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Pattern of Metabolic Syndrome in Relation to Gender among Type-II DM Patients in Hawassa University Comprehensive Specialized Hospital, Hawassa, Southern Ethiopia

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Abstract

Background: The co-existence of diabetes and metabolic syndrome (MetS) in individuals potentiate the cardiovascular risk associated with each of these mentioned circumstances. Hence investigating the presence of MetS and its individual components in diabetes mellitus (DM) patients is fundamental in order to minimize the risks of developing cardiovascular related morbidities.

Objectives: This study aimed to assess pattern of metabolic syndrome in relation to gender among type-II DM patients in Hawassa University Comprehensive specialized Hospital.

Methods: A cross-sectional study was conducted on 270 participants from March to November 2014. Structured questionnaires were used for appropriate data collection; blood glucose and lipid profiles were determined after overnight fasting. In addition, MetS was interpreted according to modified National cholesterol Education Program Adult Treatment Panel-III guideline and finally in all cases, at 95% confidence interval (CI), a P value <0.05 was accepted as statistically significant.

Results: The prevalence of MetS was 45.9% and the proportion of MetS was significantly higher in women when compared to men (60.6% vs. 36.7%; p<0.0001), respectively. Elevated TGs was 68.1% and it was found to be the most frequently encountered MetS component followed by Low HDL-c (47%) other than hyperglycemia. Abdominal obesity and low HDL-c were significantly higher in women when compared to men (p<0.0001 for both). In addition, being women [AOR (95%CI): 4.1(1.5-10.9)], overweight [AOR (95%CI): 12(2.3-61.4)], and obesity [AOR (95%CI): 19.8 (3.1-124.7)], were significantly positively associated with MetS. Furthermore duration since the diagnosis of diabetes was also significantly associated with MetS.

Conclusions: Applying comprehensive management approach in each abnormal component of MetS is a fundamental in order to minimize cardiovascular risks. In addition, cohort studies should be conducted to address others hidden factors that potentiate MetS.

Keywords: Cardiovascular disease; Metabolic syndrome; Diabetes

Introduction

Diabetes mellitus (DM) is a global problem, currently estimated more than 171 million individuals (>2.8% of the world's population), and it is expected to rise 366 million (4.4% of the world's population) and of this, >80% DM patients will be in developing countries by 2030 [1].

Metabolic syndrome (MetS) is a group of clinical and biological abnormalities that confers a greater risk of developing type II diabetes, cardiovascular diseases (CVD) and other related health problems [2]. Type II DM, is the one component of MetS which can leads the development of cardiovascular disease, and MetS is a cluster of metabolic disorders of numerous etiologies [3]. These include abdominal obesity, raised blood pressure, hyperglycemia and lipid profile derangement [3,4]. In addition various metabolic disorders were included with MetS later, such as micro-albuminuria, hyperuricemia (gout) and defects in fibrinolysis and blood coagulation [5]. Around 70-80% of the population with DM were diagnosed with the MetS [6,7]. Worldwide, 20-25% of the adults have been expected to have the MetS. Individuals with MetS are twofold as expected to die and three times as likely to have a heart attack or stroke when compared to people without MetS [8]. This indicates the co-existence effect of type II DM and MetS on cardiovascular risks [9]. Strictly diagnosing of MetS and its components in DM patients is a vital in order to promote patients health care and to minimize CVD related morbidity and mortality.

Data are available regarding the prevalence and rising trends of type II DM in Sub-Sahara. However, studies on the prevalence of the MetS among type-II DM patients are still inadequate in developing countries like Sub-Saharan Africa including Ethiopia. Hence, this study was aimed to assess the prevalence and risk factors of MetS among type-II DM patients in Hawassa University Comprehensive specialized Hospital, Southern Ethiopia.

Materials and Methods

Study setting and study population

A cross-sectional study was conducted among type II DM patients those who had regular follow-up at outpatient clinic of chronic diseases from March to November 2014, at Hawassa University comprehensive specialized Hospital, Southern Nations Nationalities and Peoples Region (SNNPR). Hawassa is the capital city of the region and located 275 km from Addis Ababa, which is the capital city of Ethiopia. The altitude of the town is 1697 meters above sea level with the mean annual temperature and rainfall of 20.9°C and 997.6 mm respectively. This hospital was established in November, 2005 and it serves for more than 10 million people and provides health care services for populations of SNNPR and neighboring regions. The study participants were previously diagnosed/known type II DM patients; however patients who were on statin drugs, pregnant women, previously known heart failures and renal failures were excluded from the study.

Sample size and sampling technique

Sample size calculation was based on the prevalence of MetS in Ghanaian Type II DM patients, which was 24% [10]. The required sample size was computed using single population proportion formula,

$$n = \frac{\left(Z_{\alpha/2}\right)^2 p(1-p)}{d^2}$$

Where, P= proportion of MetS, $Z_{\alpha/2}$= Critical value at 95% level of confidence (Z =1.96) d=Margin of error (5%). Based on the above formula the final sample size was 281. Then, systematic random sampling technique was applied to select the study participants from the study populations.

Data collection

Socio-demographic, clinical and anthropometric data collection: The socio-demographic, clinical and anthropometric related data of the study participants were collected using structured questionnaire including with review of patients clinical records.

Systolic blood pressure (SBP) and diastolic blood pressure (DBP) was measured from each subject with a standard adult arm cuff (sphygmomanometer). Trained nurses who were working in the outpatient chronic diseases follow-up clinic were done the measurement from right hand after patients rested for at least 5 minutes. The precision of the measurement was checked by using two readings within two minutes difference and finally the average of the two readings was taken as blood pressure. Data regarding weight (in Kilogram (kg) and to the nearest 0.1 kg), height (in meters (m) and to the nearest 0.1 m) and waist circumference (in centimeter (cm) and to the nearest 0.1 cm) were collected according to WHO STEPS manual [11] using appropriate equipments as well as measuring scales. Height of the participants was measured without wearing shoes and weight was taken with wearing light garments. In addition waist circumference was measured with measuring tape at the midpoint between the inferior angle of rib and the iliac crest at the end of a relaxed expiration so far patients were upright properly. Furthermore body mass index (BMI: kg/m^2) was calculated by dividing individual's weight (kg) by height squared (m^2).

Blood collection and serum biochemical determination

About 4-5 milliliters (ml) of venous blood sample was drawn from each study participant after overnight fasting and centrifuged at 3000 cycles/min, and then serum was obtained. Also serum samples were analyzed for FBS and lipid profile (total cholesterol (TC), high density lipoprotein cholesterol (HDL-c) and TGs) using A25TM BioSystem Random Access chemistry analyzer. Serum TC, TGs and FBS were analyzed using enzymatic colorimetric assay method (Linear chemicals, Montgat, Spain). Serum HDL-c determined by enzymatic colorimetric assay method after a selective precipitation of apolipoprotein containing lipoproteins (very low density lipoprotein cholesterol (VLDL-c) low density lipoprotein cholesterol (LDL-c), and apolipoprotein a (Lpa)) by phosphotungstic acid/$MgCl_2$ (magnesium chloride) (Linear chemicals, Montgat, Spain).

Definition of metabolic syndrome

Finally MetS was defined according to modified United States National Cholesterol Education Program, Adult Treatment Panel (NCEP-ATP) III guideline. Patients had at least three of the following risk features to be categorized under the group of MetS: abdominal obesity (defined as waist circumference >102 cm in males and >88 cm in females); elevated TGs (≥ 150 mg/dl); low HDL-c (<40 mg/dl in males and <50 mg/dl in females); elevated blood pressure (SBP ≥ 130 or DBP ≥ 85 mmHg) and FBS >110 mg/dl [12].

Data analysis

All questionnaires were checked visually, coded and entered into Statistical Package for Social Sciences (SPSS) Version 20 for analysis. To explain study population in relation to appropriate variables descriptive statistics were used. Chi-square was used for categorical variables. In addition, evaluation of differences in means of study groups was evaluated using student's t-test. In addition, bivariate and multivariate binary logistic regression models were used to assess the differences in the

distribution of categorical variables in the study groups. Furthermore, P-value <0.2 was used as a cut-off value to include variables for multivariate binary logistic regression and at 95% confidence interval (CI), a P value <0.05 was accepted as statistically significant.

Data quality control

Nurses working in the outpatient chronic diseases follow-up clinic were trained concerning socio-demographic, clinical and physical/anthropometric data collection from the study participants. All laboratory investigations were performed by laboratory technologists using standard operating procedures (SOPs). All analytical phase of lab performances as well as reagents condition were checked daily by performing the internal quality control samples. If results fall outside established value, the run was repeated and also recalibration of instrument was done when needed.

Ethical concern

The ethical clearance of study was obtained from Institutional Review Board of the College of Medicine and Health Sciences, Hawassa University. Then official letter was submitted to hospital medical director office and data collection was performed after obtaining permission. Participation was completely voluntary, and written informed consent was obtained from all the study subjects after in-depth clarification about the objective of the study. Every information obtained throughout the study was kept with confidentiality and all laboratory analysis was performed without any charge.

Results

Background characteristics of the study subjects

Totally 281 type II DM participants were approached; of these 270 patients [166 (61.5%) males and 104(38.5%) females] were recruited in the study, with a response rate of 96.1%. The mean and standard deviation (±SD) age of the participants was 48.8 (±11.9) years and males were significantly older than females (p=0.04). About, 55.2% were urban dwellers with a high proportion of females (p=0.008). About 94.1%, 35%, and 76.7% of the study participants were married, employed, and majority time uses foot for transportation, respectively. Also 54.8% of the study participants have no income (like a housewife and older patients) and they depend on their husbands and their family **(Table 1)**.

Table 1 Socio-demographic and other characteristics of type II diabetes patients at Hawassa University comprehensive specialized hospital.

Variables		Total 270(%)	Men 166(%)	Women 104(%)	p-value
Mean Age, years (SD)		48.8(11.9)	50(12.4)	46.9(10.9)	0.04
	<45	96(35.6)	56(33.7)	40 (35.6)	
	45-54	85(31.5)	52(31.3)	33(31.7)	
	55-64	59(21.9)	37(22.3)	22(21.2)	
	≥65	30(11.1)	21(12.7)	9(8.7)	0.71
Residence:	Rural	121(44.8)	85(51.2)	36(34.6)	
	Urban	149(55.2)	81(48.8)	68(65.4)	0.008
Marital status:	Single	12(4.4)	10(6.0)	2(1.9)	
	Married	254(94.1)	154(92.8)	100(96.2)	
	Divorced	2(0.7)	1(0.6)	1(0.96)	
	Widow/widower	2(0.7)	1(0.6)	1(0.96)	0.44
Educational status	Unable to read and write	69(25.6)	27(16.3)	42(40.4)	
	Primary	67(24.8)	49(29.5)	18(17.3)	
	Secondary	67(24.8)	40(24.1)	27(26.0)	
	Tertiary	67(24.8)	50(30.1)	17(16.3)	<0.0001
Occupation	Farmer	68(25.2)	64(38.6)	4(3.8)	
	Employed	96(35.6)	70(42.2)	26(25.0)	

	Merchant	27(10.0)	25(15.1)	2(1.9)	
	Housewife	68(25.2)	0(0.0)	68(25.2)	
	Daily laborers &Others	11(4.1)	7(4.2)	4(3.8)	<0.0001
Mode of transport	foot	207(76.7)	126(75.9)	81(77.9)	
	Bicycle/cart	19(7.0)	17(10.2)	2(1.9)	
	Motor vehicle	44(16.3)	23(13.9)	21(20.2)	0.02
*Monthly income	No income (dependent)	148(54.8)	82(49.4)	66(63.5)	
	≤ 1000	45(16.7)	29(17.5)	16(15.4)	
	1001-2000	55(20.4)	39(23.5)	16(15.4)	
	2001-3000	15(5.6)	11(6.6)	4(3.8)	
	≥3001	7(2.6)	5(3.0)	2(1.9)	0.22

*Income, in Ethiopian birr

Clinical and other characteristics of the study subjects

About 92.6% of patients were ≥1year since the diagnosis of diabetes. Mean BMI and HDL-c were significantly higher in females when compared to males. Both an overweight and obese participants accounted 45.2%, and females were more obese when compared to males (22.1% vs. 4.8%; P <0.0001), respectively. In addition, 2.6% and 6.7% were ever smoked cigarette and ever drunk alcohol respectively. Oral blood glucose lowering agents have been taken by 51.9% participants; whereas 45.9% were on insulin injection and 2.2% patients were on combined treatment (oral agents and insulin injection) **(Table 2)**.

Table 2 Clinical and other characteristics of type II diabetes patients at Hawassa University comprehensive specialized hospital.

Variables		Total 270	Men N=166	Women N=104	p-value
Duration since the diagnosis of DM	<1 years	20 (7.4)	15(9.0)	5(4.8)	
	1-5 years	169(62.6)	108(65.1)	61(58.7)	
	6-10 years	58(21.5)	29(17.5)	29(27.9)	
	≥ 11 years	23(8.5)	14(8.4)	9(8.7)	0.16
Mean BMI, Kg/m^2(SD)		24.5(4.3)	23.8(3.7)	25.7(5.0)	<0.0001
	<18.5 kg/m^2	19(7.0)	12(7.2)	7(6.7)	
	18.5-24.9 kg/m^2	128(47.4)	88(53.0)	40(38.5)	
	25-29.9 kg/m^2	92(34.1)	58(34.9)	34(32.7)	
	≥ 30 kg/m^2	31(11.1)	8(4.8)	23(22.1)	<0.0001
Mean WC, cm(SD)		95.5(11.1)	94.9(10.0)	96.3(12.3)	0.33
Mean Hip cm(SD)		99(9.7)	97(8.2)	102(11.0)	<0.0001
Mean WC to Hip ratio(SD)		0.96(0.06)	0.98(0.06)	0.94(0.06)	<0.0001
Mean SBP, mmHg(SD)		125(17.2)	125.9(16.2)	123.9(18.8)	0.34
Mean DBP, mmHg(SD)		79.6(9.7)	80(9.7)	78(9.6)	0.4
Median FBS, mg/dl(SD)		80(70-203)	150(110-212)	156(117-215)	0.86
Mean HDL, mg/dl(SD)		45.1(13.6)	43.2(14.5)	48.1(11.4)	0.005
Median TGs, mg/dl (IQR)		176(134-234)	179(136-244)	172(132-223)	0.24
Ever smocked cigarette		7(2.6)	6(3.6)	1(0.96)	0.18*

Ever drank alcohol		18(6.7)	15(9.0)	3(2.9)	0.05*
Treatments for DM:	Oral agents	140(51.9)	86(51.8)	54(51.9)	
	Insulin	124(45.9)	75(45.2)	49(47.1)	
	Oral agents + insulin	6(2.2)	5(3.0)	1(0.96)	0.53*
DM treatment combination	single	202(74.8)	120(72.3)	82(78.8)	
	Combined	68(25.2)	46(27.7)	22(21.2)	0.23

BMI: Body mass index; DBP: Diastolic blood pressure; DM: Diabetes mellitus FBS: Fasting blood sugar; IQR: Interquartile range; HDL-c: High density lipoprotein cholesterol; SD: Standard deviation; WC: Waist circumference; SBP: Systolic blood pressure; TGs: Triglycerides; *: significance by Fisher's exact test

Characteristics of metabolic syndrome and its components

According to the modified NCEP-ATP III criteria, the overall 45.9% of the study participants had MetS, and the proportion was significantly higher among females when compared to males (60.6% vs. 36.7%; p<0.0001), respectively. The frequency of MetS components among the participants were: abdominal obesity, raised blood pressure, raised TGs and low HDL-c were 40.7%, 28.1%, 68.1% and 47%, respectively. In addition, the prevalence of abdominal obesity and low HDL-c were significantly higher in females when compared to males (P ≤ 0.0001) for both MetS components **(Table 3)**. Moreover, the proportion of three, four and five MetS components abnormal within a single individual were 26.3%, 16.3% and 3.7%, respectively **(Figure 1)**.

Table 3 Prevalence of metabolic syndrome and its components other than hyperglycemia among type II diabetes patients at Hawassa University compressive specialized hospital.

Variable	Total 270 (%)	Men 166(%)	Women 104(%)	p-value
Metabolic syndrome	124(45.9)	61(36.7)	63(60.6)	<0.0001
Abdominal obesity	110(40.7)	35(21.1)	75(72.1)	<0.0001
Raised triglycerides	184(68.1)	113(68.1)	71(68.3)	0.97
Reduced HDL-c	127(47.0)	63(38.0)	64(61.5)	<0.0001
Raised blood pressure	76(28.1)	48(28.9)	28(26.9)	0.78

Factors associated with the prevalence of metabolic syndrome

Bivariate analysis was applied to assess the independent risk factors for MetS. Therefore being a female the crude odds ratio and 95% confidence interval [COR (95% CI): 2.6(1.6-4.4)], duration since the diagnosis of diabetes from 1-5years [COR (95% CI): 4.6(1.3-16.4)], and duration of diabetes ≥ 6 years [COR (95% CI): 7.1(1.9-26.1)] were significantly associated with MetS. In addition, being urban dweller [COR (95% CI): 1.8(1.1-2.9)], overweight [COR (95% CI): 12.1(2.6-55.4) and obesity [COR (95% CI): 29.1(5.4-157.9)] were also significantly and positively associated with MetS.

However, multivariate analysis was adjusted for potential confounding factors, being female [AOR (95% CI): 4.1 (1.5-10.9)], duration of DM since its diagnosis from 1-5 years [AOR (95% CI): 5.5 (1.3-24.0)] and duration of DM ≥ 6 years [AOR (95% CI): 7.3 (1.6-32.7)] were significantly associated with MetS. Further, overweight and obesity were also significantly and positively associated with MetS **(Table 4)**.

Discussion

Different studies in Africa settings reported that varies prevalence's of MetS, which ranges from 51% - 60.4% [9,13-16]. However we found that the total prevalence of MetS among type II DM patients was 45.9% according to the modified NCEP-ATP III criteria. The percentage in MetS variation may be attributed to socio-demographic, individuals' lifestyle and genetic variances among our population and the above mentioned studies. In addition, one study from another Africa setting reported that 43% of MetS among DM patients and which is comparable with our finding. Furthermore, the lower prevalence rate of MetS reported from Ghana diabetic patients (24.0%) [10] and Nigeria patients (25.2%) [17], when compared to the finding of present study. The variation could be due to applying different guideline to define MetS: accordingly the above mentioned two studies were used IDF and WHO criteria; whereas we used NCEP-ATP III guideline.

Our study indicated that females have significantly high proportion of MetS when compared to males (60.6% vs. 36.7%; p ≤ 0.0001), respectively. The finding is in line with different studies report including with Sub-Saharan countries [9,10,14,18]. In addition one study revealed that the proportion of MetS was 66.8% in males and 87.1% in females [19] and the rate is higher than the present study.

This study showed that high prevalence of raised TGs level (68.1%) and studies suggest that the co-existence of elevated TGs and low HDL-c are the risk factors for developing coronary heart diseases (CHD) [20,21]. In addition studies reported that low HDL-c level and abdominal obesity were significantly higher components of MetS in females when compared to males and the finding is similar with the report of our study [16,22,23]. The low concentration of HDL-c favors the accumulation of LDL-c in the blood vessels greatly due to its poor scavenging capacity of LDL-c from the body and this initiates the risks of CVD. Furthermore it is well-known that

low concentration of HDL-c level is a strong independent risk factor for CHD [24,25].

This study showed that overweight and obesity were significantly associated with the prevalence of MetS in both logistic regression models. The finding is in line with the report of different studies [10,16,18]. In addition the present study showed that being a female was risk factor for developing MetS. Similarly several studies reported that females were at a high risk of increasing MetS and it may consequences CVD [16,26,27]. This could be attributed to genetic variation, due to their lifestyle and may be women doing light jobs. Furthermore we found that the increased duration since the diagnosis of diabetes was significantly associated with MetS. In contrary to our finding, one study revealed that no association of MetS with the duration of diabetes [28]. The discrepancy may be due to lack of knowledge and awareness regarding MetS in the current study and the educational status might have a great influence (because more than half of our study participants were ≤ primary level).

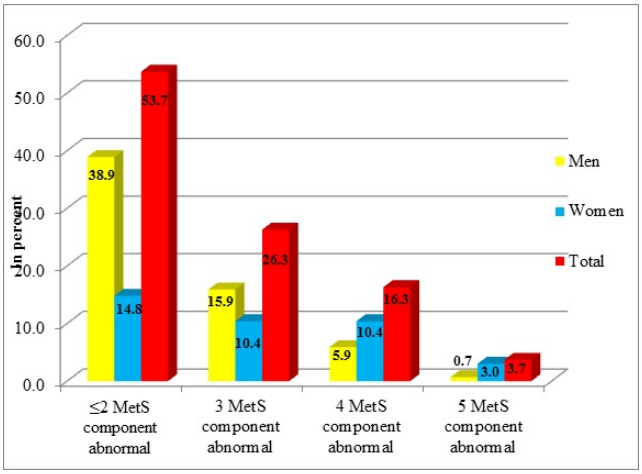

Figure 1 Trends of abnormal components of metabolic syndrome with in a single individual by sex at Hawassa University compressive specialized hospital.

Table 4 Factors associated with metabolic syndrome among type II diabetes patients at Hawassa University comprehensive specialized hospital.

Variables		MetS n(%)					
		Yes	No	COR (95% CI)	p-value	AOR (95% CI)	p-value
Gender	Men	61(22.6)	105(38.9)	1		1	
	women	63(23.3)	41(15.2)	2.6(1.6-4.4)	<0.0001	4.1(1.5-10.9)	0.005
Age, years	<45	38(14.1)	58(21.5)	1		1	
	45-54	44(16.3)	41(15.2)	1.64(0.91-2.9)	0.1	1.9(0.93-3.89)	0.08
	55-64	29(10.7)	30(11.1)	1.5(0.76-2.84)	0.24	1.9(0.85-4.3)	0.11
	≥65	13(4.8)	17(6.3)	1.2(0.51-2.68)	0.72	1.58(0.58-4.3)	0.37
Residence	Rural	46(17.0)	75(27.8)	1		1	
	Urban	78(28.9)	71(26.3)	1.8(1.1-2.9)	0.02	1.2(0.64-2.38)	0.53
Marital status	Single	3(1.1)	9(3.3)	1		1	
	Married	119(44.1)	135(50.0)	2.6(0.7-9.9)	0.15	0.9(0.19-4.27)	0.89
	Divorced/ Widow	2(0.7)	2(0.7)	3.0(0.28-31.6)	0.36	0.29(0.01-5.9)	0.42
Occupation	Farmer	26(9.6)	42(15.6)	1		1	
	Employed	48(17.8)	48(17.8)	1.6(0.86-3.0)	0.14	0.75(0.31-1.8)	0.52
	Merchant	10(3.7)	17(6.3)	0.95(0.38-2.4)	0.91	0.54(0.17-1.77)	0.31
	Housewife	37(13.7)	31(11.5)	1.9 (0.97-3.8)	0.06	0.31(0.09-1.1)	0.07
	Others	3(1.1)	8(3.0)	0.61(0.15-2.5)	0.49	0.27(0.04-1.6)	0.15
Duration of DM since its diagnosis, years	<1	3(1.1)	17(6.3)	1		1	
	01-May	76(28.1)	93(34.4)	4.6(1.3-16.4)	0.02	5.5(1.3-24.0)	0.02
	≥ 6	45(16.7)	36(13.3)	7.1(1.9-26.1)	0.003	7.3(1.6-32.7)	0.009
Mode of transportation	Foot	88(32.6)	119(44.1)	1		1	

	Cart/Bicycle	8(3.0)	11(4.1)	0.98(0.38-2.5)	0.97	1.2(0.36-3.74)	0.79
	Motor vehicle	28(10.4)	16(5.9)	2.4(1.2-4.6)	0.01	1.8(0.77-4.3)	0.17
***Monthly income**	No income	68(25.2)	80(29.6)	1		1	
	≤ 1000	19(7.0)	26(9.6)	0.9(0.44-1.7)	0.66	1.0(0.44-2.3)	0.98
	1001-2000	24(8.9)	31(11.5)	0.9(0.45-1.69)	0.77	0.54(0.22-1.33)	0.18
	2001-3000	10(3.7)	5(1.9)	2.4(0.77-7.2)	0.13	3.1(0.77-13.0)	0.11
	≥ 3001	3(1.1)	4(1.5)	0.91(0.19-4.1)	0.87	0.77(0.12-4.97)	0.78
History of alcoholism, n (%)	No	199(44.1)	133(49.3)	1		1	
	Yes	5(1.9)	13(4.8)	0.43(0.15-1.24)	0.12	0.48(0.13-1.77)	0.27
BMI, Kg/m^2	<18.5	2(0.7)	17(6.3)	1		1	
	18.5-24.9	44(16.3)	84(31.1)	4.4(0.98-20.1)	0.05	4.1(0.84-20.5)	0.08
	25-29.9	54(20.0)	38(14.1)	12.1(2.6-55.4)	0.001	12.0(2.3-61.4)	0.003
	≥ 30	24(8.9)	7(2.6)	29.1(5.4-157.9)	<0.0001	19.8(3.1-124.7)	0.001

DM: Diabetes; BMI: Body mass index; COR: Crude odds ratio; AOR: Adjusted odds ratio; CI: Confidence Interval; *: Income in Ethiopian birr; MetS: Metabolic syndrome

Limitation of the Study

We didn't perform the nutritional assessment due to its difficulties; but the increased risk of cardiovascular diseases associated with defined MetS and its components is well known. The other limitations were the cross-sectional nature of the study and only one definition was used to assess MetS; a different prevalence rate could have been seen if other definition likes, IDF and WHO were used. Irrespective of these restrictions, the study ultimately adds evidence to the limited data.

Conclusion

Type II DM patients had high prevalence of MetS and elevated TGs was the most commonly encountered component of MetS. Abdominal obesity and low HDL-c were significantly higher in females compared to males. Being an overweight, being an obese, being a women and duration since the diagnosis of diabetes were significantly associated with occurrence of MetS. Therefore all patients should get awareness concerning MetS and screened for the presence of cardiovascular risk factors that contribute to the occurrences of MetS. Similarly applying comprehensive approach in each components of MetS management (like lifestyle and diet intake modification, doing regular moderate to vigorous intensity of physical exercises and using pharmacotherapies) is also critical to minimize risks of CVD related morbidity and mortality. Furthermore cohort studies should be done to address other predictors of MetS.

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Authors' Contributions

AT and HA conceived and designed the study, performed data collection, data entry and analysis including with interpretation and manuscript preparation, DA assisted in analysis and manuscript appraisal. All authors read and accepted the final manuscript.

Competing Interests

The authors declare that they have no competing interests.

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