

Magnitude of metabolic syndrome and its associated factors among patients with type 2 diabetes mellitus in Ayder comprehensive specialized hospital, Tigray, Ethiopia, 2019: a cross sectional study

Gebreamlak Gebremedhn Gebremeskel (✉ gmost1221@gmail.com)

Kalayou Kidanu Berhe

Mekele University

Desta Siyoum Belay

Mekele University

Berihu Hailu Kidanu

Aksum University

Assefa Iyasu Negash

Aksum University

Kfle Tekulu Gebreslasse

Aksum University

Degenah Bahrey Tadesse

Aksum University

Mulugeta Molla Birhanu

St. paulos medical college

Research note

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Abstract

Objective The aim of this study was to assess magnitude of metabolic syndrome and its associated factors among type 2 diabetes mellitus patients in Ayder comprehensive specialized hospital. A hospital based cross sectional study design was used. Binary logistic regression was used and all independent variables were analyzed to test the association with dependent variable. Finally, in multivariable analysis statistical association was declared at P-value <0.05. **Result** A total of 420 respondents (208 males and 211 females) were enrolled; the mean age was 56.36 (SD 10.18), 51.1% of the respondents had metabolic syndrome according to international diabetes federation. Sex and age were statistically associated with metabolic syndrome with [AOR (95% CI) = 1.93(1.057, 3.533) and 1.04 (1.012, 1.072)] respectively. Regular physical exercise, overweight and obesity were statistically associated with metabolic syndrome with [AOR (95% CI) = 1.84 (1.002, 3.362), 2.68 (1.518, 4.747) and 3.55 (1.254, 10.074)] respectively. To conclude, Magnitude of metabolic syndrome was high. The associated factors for metabolic syndrome are physical inactivity, inadequate intake of fruits, family history, overweight, and obesity.

Introduction

According to the new international diabetes federation (IDF) definition, metabolic syndrome is defined as central obesity (defined by waist circumference) plus any two of the four risk factors: raised triglyceride, low high density lipoprotein (HDL) cholesterol, raised blood pressure and/or raised fasting plasma glucose level. Metabolic syndrome is a complex disorder which leads type 2 diabetes patients and cardiovascular disease (CVD) to be a twin global epidemic problem [1]. The increased in the global burden of metabolic syndrome (MetS) is brought by the global epidemic of obesity and diabetes mellitus and developing countries to be the most affected compared to developed countries [2].

About 70-80% of diabetes mellitus (DM) [3] and 20-25% of adult population in the world is estimated to have metabolic syndrome and they are two times as likely to die from and three-fold as likely to have a heart attack or stroke as compared to without the syndrome. Besides, this metabolic syndrome has five times increased risk of acquiring type 2 diabetes mellitus[2]. Consumption of calorie-dense foods, sedentary lifestyle, and tobacco consumption are considered as potential risk factors for MetS [4].

Diabetes and its complications bring about substantial economic loss to patient with diabetes mellitus and their families and to health systems and national economies through direct medical costs and loss of work. Based on cost estimates from a recent systematic review, it has been estimated that the direct annual cost of diabetes to the world is more than US \$ 827 billion[5, 6].

In Ethiopia the prevalence of metabolic syndrome among type 2 diabetes mellitus according to national cholesterol education program (NCEP) on adult treatment panel (ATP) III was 45.9%. in this study elevated triglyceride and low HDL- cholesterol were found to be the predominant component of MetS[7].

There is limited data on metabolic syndrome in Ethiopia and in the horn of Africa at large. Therefore, this study is much helpful in updating data on MetS and it has a great importance towards the development

of life style modification, control and management of the metabolic syndrome and its components. Finally, this will bring non-communicable disease in general and metabolic syndrome in particular in to the clinical area, and research agenda. This study also serves as a basis for another study, and other stake holders in this regard.

Methods

Study setting and period

A hospital based cross section study design was conducted in Ayder comprehensive specialized hospital (ACSH) from February to June 2018. ACSH is found in Mekelle the capital city of [Tigray region](#) northern of [Ethiopia](#). Mekelle is located around 780 kilometers north of the Ethiopian capital city [Addis Ababa](#). The study participants were previously diagnosed/known type 2 DM patients. DM clinic is served for about 500 type 2 DM patients per month that is estimated from the average of the last six months report.

Study design: A hospital based cross section study design was conducted.

Source population: All type 2 diabetes patients attending DM clinic at ACSH.

Study population: All sampled type 2 DM patients attending DM clinic at ACSH during the data collection period.

Sample size determination

The sample size was calculated by using single proportion formula, $n = \frac{Z^2 \alpha^2 p (1 - p)}{d^2}$ at 95% confidence level, where,

$Z_{\alpha/2}$ = standard normal deviation (1.96), d = 5% of marginal error, and p = prevalence 45.9% taken from a study conducted in Hawassa Ethiopia [7].

$$n = \frac{1.96^2 \times 0.459 \times 0.541}{0.05^2}, n = 382$$

Considering 10% non-response rate the total estimated study subjects were 420 and selected by systematic random sampling technique.

Data collection procedure

Data collection was carried out from February to March 2018. To collect data a standardized, interviewer administered questionnaire and document review checklist of physical measurements were used and contains three parts. Thus are socio-demographic and medical history, the life style and related information, and physical measurement and biochemical measurements were investigated.

Measurements and tools

Anthropometric measurements: Anthropometric measurements of weight and height was measured using Seca weighing scale and stadiometer respectively and participants were wearing light clothing and without shoes. A simple flexible steel metric tape calibrated in meters was used for measuring waist circumference. Waist circumference was measured midway between the iliac crest and the lower rib margin in the horizontal plane while the participant is standing to the nearest 0.5 centimeter.

Blood pressure: Two blood pressure measurements taken after five minutes apart were determined for each participant using standard adult digital blood pressure apparatus with the correct size arm cuff. Participants was measured after 5 minutes of rest in sitting position, arm should be rest on table at heart level, back supported and legs rest on ground (no crossed). And the average readings of the two measurements was recorded in questionnaire [8].

Data quality assurance

Questionnaire was prepared in English and translated in to local language Tigrigna. Pretest was done on 5% of the subjects in Mekelle hospital two weeks before the actual data collection. Two BSC nurses and one supervisor were recruited for data collection and training was given. The collected data was checked by supervisor and principal investigator daily for its completeness and consistency before commencing analysis.

Data processing and analysis

After the data collection, the data was entered in to Epi-info version 7 and exported to SPSS version 23 statistical program. Descriptive characteristics were presented in text, frequency percentage tables, and graphs. Binary logistic regression was analyzed to see the association between the outcome variable with each independent variables. Then those variables with P-value <0.25 at bivariate analysis was included in the multivariable analysis. Odds ratio with 95% confidence level was computed and finally p-value < 0.05 is describe as a statistically associated. Model fitness was checked by using Hosmer and Lemeshow goodness fit model.

Operational definition

Metabolic syndrome: As per the definition of international diabetes federation it is defined as having central obesity (defined by waist circumference ≥ 94 cm for male and ≥ 80 cm for female) plus any two of the following four factors: raised triglycerides, reduced HDL Cholesterol, raised blood Pressure, and/or raised fasting plasma glucose.

Results

Socio-demographic characteristics

A total of 420 type 2 DM patients were enrolled in this study with 99.7% response rate. Of these respondents 211(50.4%) were females. The mean age of the respondents was 56.39 ± 10.18 [9]. The

mean household income of the respondents were $2,735.32 \pm 2,229.77$. Of the total respondents 79.7% were married, 83.1% were orthodox Christian followers (Table 1).

Metabolic syndrome and its component

According to IDF criteria 51.1% of the respondents had metabolic syndrome, with higher prevalence in females when compared to males (57.5% and 42.5% respectively). Central obesity (59.7%) was highly prevalent component of metabolic syndrome followed by elevated triglyceride (45.1%) and then hypertension and low HDL-c 41.3% and 34.4% respectively. Females were also having higher proportion of central obesity and reduced HDL than males (figure 1).

Factors associated to metabolic syndrome

Age and sex was demographic variables that shows statistical association with metabolic syndrome in multi-variable analysis with P- value 0.005 [AOR (95% CI) = 1.04 (1.01, 1.07) and P-value 0.031 [AOR (95% CI) = 1.94 (1.06, 3.54)] respectively.

Eating fruits once, twice, and four and above times in a typical week and regular physical exercise has a statistical association with metabolic syndrome with [AOR (95% CI) = 0.41 (0.21, 0.78), 0.35 (0.16, 0.76), and 0.24 (0.07, 0.75) and 1.83 (1.05, 3.36)] respectively.

Family history of DM, and chronic disease comorbid were variables that shows statistically associated with metabolic syndrome with [AOR (95% CI) = 0.54 (0.29, 0.99), and 0.42 (0.25, 0.70)] respectively and Overweight and obesity shows statistical association with metabolic syndrome with [AOR (95% CI) = 2.66(1.50, 4.69) and 3.50 (1.23, 9.91) respectively. (Table 2)

Discussion

This study was aimed to assess magnitude of metabolic syndrome and its associated factors among type 2 DM patients who have follow up in ACSH.

The magnitude of metabolic syndrome among type 2 DM patients in this study was 51.1%; which lies within a range of 12% - 86% from a review study done in sub Saharan Africa [10]. But, this study is higher than from a study conducted in Hawassa Ethiopia (45.9%), in 10 European countries (24%) and UK (32%) [7, 11]. This difference is due to difference in study setting, sample size, and the criteria used to define metabolic syndrome. The magnitude of MetS in this study is lower than from studies done in Gahanna (68.6%), Nigeria (68.7%) and Iran (64.9%) [12-14]. This variation could be due to difference in socio-cultural, study setting, study design and life style.

This study reveals that, age was significantly positively associated with metabolic syndrome, and this is in line with a study conducted in Iran [12]. This association might be due to older age participants were physically inactive and adoption of unhealthy life styles. Sex was another variable that shows statistical association with metabolic syndrome. This is consistent with studies in Hawassa Ethiopia, Addis Ababa

Ethiopia, Nigeria, and Iran [7, 12, 13, 15]. This association may be due to difference in life style and females do light job.

Eating fruit in a typical week was another variable that has a significant association with metabolic syndrome. This states that, those respondents who eat fruit at least once in a typical week was 59% protected from metabolic syndrome as compared with those who never eat fruit in a typical week. Similarly, those who eat fruit twice, four and above times in a typical week were 65% and 76% protected from metabolic syndrome respectively as compared to those who never eat fruit in a typical week. This is supported by EPHA (Ethiopia) and in line with study conducted in brazil [16, 17].

Furthermore, respondents who did not do moderate regular physical exercise were 1.83 odds to have MetS as compared to those who did regular physical exercise. This is supported by EPHA report (Ethiopia) and in line with studies done in US, Canada, and Sub-Saharan Africa [16, 18-20]. This might be due to physical exercise decreases weight and visceral fat accumulation.

In addition, the odds of MetS were 2.66 and 3.5 times higher among overweight and obesity compared to those normal weigh respondents respectively among type 2 DM patients. This is in line with studies done in Hawassa Ethiopia, Gahanna, Iran and Nigeria [7, 12, 13, 21]. But lower in AOR from a study in Hawassa. This may be due to sample size and difference in reference category.

Conclusion And Recomendations

Conclusion

The magnitude of metabolic syndrome was relatively high among type 2 diabetes mellitus. Life style modification and healthy behaviors of type 2 DM is an area of concern. Generally, the associated factors for metabolic syndrome are physical inactivity, advanced age, inadequate intake of fruits, family history, increased duration since diagnosis of DM, overweight and obesity.

Recommendations

To regional health bureau and ministry of health

As this study shows an alarmingly increase in magnitude of metabolic syndrome, life style and behavioral modification should be implemented as a matter of urgency.

To Ayder comprehensive specialized hospital

Regular screening of patients for components of MetS is vital in order to avert/limit the risks before developing cardiovascular related morbidity and mortality.

To patients

Should do regular physical exercise as recommended

Should eat fruits at least once in a typical week

Should reduce and manage their weight if they are told to do so by health care professionals

To researchers

Further cohort or interventional studies should be done to address other predictors of MetS.

Limitations

The cross sectional nature of the study; temporal relationship between exposure and disease cannot be clearly determined or not powerful

The study was conducted only in a single public hospital

Declarations

Ethical approval

Ethical approval was obtained from the institutional review board of Mekelle University College of health science. Then letter of permission was received from medical director of ACSH and given to head department in the DM clinic. All of the study participants was informed about the purpose of the study, about their right to participate or to withdraw at any time if they don't want and confidentiality of the information was obtained. Written consent was taken from participants to participate in this study and approved by the institutional review board of Mekelle University. This research is original and not considered in another journal for publication.

Consent to publish

Not applicable

Availability of data and materials

I the undersigned, declare that this is our original work and has not been submitted and considered for publish in any journal and all sources of materials and data used for this research have been secured and acknowledged.

Competing interests

Authors declared that, they have no conflict of interest and approved for publication.

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Authors' contributions

All authors' listed in this research article have been involved and contribute for this thesis. 'GG' contributes in conception, design, analysis, data interpretation, data acquisition, drafting and writing the final manuscript 'MM' contributes in conception, design, analysis, data acquisition, drafting and revising the manuscript, 'KK' contributes in design, analysis, data interpretation, drafting and revising, 'DS', 'BH', 'AI' and 'KT' contributes in design, analysis, drafting and revising, and 'DB' contributes in design, analysis, data acquisition, drafting and revising it critically for important intellectual content and all authors read and given final approval of the manuscript to be published.

Abbreviations

ACSH: Ayder Comprehensive Specialized Hospital, DM: Diabetes Mellitus, EPHA: Ethiopian Public Health Association, HDL: High Density Lipoprotein, IDF:International Diabetes Federation, MetS: Metabolic Syndrome, NCEP/ATP: National Cholesterol Education Adult Treatment Panel, US: United States

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Tables

Due to technical limitations, table ___ is only available as a download in the supplemental files section

Figures

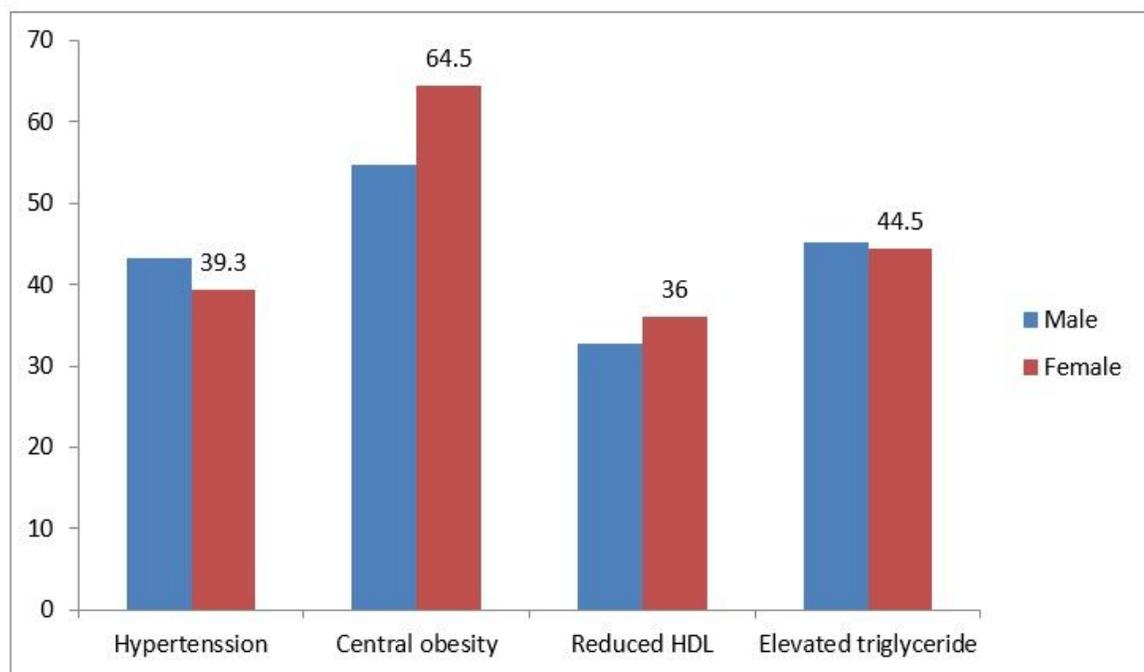


Figure 1

Frequency of component of MetS in relation to sex of respondents among type 2 DM patients in ACSH, Tigray, Ethiopia, 2018 (n =419)

Supplementary Files

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