UNIVERSITI PUTRA MALAYSIA

PREVALENCE OF METABOLIC SYNDROME AND ASSOCIATED FACTORS IN YOBE STATE PROVENCE OF NIGERIA

MUSA AUDU LIKITA

FPSK(M) 2014 5

PREVALENCE OF METABOLIC SYNDROME AND ASSOCIATED FACTORS IN YOBE STATE PROVENCE OF NIGERIA

By

MUSA AUDU LIKITA

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in

Fulfillment of the Requirements for the Degree of Master of Sciences

February 2014

DEDICATION

Dedicated to my late father Mallam Audu Likita (May his soul rest in perfect and eternal peace) my living mother Hauwa Audu and my beloved wives Aisha Ibrahim, Bahyura Suleman Tanko, and Aisha Alhaji Umaru and my hany Zubaida Mahmud Yerima.

**PREVALENCE OF METABOLIC SYNDROME AND ASSOCIATED FACTORS
IN YOBE STATE PROVENCE OF NIGERIA**

By

MUSA AUDU LIKITA

January 2014

Chairman: **Prof. Lekhraj Rampal, PhD**

Faculty: **Medicine and Health Sciences**

Metabolic syndrome (MetS) is a clustering of interrelated cardiovascular risk factors
of metabolic origin that are associated with the development of cardiovascular
diseases and type II diabetes mellitus. The objective of the study was to determine the
prevalence of the MetS and associated risk factors among civil servants in Yobe state,
Nigeria. A cross sectional study was conducted between September 2012 and January
2013, using a stratified multi stage cluster sampling design. Biomedical (fasting blood
glucose and lipid profile), anthropometry, blood pressure and questionnaire based risk
factors were assessed. Metabolic syndrome was defined according to the International
Diabetes Federation (IDF). Multivariate models were used to study the association
between independent risk factors and the prevalence of the MetS. Out of the 500
respondents, 445 agreed to participate in the study giving a response rate of 89%. The
prevalence of MetS was 36.4% among Yobe state civil servants and was significantly
higher in females (45.9%) as compared to 31.3% in males (p = 0.002). The
prevalence of MetS increased significantly with age in both gender, ranging from
19.7% to 48.1% in males and 46.6% to 60.0% in females. The most frequently
observed metabolic features were increased waist circumference 51.7% (women
81.5% and men 35.1%), high blood pressure 46.3% (females 49.7% and males
44.4%), elevated fasting blood glucose 48.8% (males 44.4%, and females 40.1%),
high triglycerides 48.5% (males 58.3% females 37.5%), whereas low high density
lipoproteins cholesterol was observed to be less (13.0 %) frequent (females 15.3%,
and males 12.5%). Adjusted odds ratio (OR) showed that gender, age, monthly
income, education, tobacco use, alcohol consumption, family history of hypertension,
diabetes and obesity and physical inactivity were significantly associated with MetS.
The odds of females having MetS were 4.25 times higher compared to males (OR=
4.225; 95% CI 2.441 - 7.315). Respondents aged 50 years and above had more than

two fold increased risk of MetS compared to younger age (OR= 2.23; 95% CI 1.071 - 4.637). Respondents with a family history of hypertension, diabetes and/or obesity were six times at risk of having MetS (OR= 6.228; 95%CI 3.614 - 10.732) compared to those that do not have such family history. Tobacco users were more than four times at high risk of having MetS than those that never used tobacco (OR= 4.563; 95%CI 2.449 - 8.502), P<0.001. Similarly heavy alcohol drinkers were found to have four times odds of having MetS than the non-alcohol drinkers (OR= 4.271; 95%CI 1.994 - 9.144). This study indicated that low level of physical activity is 16 times increased risk of metabolic syndrome (OR=16.23; 95%CI 5.945 - 44.33). This study indicated that the prevalence of the MetS among Yobe state civil servants is high. Longitudinal studies are required to establish true cause of metabolic syndrome in Yobe state. Early identification of MetS and interventions are important strategies in prevention and control of diabetes, cardiovascular diseases in Yobe state.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

PREVALENS SINDROM METABOLIK DAN FAKTOR – FAKTOR YANG BERKAITAN DI WILAYAH YOBE NIGERIA

Oleh

MUSA AUDU LIKITA

Januari 2014

Pengerusi: **Prof. Lekhraj Rampal, PhD**

Fakulti: **Perubatan dan Sains Kesihatan**

Sindrom metabolik (Mets) adalah kelompok yang saling faktor risiko kardiovaskular asal metabolik yang berkaitan dengan perkembangan penyakit kardiovaskular dan jenis II kencing manis. Tujuan kajian ini ialah untuk menentukan prevalens sindrom metabolik dan hubungan dengan faktor-faktor risiko dikalangan kakitangan kerajaan di negeri Yobe, Nigeria. Kajian keratan rentas telah dijalankan diantara September 2012 hingga Januari 2013, dengan menggunakan kaedah persampelan kluster pelbagai peringkat strata. Bioperubatan (glukos darah puasa dan profil lipid), antropometri, tekanan darah dan borang soal-selidik bagi menilai faktor risiko. Sindrom metabolik didefinisi berdasarkan Persekutuan Diabetes Antarabangsa. Model multivariat telah digunakan untuk mengkaji hubungan diantara faktor risiko tidak bersandar dan prevalens sindrom metabolik. Dari 500 responden, 445 bersetuju untuk menyertai kajian ini menjadikan kadar respon 89%. Prevalens sindrom metabolik adalah 36.4% di kalangan penjawat awam negeri Yobe dan adalah lebih tinggi secara bermakna di kalangan wanita berbanding lelaki (45.9%) berbanding 31.3% (p = 0.002). Prevalens sindrom metabolik meningkat secara bermakna dengan umur bagi kedua-dua semua jantina dengan julat dari 19.7% hingga 48.1% bagi lelaki dan 46.6% hingga 60.0% bagi wanita. Ciri-ciri metabolik yang paling kerap dilihat ialah lilitan pinggang yang lebar 51.7% (81.5% wanita dan 35.1% lelaki), tekanan darah tinggi 46.3% (49.7% wanita dan 44.4% lelaki), peningkatan darah glukos puasa 48.8% (44.4% lelaki, dan 40.1%wanita), tinggi trigliserid 48.5% (58.3% lelaki dan 37.5% wanita), manakala rendah kolesterol lipoprotein berdensiti tinggi (13.0%) paling kurang (15.3% wanita dan 12.5% lelaki) didapati. Nisbah odd (OR) terlaras menunjukkan bahawa jantina, peningkatan usia, pendapatan bulanan, pendidikan, penggunaan tembakau, pengambilan alkohol, sejarah tekanan darah tinggi atau kencing manis dan/atau kegemukan dikalangan ahli keluarga dan tidak aktif fizikal mempunyai hubungan yang bermakna dengan sindrom metabolik. Odd wanita mendapat sindrom metabolik adalah 4.23 kali lebih tinggi berbanding lelaki dengan (OR= 4.23; 95% CI 2.44 - 7.32). Responden yang

v

berumur 50 tahun dan ke atas mempunyai lebih dua kali ganda peningkatan risiko sindrom metabolik berbanding umur lebih muda (OR= 2.23; 95% CI 1.07-4.64). Responden yang mempunyai sejarah darah tinggi, kencing manis dan/atau kegemukan adalah 6 kali ganda risiko mendapat sindrom metabolik (OR=6.23; 95%CI 3.61 - 10.73) berbanding dengan mereka yang tidak mempunyai sejarah keluarga tersebut. Penggunaan tembakau adalah empat kali ganda berisiko tinggi untuk mendapat sindrom metabolik dari mereka yang tidak pernah menggunakan tembakau (OR=4.56; 95% CI 2.45 - 8.50). Demikian juga, peminum alkohol yang kuat didapati mempunyai empat kali odd mendapat sindrom metabolik dari meraka yang bukan peminum alkohol (OR =4.27; 95% CI 1.99 - 9.14). Kajian ini menunjukkan bahawa tahap rendah aktiviti fizikal adalah 16 kali ganda peningkatan risiko sindrom metabolik OR=16.23; 95% CI (5.94 - 44.33). Kajian ini menunjukkan bahawa prevalens sindrom metabolik di kalangan kakitangan kerajaan Negeri Yobe adalah tinggi. Kajian longitudinal diperlukan bagi menentukan penyebab sebenar sindrom metabolik di Negeri Yobe. Pengenalpastian awal sindrom metabolik dan intervensi adalah strategi penting dalam pencegahan dan kawalan kencing manis, penyakit kardiovaskular di Negeri Yobe.

ACKNOWLEDGEMENTS

Musa A. Likita

I certify that a Thesis Examination Committee has met on 8 January 2014 to conduct the final examination of Musa Audu Likita on his thesis entitled "Prevalence of Metabolic Syndrome and Associated Factors in Yobe State Province of Nigeria" 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 Science.

Members of the Thesis Examination Committee were as follows:

Sharmili Vidyadaran, PhD
Associate Professor
Faculty of Medicine and Health Science
Universiti Putra Malaysia
(Chairman)

Lye Munn Sann, PhD
Professor Dato'
Faculty of Medicine and Health Science
Universiti Putra Malaysia
(Internal Examiner)

Anita binti Abdul Rahman, PhD
Senior Lecturer
Faculty of Medicine and Health Science
Universiti Putra Malaysia
(Internal Examiner)

Mohamed Rusli Abdullah, PhD
Associate Professor
Universiti Sains Malaysia
Malaysia
(External Examiner)

NORITAH OMAR, PhD
Associate Professor and Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 10 March 2014

This thesis was submitted to the senate of the Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory committee were as follows:

Lekhraj Rampal, MBBS, MPH, DrPH, FAMM, FAMS, FPHMM
Professor
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Chairman)

Iliyasu Zubairu, MBBS, MPH, DrPH
Associate Professor
Faculty of Medicine,
Aminu Kano University Teaching Hospital- Nigeria
(Member)

Hejar Abdul Rahman, MD, MPH
Associate Professor
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Member)

Salmiah Md Said MD, MMED
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 other 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.: _____

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) are adhered to.

Signature:	_____	Signature:	_____
Name of Chairperson of Supervisory Committee:	_____	Name of Member of Supervisory Committee:	_____

Signature:	_____	Signature:	_____
Name of Member of Supervisory Committee:	_____	Name of Member of Supervisory Committee:	_____

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

This chapter portrays a brief explanation on the background of the study, the objectives, problem definition, research question as well as the significance of the study. It also highlights the hypotheses and the conceptual framework.

1.1   Background

World Health Organization (WHO) predicted that, deaths due to non-communicable disease (NCD) will increase by 17% over the next ten years globally; the greatest increase will be noticed in the African region and the Eastern Mediterranean region amounting to 27% and 25% increase in mortality respectively (Vissers et al., 2013). Western Pacific and South Asian regions will similarly receive the highest relative number of deaths (Rafael Lozano et al., 2012). Approximately, 18 million people died from cardiovascular diseases (CVD) in 2008, accounting for about 30% of all global deaths. Of these deaths, an estimated seven millions were due to coronary heart disease and six millions were due to stroke alone.Of those deaths, an estimated 7.3 million were due to coronary heart disease and 6.2 million attribute to stroke (WHO, 2011).

Action Plans for the Global Strategy for the Prevention and Control of Non-communicable diseases 2008-2013, reported that, unless necessary steps are taken, the increased in the death toll and other health related problems due to these disease burdens will continue to rise indiscriminately. The annual global healthcare cost of CVD in adults between the ages of 20 to 79 years old is 153 billion dollars (International Diabetes Federation Task Force on Diabetes Health Economics, 2010). Unless proper action has been taken, this value may likely increase to 396 billion dollars by 2025 (Alberti et al., 2007). It is also noted that majority of this increase which is expected to be of the type 2 diabetes mellitus class especially in developing countries. Incidences of diabetes mellitus in most African countries is particularly attributable to increasing ageing of the population and lifestyle changes engendered by rapid urbanization and westernization (Nwegbu and Jaiyesimi, 2012).

Metabolic Syndrome (MetS) is a clustering of interrelated cardiovascular risk factors of metabolic origin that are associated with the development of atherosclerotic cardiovascular diseases and type II diabetes mellitus (Wang et al., 2010). Central abdominal obesity, raised triglycerides, low High Density Lipoprotein (HDL), raised plasma glucose and raised blood pressure, often coexist together and are the important risk factors for the development of cardiovascular disease (Grundy, 2006).Most of the public health challenges due to metabolic diseases manifest after decades of sedentary life style and poor eating habits coupled with low level of physical activities. It affects anyone at any age, but most frequently seen in those who are significantly overweight with most of their excess fat in the abdominal area (Anderssen et al., 2007).

1.2   Problems Statement

With an estimated highest prevalence of 34% in the US and 10–50% in other countries depending on region, MetS poses a major disease burden to our modern society (Ervin, 2009).Africa, the second largest continent which makes up 22% of the world total land mass has estimated population of 642 million people living in 50 different countries enriched with more than 3000 diverse cultural and ethnic background, is equally facing a rapid demographic and epidemiological transition in the world history (Kengne, Amoah, & Mbanya, 2005). Several studies have confirmed the prevalence of the chronic diseases epidemics and that the largest proportion is expected to occur in developing countries largely due to rapid urbanization, westernization of lifestyle, ageing and changes in socioeconomic structure(Motala et al, 2009).

Recent estimates of regional prevalence of CVD in Africa by IDF projected the disease increases from 3.1% in 2007 to 3.5 % in 2025 with corresponding 80% increase in number from 10.4 million to 18.7 million (IDF Diabetes Atlas, 2012). Previous surveillance in some neighbouring African countries revealed a gradual increase in the prevalence of some cardiovascular risk factors as compared to past trend. These countries includes; Benin 3%, Mauritania 3.6%, Cameroon 6.2%, Ghana 3.2%, Niger 4.2 %, Chad 3.6%, including Nigeria 2.2% (IDF Diabetes Atlas, 2012).

Nigeria is currently recording an increase in the trend of CVD burden since the past fourth decades (Okafor, 2012). In a regional survey conducted in southern Nigeria 2010, indicate that prevalence of MetS increased from 11% among participants aged less than 29 years to 89% among participants aged 70 years and above (Ogbera, 2010a).The Northern and the Southern part of Nigeria differ in terms of climate, ethnic background, religious belief and lifestyle(Ogah OS et al., 2012).Since the two regions do not share common characteristics, data from the Southern part cannot be inferred on the population from the Northern part of Nigeria. However, little is known on the prevalence and factors associated with MetS in Northern part of Nigeria, hence this study will fill the gap and will be comparable with those studies conducted in the South. More so, if no study is done, then the burden of the disease will continue to be high in the society, complications due to CVD will affect the individual, family and the entire community.

1.2   Significance of the study

This study determines the prevalence and factors associated with MetS among civil servants in Yobe state. The prevalence is high in other parts of Nigeria, however, there is few published information on MetS in North-Eastern part of Nigeria, or any other Hausa descent, and the prevalence of CVD in Yobe state of Nigeria is unknown. Similarly, World Health Organization report from this region is also limited in number, thus this study conducted will fill the wide gap in this respect. The current study will add to the body of knowledge about the estimated number of people that are at high risk of developing cardiovascular diseases.

Similarly these findings can be used by policy makers, researchers in order to design intervention strategy aimed at reducing the burden of CVD. Likewise the study will provide an opportunity of identifying respondents that are at high risk of CVD so that they will take measures to prevent the increase in burden of the disease at community level. Also this study will be used to compare with other studies conducted in the Southern part of Nigeria to assess the disparity and/or similarity of factors associated with MetS across the regions. The findings are however relevant and do provide the evidence needed to conduct a larger scale study among this population.

1.3 Research questions

The research questions of this study were:
  i. What was the prevalence of metabolic syndrome among civil servants in Yobe State?
  ii. What are the factors that increased risk of MetS among civil servants in Yobe State?

1.5 Objectives

1.5.1 General objective

The general objective of the study was to determine the prevalence of metabolic syndrome and its associated risk factors among civil servants in Yobe State, Nigeria.

1.5.2 Specific objective

The specific objectives of the study were as follows:
  i. To determine the socio-demographic and behavioural factors of respondents by gender
  ii. To determine the prevalence of MetS among civil servants in Yobe state.
  iii. To determine the association between socio-demographic characteristics (age, gender, ethnicity, family monthly income, Education level, family history and knowledge on diabetes, hypertension and obesity) and metabolic syndrome.
  iv. To determine the association between behavioural characteristics (tobacco use, alcohol consumption) and MetS.
  v. To determine the association between physical inactivity and metabolic syndrome.
  vi. To determine the predictors of MetS.

1.6 Research hypotheses

The hypotheses of the study were as follows:
  i. The prevalence of metabolic syndrome among Yobe state civil servants was high
  ii. There is significant association between socio-demographic factors and MetS.
   • Females are at high risk of developing MetS than males
   • Prevalence of MetS is higher among older age than young
   • The risk of MetS is lower among respondents with high level of education
   • High family monthly income increases the risk of MetS
   • Prevalence of MetS significantly differs among different ethnic groups.
   • Family history of the disease increases the risk of MetS
  iii. Behavioural characteristics increase the risk of metabolic syndrome.

3

- Tobacco consumption increases the risk of Mets
- Alcohol consumption increases the risk of MetS
iv. Decrease in physical activity increases risk metabolic syndrome

1.7 Conceptual framework

This section provides a theoretical model for understanding the relationship between dependent variable (MetS) and the independent variables that focuses on multifaceted health related problems (Simmons et al., 2010). This model was used to identify direct or indirect contributors and predictors on MetS that was found to be attributable to several underlying factors (Haffner, 2006). Identifying the factors that predict MetS in this concept is necessary in understanding the target plan for intervention strategies of MetS and its consequences. Understanding the conceptual frame work will facilitate decision making regarding the role of each variables in development of metabolic syndrome.

Figure 1.1 shows the conceptual framework of metabolic syndrome. Based on the conceptual frame work, the study assessed several features that could predispose individual respondent towards the development of MetS. They include socio-demographic characteristic which includes age, gender, ethnicity, education level, total monthly family income and knowledge on hypertension, diabetes and obesity. The socio-demographic factors are known to influence the lifestyle of an individual and predispose to then occurrence of MetS (Makkes et al., 2013, Loucks et al., 2007, Rampal et al., 2012, Furgerson et al., 2010).

Behavioural risk factors such as alcohol consumptions, unhealthy diets, tobacco consumption and use of drugs also reported to enhance the development of MetS (WHO, 2013, Grundy et al., 2004, Alkerwi et al 2009). Smokeless tobacco products (chewing tobacco, moist and dry snuff) causes several adverse health related effects like oral-pharyngeal cancer, dental caries, oral lesions, addiction to Nicotine, lung diseases and cardiovascular diseases (Monson, & Beaulieu, 2011). In a large cohort study in United State reported an association between smokeless tobacco and increased risk of cardiovascular diseases (Critchley & Unal, 2003).

It has been documented that genetic factor, family history of hypertension, diabetes and obesity was significantly associated and increases the risk of MetS (Lehtovirta et al., 2000, Yeung et al., 2007). Physical inactivity was strongly independently associated with increased prevalent of MetS (Felix et al., 2011). Regular physical activity has positive effect on numerous cardiovascular risk factors that contributes to the development of MetS, therefore lifestyle intervention mainly through modification of dietary pattern and physical activity are crucial to reduce risk of vascular diseases (Lakka et al., 2007). Previous studies indicated that a rural/urban factor was strongly associated with the risk of MetS (Gyakobo et al., 2012).

Urban dwellers had a significantly higher risk of MetS than rural dwellers, because majority of the rural dwellers are made of predominantly active peasant farmers who pay much attention to traditional dietary pattern than the western dietary pattern. Complex interplay between genetic and environmental factors is belief plays a significant role in pathophysiology of CVD and MetS (Thaman et al., 2013). Genetic factor, Urban and rural factor and dietary pattern, knowledge attitude and practice on the risk factors, drugs and hormones were not highlighted in this theoretical model because they were not included in the study.
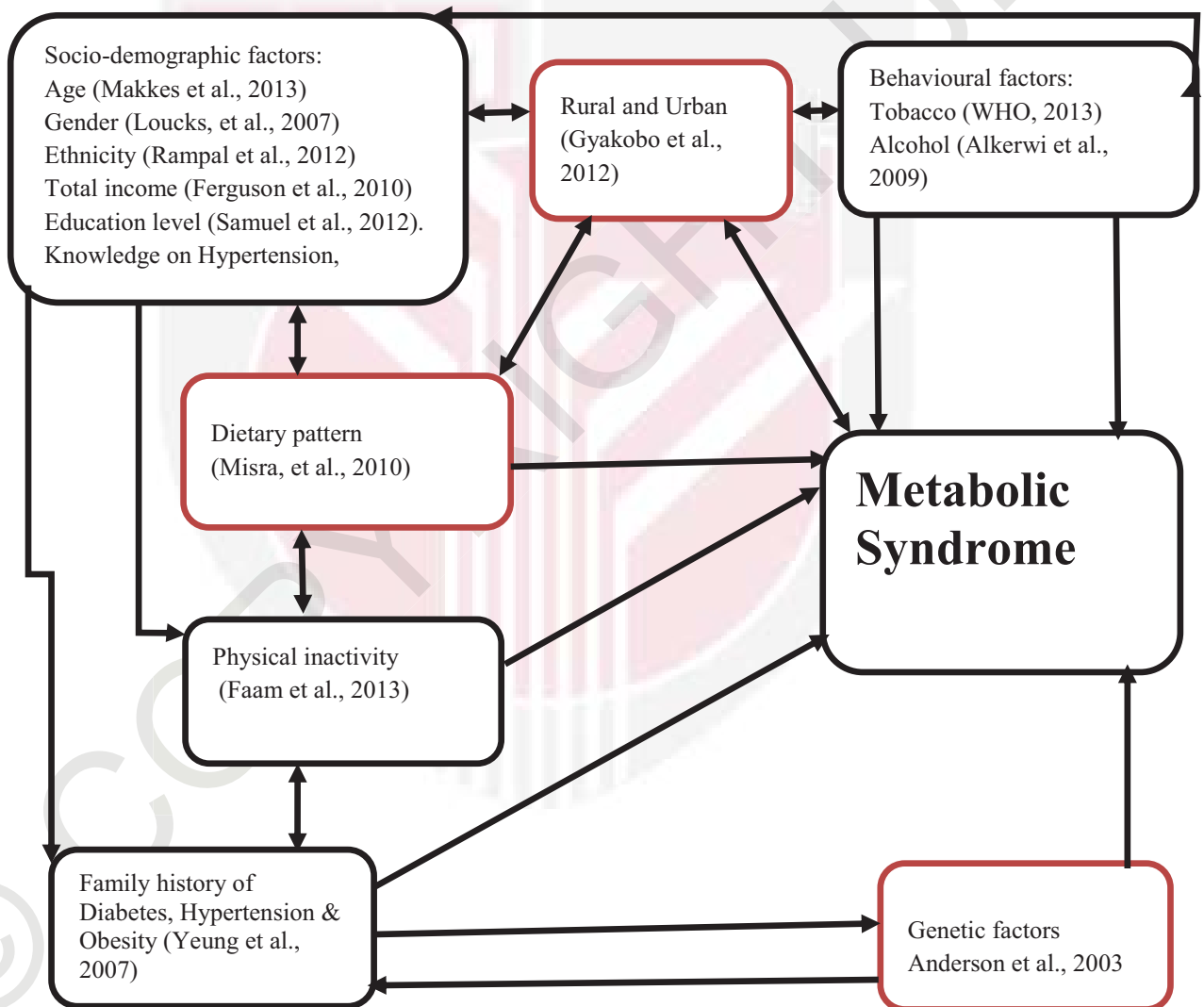
Figure 1.1   Conceptual frame work on risk factors associated with MetS

REFERENCES

Abah, S. O., Aigbiremolen, A. O., Cb, D., Ns, A., Ad, A., Fo, E., & Me, A. (2012). Prevalence of overweight and obesity among students in private and public secondary schools in a peri-urban Nigerian town, *2*(11), 51–57.

Abete, I., Goyenechea, E., Zulet, M. a, & Martínez, J. a. (2011). Obesity and metabolic syndrome: potential benefit from specific nutritional components. *Nutrition, Metabolism, and Cardiovascular Diseases : NMCD*, *21 Suppl 2*, B1–15.

Addo, J., Smeeth, L., & Leon, D. a. (2009). Obesity in urban civil servants in Ghana: association with pre-adult wealth and adult socio-economic status. *Public Health*, *123*(5), 365–70.

Adedoyin, R. A., Afolabi, A., Adegoke, O. O., Akintomide, A. O., & Awotidebe, T. O. (2013). Relationship between socioeconomic status and metabolic syndrome among Nigerian adults. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 2–5.

Adeyeye, O. O., Ogbera, A. O., Ogunleye, O. O., Brodie-Mens, A. T., Abolarinwa, F. F., Bamisile, R. T., & Onadeko, B. O. (2012). Understanding asthma and the metabolic syndrome - a Nigerian report. *International Archives of Medicine*, *5*(1), 20.

Al Zenki, S., Al Omirah, H., Al Hooti, S., Al Hamad, N., Jackson, R. T., Rao, A., Al Jahmah, N., et al. (2012). High prevalence of metabolic syndrome among Kuwaiti adults--a wake-up call for public health intervention. *International Journal of Environmental Research and Public Health*, *9*(5), 1984–96.

Alberti, K. G. M. M., Eckel, R. H., Grundy, S. M., Zimmet, P. Z., Cleeman, J. I., Donato, K. a, Fruchart, J.-C., et al. (2009a). Harmonizing the metabolic syndrome: a joint interim statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International . *Circulation*, *120*(16), 1640–5.

Alberti, K. G. M. M., Eckel, R. H., Grundy, S. M., Zimmet, P. Z., Cleeman, J. I., Donato, K. A, Fruchart, J.-C., et al. (2009b). Harmonizing the metabolic syndrome: a joint interim statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International . *Circulation*, *120*(16), 1640–5.

Alberti, K. G. M. M., Zimmet, P., & Shaw, J. (2007). International Diabetes Federation: a consensus on Type 2 diabetes prevention. *Diabetic medicine : Journal of the British Diabetic Association*, *24*(5), 451–63.

Alberts, M., Urdal, P., Steyn, K., Stensvold, I., Tverdal, A., Nel, J. H., & Steyn, N. P. (2005). Prevalence of cardiovascular diseases and associated risk factors in a rural black population of South Africa. *European Journal of Cardiovascular Prevention & Rehabilitation*, *12*(4), 347–354.

Alkerwi, A., Boutsen, M., Vaillant, M., Barre, J., Lair, M.-L., Albert, A., … Dramaix, M. (2009a&b). Alcohol consumption and the prevalence of metabolic syndrome: a meta-analysis of observational studies. Atherosclerosis, 204(2), 624–35.

Allal-Elasmi, M., Haj Taieb, S., Hsairi, M., Zayani, Y., Omar, S., Sanhaji, H., Jemaa, R., et al. (2010). The metabolic syndrome: prevalence, main characteristics and association with socio-economic status in adults living in Great Tunis. *Diabetes & Metabolism*, *36*(3), 204–8.

Amira, O. C., & Okubadejo, N. U. (2007). Frequency of complementary and alternative medicine utilization in hypertensive patients attending an urban tertiary care centre in Nigeria. BMC complementary and alternative medicine, 7, 30.

Anderssen, S. a, Carroll, S., Urdal, P., & Holme, I. (2007). Combined diet and exercise intervention reverses the metabolic syndrome in middle-aged males: results from the Oslo Diet and Exercise Study. *Scandinavian Journal of Medicine & Science in Sports*, *17*(6), 687–95.

Asia, S., Ghaffar, A., Reddy, K. S., & Singhi, M. (2002). Burden of Non-communicable dieases in South-Asia, Clinical review, BMJ, (328) 807–810.

Athyros, V. G., Liberopoulos, E. N., Mikhailidis, D. P., Papageorgiou, A. a, Ganotakis, E. S., Tziomalos, K., Kakafika, A. I., et al. (2008). Association of drinking pattern and alcohol beverage type with the prevalence of metabolic syndrome, diabetes, coronary heart disease, stroke, and peripheral arterial disease in a Mediterranean cohort. *Angiology*, *58*(6), 689–97.

Bakari, A. G., Onyemelukwe, G. C., Sani, B. G., Aliyu, I. S., Hassan, S. S., & Aliyu, T. M. (2007). Obesity, overweight and under weight in suburban northern Nigeria, 68–69.

Balasubramanyam, A., Rao, S., Misra, R., Sekhar, R. V, & Ballantyne, C. M. (2008). Prevalence of metabolic syndrome and associated risk factors in Asian Indians. *Journal of immigrant and minority health / Center for Minority Public Health*, *10*(4), 313–23.

Balhara, Y. P. S. (2012). Tobacco and metabolic syndrome. *Indian journal of endocrinology and metabolism*, *16*(1), 81–7.

Bays, H. E., Toth, P. P., Kris-Etherton, P. M., Abate, N., Aronne, L. J., Brown, W. V., Gonzalez-Campoy, J. M., et al. (2013). Obesity, adiposity, and dyslipidemia: A consensus statement from the National Lipid Association. Journal of Clinical Lipidology, 7(4), 304–383.

Beechy, L., Galpern, J., Petrone, A., & Das, S. K. (2012). Assessment tools in obesity - psychological measures, diet, activity, and body composition. *Physiology & behavior*, *107*(1), 154–71.

Beigh, S. H., & Jain, S. (2012). Prevalence of metabolic syndrome and gender differences. *Bioinformation*, *8*(13), 613–6.

Berlin, I. (2008). Smoking-induced metabolic disorders: a review. *Diabetes & metabolism*, *34*(4 Pt 1), 307–14.

Bhanushali, C. J., Kumar, K., Wutoh, A. K., Karavatas, S., Habib, M. J., Daniel, M., & Lee, E. (2013). Association between Lifestyle Factors and Metabolic Syndrome among African Americans in the United States. *Journal of nutrition and metabolism*, *2013*, 516475.

Bitzur, R., Cohen, H., Kamari, Y., Shaish, A., & Harats, D. (2009). Triglycerides and HDL cholesterol: stars or second leads in diabetes? *Diabetes care*, *32 Suppl 2*, S373–7.

Bloomfield, G. S., Kimaiyo, S., Carter, E. J., Binanay, C., Corey, G. R., Einterz, R. M., Tierney, W. M., et al. (2011). Chronic noncommunicable cardiovascular and pulmonary disease in sub-Saharan Africa: an academic model for countering the epidemic. *American heart journal*, *161*(5), 842–7.

Caceres, M., Teran, C. G., Rodriguez, S., & Medina, M. (2008). Prevalence of insulin resistance and its association with metabolic syndrome criteria among Bolivian children and adolescents with obesity. *BMC pediatrics*, (8) 31.

Centers for Disease Control and Prevention (2011). National diabetes fact sheet: national estimates and general information on diabetes and prediabetes in the United States, 2011. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2011.

Chen, M., He, M., Min, X., Pan, A., Zhang, X., Yao, P., Li, X., et al. (2013). Different physical activity subtypes and risk of metabolic syndrome in middle-aged and older Chinese people. *PloS one*, *8*(1), e53258.

Chiazor, I. E., & Oparah, A. C. (2012). Assessment of Hypertension Care in a Nigerian Hospital, *11*(February), 137–145.

Cho, Y. a, Kim, J., Cho, E. R., & Shin, a. (2011). Dietary patterns and the prevalence of metabolic syndrome in Korean women. *Nutrition, metabolism, and cardiovascular diseases : NMCD*, *21*(11), 893–900.

Choi, M., Yeom, H.-A., & Jung, D. (2013). Association between physical activity and metabolic syndrome in older adults in Korea: Analysis of data from the Korean National Health and Nutrition Examination Survey IV. *Nursing & health sciences*.

Chukwuonye, I. I., Chuku, A., John, C., Ohagwu, K. A., Imoh, M. E., Isa, S. E., Oviasu, E. (2013). Prevalence of overweight and obesity in adult Nigerians - a systematic review. Diabetes, Metabolic syndrome and Obesity : Targets and Therapy, 6, 43–7.

Clerc, O., Nanchen, D., Cornuz, J., Marques-Vidal, P., Gmel, G., Daeppen, J.-B., Paccaud, F., et al. (2010). Alcohol drinking, the metabolic syndrome and diabetes in a population with high mean alcohol consumption. *Diabetic medicine : a journal of the British Diabetic Association*, *27*(11), 1241–9.

Cooney, M. T., Dudina, a, De Bacquer, D., Wilhelmsen, L., Sans, S., Menotti, a, De Backer, G., et al. (2009). HDL cholesterol protects against cardiovascular disease in both genders, at all ages and at all levels of risk. *Atherosclerosis*, *206*(2), 611–6.

Cornier, M.-A., Dabelea, D., Hernandez, T. L., Lindstrom, R. C., Steig, A. J., Stob, N. R., Van Pelt, R. E., et al. (2008b). The metabolic syndrome. Endocrine reviews, 29(7), 777–822. doi:10.1210/er.2008-0024.

Craig CL, Marshall AL, Sjostrom M, et al. International Physical Activity Questionnaire: 12-Country Reliability and Validity. Med Sci Sports Exerc. 2003;35(8):1381–1395.

Critchley, J. a, & Unal, B. (2003). Health effects associated with smokeless tobacco: a systematic review. *Thorax*, *58*(5), 435–43.

Darmon, N., & Drewnowski, A. (2008). Does social class predict diet quality? The American journal of clinical nutrition, 87(5), 1107–17.

Darnton-Hill, I., Nishida, C., & James, W. (2007). A life course approach to diet, nutrition and the prevention of chronic diseases. Public Health Nutrition, 7(1a), 101–121.

De Backer, G., Ambrosionie, E., Borch-Johnsen, K., Brotons, C., Cifkova, R., Dallongeville, J., Ebrahim, S., et al. (2003). European guidelines on cardiovascular disease prevention in clinical practice: Third Joint Task Force of European and other Societies on Cardiovascular Disease Prevention in Clinical

Practice (constituted by representatives of eight societies and by invit. *European Journal of Cardiovascular Prevention & Rehabilitation*, *10*(1 Suppl), S1–S78.

Demark-wahnefried, W., Bandera, E. V, Gapstur, S., & Patel, A. V. (2012). American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention Reducing the Risk of Cancer With Healthy Food Choices and Physical Activity.

Desalu, O. O., Iseh, K. R., Olokoba, a B., Salawu, F. K., & Danburam, a. (2010). Smokeless tobacco use in adult Nigerian population. *Nigerian journal of clinical practice*, *13*(4), 382–7.

Després, J.-P., Lemieux, I., Bergeron, J., Pibarot, P., Mathieu, P., Larose, E., Rodés-Cabau, J., et al. (2008a). Abdominal obesity and the metabolic syndrome: contribution to global cardiometabolic risk. *Arteriosclerosis, thrombosis, and vascular biology*, *28*(6), 1039–49.

Després, J.-P., Lemieux, I., Bergeron, J., Pibarot, P., Mathieu, P., Larose, E., Rodés-Cabau, J., et al. (2008b). Abdominal obesity and the metabolic syndrome: contribution to global cardiometabolic risk. *Arteriosclerosis, thrombosis, and vascular biology*, *28*(6), 1039–49.

Dinsa, G. D., Goryakin, Y., Fumagalli, E., & Suhrcke, M. (2012). Obesity and socioeconomic status in developing countries: a systematic review. *Obesity reviews : an official journal of the International Association for the Study of Obesity*, *13*(11), 1067–79.

Diseases, N., Control, N. D., & States, M. (2013). Draft action plan for the prevention and control of noncommunicable diseases 2013 – 2020, (November 2012), 1–36.

Dunkley, A. J., Taub, N. a, Davies, M. J., Stone, M. a, & Khunti, K. (2009). Is having a family history of type 2 diabetes or cardiovascular disease a predictive factor for metabolic syndrome? *Primary care diabetes*, *3*(1), 49–56.

Ehizele, a O., Azodo, C. C., Ojehanon, P. I., Akhionbare, O., Umoh, a O., & Adeghe, H. a. (2012). Prevalence of tobacco use among dental patients and their knowledge of its health effects. *Nigerian journal of clinical practice*, *15*(3), 270–5.

Ejike, C. E., & Ijeh, I. I. (2012). Obesity in young-adult Nigerians: variations in prevalence determined by anthropometry and bioelectrical impedance analysis, and the development of % body fat prediction equations. *International archives of medicine*, *5*(1), 22. doi:10.1186/1755-7682-5-22

Emanuela, F., Grazia, M., Marco, D. R., Maria Paola, L., Giorgio, F., & Marco, B. (2012). Inflammation as a Link between Obesity and Metabolic Syndrome. *Journal of nutrition and metabolism*, *2012*, 476380.

Ervin, R. B. (2009). Prevalence of metabolic syndrome among adults 20 years of age and over, by sex, age, race and ethnicity, and body mass index: United States, 2003-2006. *National health statistics reports*, (13), 1–7.

Ervin, R. B. (2009). Prevalence of metabolic syndrome among adults 20 years of age and over, by sex, age, race and ethnicity, and body mass index: United States, 2003-2006. *National health statistics reports*, (13), 1–7. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/19634296

Esteghamati, A., Khalilzadeh, O., Rashidi, A., Meysamie, A., Haghazali, M., Asgari, F., Abbasi, M., et al. (2009). Association between physical activity and insulin resistance in Iranian adults: National Surveillance of Risk Factors of Non-Communicable Diseases (SuRFNCD-2007). *Preventive medicine*, *49*(5), 402–6.

Faam, B., Hosseinpanah, F., Amouzegar, A., Ghanbarian, A., Asghari, G., & Azizi, F. (2013). Leisure-Time Physical Activity and Its Association With Metabolic Risk Factors in Iranian Adults: Tehran Lipid and Glucose Study, 2005-2008. *Preventing chronic disease*, *10*(8), E36.

Fan, A. Z., Russell, M., Naimi, T., Li, Y., Liao, Y., Jiles, R., & Mokdad, A. H. (2008). Patterns of alcohol consumption and the metabolic syndrome. The Journal of clinical endocrinology and metabolism, 93(10), 3833–8.

Fuster, V., & Kelly, B. B. (2010). 2010. Promoting Cardiovascular Health in the Developing World: A Critical Challenge to Achieve Global Health. gton, DC: The National Academies Pres, (202) 334-3313.

Farooqui, A. A. (2013). *Metabolic Syndrome*, an important risk factor for stroke,Alzhiemer diseases and depression. New York, NY: Springer New York.

Federa-, T. I. D., & Ex-, N. (2008). Prevalence of the Metabolic Syndrome Among a Racially / Ethnically Diverse Group of U . S . Eighth-Grade Adolescents and Associations With Fasting Insulin and Homeostasis Model Assessment of Insulin, *31*(10).

Felix, K. A., Ulf, E., Soren, B., Jean, C. M., Nicholas, J. W. (2011). Urbanization, Physical Activity, and Metabolic Health in Sub-Saharan Africa, cardiovascular and metabolic risk, Diabetes Care 34:491–496,

Ferguson, T. S., Younger, N., Tulloch-reid, M. K., Forrester, T. E., Cooper, R. S., Broeck, J. Van Den, & Wilks, R. J. (2010a). Prevalence of the Metabolic Syndrome in Jamaican Adults and its Relationship, *59*(876).

74

Ferguson, T. S., Younger, N., Tulloch-reid, M. K., Forrester, T. E., Cooper, R. S., Broeck, J. Van Den, & Wilks, R. J. (2010b). Prevalence of the Metabolic Syndrome in Jamaican Adults and its Relationship, *59*(876).

Filaković, P., Erić, A. P., & Radanović-Grgurić, L. (2012). Metabolic Syndrome and Psychotropic Medications. *Med Glas (Zenica),* 9(2):180-8.

Finucane, M. M., Stevens, G. a, Cowan, M. J., Danaei, G., Lin, J. K., Paciorek, C. J., … Ezzati, M. (2011b). National, regional, and global trends in body-mass index since 1980: systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9·1 million participants. *Lancet*, *377*(9765), 557–67.

Finucane, M. M., Stevens, G. a, Cowan, M. J., Danaei, G., Lin, J. K., Paciorek, C. J., Singh, G. M., et al. (2011). National, regional, and global trends in body-mass index since 1980: systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9·1 million participants. *Lancet*, *377*(9765), 557–67.

Foulds, J., Ramstrom, L., Burke, M., & Fagerstro, K. (2003). Effect of smokeless tobacco (snus) on smoking and public health in Sweden, 349–359.

Forouhi, N. G., & Sattar, N. (2006). CVD risk factors and ethnicity--a homogeneous relationship? Atherosclerosis. Supplements, 7(1), 11–9.

Fryar, C. D., Chen, T.-C., & Li, X. (2012). Prevalence of uncontrolled risk factors for cardiovascular disease: United States, 1999-2010. *NCHS data brief*, (103), 1–8.

Ghaffar, A., Asia, S., Reddy, K. S., & Singhi, M. (2002). Burden of non-communicable diseases in Asia, Clinical review, BMJ, 328: 807–810.

Giacco, R., Della Pepa, G., Luongo, D., & Riccardi, G. (2011). Whole grain intake in relation to body weight: from epidemiological evidence to clinical trials. *Nutrition, metabolism, and cardiovascular diseases : NMCD*, *21*(12), 901–8.

Go, A. S., Mozaffarian, D., Roger, V. L., Benjamin, E. J., Berry, J. D., Borden, W. B., Bravata, D. M., et al. (2013). Heart disease and stroke statistics--2013 update: a report from the American Heart Association. *Circulation*, *127*(1), e6–e245.

Gordon, N. F., Gulanick, M., Costa, F., Fletcher, G., Franklin, B. a, Roth, E. J., & Shephard, T. (2004). Physical activity and exercise recommendations for stroke survivors: an American Heart Association scientific statement from the Council on Clinical Cardiology, Subcommittee on Exercise, Cardiac Rehabilitation, and Prevention; the Council on Cardiovascular Nursing; the Council on Nutrition, Physical Activity, and Metabolism; and the Stroke Council. *Circulation*, *109*(16), 2031–41.

Gupta, R., Deedwania, P. C., Sharma, K., Gupta, A., Guptha, S., Achari, V.,Gupta, R. (2012). Association of educational, occupational and socioeconomic status with cardiovascular risk factors in Asian Indians: a cross-sectional study. *PloS one*, *7*(8), e44098.

Guo, F., He, D., Zhang, W., & Walton, R. G. (2012). Trends in prevalence, awareness, management, and control of hypertension among United States adults, 1999 to 2010. *Journal of the American College of Cardiology*, *60*(7), 599–606.

Gyakobo, M, Amoah A.G.B, Snow R. C. (2012). Prevalence of the metabolic syndrome in a rural population in Ghana.BMC Endocrine disorder, 12 (1), 1-9

Grundy, S. M. (2004). Obesity, metabolic syndrome, and cardiovascular disease. *The Journal of clinical endocrinology and metabolism*, *89*(6), 2595–600.

Grundy, S. M. (2006). Metabolic syndrome: connecting and reconciling cardiovascular and diabetes worlds. *Journal of the American College of Cardiology*, *47*(6), 1093–100.

Hadaegh, F., Khalili, D., Ghasemi, a, Tohidi, M., Sheikholeslami, F., & Azizi, F. (2009). Triglyceride/HDL-cholesterol ratio is an independent predictor for coronary heart disease in a population of Iranian men. *Nutrition, metabolism, and cardiovascular diseases : NMCD*, *19*(6), 401–8.

Haffner, S. M. (2006). The metabolic syndrome: inflammation, diabetes mellitus, and cardiovascular disease. *The American journal of cardiology*, *97*(2A), 3A–11A.

Hall, V., Thomsen, R. W., Henriksen, O., & Lohse, N. (2011). Diabetes in Sub Saharan Africa 1999-2011: epidemiology and public health implications. A systematic review. *BMC public health*, *11*(1), 564.

Handelsman, Y. (2009). Metabolic syndrome pathophysiology and clinical presentation. Toxicologic pathology, 37(1), 18–20.

He, Y., Lam, T. H., Jiang, B., Wang, J., Sai, X., Fan, L., … Hu, F. B. (2009). Combined effects of tobacco smoke exposure and metabolic syndrome on cardiovascular risk in older residents of China. Journal of the American College of Cardiology, 53(4), 363–71.

Hendriks, M. E., Wit, F. W. N. M., Roos, M. T. L., Brewster, L. M., Akande, T. M., De Beer, I. H., Mfinanga, S. G., et al. (2012). Hypertension in sub-Saharan Africa: cross-sectional surveys in four rural and urban communities. *PloS one*, *7*(3), e32638. doi:10.1371/journal.pone.0032638

Hildrum, B., Mykletun, A., Hole, T., Midthjell, K., & Dahl, A. a. (2007). Age-specific prevalence of the metabolic syndrome defined by the International Diabetes

Federation and the National Cholesterol Education Program: the Norwegian HUNT 2 study. *BMC public health*, *7*, 220.

Hosmer, D. W., Lemeshow, S. (2000). Applied Logistic Regression (Second edition). A Wiley-Interscience publication, John Wiley & Sons, Inc..

Hunt, K. J., Resendez, R. G., Williams, K., Haffner, S. M., & Stern, M. P. (2004). National Cholesterol Education Program versus World Health Organization metabolic syndrome in relation to all-cause and cardiovascular mortality in the San Antonio Heart Study. *Circulation*, *110*(10), 1251–7.

Hwang, C. K., Han, P. V, Zabetian, A., Ali, M. K., & Narayan, K. M. V. (2012). Rural diabetes prevalence quintuples over twenty-five years in low- and middle-income countries: a systematic review and meta-analysis. *Diabetes research and clinical practice*, *96*(3), 271–85.

IDF Diabetes Atlas. (2012) International Diabetic Federation, 5Th Edition, 2012 update.

International Diabetes Federation (IDF) Diabetes Atlas (2011) Sixth Edition, published in the World Diabetes Atlas.

Jodie B., Amanda K., Sophie L., Daniel S., Ewan W (2010). The Biochemical and Pathophysiological Effects of Alcohol Consumption," *Christian Spirituality and Science*: Vol. 8: Iss. 1, Article 3

Kadowaki, T., Yamauchi, T., Kubota, N., Hara, K., Ueki, K., & Tobe, K. (2006). Review series Adiponectin and adiponectin receptors in insulin resistance , diabetes , and the metabolic syndrome, 116(7).

Kaduka, L. U., Kombe, Y., Kenya, E., Kuria, E., Bore, J. K., Bukania, Z. N., & Mwangi, M. (2012). Prevalence of metabolic syndrome among an urban population in Kenya. *Diabetes care*, *35*(4), 887–93.

Kahn, S. E. (2003). The relative contributions of insulin resistance and beta-cell dysfunction to the pathophysiology of Type 2 diabetes. Diabetologia, 46(1), 3–19.

Kassi, E., Pervanidou, P., Kaltsas, G., & Chrousos, G. (2011). Metabolic syndrome: definitions and controversies. *BMC medicine*, *9*(1), 48.

Kastorini, C.-M., Milionis, H. J., Esposito, K., Giugliano, D., Goudevenos, J. a, & Panagiotakos, D. B. (2011). The effect of Mediterranean diet on metabolic syndrome and its components: a meta-analysis of 50 studies and 534,906 individuals. *Journal of the American College of Cardiology*, *57*(11), 1299–313.

Kato, I. (2003). Insulin-mediated effects of alcohol intake on serum lipid levels in a general population The Hisayama Study. Journal of Clinical Epidemiology, 56(2), 196–204.

Kaur, P., Radhakrishnan, E., Rao, S. R., Sankarasubbaiyan, S., Rao, T. V., & Gupte, M. D. (2010). The metabolic syndrome and associated risk factors in an urban industrial male population in South India. The Journal of the Association of Physicians of India, 58(June), 363–6, 371.

Khanam, M. A., Qiu, C., Lindeboom, W., Streatfield, P. K., & Nahar, Z. (2011). The Metabolic Syndrome : Prevalence , Associated Factors , and Impact on Survival among Older Persons in Rural Bangladesh, 6(6).

Kengne, A. P., Amoah, A. G. B., & Mbanya, J.-C. (2005). Cardiovascular complications of diabetes mellitus in sub-Saharan Africa. *Circulation*, *112*(23), 3592–601.

Kim, Y., Conners, R. T., Hart, P. D., Kang, Y.-S., & Kang, M. (2013). Association of physical activity and body mass index with metabolic syndrome among US adolescents with disabilities. *Disability and Health Journal*.

Kinra, S., Bowen, L. J., Lyngdoh, T., Prabhakaran, D., Reddy, K. S., Ramakrishnan, L., Gupta, R., et al. (2010). Sociodemographic patterning of non-communicable disease risk factors in rural India: a cross sectional study. *Bmj*, *341*(sep27 1), c4974–c4974.

King, M., Smith, A., & Gracey, M. (2009). Indigenous health part 2: the underlying causes of the health gap. Lancet, 374(9683), 76–85.

Kimberly, V. S., Noreen G. Socioeconomic differences in health among older adults in Mexico,*Social Science & Medicine (*65) 1372–1385.

Koppes, L. L. J., Jacqueline, M. D., Henk, F. J. H., Lex, M. B., Robert, J. H. (2005). Modertae alcohol consumption lowers the risk of type ii diabetes. Meta-analysis of prospective observational studies.Diabetes care,28: 719-725.

Krauss, R. M., Blanche, P. J., Rawlings, R. S., Fernstrom, H. S., & Williams, P. T. (2006). Separate effects of reduced carbohydrate intake and weight loss on, (Cvd).

Kruk, J. (2007). Physical activity in the prevention of the most frequent chronic diseases: an analysis of the recent evidence. *Asian Pacific Journal of Cancer Prevention : APJCP*, *8*(3), 325–38.

Laclaustra, M., Corella, D., & Ordovas, J. M. (2007). Metabolic syndrome pathophysiology: the role of adipose tissue. Nutrition, metabolism, and cardiovascular diseases : NMCD, 17(2), 125–39.

Lakka, T. A., Laaksonen, D. E. (2007). Physical activity in prevention and treatment of the metabolic syndrome. Appl Physiol Nutr Me, 32(1):76-88.

Lehtovirta M, Kaprio J, Forsblom C, Eriksson JJT & Groop L (2000) Insulin secretion and insulin sensitivity in monozygotic and dizygotic twins. *Diabetologia* (in press).

Lemogoum, D., Degaute, J.-P., & Bovet, P. (2005). Stroke prevention, treatment, and rehabilitation in sub-saharan Africa. *American journal of Preventive Medicine*, *29*(5 Suppl 1), 95–101.

Lim, S. S., Vos, T., Flaxman, A. D., Danaei, G., Shibuya, K., Adair-Rohani, H., … Aryee, M. (2012). A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet*, *380*(9859), 2224–60.

Lindgren, C. M., Heid, I. M., Randall, J. C., Lamina, C., Steinthorsdottir, V., Qi, L., Speliotes, E. K., et al. (2009). Genome-wide association scan meta-analysis identifies three Loci influencing adiposity and fat distribution. *PLoS genetics*, *5*(6), e1000508.

Lindsay, R. S., Howard, B. V (2004). Cardiovascular risk associated with the metabolic syndrome. Curr Diab Rep; 4:63.

Lloyd-Jones, D., Adams, R. J., Brown, T. M., Carnethon, M., Dai, S., De Simone, G., Ferguson, T. B., et al. (2010). Heart disease and stroke statistics--2010 update: a report from the American Heart Association. *Circulation*, *121*(7), e46–e215.

Loucks, E. B., Rehkopf, D. H., Thurston, R. C., & Kawachi, I. (2007). Socioeconomic disparities in metabolic syndrome differ by gender: evidence from NHANES III. *Annals of Epidemiology*, *17*(1), 19–26.

Makkes, S., Renders, C. M., Bosmans, J. E., Van der Baan-Slootweg, O. H., & Seidell, J. C. (2013). Cardiometabolic risk factors and quality of life in severely obese children and adolescents in the Netherlands. *BMC Pediatrics*, *13*, 62.

Mann, R.E., Smart, R. G.and Govoni, R., (2003). The Epidemiology of alcoholic liver disease, *Alcohol Research and Health*, 27(3): 209-19

Marquezine, G. F., Oliveira, C. M., Pereira, A. C., Krieger, J. E., & Mill, J. G. (2008). Metabolic syndrome determinants in an urban population from Brazil: social class

and gender-specific interaction. *International Journal of Cardiology*, *129*(2), 259–65.

Makkes, S., Renders, C. M., Bosmans, J. E., van der Baan-Slootweg, O. H., & Seidell, J. C. (2013). Cardiometabolic risk factors and quality of life in severely obese children and adolescents in the Netherlands. *BMC Paediatrics*, *13*, 62.

Mathers, C. D., & Loncar, D. (2006a). Projections of global mortality and burden of disease from 2002 to 2030. *PLoS Medicine*, *3*(11), e442.

Mathers, C. D., & Loncar, D. (2006b). Projections of global mortality and burden of disease from 2002 to 2030. *PLoS Medicine*, *3*(11).

Matsuzawa, Y. (2006). The metabolic syndrome and adipocytokines. *FEBS letters*, *580* (12), 2917–21.

Mazumdar, P. and Liguori G. (2011). Persistent increase of prevalence of metabolic syndrome among U.S. Adults: NHANES III to NHANES 1999–2006. *Diabetes Care 34*(1), 1–4.

Mehairi, A. E., Khouri, A. a, Naqbi, M. M., Muhairi, S. J., Maskari, F. a, Nagelkerke, N., & Shah, S. M. (2013). Metabolic syndrome among Emirati adolescents: a school-based study. *PloS one*, *8*(2), e56159.

Meigs, J. B., Wilson, P. W. F., Fox, C. S., Vasan, R. S., Nathan, D. M., Sullivan, L. M., & D'Agostino, R. B. (2006). Body mass index, metabolic syndrome, and risk of type 2 diabetes or cardiovascular disease. *The Journal of Clinical Endocrinology and Metabolism*, *91*(8), 2906–12.

Metelskaya, V. a, Shkolnikova, M. a, Shalnova, S. a, Andreev, E. M., Deev, A. D., Jdanov, D. a, Shkolnikov, V. M., et al. (2012). Prevalence, components, and correlates of metabolic syndrome (MetS) among elderly Muscovites. *Archives of Gerontology and Geriatrics*, *55*(2), 231–7.

Misra, A., & Khurana, L. (2008). Obesity and the metabolic syndrome in developing countries. *The Journal of Clinical Endocrinology and Metabolism*, *93*(11 Suppl 1), S9–30.

Misra, A., Singhal, N., & Khurana, L. (2010). Obesity, the metabolic syndrome, and type 2 diabetes in developing countries: role of dietary fats and oils. *Journal of the American College of Nutrition*, *29*(3 Suppl), 289S–301S.

Mohamud, W. N. W., Ismail, A. A.-S., Sharifuddin, A., Ismail, I. S., Musa, K. I., Kadir, K. A., Kamaruddin, N. A., et al. (2011a). Prevalence of metabolic syndrome and its risk factors in adult Malaysians: results of a nationwide survey. *Diabetes Research and Clinical Practice*, *91*(2), 239–45.

Mohamud, W. N. W., Ismail, A. A.-S., Sharifuddin, A., Ismail, I. S., Musa, K. I., Kadir, K. A., Kamaruddin, N. A., et al. (2011b). Prevalence of metabolic syndrome and its risk factors in adult Malaysians: results of a nationwide survey. *Diabetes Research and Clinical Practice*, *91*(2), 239–45.

Monson, A. Lou, Ph, D., & Beaulieu, J. A. (2011). Smokeless Tobacco Use and Knowledge among University Students, *9*, 1–9.

Morrison, J. a, Friedman, L. A., & Gray-McGuire, C. (2007). Metabolic syndrome in childhood predicts adult cardiovascular disease 25 years later: the Princeton Lipid Research Clinics Follow-up Study. *Pediatrics*, *120*(2), 340–5.

Motala, A. a, Esterhuizen, T., Pirie, F. J., & Omar, M. a K. (2011). The prevalence of metabolic syndrome and determination of the optimal waist circumference cutoff points in a rural South african community. *Diabetes care*, *34*(4), 1032–7.

Mozumdar A. Liguori G (2011) Persistent Increase of Prevalence of metabolic syndrome among U.S. Adults:NHANES III to NHANES 1999–2006 Diabetes Care, Volume*34*(1), 1–4.

Naghavi M, Forouzanfar M H (2010) Burden of non-communicable diseases in sub-Saharan Africa in 1990 and 2010: Global Burden of Diseases, Injuries, and Risk Factors Study 2010: *The Lancet,* (381), S95.

Nagy, L. E., (2004) Molecular aspects of alcohol metabolism: Transcription Factors Involved in Early Ethanol- Induced Liver Injury. *Annual Review of Nutrition*, 24: 55-78.

Nguyen, N. T., Magno, C. P., Lane, K. T., Hinojosa, M. W., & Lane, J. S. (2008). Association of hypertension, diabetes, dyslipidemia, and metabolic syndrome with obesity: findings from the National Health and Nutrition Examination Survey, 1999 to 2004. *Journal of the American College of Surgeons*, *207*(6), 928–34.

Nguyen, T. H. H. D., Tang, H. K., Kelly, P., Van der Ploeg, H. P., & Dibley, M. J. (2010). Association between physical activity and metabolic syndrome: a cross sectional survey in adolescents in Ho Chi Minh City, Vietnam. *BMC Public Health*, *10*, 141.

National Population Commission (NPC) and ICF Macro. 2009. Nigeria Demographic and Health Survey 2008: Key findings. Calverton, Maryland, USA: NPC and ICF Macro

Njelekela, M. a, Mpembeni, R., Muhihi, A., Mligiliche, N. L., Spiegelman, D., Hertzmark, E., Liu, E., et al. (2009). Gender-related differences in the prevalence

of cardiovascular disease risk factors and their correlates in urban Tanzania. *BMC Cardiovascular Disorders*, *9*, 30.

Nshisso, L. D., Reese, A., Gelaye, B., Lemma, S., Berhane, Y., & Williams, M. a. (2012). Prevalence of hypertension and diabetes among Ethiopian adults. *Diabetes & Metabolic Syndrome*, *6*(1), 36–41.

Nguyen, N. T., Magno, C. P., Lane, K. T., Hinojosa, M. W., & Lane, J. S. (2008). Association of hypertension, diabetes, dyslipidemia, and metabolic syndrome with obesity: findings from the National Health and Nutrition Examination Survey, 1999 to 2004. *Journal of the American College of Surgeons*, *207*(6), 928–34.

Ntandou, G., Delisle, H., Agueh, V., & Fayomi, B. (2009). Abdominal obesity explains the positive rural-urban gradient in the prevalence of the metabolic syndrome in Benin, West Africa. Nutrition research (New York, N.Y.), 29(3), 180–9.

Nwegbu M. M., Jaiyesimi O. O. (2012) Prevalence of metabolic syndrome amongst apparently healthy Nigerian adults in a hospital setting. *Journal of Medicine and Medical Sciences* 3(1), 077-082

Ogah, O. S., Okpechi, I., Chukwuonye, I. I., Akinyemi, J. O., Onwubere, B. J., Falase, A. O., Stewart, S., et al. (2012). Blood pressure, prevalence of hypertension and hypertension related complications in Nigerian Africans: A review. *World Journal of Cardiology*, *4*(12), 327–40.

Ogbera, A. O. (2010a). Prevalence and gender distribution of the metabolic syndrome. *Diabetology & Metabolic Syndrome*, *2*, 1.

Ogbera, A. O. (2010b). Prevalence and gender distribution of the metabolic syndrome. *Diabetology & Metabolic Syndrome*, *2*, 1.

Okafor, C. I. (2012). The metabolic syndrome in Africa: Current trends. *Indian Journal of Endocrinology and Metabolism*, *16*(1), 56–66.

Okosun, I. S., Davis-smith, M., & Seale, J. P. (2011). Awareness of diabetes risks is associated with healthy lifestyle behavior in diabetes free American adults : Evidence from a nationally representative sample. *Primary Care Diabetes*, *6*(2), 87–94.

Olatunbosun, S. T., Kaufman, J. S., & Bella, a F. (2011). Prevalence of obesity and overweight in urban adult Nigerians. *Obesity reviews : an official journal of the International Association for the Study of Obesity*, *12*(4), 233–41.

Ov, R. N. L., & Om, U. (2011). Impact of BMI and the Metabolic Syndrome on the Risk of Diabetes in Middle-Aged, *34*(1).

Owolabi, M. O., & Agunloye, a M. (2013). Risk factors for stroke among patients with hypertension: a case-control study. *Journal of the Neurological Sciences*, *325*(1-2), 51–6.

Park, H., & Kim, K. (2012). Association of alcohol consumption with lipid profile in hypertensive men. *Alcohol and alcoholism (Oxford, Oxfordshire)*, *47*(3), 282–7.

Park, H. S., Park, C. Y., Oh, S. W., & Yoo, H. J. (2008). Prevalence of obesity and metabolic syndrome in Korean adults. *Obesity reviews : an official journal of the International Association for the Study of Obesity*, *9*(2), 104–7.

Penno, G., Miccoli, R., Pucci, L., & Del Prato, S. (2006). The metabolic syndrome. Beyond the insulin resistance syndrome. *Pharmacological research : the official journal of the Italian Pharmacological Society*, *53*(6), 457–68.

Puoane, T., Steyn, K., Bradshaw, D., Laubscher, R., Fourie, J., Lambert, V., (2002). Obesity in South Africa: the South African demographic and health survey. Obes Res,10:1038-1048.

Rafael Lozano et al. (2012). Global and Regional Mortality From 235 Causes of Death for 20 Age Groups in 1990 and 2010: A Systematic Analysis for the Global Burden of Disease Study 2010," The Lancet 380, no. 9859: 2095-128.

Ragland, B. D., Konrad, R. J., Chaffin, C., Robinson, A., & Hardy, R. W. (2000). Assay in Diabetic Patients : Effect of Glycemic Control. *Clinical chemistry,* 46 (11), 1848-1851.

Ramachandran, A., Snehalatha, C., Shetty, A. S., & Nanditha, A. (2012). Trends in prevalence of diabetes in Asian countries. *World Journal of Diabetes*, *3*(6), 110–7.

Rambhade, S., Chakraborty, A. K., Patil, U. K., & Rambhade, A. (2010). Journal of Chemical and Pharmaceutical Research, 2(6), 7–25.

Rampal, L., Rampal, S., Azhar, M. Z., & Rahman, a R. (2008). Prevalence, awareness, treatment and control of hypertension in Malaysia: a national study of 16,440 subjects. *Public Health*, *122*(1), 11–8.

Rampal, S., Mahadeva, S., Guallar, E., Bulgiba, A., Mohamed, R., Rahmat, R., Arif, M. T., et al. (2012). Ethnic differences in the prevalence of metabolic syndrome: results from a multi-ethnic population-based survey in Malaysia. *PloS one*, *7*(9), e46365.

Rasmussen, B. M., Vessby, B., Uusitupa, M., Berglund, L., Pedersen, E., Riccardi, G., Rivellese, A. a, et al. (2006). Effects of dietary saturated, monounsaturated, and n-3 fatty acids on blood pressure in healthy subjects. *The American Journal of Clinical Nutrition*, *83*(2), 221–6.

Ravikiran, M., Bhansali, A., Ravikumar, P., Bhansali, S., Dutta, P., Thakur, J. S., Sachdeva, N., et al. (2010). Prevalence and risk factors of metabolic syndrome among Asian Indians: a community survey. *Diabetes Research and Clinical Practice*, *89*(2), 181–8.

Reaven, G. M. (2005). The Metabolic Syndrome : Requiescat in Pace, *Clinical Chemistry, 51 (6) 931–938*

Reddy, K. S., Prabhakaran, D., Chaturvedi, V., Jeemon, P., Thankappan, K. R., Ramakrishnan, L., … Jaison, T. M. (2006). Methods for establishing a surveillance system for cardiovascular diseases in Indian industrial populations. *Bulletin of the World Health Organization*, *84*(6), 461–9.

Report, F. (2002). Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report,*NIH Publication,* (2), 5215

Roger, V. L., Go, A. S., Lloyd-Jones, D. M., Benjamin, E. J., Berry, J. D., Borden, W. B., Bravata, D. M., et al. (2012). Heart disease and stroke statistics--2012 update: a report from the American Heart Association. *Circulation*, *125*(1), e2–e220.

Rouvre, M., Vol, S., Gusto, G., Born, C., Lantieri, O., Tichet, J., & Lecomte, P. (2011a). Low high density lipoprotein cholesterol: prevalence and associated risk-factors in a large French population. *Annals of Epidemiology*, *21*(2), 118–27.

Rouvre, M., Vol, S., Gusto, G., Born, C., Lantieri, O., Tichet, J., & Lecomte, P. (2011b). Low high density lipoprotein cholesterol: prevalence and associated risk-factors in a large French population. *Annals of Epidemiology*, *21*(2), 118–27.

Saarni, S. E., Pietiläinen, K., Kantonen, S., Rissanen, A., & Kaprio, J. (2009). Association of smoking in adolescence with abdominal obesity in adulthood: a follow-up study of 5 birth cohorts of Finnish twins. *American Journal of Public Health*, *99*(2), 348–54.

Sabanayagam, C., Zhang, R., & Shankar, A. (2012). Markers of Sleep-Disordered Breathing and Metabolic Syndrome in a Multiethnic Sample of US Adults: Results from the National Health and Nutrition Examination Survey 2005-2008. *Cardiology Research and Practice*, *2012*, 630802.

Saeed, O., Gupta, V., Dhawan, N., Streja, L., Shin, J. S., Ku, M., Bhoi, S., et al. (2009). Knowledge of modifiable risk factors of Coronary Atherosclerotic Heart Disease (CASHD) among a sample in India. *BMC International Health and Human Rights*, *9*, 2.

Sani, M. U., Wahab, K. W., Yusuf, B. O., Gbadamosi, M., Johnson, O. V, & Gbadamosi, A. (2010). Modifiable cardiovascular risk factors among apparently healthy adult Nigerian population - a cross sectional study. BMC research notes, 3, 11.

Samuel, P., Antonisamy, B., Raghupathy, P., Richard, J., & Fall, C. H. D. (2012). Socio-economic status and cardiovascular risk factors in rural and urban areas of Vellore, Tamilnadu, South India. *International Journal of Epidemiology*, *41*(5), 1315–27.

Santos, A. C., Ebrahim, S., & Barros, H. (2008). Gender, socio-economic status and metabolic syndrome in middle-aged and old adults. BMC public health, 8, 62.

Sawant, A., Mankeshwar, R., Shah, S., Raghavan, R., Dhongde, G., Raje, H., D'souza, S., et al. (2011). Prevalence of metabolic syndrome in urban India. *Cholesterol*, *2011*, 920983.

Schäfer, I., Von Leitner, E.-C., Schön, G., Koller, D., Hansen, H., Kolonko, T., Kaduszkiewicz, H., et al. (2010). Multimorbidity patterns in the elderly: a new approach of disease clustering identifies complex interrelations between chronic conditions. *PloS one*, *5*(12), e15941.

Schutte, A. E., & Olckers, A. (2007). Metabolic syndrome risk in black South African women compared to Caucasian women. *Hormone and Metabolic Research*, *39*(09), 651-657.

Shin, M.-H., Kweon, S.-S., Choi, J.-S., Rhee, J.-A., Nam, H.-S., Jeong, S.-K., … Lee, Y.-H. (2013). Average Volume of Alcohol Consumed, Drinking Patterns, and Metabolic Syndrome in Older Korean Adults. *Journal of Epidemiology*, *23*(2), 122–131.

Sicree, B. R., Shaw, J., & Zimmet, P. (2011). The Global Burden Diabetes and Impaired Glucose Tolerance. IDF Diabetes Atlas fourth edition, 1–105.

Simmons, R. K., Alberti, K. G. M. M., Gale, E. a M., Colagiuri, S., Tuomilehto, J., Qiao, Q., Ramachandran, a, et al. (2010). The metabolic syndrome: useful concept or clinical tool? Report of a WHO Expert Consultation. Diabetologia, 53(4), 600–5.

Sirdah, M. M., Abu Ghali, A. S., & Al Laham, N. a. (2012). The reliability of the National Cholesterol Education Program's Adult Treatment Panel III

(NCEP/ATP III) and the International Diabetes Federation (IDF) definitions in diagnosing metabolic syndrome (MetS) among Gaza Strip Palestinians. *Diabetes & Metabolic Syndrome*, *6*(1), 4–8.

Sirdah, M. M., Abu Ghali, A. S., & Al Laham, N. a. (2012). The reliability of the National Cholesterol Education Program's Adult Treatment Panel III (NCEP/ATP III) and the International Diabetes Federation (IDF) definitions in diagnosing metabolic syndrome (MetS) among Gaza Strip Palestinians. *Diabetes & Metabolic Syndrome*, *6*(1), 4–8.

Siri-Tarino, P. W., Sun, Q., Hu, F. B., & Krauss, R. M. (2010a&b). Saturated fatty acids and risk of coronary heart disease: modulation by replacement nutrients. Current atherosclerosis reports, 12(6), 384–90.

Sobngwi, E., Ndour-mbaye, M., Boateng, K. A., Ramaiya, K. L., Njenga, E. W., Diop, S. N., Mbanya, J., et al. (2011). Type 2 diabetes control and complications in specialised diabetes care centres of six sub-Saharan African countries : The Diabcare Africa study. *Diabetes Research and Clinical Practice*, *95*(1), 30–36.

Sofi, F., Capalbo, A., Cesari, F., Abbate, R., & Gensini, G. F. (2008). Physical activity during leisure time and primary prevention of coronary heart disease: an updated meta-analysis of cohort studies. *European journal of cardiovascular prevention and rehabilitation : official journal of the European Society of Cardiology, Working Groups on Epidemiology & Prevention and Cardiac Rehabilitation and Exercise Physiology*, *15*(3), 247–57.

Song, Y.-M., Ferrer, R. L., Cho, S., Sung, J., Ebrahim, S., & Davey Smith, G. (2006). Socioeconomic Status and Cardiovascular Disease Among Men: The Korean National Health Service Prospective Cohort Study. *American Journal of Public Health*, *96*(1), 152–159.

Steinmetz A, Fenselau S, Schrezenmeir J. (2001). Treatment of dyslipoproteinemia in metabolic syndrome. Experimental Clinical Endocrinology and Diabetes: 109:S548-59

Stringhini, S., Viswanathan, B., Gédéon, J., Paccaud, F., & Bovet, P. (2012). The social transition of risk factors for cardiovascular disease in the African region: Evidence from three cross-sectional surveys in the Seychelles. *International journal of cardiology*.

Sun, K., Liu, J., & Ning, G. (2012a). Active smoking and risk of metabolic syndrome: a meta-analysis of prospective studies. *PloS one*, *7*(10), e47791.

Sun, K., Liu, J., & Ning, G. (2012b). Active smoking and risk of metabolic syndrome: a meta-analysis of prospective studies. *PloS one*, *7*(10), e47791.

Survey, D. H. S. E. (2004). Nigeria DHS EdData Survey 2004 Education Data for Decision making.Calverton, Maryland, USA: *National Population Commission and ORC Macro.* 1-177

Taheri, S., Lin, L., Austin, D., Young, T., & Mignot, E. (2004). Short sleep duration is associated with reduced leptin, elevated ghrelin, and increased body mass index. *PLoS medicine*, *1*(3), e62. doi:10.1371/journal.pmed.0010062

Thaman, R. G., Arora, G. P. (2013).Metabolic Syndrome: Definition and Pathophysiology– the discussion goes on!Journal of Physiology and Pharmacology Advances, 3(3): 48-56

Third Report of the National Cholesterol Education Program (NCEP) Adult Treatment, Panel (ATP III) for the Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. (2002). *Circulation*; 106:3143

Toth, P. P., Zarotsky, V., Sullivan, J. M., & Laitinen, D. (2009). Cardiovascular Diabetology US managed care plan : a retrospective database analysis, *8*, 1–8.

Tseng, L.-N., Tseng, Y.-H., Jiang, Y.-D., Chang, C.-H., Chung, C.-H., Lin, B. J., Chuang, L.-M., et al. (2012). Prevalence of hypertension and dyslipidemia and their associations with micro- and macrovascular diseases in patients with diabetes in Taiwan: an analysis of nationwide data for 2000-2009. *Journal of the Formosan Medical Association = Taiwan yi zhi*, *111*(11), 625–36.

Tuei, V. C., Maiyoh, G. K., & Ha, C. (2010). Type 2 diabetes mellitus and obesity in sub-Saharan Africa, (July), 433–445.

Ulasi, I. I., Ijoma, C. K., & Onodugo, O. D. (2010). A community-based study of hypertension and cardio-metabolic syndrome in semi-urban and rural communities in Nigeria. *BMC health services research*, *10*, 71.

Use, T. (2012). Tobacco Use in Canada : Patterns and Trends.2012 Edition, Propel center for population Health Impact, University of Waterloo, 15-124.

Reid J. L. Hammond D. Burkhalter R. Ahmed R. (2012). Tobacco Use in Canada: Patterns and Trends.2012 Edition. Waterloo, ON: Propel Centre for Population Health Impact, S1-S23.

Vijayaraghavan, K. (2010). Treatment of dyslipidemia in patients with type 2 diabetes. *Lipids in health and disease*, *9*, 144.

Vissers D.H.W., Taeymans J., Baeyens J.P., Poortmans J. (2013) The Effect of Exercise on Visceral Adipose Tissue in Overweight Adults: ASystematic Review and Meta-Analysis. PLoS ONE 8(2): e56415. doi:10.1371/journal.pone.0056415

Wakabayashi, I. (2012). Influence of age and gender on triglycerides-to-HDL-cholesterol ratio (TG/HDL ratio) and its association with adiposity index. *Archives of gerontology and geriatrics*, *55*(3), 729–34.

Wang, W., Luo, Y., Liu, Y., Cui, C., Wu, L., Wang, Y., Wang, H., et al. (2010). Prevalence of metabolic syndrome and optimal waist circumference cut-off points for adults in Beijing. *Diabetes research and clinical practice*, *88*(2), 209–16.

Weitzman, M., Cook, S., Auinger, P., Florin, T. a, Daniels, S., Nguyen, M., & Winickoff, J. P. (2005). Tobacco smoke exposure is associated with the metabolic syndrome in adolescents. Circulation, 112(6), 862–9.

Wildman, R. P., Gu, D., Reynolds, K., Duan, X., Wu, X., & He, J. (2005). Are waist circumference and body mass index independently associated with cardiovascular disease risk in Chinese adults ? 1 – 3, (8).

Wilsgaard, T., & Jacobsen, B. K. (2007). Lifestyle factors and incident metabolic syndrome. The Tromsø Study 1979-2001. Diabetes research and clinical practice, 78(2), 217–24.

WHO, (2008). World Health Organization, the global burden of disease: 2004 update. Geneva, Switzerland.

WHO, (2011). World Health Organization Global atlas on cardiovascular disease prevention and control, Geneva, Switzerland.

WHO, Diseases Control & States, 2013, Draft Action Plan for the prevention and control of Non communicable diseases 2013-2020.Executive Board 132(7) session, (67) 373.

WHO, (2013). World Health Organization Fact Sheet on Woman's Health cause specifc mortality: regional estimate for 2000-2011, updated 2013

World Health Organization. Global Health Observatory Data Repository [online database]. Geneva, World Health Organization, 2008 (http://apps.who.int/gho/data/view.main) Accessed 11th February 2013.

WHO, (2013), World Health Organization Global Strategy on Diet, Physical Activity and Health, Physical Inactivity: A Global Public Health Problem

WHO Fact Sheet on Alcohol, (2011), World Health Organization Global strategy to reduce the harmful use of alcohol.

WHO Fact Sheet on Tobacco (2013), World Health Organization updated 2013

Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: Diagnosis and classification of diabetes mellitus. Geneva, World Health Organization, 1999.

Xu, W., Ruan, X., Fu, X., Zhu, Q., Zhang, H., Bai, Y., … Zhao, G. (2010). Prevalence of the metabolic syndrome in Pudong New Area of Shanghai using three proposed definitions among Chinese adults. *BMC Public Health*, *10*, 246.

Yeung, E. H., Pankow, J. S., Astor, B. C., Powe, N. R., Saudek, C. D., Kao, W. H.(2007). Increased risk of type 2 diabetes from a family history of coronary heart disease and type 2 diabetes. Diabetes Care, Jan Issue; 30(1):154-6.

Yoon, S. S., Burt, V., Louis, T., & Carroll, M. D. (2012). Hypertension among adults in the United States, 2009-2010. *NCHS data brief*, (107), 1–8.

2008-2013 Action Plan for the Global Strategy for the Prevention and Control of Noncommunicable Diseases The six objectives of the 2008-2013 Action Plan are : (2013).

Zhan, Y., Yu, J., Chen, R., Gao, J., Ding, R., Fu, Y., & Zhang, L. (2012). Socioeconomic status and metabolic syndrome in the general population of China: a cross-sectional study.*BMC Public Health* (12) 921.