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Prevalence Of Metabolic Syndrome And Its Components In Jimma Town, South West Ethiopia.

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Abstract:

Introduction: The metabolic syndrome has become one of the major public-health challenges worldwide [35]. Metabolic syndrome (Met S) is a cluster of metabolically related cardiovascular disease (CVD) risk factors such as obesity, atherogenic dyslipidemia, elevated blood pressure and abnormal glucose. Metabolic syndrome is highly prevalent among adults in developed countries and is an emerging health problem in developing countries. The criteria used for defining Metabolic syndrome are those proposed by International Diabetes Federation (IDF), National Cholesterol Education Programme-Adult Treatment Pannel-III (NCEP-ATP III).

Objective: The objective of this study was to assess the prevalence of metabolic syndrome, its components, and its major risk factors among adults ≥ 20 in Jimma Town, South West Ethiopia according to IDF and NCEP ATP III criteria. The purpose of these definitions is to find out the edge group in the population who are at increased risk of developing cardio-metabolic diseases (CVDs / CHDs).

Methods: A community based cross-sectional study was conducted to determine prevalence of Met S in accordance with the stepwise approach of WHO. Met S prevalence was determined from the anthropometric measurements and biochemical estimations by using IDF and NCEP ATP -III definitions.

Results and discussion: The overall prevalence of Met S in adults, ≥ 20 years was estimated to be 16.7% (IDF criteria) and 10.5 % (NCEP ATPIII criteria). The prevalence rate gradually increased as on aging with a decline in the old age. The prevalence rate was observed to be the highest among the 45-54 years age category in both men and women (Met S IDF=32.5% and Met S ATP III=20.7%). This might be a result of an age-related variation in different components of the Met S cluster such as WC, HDL-C and TG. Generally, women of the study population were more prone to Met S as per both definitions (Met S-IDF: Men=11%, Women=21.7% and Met S ATP III: Men=6%, Women =14.5%). Further, within the Met S category majority were females (Met S IDF-68.6% and Met S ATP- III-73.2%). Among the occupational categories house wives were at more risk of Met S (Met S IDF: 31.1% and Met S ATP III: 19.8%) and might be because of insufficient physical exercise, child delivery /menopause associated changes, the general reclining nature. No significant association was found between income, educational status and Met S. Logistic regression analysis revealed that sex(female), age (45-54 years), occupation (house wife category), are directly associated with the development of Met S according to IDF as well as ATP-III criteria.

Conclusions: The overall prevalence of Met S in Jimma Town was estimated to be 16.7% and 10.5 % by IDF and NCEP ATP III criteria respectively. Prevalence increases with age with a slight decline in the old age population; middle aged individuals (45-54 years age category) were at more risk; women were at greater risk compared to men in all age groups.

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Key words: Metabolic syndrome (Met S), Met S IDF, Met S –ATP-III, occupational category , prevalence

INTRODUCTION:

The metabolic syndrome has become one of the major public-health challenges worldwide [1].Metabolic syndrome is a cluster of metabolically related cardiovascular disease (CVD) risk factors that increases the risk of CVD by 2-folds and the risk of developing type 2 diabetes mellitus by 3-folds. The cluster includes various combinations of obesity (total body obesity measured by body mass index, or central obesity measured by waist-to hip ratio or waist circumference), atherogenic dyslipidemia (increased triglycerides, decreased high-density lipoprotein cholesterol), elevated blood pressure (systolic and diastolic), abnormal glucose tolerance, an insulin resistance measured by the homeostasis model assessment (HOMAIR) or fasting insulin.[2,3] The syndrome has been given different names such as the insulin resistance syndrome, or syndrome X [3,4, 5] and the deadly quartet, [6] the most popular being metabolic syndrome.[7]

The associated risk factors with metabolic syndrome can be divided into modifiable and non-modifiable types. The major modifiable types include high blood pressure, disturbances in sex hormones (e.g., polycystic ovary syndrome (POS), mental ill health, hyperandrogenism in pre- and postmenopausal women, energy excess (higher carbohydrate, high fat, low dietary fiber, high meat intake, family history (diabetes, hypertension, obesity , overweight) life style characteristics (tobacco use, alcohol consumption, physical inactivity, snoring and obstructive sleep apnea syndrome, psychosocial and personality factors (lower social class , difficulty in coping with stress low socioeconomic status, alcohol) etc. On the other hand, the non modifiable risk factors include age, sex, ethnicity, family history and previous stroke and heart attack. [8,9,10]

The global statistics shows that approximately a quarter of adult populations suffer from this clinical entity [11]. According to various studies the prevalence of MetS in general population in the United States, Saudi Arabia, and Turkey are 24%, 39.3%, and 33.4%, respectively [12,13,14]. The literature also reveals that the prevalence of MS in Tehran is 30.1% while prevalence of MS in three major cities in center of Iran is 23.3%. A more interesting part of the MetS story in Iran is that 45% of adult the population in Khorasan (Northeast Iran) has MetS [15,16,17]. Similarly, the prevalence of the metabolic syndrome according to the WHO definition in seven European countries was estimated to be 23%. [18] In Canada, more than a quarter of the population between the ages of 35 to 75 years was affected by the metabolic syndrome based on the ATP III criteria [19]. At least 12% of the population aged 25 years and above was found to have three or more risk factors in Australia [20].

The third National Health and Nutrition Examination Survey in the United States reported the prevalence of Met S is 24 per cent in healthy adults and found that cardiovascular and all-cause mortalities to be increased in men and risk of coronary disease increased in women [21]. The men with Met S have been reported to be 2-4 times more likely to die of any cause than those without Met S, even after adjustment for conventional risk factors [22]. Metabolic syndrome is evolving into a pandemic, contributing to approximately 6-7% for all-cause mortality,12– 17% for cardiovascular disease, and 30–52% for diabetes in the population [23]. In populations free of cardiovascular disease at baseline, cardiovascular morbidity and mortality increases 1.5- to 3-fold in the presence of the metabolic syndrome [24, 25]. According to International Diabetes Federation (IDF) a quarter of the world's adults have metabolic syndrome. People with metabolic syndrome are twice as likely to die from, and three times as likely to have a heart attack or stroke compared with people without the syndrome. People with metabolic syndrome have a five-fold greater risk of developing type 2 diabetes mellitus. Up to 80% of the 200 million people with diabetes globally will die of cardiovascular disease. This puts metabolic syndrome and diabetes way ahead of HIV/AIDS in morbidity and mortality terms yet the problem is not as well recognized. The main reason behind this is that the combination of MetS risk factors interacts synergistically to start or accelerate the progression of atherosclerosis [26].

In Africa, the first reported MetS study conducted in the mid-90s in Cameroon found a 1.5% and 1.3% prevalence of MetS among urban dwelling women and men using IDF criteria; however, the study did not measure HDL-C concentrations [27]. A second study conducted in 2004 in Seychelles, found a high prevalence of MS where 25%–30% of their study population had the syndrome [28]. A recent study involving adults in semi-urban and rural communities in Nigeria found a prevalence of MS to be 18% [29]. A community based study conducted in Tanzania in 2009 reported a 38% prevalence of MetS [30] The prevalence of Met S in children and adolescents is relatively low (4%) when compared to the adult population (24%), except amongst overweight and obese adolescents where the prevalence of the metabolic syndrome has been reported as high as 29% [31,32,33].

Another important issue of MetS is that early diagnosis and efficient management of the disease will result in the reduced risk of future development of CAD [34,35,36]. Previous research indicated that the risk for CHD and stroke was increased threefold in subjects with metabolic syndrome ($P<0.001$). Cardiovascular mortality was also markedly increased in subjects with metabolic syndrome (12.0 vs. 2.2%, $P < 0.001$) [37]. Another study showed that patients with even one or two metabolic syndrome components were at increased risk for mortality from CHD and CVD. Moreover, metabolic syndrome overall more strongly predicts CHD, CVD, and total mortality than its individual components [38]. Similarly, the risk of incident CVD increased in conjunction with rising numbers of the components of metabolic syndrome; 2.5% of individuals with one component developed CVD, whereas 14.9% of those who had four or more components developed the disease. [39,]

In Ethiopia only single cross-sectional study among working adults conducted in Addis Ababa, revealed that the overall prevalence of MetS was 12.5% and 17.9% according to ATP III and IDF definitions respectively. Using ATP III criteria, the prevalence of MetS was 10.0% in men and 16.2% in women. Application of the IDF criteria resulted in a MS prevalence of 14.0% in men and 24.0% in women [40]. But still no population based study has systematically evaluated the prevalence of MetS among Ethiopians. In our study area,

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Jimma town, no study has been conducted on prevalence and risk factors of metabolic syndrome. Therefore the present study will determine the prevalence of metabolic syndrome and its components in Jimma town, South West Ethiopia.

The ultimate importance of studying metabolic syndrome is that it helps to identify individuals at high risk of both type 2 diabetes and cardiovascular disease (CVD). The main reason behind this is that the combination of MetS risk factors interacts synergistically to start or accelerate the progression of atherosclerosis. So that, the findings of this study will provide relevant information that shows the extent and risk factors of MS and Provide strategies for screening, early identification, and clinical management of high risk groups before they develop CVD, type 2 diabetes mellitus and renal nephropathy. It may in general help the health management at a higher level and in particular those health institutions in the region to understand the extent and risk factors associated with MetS and will be helpful for local health planners, local health department and those organization working on health related areas to consider the problem during their planning and designing intervention strategies particularly and during monitoring and evaluation of health service activities in general.

MATERIALS AND METHODS

Study Area, Period Study Design: This study was conducted from January to March, 2013 in Jimma town, south west Ethiopia. Jimma is located 357 Kilo meters South West of Addis Ababa. A community based cross-sectional study design was employed to determine prevalence and to assess risk factors for Met S in Jimma town. Individuals aged 20 or more living in Jimma town at least for the last six months were included in the study. Individuals aged less than 20 years, having as cites due to any cause, pregnant women, known CVD and DM patients and HIV positive patients on ART were exempted from the study.

Sample Size Determination: In this study, sample size was determined using single population proportion formula by assuming a confidence level of 95%, a design effect of 2, and 5% allowance for non- response rate. The total sample size became 1,316 individuals. Multi-stage sampling technique was employed for this study.

Data Collection: The data collection was conducted in accordance with the STEP wise approach of the World Health Organization (WHO) for NCD surveillance in developing countries [41]. The approach had three levels: (1) interviewer administered questionnaires was used to gather socio-demographic characteristics and information about life style factors (2) Anthropometric measurements (weight, height, BMI, waist circumference) and blood pressure were determined by using standardised devices/instruments (3) biochemical analyses were done to determine participants' Serum triglycerides (TGs), serum total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C) and fasting blood glucose (FBG). Digital sphygmomanometer was used to measure the systolic and diastolic pressure. Auto analyzer (Human Star Model 80) was used for all biochemical analysis to maintain the accuracy. Serum sample were used for the estimation of lipid profile (total cholesterol, HDL-C, LDL-C, and Triglycerides) by using quality reagent Kits (Human). Glucose oxidase based reagent kit (Human) method was employed to determine Fasting Plasma Glucose (FPG/FBG). A separated data collecting format was used to record data from anthropometric measurements digital sphygmomanometer and biochemical analysis.

Anthropometric measurements: Weight was measured in kilograms (kg) using the WHO weighing scale (digital weighing machine) at a precision of 0.1kg with the study subjects minimally dressed. Height was measured in centimetre (cm) in erect position at a precision of 0.1cm with shoes removed using a height scale. Waist circumference (WC) was measured in cm at the midpoint of the line between the lowest border of the thoracic cage and anterior superior iliac spine using a measuring tape. BMI was calculated as weight in Kg / height in Meter square.

Blood Pressure Measurements: Blood pressure was measured using automatic digital sphygmomanometer. The measurement protocol used was as follows. After a supine rest of 5 minutes, one measurement in the standing position, and two in the sitting position at 5-minute intervals on the left and right hand were done. The mean of all three measurements was used as the systolic and diastolic blood pressures.

Biochemical Analysis: For laboratory analysis, 6 ml of venous blood samples from the ante-cubital vein was taken after. The study participants were advised to take an overnight fasting of 10-12 hours before collecting the blood samples for the determination of FBG and lipid profiles. Fasting blood (plasma) glucose, serum total cholesterol, HDL-C and triglycerides were determined by Auto analyzer (Human Star Model 80) method by using specific reagents (Human). LDL-C was calculated using the **Freidwald formula**[42].

VLDL = Triglycerides ÷5; LDL = Total cholesterol – (HDL + VLDL)

Determination of Met S: IDF and NCEP ATP III criteria were used to determine the presence of Metabolic Syndrome in an individual. In accordance with the IDF criteria, subjects were classified as having Met S if participants had abdominal obesity (defined as waist circumference of ≥94 cm for men and ≥80 cm women) plus two of any of the following risk factors:(1) Raised TG level (≥150 mg/dL) (2) Reduced HDL-C (<40 mg/dL in males and <50mg/dL in females) (3) Raised blood pressure (systolic BP ≥130 or diastolic BP ≥85 mmHg) (4) Raised FG (≥100 mg/dL). In accordance with the ATP III criteria, subjects were classified as having Met S if participants had three or more of the following risk factors:(1) Abdominal obesity (waist circumference >102 cm in males and >88 cm in females) (2) Hyper-triglyceridemia (TG ≥150 mg/dL) (3) Reduced HDL-C (<40 mg/dL in males and <50 mg/dL in females) (4) High BP (≥130/85 mmHg)and (5) FBG (≥110 mg/dL).

Data Quality Assurance: Effective training was provided for data collectors and supervisors on the data collection process and the collected data were checked for completeness and consistency on the same day of collection. The generated data using questionnaire and biochemical

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analysis were cheeked, edited, coded, and entered into a personal computer using facilities Statistical Package for Social Sciences (SPSS) version 19.0. The association between dependent and independent variables were analyzed and presented using chi square test at the adopted confidence level of 95%, P value of 0.05 (i.e. 5%) or less were considered to be significant. The strength of statistical association was measured by adjusted odds ratios at 95% confidence intervals. Binary Logistic regression was used to determine association between dependent and the independent variables.

Ethical clearance: The ethical clearance for the study was obtained from Jimma University, College of public health and Medical Science, Ethical Review Committee through Department of Biomedical Science.

RESULTS

A community based cross-sectional study was employed to determine prevalence of Metabolic Syndrome (Met S) in Jimma town according to IDF and NCEP ATP- III definitions. Out of 1316 individuals 620 (47.1%) were males and 696(52.9%) were females.

1. Demographic characteristics of the study population: The demographic characteristics of the study population are given in Table .1.

Table: 1. Demographic characteristics of the study population.

Characteristics		Total N (%) N=1316	Men N (%) N=620	Women N (%) N=696	P value
Age groups (Years)	20-24	182(13.8)	71(11.5)	111(15.9)	0.000
	25-34	354(26.9)	153(24.7)	201(28.9)	
	35-44	282(21.4)	142(22.9)	140(20.1)	
	45-54	233(17.1)	106(17.1)	127(18.2)	
	>54	265(20.1)	148(23.9)	117(16.8)	
	Total	1316(100)	620(47.1)	696(52.9)	
Ethnicity	Amhara	341(25.9)	155(25)	186(26.7)	0.000
	Tegrie	132(10)	32(5.2)	100(14.4)	
	Oromio	489(37.2)	228(36.8)	261(37.5)	
	Gurage	58(4.4)	45(7.3)	13(1.9)	
	Others*	296(22.5)	160(25.7)	136(19.5)	
	Total	1316(100)	620(47.1)	696(52.9)	
Religion	Muslim	368(28)	216(34.8)	152(21.8)	0.005
	Orthodox	799(60.7)	328(52.9)	471(67.7)	
	Protestant	139(10.6)	66(10.6)	73(10.5)	
	Catholic	10(0.8)	10(1.6)	0(0)	
	Total	1316(100)	620(47.1)	696(52.9)	
Marital status	Single	252(19.1)	130(21)	22(17.5)	0.001
	Married	727(55.2)	338(54.5)	389(55.9)	
	Widowed	235(17.9)	104(16.8)	131(18.8)	
	Divorced	102(7.8)	48(7.7)	54(7.8)	
	Total	1316(100)	620(47.10)	696(52.9)	

**Yem, Hadya ,Kembata ***P<0.05 is significant

1.1. Age: The individuals were categorized according to their age. Out of 1316 individuals 182 (13.8%) are in the age group 20-24,354(26.9%) are in the age group 25-34, 282(21.4%) are in the age of 35-44, 233(17.1%) are in the age of 45-54, and 265(20.1%) are in the age of 55 years or above (P=0.000**). Within the study population 25-34 years age group is the dominant one followed by 35-44 years age group.

1.2. Ethnicity: Out of 1316 individuals Amhara constitute 341(25.9%),Tegrie constitute 132(10%),Oromio constitute 489(37.2%), Gurage constitute 58(4.4%) and all others (Yem, Hadya ,Kembata) together constitute 296(22.5%)(P=0.000**). Jimma comprises all the major ethnicities of Ethiopia with Oromia being the major and dominant one.

1.3. Religion: In the study population 368(28%) were Muslims, 799(60.7%) were Orthodox Christians, 139(10.6%) were protestants 10 (0.8 %) were Catholics with orthodox being the prominent religion (P=0.005**). Out of 1316 individuals 252(19.1%) were single, 727(55.2%) were married, 235 (17.9%) were widowed and 102(7.8%) were divorcees (P=0.001**).

2. Social characteristics of the population: The occupational, educational and income status of the population are given in Table: 2.

2.1. Occupation: Considering occupational status of the study population, 376(28.6%) were government employed 293(22.3%) were private employed, 86(6.5%) were merchants, 21(1.6%) were farmers, 79(6%) were students, 293(22.3%) were housewives and 168(12.8%) belong to

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other modes of occupation. Government servants seemed to be the major category followed by private employees and housewives and farmers were very few in number (P=0.000**).

Table: 2. Social characteristics of the study population.

Characteristics		Total N (%) N=1316	Men N (%) N=620	Women N (%) N=696	P value
Occupation	Govt. Employed	376(28.6)	200(32.3)	176(25.3)	0.000
	Private employed	293(22.3)	186(30)	107(13.4)	
	Merchant	86(6.5)	40(6.5)	46(6.6)	
	Farmer	21(1.6)	12(1.9)	9(1.3)	
	Student	79(6)	22(3.5)	57(8.2)	
	Housewife	293(22.3)	0(0)	293(41.3)	
	Others	168(12.8)	144(23.2)	24(3.4)	
	Total	1316(100)	620(47.1)	696(52.9)	
Education	Illiterate	244(18.5)	90(14.5)	154(22.1)	0.000
	Primary	469(35.6)	204(32.9)	265(38.1)	
	Secondary	397(30.2)	226(36.5)	171(24.6)	
	Higher secondary(10+2)	148(11.2)	69(11.1)	79(11.4)	
	10+4 and above	58(4.4)	31(5)	27(3.9)	
	Total	1316(100)	620(47.1)	696(52.9)	
Monthly income	<1000	945(71.8)	395(63.7)	550(79)	0.001
	1001-3000	303(23)	178(28.7)	125(18)	
	>3000	68(5.2)	47(7.6)	21(3)	
	Total	1316(100)	620(47.1)	696(52.9)	

***P<0.05 is significant

2.2. Education: The educational status reflects the developmental potential of a population. All over Ethiopia this is a time of educational revolution and innovations. Within the study population, 244(18.5%) were illiterate, 469(35.6%) have completed primary education, 397(30.2%) had secondary education, 148(11.2%) have completed 10+2 (preparatory) and 58(4.4%) have completed their graduation/higher education (P=0.000**).

2.3. Monthly Income: Regarding monthly income of the household/family, 945(71.8%) have a monthly income of <1000 Ethiopian Birr, 303(23%) have 1000-3000 Ethiopian Birr and 68(5.2%) have >3000 Ethiopia Birr. Majority belong to the <1000 category, reflects the poor economic status of the study population (P=0.001**).

2.3.1. Average age and monthly income of the study population

The average monthly income and average age of the population are given in Table.2.1

Table: 2.1. Average age and monthly income of the study population

Parameters	Total N=1316 Mean(SD)	Male N=620 Mean(SD)	Female N=696 Mean(SD)	P value
Age (years)	40.52±15.06	42.46±16.16	38.79±13.8	0.267
Monthly income (in Ethiopian Birr)	1065±750	1261±850	890.4±600	0.000

***P<0.05 is significant

The average age of the study population was 40.52±15.06.In the case of men the average age was 42.46±16.16 and for women it was 38.79±13.8.The average household/family income was found to be 1065±750. It is very important to take in to account the mean age and mean family income of the study population because possibly it may have some correlation with the development of the Metabolic syndrome.

3. Life style characteristic of the study population: The life style characteristics of the study population are given in Table .3. Within the study population 92 (7%) were cigarette smokers and 1224(93%) were non smokers, 686(52.1%) were alcohol

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consumers and 630(47.9%) were non consumers, 288(21.9%) were Khat chewers and 1028(78.1%) were non- chewers. Alcohol consumption is the prominent life style characteristic followed by Khat chewing and cigarette smoking.

Cigarette smoking was found to be very common among males (14.8%) than females (P=0.000**). But, alcohol consumption is observed to be almost similar (Males, 52.1% and females, 52.2%) in both groups (P=0.514). The Khat chewing tendency seemed to be more common among the males (31.3%) compared to females (13.5%) of the study population (P=0.000**).

Table:3. Life style characteristics of the study population.

Characteristics		Total N (%) N=1316	Men N (%) N=620	Women N (%) N=696	P value
Smoking	Currently smoker	92(7)	92(14.8)	0(0)	0.000
	Currently Non- smoker	1224(93)	528(85.2)	696(100)	
	Total	1316(100)	620(47.1)	696(52.9)	
Alcohol consumption	Currently Consumer	686(52.1)	323(52.1)	363(52.2)	0.514
	Currently Non consumer	630(47.9)	297(47.9)	333(47.8)	
	Total	1316(100)	620(47.1)	696(52.9)	
Khat chewing	Currently Chewer	288(21.9)	194(31.3)	94(13.5)	0.000
	Currently Non chewer	1028(78.1)	426(68.7)	602(86.5)	
	Total	1316(100)	620(47.1)	696(52.9)	

***P<0.05 is significant

4. Anthropometric characteristics of the study population: Based on the BMI and blood pressure measurements (Anthropometric Measurements) individuals of the study population are categorized and the results are given in Table .4.

4.1: BMI Categories: Based on the body mass index individuals of the study population are categorized in to Underweight (BMI, <18.5), Normal (BMI, 18.5-24.9), Overweight (BMI, 25-29.9) and Obese (BMI, ≥30). 98 individuals (7.4%) are underweight, 1014(77.1%) are normal, 137(10.4%) are overweight and 67(5.1%) are Obese. This reflects that Obesity is not that much prevalent in the general population of Jimma. The three abnormal BMI categories such as Underweight (male-5.8% and female-8.9%), overweight (male-7.9% and female-12.6%)) and Obese (male-4% and female-6%) are more prevalent among females than in males (P=0.000***).

Table: 4. Anthropometric characteristics of the study population.

Characteristics		Total N (%) N=1316	Men N (%) N=620	Women N (%) N=696	P value
BMI groups	Underweight (BMI <18.5)	98(7.4)	36(5.8)	62(8.9)	0.000
	Normal (BMI 18.5-24.9)	1014(77.1)	510(82.3)	504(72.4)	
	Over weight (BMI 25-29.9)	137(10.4)	49(7.9)	88(12.6)	
	Obese (BMI ≥ 30)	67(5.1)	25(4)	42(6)	
	Total	1316(100)	620(47.1)	696(52.9)	
Blood pressure categories	Normotensive*	695(52.8)	269(43.4)	426(61.2)	0.000
	Pre-hypertensive*	444(33.7)	297(47.9)	147(21.1)	
	Stage I hypertension*	135(10.3)	46(7.4)	89 (12.8)	
	Stage II hypertension*	42(3.2)	8(1.3)	34(4.9)	
	Total	1316(100)	620(47.1)	696(52.9)	

***P<0.05 is significant

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**Normo-tensive: Systolic BP <120 mm Hg and diastolic BP <80 mm of Hg*

** pre-hypertensive: Systolic BP 120 -139 mm Hg and diastolic BP 80-89 mm of Hg*

** Stage I Hypertension: Systolic BP 140-159 mm Hg and diastolic BP 90-99 mm of Hg*

** Stage II hypertension: Systolic BP ≥ 160 mm Hg and diastolic BP ≥100 mm of Hg*

4.2.Blood pressure categories*:* Based on the blood pressure measurements (both systolic and diastolic) individuals of the study population were categorized in to various blood pressure categories(table.8) such as 1.Normotensive (Systolic BP <120 mm Hg and diastolic BP <80 mm of Hg) 2. Pre-hypertensive (Systolic BP 120 -139 mm Hg and diastolic BP 80-89 mm of Hg). 3. Hypertension stage I (Systolic BP 140-159 mm Hg and diastolic BP 90-99 mm of Hg) and 4.Hypertension stage II (Systolic BP ≥ 160 mm Hg and diastolic BP ≥100 mm of Hg). In the study population 695(52.8%) were normo-tensive, 444(33.7%) were pre-hypertensive, 135 (10.3%) were HT stage –I and 42(3.2%) were in HT stage –II categories. HT stage I (male-7.4% and female-12.8%) and HT stage II (male-1.3% and females-4.9%) were observed to be more prevalent among females than among males of the study population (P=0.000***).

4.2. 1. Age -related variations in Blood pressure in the study population: The age related variations in the blood pressure measurements of the study population are given in Table: 5.1. The percentages of normo-tensive, pre-hypertensive, HT stage I and HT stage II individuals in different age group have shown a definite pattern of variation.

Table 4.2.1.Age /BP relationship of the study population.

Age group	Normotesnsive	Pre-hypertensive	HT stage I	HT stage II	Total
20-24	167(88.4)	18(9.5)	4(2.1)	0(0)	0.000
25-34	266(80.9)	63(19.1)	0(0)	0(0)	
35-44	122(45.2)	90(33.3)	32(10.8)	14(4.7)	
45-54	104(35.3)	145(49.2)	43(15.9)	15(5.6)	
>54	36(15.5)	128(54.9)	56(24)	13(5.6)	
Total	695(52.8)	444(33.7)	135(10.3)	42(3.2)	

***P<0.05 is significant

The percent of normotensive individuals decreases as we go up along the age group. Whereas, percentages of prehypertensive, HT stage I and HT stage II individuals increases as we go up along the age groups. This clearly revealed that there is a gradual, but significant increase in BP as the age increases because of the loss of elasticity of the blood vessel wall resulting in an increase in peripheral resistance known as atherosclerosis (P=0.000***). This could be one of the reasons behind an increase in the prevalence of Met S in the aged categories as compared to young.

5. Means of Anthropometric and Biochemical characteristics of the study population

5.1. Means of Anthropometric Measurements: The mean of various anthropometric measurements are incorporated in Table.5. All these parameters are the determinants of the Metabolic syndrome (Met S) according to IDF as well as ATP-III criteria. Therefore the individual mean values of these parameters are having significances in determining the Met S in an individual as well as in determining overall prevalence in the general population

5.1.1. Mean Body Mass Index (BMI): The mean BMI of the study population was estimated to be 22.48±3.6. There is no significant difference in the mean BMI (P=0.254) between men (22.33±2.99) and women (22.62±4.05). This value is within the normal range of BMI (18.5-24.9) indicating that the population as a whole belongs to the normal weight group as per BMI categorization.

5.1.2. Mean Waist Circumference (WC): Waist circumference is a measure of abdominal obesity and is one of the determinants of metabolic syndrome as per IDF as well as ATP-III criteria. The mean waist circumference of the study population was found to be 83.38±10.29 cm. For men it was 85.24±9.45 cm, which is far below the cut of limits of IDF (≥94cms) and ATP-III (>102cms) to be considered as a causative factor (determinant) of Met S. This means that the population as a whole is having only less potential to develop metabolic syndrome. For women the mean waist circumference was 81.74±10.71cm, which is a bit above the cut of limits of IDF (≥80 cms) and far below the cut of limit of ATP –III (>88cms) stating that the females of the study population are having more potential to develop Met-S(particularly Met S – IDF as per definition) as compared to the male population. There observed a significant difference in the mean WC exist between men and women (P=0.010**) of the study population. This could be one of the reasons for the higher prevalence of both Met S ATP and Met S IDF in women compared to men in all age categories.

5.1.3. Mean Blood Pressure (BP) (Systolic BP(s BP) and Diastolic BP(d BP): Elevated Blood Pressure (BP systolic as well as diastolic) is a determinant of metabolic syndrome. A systolic BP ≥130 mm of Hg and a diastolic BP ≥85 mm of Hg (for men and women) are determinants of metabolic syndrome according to IDF as well as ATP- III definitions. The mean systolic BP and diastolic BP of the study population were 123.69±14.21mm of Hg and 84.45±9.2 mm of Hg respectively. These values are below the prescribed cut of limits (systolic BP,≥130 m of Hg and diastolic BP

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,85 mm of Hg) by IDF and ATP –III reflecting a very less potential of the population to be affected by Met S. There is no significant difference in BP systolic (P=0.982) or BP diastolic (P=0.314) between men and women of the study population.

5.2. Means of Biochemical parameters: In addition to anthropometric measurements such as increase waist circumference (abdominal obesity) elevated BP there are certain biochemical parameters which can contribute to the development of Met S (determinants of Met S) and are given in table.5. These parameters include elevated serum Triglyceride (≥150 mg /dL), decreased HDL cholesterol (≤40 mg /dL for men and ≤ 50 mg /dl for women) and elevated Fasting blood Glucose level (≥100 mg /dL according to IDF and ≥110 mg/dL according to ATP-III).The concentrations of these biochemical parameters are controlled by dietary, lifestyle as well as hereditary factors.

Table:5. Means of Anthropometric and biochemical characteristic of the study population.

Parameters	Total N=1316 Mean(SD)	Male N=620 Mean(SD)	Female N=696 Mean(SD)	P value
BMI(kg/m^2)	22.48±3.6	22.33±2.99	22.62±4.05	0.254
Waist circumference(cms)	83.38±10.29	85.24±9.45	81.74±10.71	0.010
Waist /hip ratio	0.865±0.068	0.873±0.63	0.857±0.072	0.615
Systolic BP(mm of Hg)	123.69±14.21	123.61±11.13	123.76±16.48	0.982
Diastolic BP(mm of Hg)	84.45±9.2	85.51±8.79	83.50±9.54	0.314
Serum Triglyceride(mg/dL)	114.44±27.51	119.51±26.34	109.93±27.77	0.001
SerumTotal cholesterol (mg/dL)	179.9±23.29	181.68±21.86	178.33±24.41	0.123
Serum HDL-cholesterol (mg/dL)	47.63±7.14	46.72±7.14	48.43±7.06	0.234
Serum LDL-cholesterol (mg/dL)	109.93±21.9	111.12±20.83	108.86±22.76	0.138
Fasting Blood Glucose (mg/dL)	90.27±14.51	91.46±14.5	89.21±14.4	0.329

***P<0.05 is significant

5.2.1.Mean Serum Triglyceride(TG): The mean serum Triglyceride level of the study population is 114.44±27.51mg/dL (119.51±26.34 for men and 109.93±27.77 for women) is below the cut of value by IDF and ATP –III (≥150 mg dl) and therefore the population as a whole is having only less potential to develop metabolic syndrome. There found a significant difference in the mean TG level between men and women of the study population (P=0.001**).

5.2.2. Mean Serum Total cholesterol (TC): The Serum Total cholesterol (TC) concentration is not a direct determinant of Met S, but as it is having direct relation with serum HDL cholesterol level, it also can be considered as an indirect determinant. The mean total cholesterol level of the study population was 179.9±23.29 mg /dL (181.68±21.86 for men and 178.33±24.41 for women). The mean TC value is within the clinically accepted normal range of serum total cholesterol (150- 200 mg /dL) and therefore it is not a very serious risk factor for the development of Met S as far as the entire population is concerned. There was no significant difference in the mean TC level between men and women of the study population (P=0.123).

5.2.3. Mean Serum High Density Lipoprotein Cholesterol (HDL-C): Decreased serum HDL- C level is a direct determinant of Met S. According to both NCEP ATP-III and International diabetes Federation (IDF) criteria a serum HDL -C level < 40 mg/d L in Men and > 50 mg/dL in Women are considered as determinant of Met S. In the study population the mean HDL –C concentration is found to be 47.63±7.14 mg / dL with 46.72±7.14 mg /d L in Men and 48.43±7.06 mg/dL in women. These results show that the women are having a better potential to develop Met S compared to Men in the study population. There was no significant difference in the mean HDL-C values between men and women of the study population (P=0.243).

5.2.4.Mean Serum Low Density Lipoprotein Cholesterol(LDL-C): In a healthy individual (men and women) the LDL cholesterol level (LDL-C) concentration should be less than 130 mg /d L according to the world wide criteria, but is not a direct determinant of Met S as HDL-C. In the study population the mean LDL-C level is 109.93±21.9mg /d L (111.12±20.83 for men and 108.86±22.76 for women) indicating that the study population as a whole is having normal LDL- C level. There was no significant difference in the mean LDL-C level between men and women of the study population (P=0.138).

5.2.5. Mean Fasting Blood Glucose (FBG): Increased Fasting blood glucose (FBG) concentration is a direct determinant of the so called Met S according to IDF as well as ATP –III criteria. According to IDF definition a FBG ≥ 100 mg /dL is a metabolic syndrome determinant and according to ATP-III FBG ≥110 is a metabolic syndrome determinant. The mean FBG of the study population was found to be 90.27±14.51mg/d L (91.46±14.5 for men and 89.21±14.4 for women) and there for it is not an independent determinant of Met S by either IDF or ATP- III definition as far as the entire population is concerned. There was no significant difference in the mean FBG between men and women of the study population (P=0.329).

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5.3. Age related variations in biochemical characteristics

The variations in the biochemical parameters (some of these are direct determinants of metabolic syndrome while others are indirect) between different age groups are incorporated in Table. 5.1.

5.3.1. Variations in Serum Triglyceride (TG): There observed a gradual increase in serum triglyceride as the age advances. For 20-24 years age group the mean TG level was 98.84 ±20.83 mg /dL but for >54 years age group it was significantly increased to 143.25±27.4 mg/dL with the mean value of the study population being 114.44±27.51mg/dL(P=0.002**). TG level ≥150 mg/dL is a Met S determinant by both NCEP ATP-III and IDF criteria.

5.3.2. Variations in Serum Total Cholesterol (TC): There observed a gradual increase in serum TC level according to age. For 20-24 age category the mean TC level was 164.61±12.01mg/dL,25-34 age category 172.66±22.76 mg/dL, 35-44 age category 179.01±18.92 mg/dL, 45-54 age category 187.44±25.12 mg/dL and for >54 age category 192.82±21.55 mg/dL with overall mean value of TC for the entire study population being179.9±23.29 mg/dL(P=0.012**). An important thing to point out is that the means of TC concentrations for all the age categories as well as the overall mean are in the normal range of serum total cholesterol (150-200mg/dL) indicating that the study population as a whole is normo cholesteremic. But, even though mild a gradual increase the TC level towards old age can contribute to the development of atherosclerosis, resulting in hypertension (determinant of Met S both NCEP ATP-III and IDF criteria) and the development of Met S.

5.3.3. Variations in Serum HDL- C: HDL-C concentration was observed to be gradually decreased according to age. For 20-24 age group, the mean serum HDL–C was 52.15±6.41mg/dL,25-34 age category 50.23±6.99 mg/dL, 35-44 age category 45.12±6.79 mg/dL, 45-54 age category 43.17±5.06 mg/dL and for the > 54 category 40.11±6.83 mg / dL and the mean value for the entire study population was estimated to be 47.63±7.14 mg/dL(P=0.002**).

Table: 5.1. Comparison of biochemical parameters in different age groups

Biochemical parameters	Age groups(in Years)					For entire study population	P value
	20-24 Years	24-34 Years	34-44Years	44-54Years	>54 Years		
Serum Triglyceride (mg/dL) Mean (±SD)	98.84±20.83	112.79±31.04	120.43±26.56	137.86±21.04	143.25±27.4	114.44±27.51	0.002
SerumTotal cholesterol (mg/dL) Mean (±SD)	164.61±12.01	172.66±22.76	179.01±18.92	187.44±25.12	192.82±21.55	179.9±23.29	0.012
Serum HDL-cholesterol (mg/dL) Mean (±SD)	52.15±6.41	50.23±6.99	45.12±6.79	43.17±5.06	40.11±6.83	47.63±7.14	0.002
Serum LDL-cholesterol (mg/dL) Mean (±SD)	97.20±18.49	101.79±21.54	108.61±18.47	117.48±20.02	122.65±19.52	109.93±21.9	0.001
Fasting Blood Glucose (mg/dL) Mean (±SD)	87.15±11.65	94.07±13.99	93.31±16.37	98.68±10.5	89.89±15.39	90.27±14.51	0.018

***P<0.05 is significant

As far as the men population is concerned all these mean values are above the minimum required level (40 mg/dL), but for women population > 35 Years of age (35-44, 45-54 and >54 age categories) the mean values are below the minimum required level (>50mg/dL) according to NCEP ATP-III and IDF. The decreased HDL-C level in the women population above 35 years is one of the possible reasons for the women being prone to Met S compared to men particularly as the age advances. This is because of the fact that HDL-C level < 50 mg /dL itself is a Met S determinant in women (not in Men where it is <40 mg /dL) by both NCEP ATP-III and IDF.

5.3.4. Variations in Serum LDL- C:

LDL- C concentration gradually increased as we go up in different age groups from 20-24 category (97.20±18.49 mg/dL) to 25-34 category (101.79±21.54mg/dL) to 35-44 category(108.61±18.47mg/dL)to 45-54category(117.48±20.02mg/dL)andto>54category(122.65± 19.52mg/dL).The mean LDL-C of the study population was found to be 109.93±21.9 mg/dL(P=0.001**). LDL- C is not considered as a direct determinant of Met S according to both NCEP ATP-III and IDF criteria, but as it is having some influence on TC and HDL-C concentration, this can be considered as an indirect determinant of Met S. Therefore, it is prescribed that the LDL-C level should not exceed 130 mg/dL in both men and women. If it is exceeded, it will have an effect on the development of Met S by facilitating atherosclerosis and thereby increasing blood pressure, which is a Met S determinant by both NCEP ATP-III and IDF criteria.

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5.3.5.Variations in Fasting Blood Glucose (FBG): A slight increase in the mean Fasting Blood Glucose (FBG) was observed as on increase in age (87.15±11.65 for 20-24 age group, 98.68±10.5 for 45-54 age group) and then decreases towards the old age (89.89±15.39 for > 54 category) with 90.27±14.51 being the mean value for the entire study population. The highest mean FBG was noticed in the 45-54 age group (P=0.018**).

6. Prevalence of Metabolic syndrome in the study population

6.1. Prevalence of Met S IDF according to age and sex: In accordance with the International Diabetes Federation (IDF) criteria, subjects were classified as having MS if participants have abdominal obesity (defined as waist circumference of ≥94 cm for men and ≥80 cm women) plus two of any of the following risk factors and the results are summarized in Table:6.1.(1) Raised TG level (≥150 mg/dL) (2) Reduced HDL-C (<40 mg/dL in males and <50mg/dL in females) (3) Raised blood pressure (systolic BP ≥130 or diastolic BP ≥85 mmHg) (4) Raised FG (≥100 mg/dL).

Table: 6.1. Prevalence of Metabolic syndrome according to IDF definitions.

Age groups (Years)	No Met S N=1316 N (%)	Metabolic syndrome-IDF(Met S- IDF)			P value
		Male N=620 N (%)	Female N=696 N (%)	Total N=1316 N (%)	
20-24(N=189)	182(96.3)	2(2.7)	5(4.3)	7(3.7)	0.448
24-34(N=329)	312(94.8)	5(3.5)	12(6.4)	17(5.2)	0.185
34-44(N=270)	229(84.8)	11(8)	30(22.7)	41(15.2)	0.001***
45-54(N=295)	199(67.5)	28(21.5)	68(41.2)	96(32.5)	0.001***
>54(N=233)	174(74.7)	23(16.7)	36(37.9)	59(25.3)	0.001
Total(N=1316)	1096(83.3)	69(11.1)*	151(21.7)**	220(16.7)	0.001***

***P<0.05 is significant

*69/220(out of MS 31.4% are males); **151/220(out of MS 68.6% are females)

According to IDF definition in the study population the overall prevalence rate of Metabolic Syndrome (Met S-IDF) was estimated to be 16.7%. The prevalence rate was found to be significantly more (P=0.001***) among females of the study population (21.7%) compared to males (11.1%). The prevalence of Met S IDF vary in different age categories of the study population with 20-24 Years(3.7%),25-34 years (5.2%), 35-44 years (15.2%) 45-54 years (32.5%) and > 54 years (25.3%). It was observed that the prevalence rate increases as the age advances with a slight decline in the old age group (>54). The 45-54 years category was very much affected by metabolic syndrome (32.5%) and the 20-24 years category being the least affected (3.7%). Particularly women in the age of 45-54 are the highly affected group with a very high prevalence rate (41.2%). Again men in the age group of 45-54 years shown the highest prevalence of Met S IDF (21.5%)(P=0.001***)

To summarize, out of 1361 individuals of the study population 220 are affected by Met S – IDF (16.7%). Out of the 220 Met S – IDF individuals 69(31.4%) are males and 151(68.6%) are females (percentages not shown in the table) ie. females of the study population show more tendency to develop Met S – IDF compared to males (P=0.001**).

6.2. Prevalence of Met S ATP-III according to age and sex: In accordance with the National Cholesterol Education Programme Adult -Treatment Panel (NCEP-ATP III) criteria, subjects were classified as having MS if participants have three or more of the following risk factors and the results are summarized in Table: 6.2. (1) Abdominal obesity (waist circumference >102 cm in males and >88 cm in females)(2) Hyper-triglyceridemia (TG ≥150 mg/dL) (3) Reduced HDL-C (<40 mg/dL in males and <50 mg/dL in females) (4) High BP (≥130/85 mmHg)(5) FBG (≥110 mg/dL).

Table: 6.2. Prevalence of Metabolic syndrome according to ATP-III definitions.

Age groups (Years)	No Met S N=1316 N (%)	Metabolic syndrome-ATP-III(MetS-ATP-III)			P value
		Male N=620 N (%)	Female N=696 N (%)	Total N=1316 N (%)	
20-24(N=189)	183(97.3)	2(2.7)	4(3.4)	6(3.2)	0.573
24-34(N=329)	314(95.4)	3(2.1)	12(6.4)	15(4.6)	0.055
34-44(N=270)	243(90)	5(3.6)	22(16.7)	27(10)	0.000
44-54(N=295)	234(79.3)	18(13.8)	43(26.1)	61(20.7)	0.007***
>54(N=233)	204(87.6)	9(6.5)	20(21.1)	29(12.4)	0.001
Total(N=1316)	1178(89.5)	37(6)*	101(14.5)**	138(10.5)	0.001

***P<0.05 is significant

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*37/138(out of MS 26.8% are males); **101/138(out of MS 73.2% are females)

According to NCEP-ATP III definition in the study population the overall prevalence rate of Metabolic Syndrome (Met S-ATP-III) was estimated to be 10.5%. The prevalence rate was found to be more among females (P=0.001**) of the study population (14.5%) compared to males (6%). The prevalence of Met S-ATP-III vary in different age categories of the study population with 20-24 Years(3.2%),25-34 years (4.6%), 35-44 years (10%) 45-54 years (20.7%) and > 54 years (12.4%). It was observed that the prevalence rate increases as the age advances with a slight decline in the old age group (>54). The 45-54 years category was very much affected by metabolic syndrome (20.7%) and the 20-24category being the least affected (3.2%). Particularly women in the age of 45-54 are the highly affected group with a very high prevalence rate (26.1%). Men in the age group of 45-54 years showed the highest prevalence (13.8%) of Met S-ATP-III(P=0.007**).

In short, Out of 1361 individuals of the study population 138 were affected with Met S – ATP-III (10.5%). Out of the 138 Met S-ATP-III individuals 37(26.8%) are males and 101(73.2%) are females (percentages are not shown in table) ie. females of the study population were more affected with Met S-ATP-III compared to males.

7. Variations in the prevalence of Met S according to socio-demographic factors

7.1. Met S IDF Vs different socio-demographic factors: Educational, Occupational as well as income status of the individual can have influence on the development of Met S. Prevalence of Met S-IDF in different educational, occupational and income groups are incorporated in Table: 7.1.

Table: 7.1. Prevalence of MS IDF based on socio-demographic factors.

Characteristics		No Met S-IDF N =1316 N (%)	Met S-IDF N =1316 N (%)	P value
Occupation	Govt. Employee N=376(28.6%)	320(85.1)	56(14.9)	0.000
	Private employee N=293(22.3%)	269(91.8)	24(8.2)	
	Merchant N=86(6.5%)	74(86)	12(14)	
	Farmer N=21(1.6%)	16(76.2)	5(23.8)	
	Student N=79(6%)	79(100)	0(0)	
	House wife N=293(22.3%)	202(68.9)	91(31.1)	
	Others N168 (12.8%)	136(81)	32(19)	
	Total N=1316(100%)	1096(83.3)	220(16.7)	
Income group	<1000 Birr N= 945(71.8%)	806(85.3)	139(14.7)	
	1000-3000 N=303(23%)	236(77.9)	67(22.1)	0.005
	>3000 N=68(5.2%)	54(79.4)	14(20.6)	
	Total=1316(100%)	1096(83.3)	220(16.7)	
Educational status	Illiterate N=244(18.5%)	178(73)	66(27)	0.000
	Primary N=469(35.6%)	384(81.9)	85(18.1)	
	Secondary N=397(30.2%)	352(88.7)	45(11.3)	
	10+2 complete N=148(11.2%)	136(91.9)	12(8.1)	
	10+4 and Above N=58(4.4%)	46(79.3)	12(20.7)	
	Total=1316(100%)	1096(83.3)	220(16.7)	

***P<0.05 is significant

7.1.1. Occupational status and Met S IDF: 14% of the Government employees, 8.2% of the private employees, 14 % of merchants, 23.8% of farmers, 0% of the students, 31.1% of the housewives and 19% of the others had Met S IDF. House wives are the occupational category which had

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more prevalence rate of Met S IDF (31.1%) and student category had the least (0%)(P=0.000**).

7.1.2. Income status and Met S IDF: Among the different income groups <1000 Birr category had 14.7%, 1000-3000 Birr category had 22.1% and >3000 Birr category had 20.6% prevalence of Met S IDF. The highest prevalence of Met S-IDF was noticed in the 1000-3000 Ethiopian Birr category (22.15%) and the least in the <1000 Ethiopian Birr category(P=0.005***).

7.1.3. Educational status and Met S IDF: In different educational group of the population, illiterates category had 27%, primary category had 18.1%,secondary category had 11.3%,10+2 category had 8.1% and 10+ 4 and above category had 20.7% prevalence of Met S-IDF. The highest prevalence of Met S IDF was noticed among the illiterate group (27%) and the lowest among the 10+2 category (8.1%)(P=0.000**).

7.2. Met S ATP- III Vs socio-demographic factors: The data regarding the influence of various socio-demographic factors on the development of Met S ATP- III are shown in Table 7.2.

Table: 7.2. Prevalence MS ATP-III based on socio-demographic factors.

Characteristics		No Met S-ATP-III N =1316 N (%)	Met S-ATP-III N =1316 N (%)	P value
Occupation	Govt. Employee N=376(28.6%)	332(88.3)	44(11.7)	0.040
	Private employee N=293(22.3%)	279(95.2)	14(4.8)	
	Merchant N=86(6.5%)	78(90.7)	8(9.3)	
	Farmer N=21(1.6%)	20(95.2)	1(4.8)	
	Student N=79(6%)	79(100)	0(0)	
	House wife N=293(22.3%)	235(80.2)	58(19.8)	
	Others N168 (12.8%)	155(92.3)	13(7.7)	
	Total N=1316(100%)	1178(89.5)	138(10.5)	
Income group	<1000 Birr N= 945(71.8%)	868(91.9)	77(8.1)	0.000
	1000-3000 N=303(23%)	254(83.8)	49(16.2)	
	>3000 N=68(5.2%)	56(82.4)	12(17.6)	
	Total=1316(100%)	1178(89.5)	138(10.5)	
Educational status	Illiterate N=244(18.5%)	209(85.7)	35(14.3)	0.039
	Primary N=469(35.6%)	417(89.9)	52(11.1)	
	Secondary N=397(30.2%)	366(92.2)	31(7.8)	
	10+2 complete N=148(11.2%)	137(92.6)	11(7.4)	
	10+4 and Above N=58(4.4%)	49(84.5)	9(15.9)	
	Total=1316(100%)	1178(89.5)	138(10.5)	

***P<0.05 is significant

7.2.1. Occupational status and Met S ATP-III: According to ATP- III criteria the overall prevalence of Met S in the study population was 10.5 %. 11.7% of the Government employees, 4.8% of the private employees, 9.3 % of merchants, 4.8% of farmers, 0% of the students, 19.8% of the housewives and 7.7% of the others had Met S ATP-III. House wives are the occupational category which showed the highest prevalence (P= 0.040**) of Met S IDF (19.8%) and student category showed the least (0%).

7.2.2. Income status and Met S ATP-III: Among the different income groups <1000 Birr category had 8.1%,

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1000-3000 Birr category had 16.2% and >3000 Birr category had 17.6% prevalence of Met S ATP-III. The highest prevalence of Met S-ATP-III was noticed in the >3000 Ethiopian Birr category (17.6%) and the least in the <1000 Ethiopian Birr category (8.1%). There observed a significantly high prevalence of Met S – ATP-III in high income groups compared to low income category (P= 0.000**).

7.2.3. Educational status and Met S ATP-III: Among different educational categories of the study population, illiterates had 14.3%, primary had 11.1%, and secondary had 7.8%, 10+2 had 7.4% and 10+ 4 and above category had 15.9% prevalence of Met S-ATP-III. There exist no profound correlation between education and prevalence rate of Met S- ATP-III (P=0.039).

8. Predictors of Met S in the study population

8. 1.Predictors of Met S -IDF in the study population

The results of Binary Logistic regression analysis (Table:18.1) revealed that Female sex((AOR=0.145; 95%CI=0.78-0.272), 45-54 age category (AOR=0.555; 95% CI=1.981- 3.061), House wife category (AOR=4.10; 95%CI=0.068-0.532),overweight (AOR=0.136; 95%CI=0.063-1.293),obesity(AOR=0.346;95%CI=0.129-0.929),pre-hypertensive state (AOR=0.161;95%CI=0.043-0.549),hypertension-stage-I(AOR=2.620;95%CI=2.792-8.667) and hypertension-stage-II(AOR=12.293;95%CI=3.456-43.72) are associated with the development of Metabolic syndrome IDF.

Table:18.1. Predictors of Metabolic syndrome (IDF) in Jimma Town,south west Ethiopia.

Characteristics		No MS ATP N (%)	MS ATP N (%)	AOR	C I 95 %
Sex	Male	551(88.9)	69(11.1)	1.00	
	Female	545(78.3)	151(21.7)	0.145	0.78-0.272*
Age(in Years)	20-24	182(96.3)	7(3.7)	1.00	
	25-34	312(94.8)	17(5.2)	0.387	0.119-1.258
	35-44	229(84.8)	41(15.2)	0.809	0.351-1.867
	45-54	199(67.5)	96(32.5)	0.555	0.303-0.890*
	>54	174(74.7)	59(25.3)	1.733	1.981-3.061*
Education	Illiterate	178(73)	66(27)	1.00	
	Primary	384(81.9)	85(18.1)	0.782	0.177-3.455
	Secondary	352(88.7)	45(11.3)	0.843	0.204-3.474
	10+2 complete	136(91.9)	12(8.1)	0.887	0.218-3.611
	10+4and above	46(79.3)	12(20.7)	0.795	0.174-3.629
Monthly income	<1000	806(85.3)	139(14.7)	1.00	
	1000-3000	236(77.9)	67(22.1)	0.607	0.247-1.495
	>3000	54(79.4)	14(20.6)	1.533	0.618-3.804
Occupation	Govt. Employee	320(85.1)	56(14.9)	1.00	
	Private employee	269(91.8)	24(8.2)	0.495	0.224-1.097
	Merchant	74(86)	12(14)	0.374	0.165-1.847*
	Farmer	16(76.2)	5(23.8)	0.196	0.865-1.345
	Student	79(100)	0(0)	0.395	0.456-1.209
	House wife	202(68.9)	91(31.1)	4.100	0.068-0.532*
	Others	136(81)	32(19)	0.440	0.191-1.014
Body mass Index(BMI) group	Underweight	98(100)	0(0)	1.00	
	Normal	892(88)	122(12)	0.100	0.891-1.239
	Overweight	86(62.8)	51(37.2)	0.136	0.063-1.293*
	Obese	20(29.9)	47(70.1)	0.346	0.129-0.929*
BP Groups	Normo-tensive	681(98)	14(2)	1.00	
	Pre-hypertensive	326(73.4)	118(26.6)	0.161	0.043-0.549*
	Hypertension Stage-I	55940.7)	80(59.3)	2.620	2.792-8.667*
	Hypertension-Stage-II	34(81)	42(3.2)	12.293	3.456-43.72*

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8.2. Predictors of Met S ATP-III in the study population: In general the results of Logistic regression analysis(Table:18.2) revealed that Female sex((AOR=0.135; 95%CI=0.070-0.262), 45-54 age category (AOR=0.452; 95%CI=0.238- 0.858), House wife category (AOR=0.453;95%CI=0.066-0.496),overweight(AOR=0.158;95%CI=0.0730.344),obesity(AOR=0.464;95%CI=0.169-0.853),pre-hypertensive state(AOR=0.208;95%CI=0.053-0.813),hypertension-stage-I(AOR=3.382;95%CI=1.875-11.1) and hypertension-stage - II(AOR=14.45;95%CI=3.98-52.45) are associated with the development of Metabolic syndrome ATP-III.

Table:18.2. Predictors of Metabolic syndrome ATP –III in Jimma Town south west Ethiopia.

Characteristics		No MS ATP N (%)	MS ATP N (%)	AOR	C I 95 %
Sex	Male	583(94)	37(6)	1.00	
	Female	595(85.5)	101(14.5)	0.135	0.070-0.262*
Age(in Years)	20-24	183(97.3)	6(3.2)	1.00	
	25-34	314(95.4)	15(4.6)	0.294	0.083-1.048
	35-44	243(90)	27(10)	0.683	0.283-1.64
	45-54	234(79.3)	61(20.7)	0.452	0.238-0.858*
	>54	204(87.6)	29(12.4)	1.420	0.785-2.56
Education	Illiterate	209(85.7)	35(14.3)	1.00	
	Primary	417(89.9)	52(11.1)	1.054	0.228-4.87
	Secondary	366(92.2)	31(7.8)	1.005	0.230-4.38
	10+2 complete	137(92.6)	11(7.4)	1.220	0.285-5.23
	10+4and above	49(84.5)	9(15.9)	1.201	0.252-5.73
Monthly income	<1000	868(91.9)	77(8.1)	1.00	
	1000-3000	254(83.8)	49(16.2)	0.521	0.213-1.274
	>3000	56(82.4)	12(17.6)	1.425	0.588-3.450
Occupation	Govt. Employee	332(88.3)	44(11.7)	1.00	
	Private employee	279(95.2)	14(4.8)	0.423	0.184-1.972
	Merchant	78(90.7)	8(9.3)	0.393	0.174-1.08
	Farmer	20(95.2)	1(4.8)	0.181	0.234-1.889
	Student	79(100)	0(0)	0.021	0.567-2.123
	House wife	235(80.2)	58(19.8)	0.453	0.066-0.496*
	Others	155(92.3)	13(7.7)	0.013	0.194-1.062
Body mass Index(BMI) group	Underweight	98(100)	0(0)	1.00	
	Normal	953(94)	61(6)	0.00	0.235-1.076
	Overweight	103(75.2)	34(24.8)	0.158	0.073-0.344*
	Obese	24(35.8)	43(64.2)	0.464	0.169-0.853*
BP Groups	Normo-tensive	694(99.9)	1(0.1)	1.00	
	Pre-hypertensive	362(81.5)	82(18.5)	0.208	0.053-0.812*
	Hypertension Stage-I	82(60.7)	53(39.3)	3.382	1.875-11.7*
	Hypertension-Stage-II	40(95.20)	2(4.8)	14.45	3.98-52.45*

.DISCUSSION

A community based cross-sectional study was employed to determine prevalence and assessing the risk factors for Metabolic Syndrome (Met S) in Jimma town. The study population includes 1316 individuals above 20 years of age from the 7 Kebeles (divisions) of Jimma Town South West Ethiopia.

1. Socio-demographic characteristics of the study population.

Jimma is a medium class city in Ethiopia. Out of 1316 individuals 620 (47.1%) were males and 696(52.9%) were females. Within the study population 25-34 years age group is the dominant one followed by 35-44 years age group. The individuals of the study population belong to different ethnic groups having slight variations in their life style and food habit. Jimma comprises all the major ethnicities of Ethiopia with Oromia being the major and dominant one (P=0.000***). Jimma city itself is in the Oromia regional state of Ethiopia and the other ethnicities are invaded there mainly for their job and education. Nowadays more number of people being migrating from the surrounding villages to the Jimma city for their job and education is an upcoming scenario. Orthodox was the found to be the prominent religion (P=0.005**).

Government servants seemed to be the major occupational category followed by private employees and housewives and farmers were very few in number (P=0.000**). The educational status reflects the developmental potential of a population. All over Ethiopia this is a time of educational revolution and innovations. In Jimma town, majority of the population are below the primary educational level or illiterate. In the study population 71.8% have a monthly income of <1000 Ethiopian Birr ie. the economic condition of majority of the population is pathetic (P=0.001**).The average age of the

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study population was 40.52±15.06 years and average household/family income was found to be 1065±750 Ethiopian Birr. It was very important to take in to account the mean age and mean family income of the study population because possibly it may have some correlation with the development of the Metabolic syndrome (Met S).

2. Life style characteristic of the study population

In the study population 7% were cigarette smokers, 52.1% were alcohol consumers and 21.9% were Khat chewers. Alcohol consumption is the prominent life style characteristic followed by Khat chewing and cigarette smoking. Cigarette smoking was found to be very common among males than females (P=0.000**) but, alcohol consumption was observed to be almost similar in both groups (P=0.514). The Khat chewing tendency seemed to be significantly high among the males (P=0.000**) of the study population.

3. Anthropometric characteristics of the study population

The results revealed that Obesity is not that much prevalent in the general population of Jimma. The three abnormal BMI categories such as Underweight, Overweight and Obese were more prevalent among females than in males (P=0.000***).This means that the male population led a healthier life as compared to females. Hypertension (HT) stage I and HT stage II were observed to be more prevalent among females than among males of the study population (P=0.000***). Overweight, Obesity and hypertension (being metabolic syndrome components) were more prevalent among the females of the study population than among the males and could be a reason behind the higher prevalence of Met S in females.

The percentage of normotensive individuals were found to be decreased as we go up along the age group, whereas the percentages of prehypertensive, HT stage I and HT stage II individuals were found to be increased. This clearly revealed that there is a gradual, but significant increase in BP(HT) as the age increases because of the loss of elasticity of the blood vessel wall resulting in an increase in peripheral resistance known as atherosclerosis (P=0.000***). HT being an independent metabolic syndrome component could cause an increase in the prevalence of Met S in the aged categories as compared to young.

The mean BMI of the study population was estimated to be 22.48±3.6 and there was no significant difference between men and women. This value was within the normal range of BMI (18.5-24.9) indicating that the population as a whole belonged to the normal weight group and it has only less potential to develop Met S.

Waist circumference (WC) is a measure of abdominal obesity and is one of the components of metabolic syndrome as per IDF as well as ATP-III criteria. The mean WC of the study population was found to be 83.38±10.29 cm. This means that the population as a whole was having only less potential to develop metabolic syndrome. For women the mean waist circumference was 81.74±10.71cm, which was a bit above the cut of limits of IDF (≥80 cms) and far below the cut of limit of ATP –III (>88cms) stating that the females of the study population were having more potential to develop Met-S (particularly Met S – IDF as per definition) as compared to the male population. There observed a significant difference in the mean WC existed between men and women (P=0.010**). This could be one of the reasons for the higher prevalence of both Met S ATP and Met S IDF in women compared to men in all age categories.

Obesity is one of the reasons for insulin resistance and type II diabetes mellitus. During diabetes mellitus there will be hyperglycemia characterized by increased FBG and high rate of lipolysis in the adipose tissue resulting in the liberation of free fatty acid (fatty acid mobilization). It is also believed that insulin resistance results in an increased flow of free fatty acids from adipose tissue to the liver. The increased availability of fatty acids for triglyceride formation is a driving force for increased hepatic secretion of triglyceride-rich lipoproteins with secondary effects on HDL and LDL metabolism. [43, 44]. Thus, obesity characterised by increased waist circumference is a determinant of Metabolic syndrome. As the mean WC for women is greater than that of men women were found to be more obese in the study population and therefore they had more potential to develop Met S.
Visceral adipose tissue may contribute to the metabolic and cardiovascular disorders independent of insulin resistance. Body fat distribution may determine insulin resistance and Met S in humans, independent of obesity [45,46]. Visceral adipose tissue, especially the omental and mesenteric fat pads, which are drained by portal circulation, has unique metabolic characteristics compared with other adipose tissues [47].

The mean systolic BP and diastolic BP of the study population were 123.69±14.21mm of Hg and 84.45±9.2 mm of Hg respectively. These values are below the prescribed cut of limits (systolic BP, ≥130 m of Hg and diastolic BP, 85 mm of Hg) by IDF and ATP –III reflecting a very less potential of the population to be affected by Met S. There was no significant difference in mean BP systolic or BP diastolic between men and women of the study population. But, it was observed that HT stage I and HT stage II are significantly more among women compared to men(P=0.000***) and HT being one of the Met S determinant (for Met S IDF and Met S ATP-III)could be one reason for the higher prevalence of Met S in women category.

4. Biochemical characteristics of the study population

There are certain biochemical parameters which are components of Met S. These parameters include elevated serum Triglyceride (≥150 mg /dL), decreased HDL cholesterol (≤40 mg /dL for men and ≤ 50 mg /dl for women) and elevated Fasting blood Glucose level (≥100 mg /dL according to IDF and ≥110 mg/dL according to ATP-III).The concentrations of these biochemical parameters are controlled by dietary, lifestyle as well as hereditary factors.

The mean serum Triglyceride level of the study population was estimated to be 114.44±27.51mg/dL (is below the cut of value by IDF and ATP –III (≥150 mg dl) and therefore the population as a whole is having only less potential to develop metabolic syndrome. There found a significant difference in the mean TG level between men and women of the study population (P=0.001**).

Serum Total cholesterol (TC) concentration is not a component Met S, but as it is having direct relation with serum HDL cholesterol level and therefore, it also can be considered as an indirect determinant. The mean total cholesterol level of the study population was 179.9±23.29 mg /dL. The mean TC value was within the clinically accepted normal range of serum total cholesterol (150- 200 mg /dL) and therefore it could not be a very serious risk factor for the development of Met S as far as the entire population is concerned. There was no significant difference in the mean TC level between men and women of the study population (P=0.123).

Decreased serum HDL- C level is a direct determinant of Met S. According to both NCEP ATP-III and International diabetes Federation (IDF) criteria. A serum HDL -C level < 40 mg/d L in men and <50 mg/dL in women are considered as determinant of Met S. In the study population the mean HDL –C concentration is

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found to be 46.72±7.14 mg /d L in Men and 48.43±7.06 mg/dL in women. These results revealed that the women are having a better potential to develop Met S compared to men of the study population.

Serum LDL cholesterol (LDL-C) concentration should be less than 130 mg /d L according to the general diagnostic criteria, but is not a direct determinant of Met S as HDL-C. In the study population the mean LDL-C level was estimated as 109.93±21.9mg /d L indicating that the study population as a whole is having normal LDL- C level. There was no significant difference in the mean LDL-C level between men and women of the study population (P=0.138).

Increased Fasting blood glucose (FBG) concentration is a direct determinant of the so called Met S according to IDF as well as ATP –III criteria. According to IDF definition a FBG ≥ 100 mg /dL is a metabolic syndrome determinant and according to ATP-III FBG ≥110 is a metabolic syndrome determinant. The mean FBG of the study population was found to be 90.27±14.51mg/d L (91.46±14.5 for men and 89.21±14.4 for women) and there for it was not an independent determinant of Met S by either IDF or ATP- III definition as far as the entire population is concerned. There was no significant difference in the mean FBG between men and women of the study population (P=0.329).

There observed a gradual increase in serum triglyceride as the age advances (P=0.002**). TG level ≥150 mg/dL is a Met S determinant by both NCEP ATP-III and IDF criteria. Therefore the gradual increase in TG level towards older age is highly significant and might be one of the factors responsible for the increased prevalence of Met S towards elderly.

There observed a gradual increase in serum TC level during aging (P=0.012**). An important thing to point out is that the means of TC concentrations for all the age categories as well as the overall mean are in the normal range of serum TC (150-200mg/dL) indicating that the study population as a whole was normo cholesteremic. But, even though mild, a gradual increase in the mean TC level towards old age could contribute to the development of atherosclerosis, resulting in hypertension (determinant of Met S both NCEP ATP-III and IDF criteria) and the development of Met S. This could be a reason for the increased prevalence of Met S in elderly compared to youngsters of the study population.

HDL-C concentration was observed to be gradually decreased according to age. (P=0.002**). This gradual decrease in HDL-C concentration during ageing could be one of the reasons for the increased prevalence of Met S towards old age. As far as the men population is concerned all these mean values were above the minimum required level (40 mg/dL), but for women population > 35 Years of age (35-44, 45-54 and >54 age categories) the mean values were below the minimum required level (>50mg/dL) and could cause Met S (IDF and ATP III). The decreased HDL-C level in the women population above 35 years could be one of the possible reasons for the women being highly prone to Met S compared to men. This is because of the fact that HDL-C level < 50 mg /dL itself is a Met S component particularly in women (not in Men where it is <40 mg /dL) by both NCEP ATP-III and IDF.

LDL- C concentration gradually increased as we go up in different age groups (P=0.001**). LDL- C is not considered as a direct determinant of Met S according to both NCEP ATP-III and IDF criteria, but as it is having some influence on TC and HDL-C concentration, this can be considered as an indirect determinant of Met S. Therefore, it is prescribed that the LDL-C level should not exceed 130 mg/dL in both men and women. If it is exceeded, it will have an effect on the development of Met S by facilitating atherosclerosis and thereby increasing blood pressure.

A slight increase in the mean Fasting Blood Glucose (FBG) was observed as on age increases and then decreased towards the old age (P=0.018**),with 90.27±14.51 being the mean value for the entire study population. The highest mean FBG was noticed in the 45-54 age group. An elevated FBG is one of strong determinant of Met S both by NCEP ATP-III and IDF criteria and this might be one of the possible reasons for the high prevalence of the same in 45-54 age group. It is important to note that the Met S (by ATP-III and IDF) prevalence was significantly less in <35 years categories (20-24 years and 25-34 years) >54 years category compared to 45-54 category. In other word, there was an important correlation (parallelism) between FBG levels and Met S prevalence stating that increased FBG due to insulin resistance (Type –2 DM/obesity/increased abdominal fat /increased WC) was the major reason for Met S in the study population.

6. Magnitude of Metabolic syndrome in the study population

Met S IDF: The overall prevalence rate of Met S Met S-IDF was estimated to be 16.7%. The prevalence rate was found to be significantly more (P=0.001***) among females of the study population (21.7%) compared to males (11.1%). It was observed that the prevalence rate increases as the age advances with a slight decline in the old age group (>54). The 45-54 years category was highly affected with Met S IDF (32.5%) and the 20-24 years category being the least affected (3.7%). Particularly women in the age of 45-54 were the highly affected group with a very high prevalence rate (41.2%). Again men in the age group of 45-54 years shown the highest (P=0.001***) prevalence of Met S IDF (21.5%).Out of 1361 individuals of the study population 220 were affected by Met S – IDF (16.7%). Out of the 220 Met S – IDF individuals 69(31.4%) were males and 151(68.6%) were females, ie. females of the study population showed more tendency to develop Met S – IDF compared to males (P=0.001**).

Met S ATP-III: The overall prevalence rate of Met S-ATP-III in the study population was estimated to be 10.5%. The prevalence rate was found to be more among females (P=0.001**) of the study population (14.5%) compared to males (6%). Similar to the case of Met S IDF, Met S ATP III prevalence rate also showed the same pattern of distribution ie. increased with age with a slight decline in the old age group (>54). The 45-54 years category was very much affected by metabolic syndrome (20.7%) and the 20-24category was the least affected (3.2%). Particularly women in the age of 45-54 were the highly affected group with a very high prevalence rate (26.1%). Again, men in the age group of 45-54 years showed the highest prevalence (13.8%) of Met S-ATP-III(P=0.007**).

In short, Out of 1361 individuals of the study population 138 were affected with Met S – ATP-III (10.5%). Out of the 138 Met S-ATP-III individuals 37(26.8%) are males and 101(73.2%) are females (percentages are not shown in table) ie. females of the study population were more affected with Met S-ATP-III compared to males.

The increase in the prevalence rate of Met S towards aging is because of the age related variations in anthropometric measurements (BP, BMI and WC) and biochemical factors (TG,TC,HDL-C,LDL-C and FBG) all these are having either direct or indirect relation with the development of Met S (components of Met S). The age related variations in anthropometric measurements and biochemical parameters are well studied in the population as a part of the investigation and the results are already discussed in this session.

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The increased prevalence in women compared to men particularly after the age of 35 years might have resulted due to the hormonal variation associated with pregnancy, child birth and menopause, due to the lack of sufficient physical exercise resulting in increased abdominal obesity(increased WC) leading to insulin resistance and subsequent alterations in carbohydrate, lipid and particularly in lipoprotein metabolism. The highest prevalence of Met S in 45-54 years age category could be particularly due to the highest mean FBG and the resulting metabolic variations resulting from obesity and insulin resistance (Type II diabetes Mellitus).

These results had similarity with those obtained form a study conducted among working adults in Addis Ababa, Ethiopia. The cross-sectional study showed that the overall prevalence of Met S was 12.5% and 17.9% according to ATP III and IDF definitions respectively. Using ATP III criteria, the prevalence of Met S was 10.0% in men and 16.2% in women. Application of the IDF criteria resulted in a Met S prevalence of 14.0% in men and 24.0% in women [40]. The prevalence of MS, irrespective of criteria used, increased markedly with age in both men and women. However, the prevalence was highest between ages 45–54 with 40.5% of men and 53.7% of women having Me S [40]. However, this study was not conducted in the general population, but among working adults. Another similar study conducted in United States showed the same pattern of variations in Met S prevalence with regards to age and sex. The study revealed that the prevalence increases with age and increase in BMI and the females showed more prevalence compared to males.(48)

In Africa, the first reported Met S study conducted in Cameroon revealed a 1.5% and 1.3% prevalence of Met S among urban dwelling women and men using IDF criteria; however, the study did not measure HDL-C concentrations [49]. A second study conducted in 2004 in Seychelles, found a high prevalence of MS where 25%–30% of their study population had the syndrome [50]. A recent study involving adults in semi-urban and rural communities in Nigeria found a prevalence of MS to be 18% [51]. A community based study conducted in Tanzania in 2009 reported a 38% prevalence of MS [52] The prevalence of the metabolic syndrome in children and adolescents is relatively low (4%) when compared to the adult population (24%), except amongst overweight and obese adolescents where the prevalence of the metabolic syndrome has been reported as high as 29% [53,54,55].The analysis of the data from the Third National Health and Nutrition Examination Survey, USA, found the prevalence of the Met S to be higher in women (22.7%) compared to men (21.9%) [56].
In India, a study conducted in Mumbai, India showed a different pattern where the prevalence of Met S in males was almost double (25.16%) than females (12.6%), and this was highly significant (P=.008) and was because of the reason that hypertriglyceridemia and decreased levels of HDL-C were found to be more in males (P<.0001) compared to females. But, the age wise distribution of prevalence of Met S was found to be the same in 20–40 and 41–60 age groups (20.61% and 20.76%), respectively, whereas >60 age group showed a marginal decrease in the prevalence (16.66%). [57]

7. Association between Socio-demographic factors and Met S in the study population.

7.1.Met S-IDF: Educational, Occupational as well as income status of the individual can have influence on the development of Met S. Considering the association between occupational status, house wives category which had shown more prevalence rate of Met S IDF (31.1%) and student category had the least (0%)(P=0.000**). The high prevalence of Met S IDF among house wives could be due to the lack of sufficient physical exercise and reclining for more duration (discussed before). The low prevalence in student category might be due to the use of more calories for intellectual brain work and also because of comparatively less age.

Among the different income categories the highest prevalence of Met S-IDF was noticed in the 1000-3000 Birr category (22.15%) and the least in the <1000 Birr category (P=0.005***). The high prevalence of Met S IDF in high income categories might be due to the intake of high calorie intake when compared with low income category leading to obesity (BMI), increased waist circumference (WC) hyper triglyceridemia etc. resulting in Met S.

In different educational group of the population the highest prevalence of Met S IDF was noticed among the illiterate group (27%) and the lowest among the 10+2 category (8.1%)(P=0.000**).The highest prevalence of Met S IDF in illiterate category should be explored further.

7.2. Met S –ATP III: House wives are the occupational category which showed the highest prevalence (P= 0.040**) of Met S ATP III (19.8%) and student category showed the least (0%). The high prevalence of Met S ATP –III among house wives could be due to the lack of sufficient physical exercise and reclining for more duration. The low prevalence in student category might be due to the use of calories for intellectual work and also because of comparatively less age and poor caloric intake because of economic factors.

Among the income groups, the highest prevalence of Met S-ATP-III was noticed in the >3000 Ethiopian Birr category (17.6%) and the least in the <1000 Ethiopian Birr category (8.1%). There observed a significantly high prevalence of Met S – ATP-III in high income groups compared to low income category (P= 0.000**). The high prevalence of Met S ATP-III in high income categories might be due to the intake of high calorie intake when compared with low income category leading to obesity (BMI), increased waist circumference (WC) hyper triglyceridemia etc. resulting in Met S. There existed a significant correlation between education and prevalence rate of Met S- ATP-III (P=0.039),but was different from the pattern obtained for Met S-IDF and therefore it is to analyzed further in detail. One report says, Met S is common in the Philippines among older, educated, and urban residents [58].

CONCLUSIONS

The cross sectional study “Metabolic syndrome and its association with substance use in Jimma Town Southwest Ethiopia” ended with the following final conclusions.

- The overall prevalence of Metabolic syndrome in Jimma Town, South West Ethiopia was estimated to be 16.7% by IDF criteria and 10.5% by NCEP ATP-III criteria.
- As per both IDF and ATPIII criteria women were found to be more affected with Met S as compared to men (Met S IDF criteria Men-11.1%, women-21.7% and Met S ATP III criteria- Men-6%, women-14.5%).
- Among men and women 45-54 age categories was found to be at increased risk of being affected with Met S both by IDF and ATP-III criteria (Met S IDF-32.5% and Met S ATPIII 20.7%).
- Women particularly at the age of 45-54 Years showed the highest prevalence of both Met S IDF (41.2%) and Met S ATPIII (26.1%).
- According to both IDF and ATP III criteria the prevalence rate increases with age in both male and female of the study population with a decline in old age population..
- There observed a decline in the prevalence rate at old age ie >54 years of age (Met S IDF 25.3% and Met S ATP III-12.4%).
- Among the occupational categories house wives are at an increased risk of getting affected with Met S (Met S IDF-31.1% and Met S ATP-III-19.8%).
- There was no relevant association between income status and educational status with the prevalence of Met S.
- High income is associated with development of Met S ATP-III but not Met S IDF.

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●BP, TC, LDL-C, TG was observed to increase with increase in age in the study population but, HDL-C level decreased with age.
●Majority of the individuals had normal BMI, under weight, over weight and obese categories are less prominent.

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