.2008.08.005

Pérez Rodrigo, C. (2013). Current mapping of obesity. *Nutrición Hospitalaria*, *28 Suppl 5*, 21–31. https://doi.org/10.3305/nh.2013.28.sup5.6915

Petry, N. M., Barry, D., Pietrzak, R. H., & Wagner, J. A. (2008). Overweight and obesity are associated with psychiatric disorders: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Psychosom.Med.*

Poterico, J. A., Stanojevic, S., Ruiz-Grosso, P., Bernabe-Ortiz, A., & Miranda, J. J. (2012). The association between socioeconomic status and obesity in Peruvian women. *Obesity (Silver Spring, Md.)*, *20*(11), 2283–9. Retrieved from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3340518&tool=pmcentrez&rendertype=abstract

Powell, L. M., & Nguyen, B. T. (2013). Fast-food and full-service restaurant consumption among children and adolescents: effect on energy, beverage, and nutrient intake. *JAMA Pediatrics*. https://doi.org/10.1001/jamapediatrics.2013.417

Ramli, M., Salmiah, M., & Nurul Ain, M. (2009). validation and pychometric properties of bahasa malaysia version of the depression anxiety and stress scales (DASS) among diabetic patients. *MJP Online Early*, 1–7. https://doi.org/10.4103/0022

Saiful, M., Yusoff, B., Fuad, A., Rahim, A., & Yaacob, M. J. (2011). The Prevalence of Final Year Medical Students with Depressive Symptoms and Its Contributing Factors. *International Medical Journal*, *18*(4), 305–309.

Samaranayake, N. R., Ong, K. L., Leung, R. Y. H., & Cheung, B. M. Y. (2012). Management of Obesity in the National Health and Nutrition Examination Survey (NHANES), 2007–2008. *Annals of Epidemiology*, *22*(5), 349–353. https://doi.org/10.1016/j.annepidem.2012.01.001

Santos M, J. L. (2009). Leptin-melanocortin system, body weight regulation and obesity. *Revista Medica De Chile*, *137*(9), 1225–1234.

Savegnago Mialich, M., Covolo, N., Cheli Vettori, J., & Jordao Junior, A. A. (2014). Relationship between body composition and level of physical activity among university students. *Revista Chilena de Nutrición*, *41*(1), 46–53. https://doi.org/10.4067/S0717-75182014000100006

Sayon-Orea, C., Martinez-Gonzalez, M. A., & Bes-Rastrollo, M. (2011). Alcohol consumption and body weight: A systematic review. *Nutrition Reviews*, *69*(8), 419–431.

Seguin, R. A., Aggarwal, A., Vermeylen, F., & Drewnowski, A. (2016). Consumption Frequency of Foods Away from Home Linked with Higher Body Mass Index and Lower Fruit and Vegetable Intake among Adults: A Cross-Sectional Study. *Journal of Environmental and Public Health*. https://doi.org/10.1155/2016/3074241

Singh, N., Bhsc, H., & Medicine, F. (2008). Review Co-morbidities of Overweight and Obesity, *85*(2), 116–120.

Smith, K. J., Blizzard, L., McNaughton, S. A., Gall, S. L., Dwyer, T., & Venn, A. J. (2011). Daily eating frequency and cardiometabolic risk factors in young Australian adults: cross-sectional analyses. *Br J Nutr*. https://doi.org/10.1017/S0007114511006398

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

Tabachnick, B. G. B. G., & Fidell, L. S. (2007). *Using Multivariate Statistics*. *Using multivariate statistics 5th ed*. https://doi.org/10.1037/022267

Teo, P. S., Nurul-Fadhilah, A., Aziz, M. E., Hills, A. P., & Foo, L. H. (2014). Lifestyle practices and obesity in Malaysian adolescents. *International Journal of Environmental Research and Public Health*, *11*(6), 5828–5838.

Todd, J. E., Mancino, L., & Lin, B.-H. (2010). The Impact of Food Away from Home on Adult Diet Quality. *SSRN eLibrary*.

Vineis, P., Stringhini, S., & Porta, M. (2014). The environmental roots of non-communicable diseases (NCDs) and the epigenetic impacts of globalization. *Environmental Research*. Academic Press Inc.

Wang, Y. C., McPherson, K., Marsh, T., Gortmaker, S. L., & Brown, M. (2011). Health and economic burden of the projected obesity trends in the USA and the UK. *The Lancet*, *378*(9793), 815–825. https://doi.org/10.1016/S0140-6736(11)60814-3

WHO. (n.d.). Global Physical Activity Surveillance. Retrieved November 3, 2016, from http://www.who.int/chp/steps/GPAQ/en/

WHO. (2008). Action Plan for the Global Strategy for the Prevention and Control of Noncommunicable Diseases 2008-2013. *Geneva: World Health Organization*, 35. Retrieved from http://www.who.int/nmh/Actionplan-PC-NCD-2008.pdf%5Cnhttp://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:20082013+Action+Plan+for+the+global+strategy+for+the+prevention+and+control+of+Noncommunicable+Diseases#0%5Cnhttp://scholar.google.com/scholar?

WHO. (2009). Interventions on diet and physical activity: What works summary report. *Geneva: Wold Health Organization*, 48. https://doi.org/10.1017/CBO9781107415324.004

WHO. (2015). WHO | Obesity and overweight, Factsheet No. 311. *WHO*. Retrieved from http://www.who.int/mediacentre/factsheets/fs311/en/%5Cnhttp://who.int/mediacentre/factsheets/fs311/en/

WHO. (2016). Obesity and overweight: Fact sheet (Updated June 2016). Retrieved October 10, 2016, from http://www.who.int/mediacentre/factsheets/fs311/en/

WHO, G. (2012). Global Physical Activity Questionnaire (GPAQ) Analysis Guide. *Geneva: World Health Organization*, 1–22. Retrieved from http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Global+Physical+Activity+Questionnaire+(GPAQ)+Analysis+Guide#1

WHO, W. H. O. (n.d.). Global Health Observatory (GHO) data for Overweight and Obesity. Retrieved October 24, 2016, from http://www.who.int/gho/ncd/risk_factors/overweight_text/en/

WHO, W. H. O. (2000). The Asia-Pacific perspective: redefining obesity and its treatment. *Geneva, Switzerland: World Health Organization*. https://doi.org/0-9577082-1-1

WHO, W. H. O. (2008). *Waist Circumference and Waist-Hip Ratio: Report of a WHO Expert Consultation Geneva, 8-11 December 2008. World Health Organization*. https://doi.org/10.1038/ejcn.2009.139

WHO, W. H. O. (2017). NCD mortality and morbidity. Retrieved March 1, 2017, from http://www.who.int/gho/ncd/mortality_morbidity/en/

Wong, S. L., & Leatherdale, S. T. (2009). Association between sedentary behavior, physical activity, and obesity: inactivity among active kids. *Preventing Chronic Disease, 6*(1), A26.

Xiao, Y., Zhao, N., Wang, H., Zhang, J., He, Q., Su, D., … Ye, Z. (2013). Association between socioeconomic status and obesity in a Chinese adult population. *BMC Public Health*, *13*(1), 355. Retrieved from http://www.biomedcentral.com/1471-2458/13/355

Xie, B., Waters, M. J., & Schirra, H. J. (2012). Investigating potential mechanisms of obesity by metabolomics. *Journal of Biomedicine and Biotechnology*, *2012*. https://doi.org/10.1155/2012/805683

Yildiz, E. A., Demirduzen, S., Dogan, V. B., Duman, S., Turkmen, N., & Yildiz, A. N. (2011). Evaluation of the dietary habits, body images and BMI of Turkish university students who live in dormitory. *Pakistan Journal of Medical Sciences*, *27*(1), 85–89.

Zarei, M., Taib, M. N. M., & Zarei, F. (2013). Factors associated with weight status among Iranian postgraduate students in Universiti Putra Malaysia (UPM). *Electronic Physician*, *5*(3), 687–97. https://doi.org/10.14661/2013.687-697