ASSESSMENT OF THE MAGNITUDE OF CENTRAL OBESITY AND ITS ASSOCIATED FACTORS AMONG ADULTS IN JIMMA TOWN, SOUTHWEST, ETHIOPIA.

By

FITSUM ENDALE (BSc)

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Jimma, Ethiopia

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FITSUM ENDALE (BSc)

Advisors:

Prof. Dr. TEFERA BELACHEW (MD, MSc, DLSHTM, PhD)

Mr. ADERAJEW NEGUSSIE (BSc, MPH/RH, Assistant professor)

June, 2016

Jimma, Ethiopia

Abstract

Background: Central obesity is an apple shape distribution of fat to the abdominal area currently identified as a major risk for metabolic syndrome and cardiovascular disease due to accumulation of liable fat. According to the World Health Organization, the worldwide prevalence of obesity was almost doubled between 1980 and 2008 with estimated 502 million adults being obese globally by 2008. In 2012, one in six adults was obese and nearly 2.8 million individuals die each year due to obesity globally. In Ethiopia, studies showed that obesity and metabolic syndrome are increasing. Many of the studies used BMI for measurement of obesity. However, there is no study that documented the prevalence of central obesity which is strong predictors of both metabolic syndrome and CVD from a community based data.

Objective: To assess the prevalence of central obesity and associated factors among adults.

Method: A community based cross-sectional study was conducted among 845 adults aged 18–64 years living in Jimma Town. The study participants were selected using multistage sampling technique. Data were collected by using an interviewer administered questionnaire and anthropometric instruments. The data were analyzed using SPSS windows version 20. *P* value < 0.05 was used to declare statistical significance.

Results: The prevalence of central obesity was 24.6%, which is 36.4% for females and 10.4% for males. On the multivariable logistic regression model after adjusting for other variables age above 55 [AOR = 3.576(95%CI: 1.397-9.153)], female [AOR = 11.443(95%CI: 6.534-20.181)], dietary diversity [AOR = 0.517(95%CI: 0.310-0.861)], alcohol consumption [AOR = 2.177(95%CI: 1.390-3.409)], snacking [AOR = 1.602(95%CI: 1.072-2.394)], physical inactivity [AOR = 2.327(95%CI: 1.437-3.767)], and high wealth index [AOR = 3.242(95%CI: 1.808-5.811)] were significantly associated with central obesity.

Conclusion and Recommendation: The result revealed that increasing prevalence of central obesity among adults of Jimma Town. Central obesity was high among those in age group between 55-64 years, in females, low diversified diet eaters, alcohol drinkers, snack users, in the high wealth group and among physically inactive individuals. Promotion of having regular physical activity, eating diversified diet, limiting alcohol drinking and snacking low energy foods are recommended to prevent central obesity and associated risks.

Key Words: Adults, Central obesity, Waist Circumference.

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Abbreviation and Acronym

ADP	Air Displacement Plethysmography
AOR	Adjusted Odds Ratio
BIA	Bioelectrical Impedance Analysis
BMI	Body Mass Index
CI	Confidence Interval
COR	Crude Odds Ratio
CT	Computerized Tomography
CVD	Cardiovascular Disease
DALYs	Disability Adjusted Life Years
DDS	Dietary Diversity Score
DEXA	Dual-Energy X-ray Absorptiometry
FFA	Free Fatty Acid
FFQ	Food Frequency Questionnaire
FMOH	Federal Ministry of Health
Gov't	Government
GPAQ	Global Physical Activity Questionnaire
HC	Hip Circumference
IDDS	Individual Dietary Diversity Score
MET	Metabolic Equivalent Task
MRI	Magnetic Resonance Imaging
NCDs	Non Communicable Diseases
NCEP-ATP III	National Cholesterol Education Program Third Adult Treatment Panel
NGO	Non-Governmental Organization
NNP	National Nutrition Program
SPSS	Statistical Package for Social Sciences
UNICEF	United Nations Children's Fund
WC	Waist Circumference
WHO	World Health Organization
WHR	Waist to Hip Ratio

1. Introduction

1.1. Background

Obesity is a condition of abnormal or excessive fat accumulation in the adipose tissue of the body (1). Obesity defined by waist circumference (WC) is known as central/abdominal obesity which is measured as the waist measured mid-way between the lowest rib cage at the mid-clavicular line and anterior superior iliac spine is the most practical indicator of fat distribution and central obesity (2, 3). It is one of the most common disorders in medical practice that invites disability, disease and premature death (4).

Based on the basis of excess body fat distribution obesity is classified into three type. The first one is the general fat type of obesity in which the whole body from head to toe looks like a barrel. The fat tissues in their body hinder the movement of all the internal organs and consequently affect their brisk functioning. The second is gynecoid (Pear type) in this type the lower part of the body has the extra flesh. This type of obesity is more common to females. The flesh is somewhat flabby in the abdomen, thighs, buttocks and legs. The third, Android/Central type of obesity is likened to the shape of an apple. The shoulders, face, arms, neck, chest and upper portion of the abdomen are bloated. The stomach gives a stiff appearance. The lower portion of the body are thinner beyond proportion in comparison with the upper part. Though this type of obesity is found more in males, it is also present to a lesser extent in women. Android type of obesity is a major risk for heart damage and heart disease due to high cholesterol (2, 4).

With the help of technologies different methods are being used to measure body fatness like Dual-Energy X-ray Absorptiometry (DEXA), Magnetic Resonance Imaging (MRI), Computerized Tomography (CT), Bioelectrical Impedance Analysis (BIA), Hydro-densitometry, Total Body Water, Air Displacement Plethysmography (ADP) Ultrasound and Skinfold thickness caliper (5). Though, the method most commonly used in the determination of obesity is Body Mass Index (BMI). However, BMI does not provide enough information regarding the distribution of fat in the body (6, 7) and it was evidenced that waist circumference is the simplest anthropometric measurements to be used to determine both the description of obesity and for identifying the individuals who are at an increased risk for chronic diseases (8, 9).

There are several cutoff criteria for central obesity using the waist circumference; however, the major ones include the National Cholesterol Education Program Third Adult Treatment Panel (NCEP-ATP III) (male >=102 cm, female >=88 cm) (10) and the International Diabetes Federation (IDF) (male >=94 cm, female >=80 cm) have a high risk of central obesity-related health problems (11). Waist-to-Hip Ratio (WHR) is another step when studying disease risks which is the waist measure divided by the circumference of the hip measured at the level of the greater trochanter off the femur, but it does not provide any additional information (2).

Even though the biological pathway by which central obesity fosters metabolic syndrome and NCDs is debatable, there are some theories that are accepted widely. Visceral fat have a particular importance in the development of chronic diseases when compared to subcutaneous fat. By which visceral fat has a higher rate of lipolysis with release of free fatty acids (FFA). Elevated levels of FFAs are known to impair insulin function and glucose uptake. FFAs mobilized from visceral fat pass directly to the liver via the portal vein, leading to hyperglycemia, hepatic insulin resistance, and dyslipidemia, hyperinsulinemia, and decreased skeletal muscle insulin sensitivity (12, 13).

Studies have also shown that the distribution of fat on the body is more critical than the total amount of fat alone. Overweight people who do not have abdominal fat are less susceptible to health problems than overweight people with abdominal fat. Independently of BMI or total body fat, central obesity is associated with increased risks of heart disease, stroke, diabetes, hypertension, gallstones, and some types of cancer (2, 14). It has been also suggested that central obesity might be the key determinant for the increasing prevalence of metabolic syndrome in countries like Sub Saharan Africa (15). Therefore, this study intends to assess the prevalence of central obesity and associated factors in Jimma town south western Ethiopia using waist circumference which is the most sensitive indicator of risks of Cardiovascular Disease (CVD) and metabolic syndrome.

1.2. Statement of the problem

Excess abdominal fat is an independent predictor of the risk factors and the morbidity of obesity related diseases such as type 2 diabetes, hypertension, dyslipidemia and cardiovascular diseases (16), which are the leading causes of deaths in the world (17). According to the World Health Organization, obesity ranks fifth and seventeenth in the list of the leading risk factors underlying the total burden of disease of the low-mortality and high-mortality in developing countries, respectively (18). About 44% of diabetes, 23% of ischemic heart disease and 7 - 41% of some cancers are attributable to obesity (19). In 2012 according to the World Health statistics report, one in six adults was obese and nearly 2.8 million individuals die each year due to obesity worldwide (20).

Globally, obesity has become pandemic affecting 200 million men and nearly 300 million women worldwide posting great public health threats to all nations and all races (21). According to the World Health Organization (WHO), worldwide prevalence of obesity is almost doubled between 1980 and 2008 with estimated 502 million adults being obese globally by 2008 and recently in 2014, 11% of men and 15% of women aged 18 years and older are obese. This shows that, more than half a billion adults worldwide are classed as obese (22).

Studies examining central obesity in Africa are rare. Although existing studies done on individual countries in Africa are showing an increasing prevalence of obesity. In 5-year periods obesity prevalence demonstrated an increase more than double from 7.0% in 1990–94 to 15.0 in 2000–04 in urban West Africa (23). The prevalence of obesity ranges from as low as 0.6% in Gambia among males to as high as 80.2% in Nauru (24).

In Ethiopia, even though there is a lack of enough evidenced based on empirical data, within two decades the prevalence of obesity has increased dramatically. According to a cross-sectional survey conducted in the mid-1990s among 15 to 24-year old young adults in Addis Ababa, Ethiopia, only 0.7% of men and 6% of women were obese (25). However, in 2008 a community based study in Addis Ababa showed that 20% of men and 38% of women were overweight and 10.8% of these women were obese which may represent a “silent epidemic” of obesity in this population (26).

The factors for central obesity development are believed to be multi causal and different studies found out that; environmental, ecological, genetic, psychosocial, urbanization and economic development leading to a nutritional transition characterized by a shift to diets of higher energy content and/or to the reduction of physical activity are factors that play major roles (19, 27).

Studies in our country show that the increasing prevalence of hypertension, diabetes and mortality from chronic NCDs reported corroborates the evidence that Ethiopia is facing the pattern of disease burden observed in other Sub-Saharan African countries (28, 29). Like many developing countries, Ethiopia is facing the consequences of epidemiologic, demographic, economic and nutrition transitions which continue to favor the emergence of epidemic of chronic non-communicable diseases (30).

To avert this devastating problem more recently the Ethiopian government have given a growing recognition to the worrying trends in the magnitude of chronic diseases and their risk factors. As a result the government included NCD as one component of the national nutrition program (NNP) (31) with the following initiatives: Promoting public awareness of healthy life styles, integration of prevention and control of life style related disease in the urban health extension program to enhance physical activities of the community**.** Federal Ministry of Health (FMOH) also launched the tobacco free and physically active initiative on April 17, 2014 (32). However, studies done among the government workers in Addis Ababa (33) and in Jimma University (34) showed that there is high prevalence of central obesity.

There is still very limited study conducted in our country specifically at community level to document the prevalence of obesity based on body mass index. However, using body mass index for predicting obesity has two important conceptual problems: first, it is not a good indicator of body fatness and is poorly correlated with the risk of CVD, secondly, the Caucasian based cut-off values are not appropriate for Ethiopians (35).

Therefore, this study intended to assess the prevalence of central obesity and associated factors among adults in Jimma Town South Western Ethiopia using waist circumference which is the most sensitive indicator of risks of CVD and metabolic syndrome.

2. Literature Review

Central obesity is a components of a defined cluster of risk factors for CVD and metabolic syndrome (36, 37), once problems for only the high-income countries, in recent days became rampant in developing countries (38).

A study done among a group of Turkish age from 18 to 59 years old adults in 2010, is one of the studies observed from community data which showed that the prevalence of central obesity was 21.6% in men, 41.4% in women (39).

A result from 33 communities of Northeast China in 2012 done in urban adults aged 18 to 74 years showed a prevalence rate of central obesity of 37.6%. There was a significant difference in the prevalence of obesity between men 31.1% and women 43.9% (40).

One of a study which observed central obesity in Northern Iran in 2010 concluded that, central obesity was the most serious health problem in the north of Iran and it was more prevalent in women than men. The result was examined from a community based data and the prevalence of central obesity was 32% and it was significantly higher in women 57.2% than in men 15.8% (41).

A study done in Abia State, Nigeria in 2013 showed the prevalence of abdominal obesity in the population was 21.75%(3.2% in men vs 39.2% in women) (42). Similarly a study in Benin also showed that the prevalence of high risk central obesity was 15.48% with the prevalence being significantly higher in women (27.39%) than in men (2.73%) (43).

One study done in Ethiopia, among working adults from permanent employees of the Commercial Bank of Ethiopia and teachers in government schools of Addis Ababa in 2011 showed a prevalence of central obesity 19.6% (33). Another community based study done in 2009 among adults of Addis Ababa also showed that central obesity was significantly higher in females (64.6%) than in males (12.9%) (26).

2.1. Factors associated with central obesity

2.1.1. Socio-economic factors

A study from Northeast China on 33 communities of urban adults also showed that Age is strongly associated with the prevalence of central obesity. The elderly age groups, in women aged 55–64 years and in men aged 45–54 years had a highest prevalence of central obesity which is significant. A higher level of education and higher income were each associated with a lower risk of central obesity (40).

The study conducted in the northern Iran also showed that socio-demographic factors are associated with central obesity. The problem was also high in uneducated people (52.3%) than in college educated people (19.9%). Individuals in the younger age between 15-25 and 25-35 years are more than 66% less likely to be obese as compared to the age group between 55-65 years and significantly married peoples are centrally obese than singles. Economic status was not associated with central obesity (41).

A study undertaken among young women aged 20 years and above in an urban slum of Chennai city, India showed a significant association between the age, religion, a higher socioeconomic status and central obesity. It has been noticed that as the socio-economic status increased, the prevalence of the central obesity also increased and the difference was found to be statistically significant. There was no significant association between the educational status, occupation, marital status and the central obesity (44).

The finding of study done in four regions of India in 2013 among adults of age 20 years and above showed that being female and higher socio-economic status and increase in age were significantly associated with central obesity in all the four studied regions (45).

The multivariable logistic regression analysis result of the study in Benin in 2013 also shows the association between socioeconomic factors and central obesity. In the study prevalence of central obesity was significantly associated with higher education, age and occupation in men as well as in women (43).

2.1.2. Behavioral factors

Another Korean study among adults of aged 30 to 87 who visited the health promotion centers in Seoul in 2010 showed that after adjustment for age, smoking, physical activity, income and marriage status, men and women with a high alcohol intake were positively correlated with high waist circumference (46).

A cross-sectional study carried out among University students of Tamale, Ghana in 2015 shows that alcoholic and non-alcohol beverages > 3 times a week was associated to central obesity. In the study those individuals who consumed alcoholic and non-alcoholic beverages > 3 times per week (47).

The study done in Spain among adults age 25-74 years in 2007 shows that the multiple logistic regression analysis, controlled for energy underreporting, smoking, educational level, leisure-time physical activity, energy, and diet quality, revealed that consuming more than 3 drinks of alcohol per day was significantly associated with the risk of abdominal obesity in men. Consumption of alcohol was also directly associated with total energy intake in men and women. The proportion of energy underreporting significantly decreased with higher amounts of alcohol drinking in both genders (48).

A study in Switzerland in 2011, shows that Current smokers (29% of men and 24% of women) had lower mean waist circumference, body fat percentage, and body-mass index compared with non-smokers and Age-adjusted mean waist circumference and body fat increased with cigarettes smoked per day among smokers (49).

A study in South Korea, reveals that after restricting the analyses to past/current smokers, it was found that significant dose-dependent associations of smoking pack-years with abdominal and visceral obesity (50).

2.1.3. Dietary factors

One influential factor for central obesity is eating patterns: what, how much and where we eat. Now a day's people are consuming prepared and processed foods because they are more accessible than ever before and in larger portion sizes.

A data from the cross-sectional NHANES study done in United States in 2014 using food diversity index showed Dietary Diversity Score (DDS) has an inversely association with indicators of body adiposity in both sexes and indicates that greater healthful food variety may protect against excess adiposity (51).

The result of a study from a community based Sri Lankan adults aged > 18 years in 2013 showed the positive association between high dietary diversity and central obesity. The study implies that as dietary diversity increases the level of waist circumference and energy consumption was significantly increased in the population. The abdominal obese participants had higher DDS values compared to non-abdominally obese groups (52).

The study done among Iranian female youth of Isfahan University in 2010 showed that there were inverse associations among DDS and central obesity. In the study the probability of central obesity decreases with quartiles of DDS (53).

From the study of US adults age 20 years and above in 2015 showed that eating frequency have a positive association with central obesity. In the multivariate analyses without taking into account Energy Intake: Estimated Energy Requirement, all measures of Eating Frequency, Meal Frequency and Snack Frequency showed inverse or null associations with central obesity in both sexes. However, after full adjustment including Energy Intake: Estimated Energy Requirement, it is found positive associations between all Eating Frequency all, Eating Frequency energy, and Eating Frequency >50kcal and central obesity in men and those for Eating Frequency >50kcal (and null associations for Eating Frequency all and Eating Frequency energy) in women. It is found that higher Eating Frequency, Meal Frequency and Snack Frequency are associated with an increased likelihood of central obesity (54).

From the analysis of the nationwide individual survey study in Brazil in 2013 show that snacking is prevalent among Brazilians and is an important contributor to daily energy intake and highlight that many of the foods commonly consumed as snacks would be classified as foods high in solid fats and added sugars it is seen that considerably higher daily energy intake among snack users (1929 and 2334 kcal among light and heavy snack users, respectively) compare to non-snack users (1548 kcal, results not shown elsewhere) (55).

Another study from US in 2014 showed that as several snacking patterns were associated with better diet quality than those who do not consume snacks. In the study none of the snacking patterns were associated with cardiovascular risk factors like central obesity (56).

2.1.4. Activity factors

Physical activity is defined as any bodily movement produced by skeletal muscles that result in a substantial increase over the resting energy expenditure. There is realistic relationship between physical activity and well-being for people it plays a major role in preventing many NCDs (57), mainly abdominal obesity because it is preferentially lost during a physical activity (58).

A study done among civil servants in Tamale metropolis, Ghana in 2012 revealed that the level of physical activity appears to be a key determinant of the prevalence of central obesity. In this study subjects with lower levels of physical activity demonstrated a higher likelihood of central obesity. As the level of physical activity increases, the odds of central obesity will significantly decrease (59).

The study conducted among adults of 18 years and above at the outpatient clinic of the Baptist Medical Centre in Ogbomoso, Nigeria in 2011 is one of the study that shows the association between physical inactivity and central obesity. The study implies that high prevalence of physical inactivity amongst women is one of the factors that is responsible for their high prevalence of central obesity (27).

2.2. Conceptual framework for the factors of central obesity

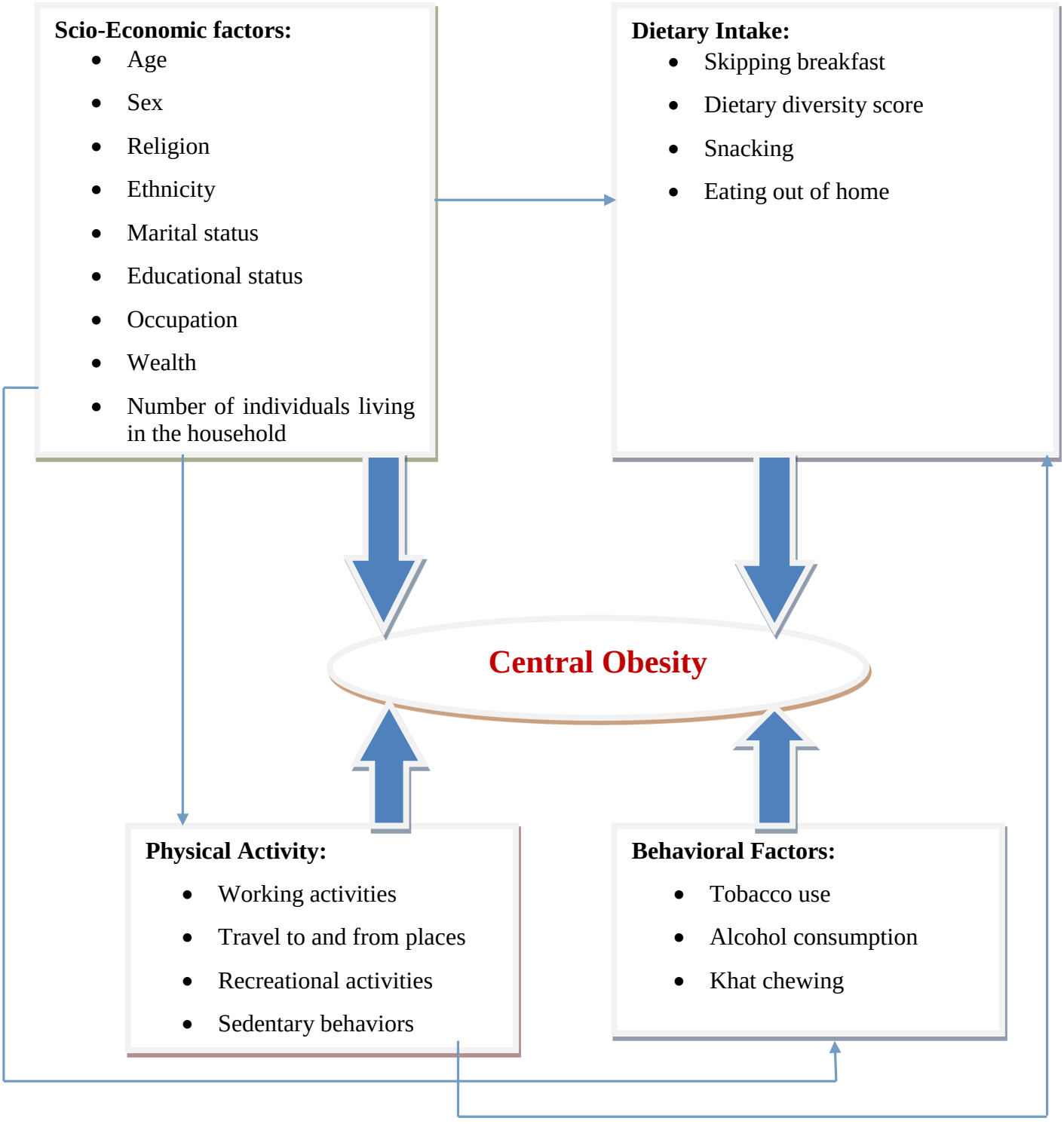

Figure 1: Conceptual framework for factors determining central obesity synthesized by investigator based on literature review.

2.3. Significance of the study

Developing countries are in economic transition, leading them to a nutritional transition characterized by a shift to diets of higher energy content and/or to the reduction of physical activity in which changes the living condition of the people as a result that expected to favor the increase burden of NCDs in different countries by different factors. A few years ago this countries were in a problem with under-nutrition and now the fate changed to include obesity tiered a double burden of malnutrition especially in Sub-Saharan Africa. NCDs affect the adult group of the population, which are productive group of people for the country leading them to be diseased and disabled. The cause of NCDs are mostly modifiable and can be preventable if diagnosed earlier. In order to tackle the increasing burden of these diseases it is necessary to study the major risk factors that are causing them.

Measuring obesity is a key factor in the diagnosis and surveillance of the increasing prevalence of metabolic related disease. There are different advanced methods to measure obesity in clinical setting, which are difficult to use at community level due to different constraints. The most common method used to measure obesity at community level until now is BMI. But recently numerous studies have demonstrated that BMI does not estimate central obesity and metabolic related disease as other anthropometric measurements, such as WHR and WC compared to total body fat indicators and it is evidenced that central obesity is considered as a better surrogate measurement of visceral adiposity, which is a risk factor for insulin resistance and CVD.

Although, there are studies that have been carried out on prevalence of central obesity as a component of metabolic syndrome studies in different parts of our country; but most of them are institution and hospital-based studies which excludes the unemployed group of people. So this study intended to assess the prevalence of central obesity and associated factors among adults in Jimma Town. This study may predict the status of metabolic syndrome independent to different body frame which will help to design appropriate strategy to prevent metabolic syndrome in adults and may also fill the research gap in the study area and will be used as a reference for researchers.

3. Objectives

3.1. General objective

- To assess the prevalence of central obesity and associated factors among adults in Jimma Town, Southwest, Ethiopia, 2016.

3.2. Specific objective

- To determine the prevalence of central obesity among adults in Jimma Town, Southwest, Ethiopia.
- To identify factors of central obesity among adults in Jimma Town, Southwest, Ethiopia.

4. Methods and Materials

4.1. Study area and Period

The study was conducted in Jimma Town, Southwest Ethiopia. The town is located at 354 km south west of Addis Ababa. The city is found approximately 7°40'N latitude and 36°50'E longitude. The town has an area of 44.86sq.km with an altitude of 1750-2000m above sea level, temperature range of 20-30 °C and average annual rainfall of 800-2500mm[3]. Based on the projection from Ethiopian Central Statistical Agency of 2007, Jimma is the fifth largest city in Ethiopia with an estimated population of about 189,733, of whom 92,996 males and 96,764 females. According to Jimma city administration office report, the town has 17 kebeles and 36,333 total households. As to the 20015/16 Jimma Town Health Bureau Statistics, there are 6 public health institutions (4 health centers & 2 hospitals) and 18 private clinics (33 medium and 6 small clinics) in the town. The study was carried out among adults in Jimma Town from March to April 2016.

4.2. Study Design

Cross sectional study design was employed.

4.3. Population

4.3.1. Source Population

All adults residing in selected kebeles of Jimma Town at the time of the study.

4.3.2. Study Population

A randomly selected adults residing in selected households in Jimma Town.

4.4. Inclusion and Exclusion Criteria

4.4.1. Inclusion Criteria

- Adults age 18 - 64
- Being inhabitants of Jimma Town for at least six months before the survey.

4.4.2. Exclusion Criteria

- Women with self-reported pregnancy
- Sick and unable to communicate
- Adults with body deformity around the abdomen.

4.5. Sample Size and Sampling Technique

4.5.1. Sample Size Determination

To determine the minimum sample size required a formula for estimation of single population proportion was used:

$$\mathbf{n} = \frac{(Z_{\alpha/2})^2 * (p)\,(q)}{d^2}$$

Where, **d** = Acceptable margin of error (precision of measurement) = 5%

z = Standard normal variable corresponding to 95% confidence level (1.96)

p = Expected prevalence of central obesity to be 50%

q = 1-p

$$\mathbf{n} = \frac{(1.96)^2 * (O.5)\,(0.5)}{(0.05)^2} = \mathbf{384}$$

- Since we used a multistage sampling, we considered a design effect of 2, which gives a final sample size of :

  n = 384 * 2 = **768**

- Adding 10% for non-responders the final sample size became:

  n = 768 + 10% non-response rate = **845 Adults.**

NB: Sample size was also calculated for the factors but the maximum was obtained with this prevalence.

4.5.2. Sampling Technique and Procedure

A multistage stage sampling technique was used to select the study subjects. Initially, simple random sampling was used to select 6 kebeles from the total of 17 kebeles list by considering WHO rule of thumb of 30% inclusion for prevalence studies (60). The number of households required was allocated to each kebeles proportionately. Then, systematic sampling technique was used to select households from each selected kebeles, bottle spinning method at the middle of the selected kebeles was used to select the first house. Then, a random number was selected within the sampling interval and the number of households in the direction of the head of the bottle were counted until the selected number is reached, then, the next household was selected by adding the sampling interval to the randomly selected number. Finally, one eligible adult was selected from each household using simple random sampling.

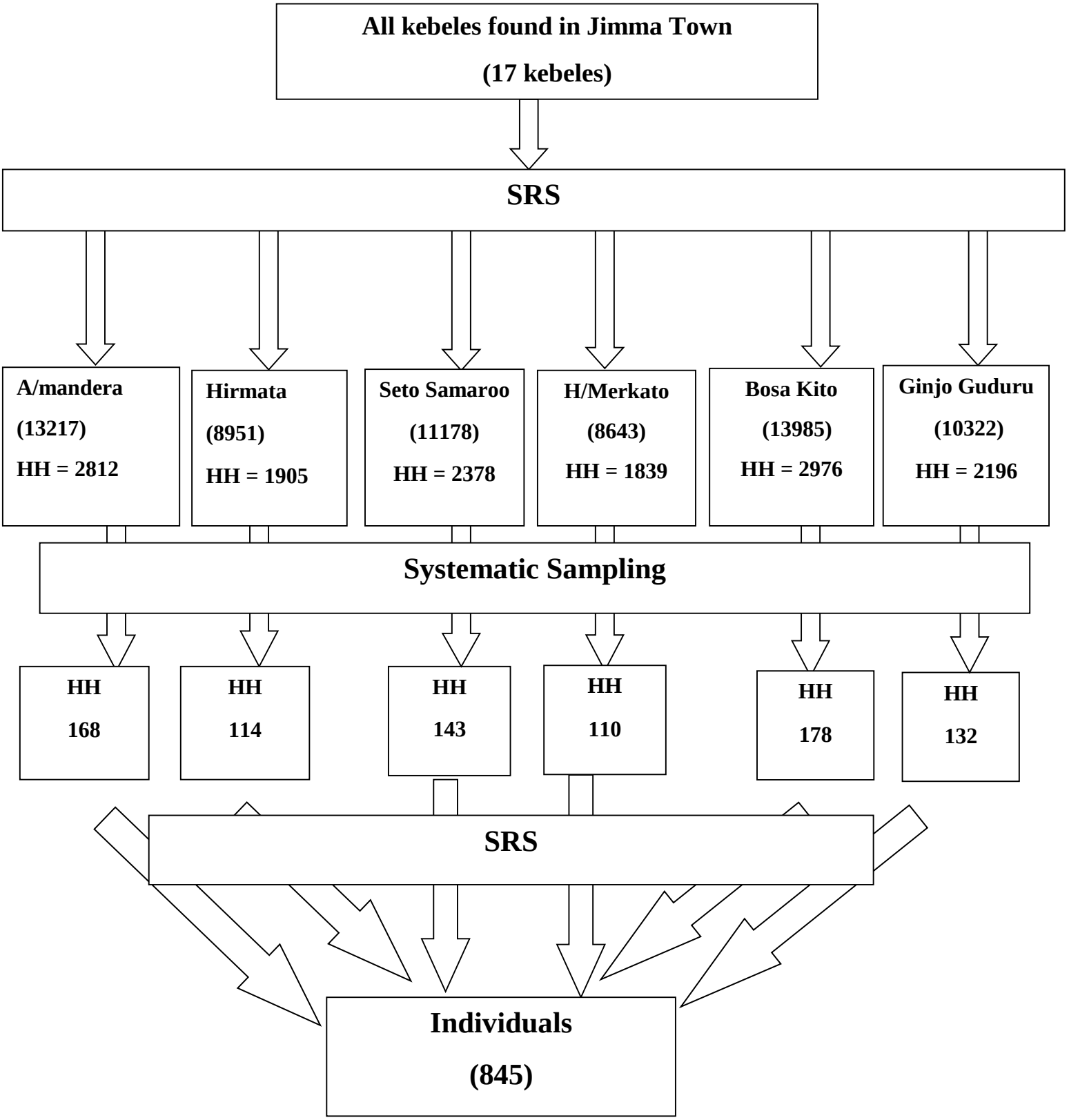

Figure 2: Schematic presentation of sampling procedure of study subjects, 2016.

4.6. Variables

4.6.1. Dependent Variable

- Central / Abdominal Obesity

4.6.2. Independent Variables

- **Socioeconomic status**
    - ❖ Age
    - ❖ Sex
    - ❖ Religion
    - ❖ Ethnicity
    - ❖ Educational status
    - ❖ Marital status
    - ❖ Occupation
    - ❖ Wealth
    - ❖ Number of individuals living in the household
- **Behavioral Factors**
    - ❖ Tobacco use
    - ❖ Alcohol consumption
    - ❖ Khat chewing
- **Dietary Intake**
    - ❖ Skipping breakfast
    - ❖ Dietary diversity score
    - ❖ Snacking
    - ❖ Eating out of home
- **Physical Activity**
    - ❖ Working activities
    - ❖ Travel to and from places
    - ❖ Recreational activities
    - ❖ Sedentary behaviors

4.7. Data Collection Procedure

All the participants were interviewed for their socio-demographic information, dietary intakes, physical activity and health risky behavior. Anthropometric measurement was taken at the end of the interview. The data were collected by six diploma nurses and supervisors were three MSc students. Two data collectors and one immediate supervisor were assigned to each kebele.

4.7.1. Data Collection Instrument

Structured interviewer administered questionnaire was adapted from WHO-STEP wise structured questionnaire for chronic non-communicable disease having socio-demographic information, dietary intakes, physical activity and health risky behavior questions and anthropometric measurement was used.

Assessment of dietary habit

A food frequency questionnaire (FFQ) modified from WHO-STEP wise approach was used to assess the dietary habits of the participants. The FFQ consisted of a list of food groups. Participants were asked to report their frequency of consumption number of times consumed weekly. One usual week was evaluated from the past 12 months(3). For dietary diversity, a simple count of the number of food groups was calculated. The DDS was ranked in to two groups, six and over (high) and less than six (low) food groups consumed in the usual days of a week (61).

Assessment of physical activity level

The global physical activity questionnaire (GPAQ) developed by WHO for physical activity surveillance was used to assess the physical activity pattern among selected individuals in three domains including activity at work, travel to and from places and recreational activities and sedentary behavior through face-to-face interview of the respondent in the study area. The activity level of the study participants were evaluated according to the standard WHO total physical activity calculation guide and the level of total physical activity was categorized as physically active and physically in-active (3).

Anthropometric Measurements

Waist circumference was measured on a standing position midway between the lower rib margin and the anterior superior iliac crest in the horizontal plane using a flexible plastic metric tape at the nearest 0.1 cm. The measurement was taken when the participant is at the end of the gentle expiration, after taking a deep inhalation with the tape snug but ensuring it is not compressing the skin (3).

4.8. Operational Definition of Terms

Adult: Individuals age found between 18 and 64years.

Alcohol: Current users were those who drink alcohol in the past 12 month at least 3 days per week and above (62).

Central obesity: Measure of waist circumference for European region recommended by IDF for male >=94 cm and female >=80 cm (11).

Normal central obesity: Measure of waist circumference <94 cm for male and <80 cm female.

Khat chewing: Current khat chewers were considered as if they had been chewing chat for more than 6 months and chew chat within 30 days preceding the study. Ever-chewers are as those who chew khat and didn't chew within 30 days preceding the study. Those who have never chewed khat as non-chewers (63).

High DDS: Consuming 6 & over food groups.

Low DDS: Consuming less than 6 food groups (61).

Physically active: If the total physical activity MET minute/week is at least 600 MET-minutes.

Physically in-active: If the total physical activity MET minute/week is < 600 MET-minutes (3).

Smoking: A daily smoker was defined as one who smoked at least 1 cigarette per day (at least 7 cigarettes per week). Those who smoked less than 1 cigarette per day or 7 cigarettes per week were designated as occasional smokers. Current smokers included daily and occasional smokers. Those who had smoked at least 1 cigarette per day for at least 6 months but had quitted were designated as ex-smokers, and those who had never smoked at all were designated as never smokers (64).

Snack: Any kind of food taken additionally between the three main meals.

4.9. Data Processing and Analyses

The data were checked, coded and entered using Epi-Data version 3.1 and exported to SPSS windows version 20 for cleaning and analyses. The analyses was conducted in two steps. First, descriptive statistics was conducted and the results were presented using figures, tables and charts.

Second, bivariate analyses were carried out to see the association between the dependent and each independent variable, Variables having a *P* - value <0.25 were selected to be a candidates for multivariable analyses. In the multivariable analyses variables having *P*-values < 0.05 were declared as statistically significant. The Hosmer and Lemeshow's goodness-of fit test was considered to check model fitness. Multicollinearity was also checked by checking whether the standard error was < 2, VIF<5, tolerance >0.1 matrix and all tests were two sided.

4.10. Data Quality Control

The data quality was ensured during tool development, data collection, coding, entry and analysis. The questionnaire was first prepared in English then translated to Amharic and Afan Oromo languages and re-translated to English before data collection and different translator was used to keep the consistency of the questionnaire. Waist circumference was taken using standard method. The measurement was taken in duplicate and the average value was taken. A three days training was given for the data collectors and the instrument was tested on 5% or 42 of the respondents in Bechobore kebele to prevent data contamination prior to the study. Supervisors made on the spot checking and review of all the completed questionnaires to ensure completeness and consistency of the information collected and incorrectly filled or missed questionnaire was given back to the respective data collectors for correction. Supervisors were also re-took measurements on 10% of the study participants from each data collectors to check reliability of the measurements.

The value for being centrally obese was classified based on the measure of waist circumference for European region (IDF) for Males >=94 cm and females >=80 cm (11).

After checking the assumptions wealth index was computed by using principal component analysis and the first factor that explains the largest variation was taken and ranked divided into tertiles.

4.11. Ethical Consideration

After approval of the proposal, ethical clearance and formal letter was obtained from research ethics committee of Jimma University. The necessary permission was obtained from Jimma Town Health Bureau Office, administrative office and from the selected kebele offices. Participant in selected house was given a written consent. Selected individuals were asked for their permission and those who refuse to participate were excluded. Participants were assured that their name will not be stated, data will be kept confidential and anonymous and it will be used only for research purpose. They were also informed that they will not be forced to answer the entire question and they can withdraw at any time if they do not want to participate.

4.12. Dissemination Plan

The findings of this study is planned to be submitted to Jimma University College of Health Sciences and Jimma Town Health Bureau. The findings is also planned to disseminate to different stakeholders that have a contribution to improve the country health situation. Finally, effort will be made to present the result in various seminars and workshops and publish in scientific journals.

5. Results

5.1. Socio-demographic characteristics of the study subjects

Out of 845 sampled participants, 806 participated in the study making a 95.4% of response rate. Among the 806 study participants, three hundred and sixty six (45.4%) were males and four hundred and forty (54.6%) were females. The median age (±SD) of the study population was 30 (±10.4) years (Table 1).

Table 1: Demographic characteristics of the respondents among adults in Jimma Town, 2016.

Variables		Number	%
Sex	Female	440	54.60
	Male	366	45.40
Age	18-24	154	19.10
	25-34	370	45.90
	35-44	136	16.90
	45-54	104	12.90
	55-64	42	5.20
Ethnicity	Oromo	380	47.10
	Amhara	164	20.30
	Gurage	86	10.70
	Kafa	52	6.50
	Yem	46	5.70
	Dawro	36	4.50
	Tigre	18	2.20
	Others[1]	42	2.90
Educational status	No formal schooling	38	4.70
	Primary	184	22.80
	Secondary	222	27.50
	College and above	362	44.90
Marital status	Married	418	51.90
	Single	292	36.20
	Divorced	54	6.70
	Widowed	42	5.20
Religion	Orthodox	328	40.70
	Muslim	260	32.30
	Protestant	188	23.30
	Others[2]	30	3.70
Occupation	Gov't employee	312	38.70
	Non Gov't employee	272	33.70
	Student	74	9.20
	Unemployed	148	18.40
Wealth Index	Low	264	32.80
	Middle	274	34.00
	High	268	33.30
Household size	<=5	676	83.90
	>5	130	16.10

1=Wolayeta, Silte 2= Catholic, Waqefeta

5.2. Prevalence of central obesity

Out of the total sample, one hundred ninety eight individuals were centrally obese giving prevalence of 24.6% (21.5-27.7). It was 10.4% and 36.4%, in men and women, respectively. Six hundred and eighty (75.4%) had normal central adiposity (Figure 3).

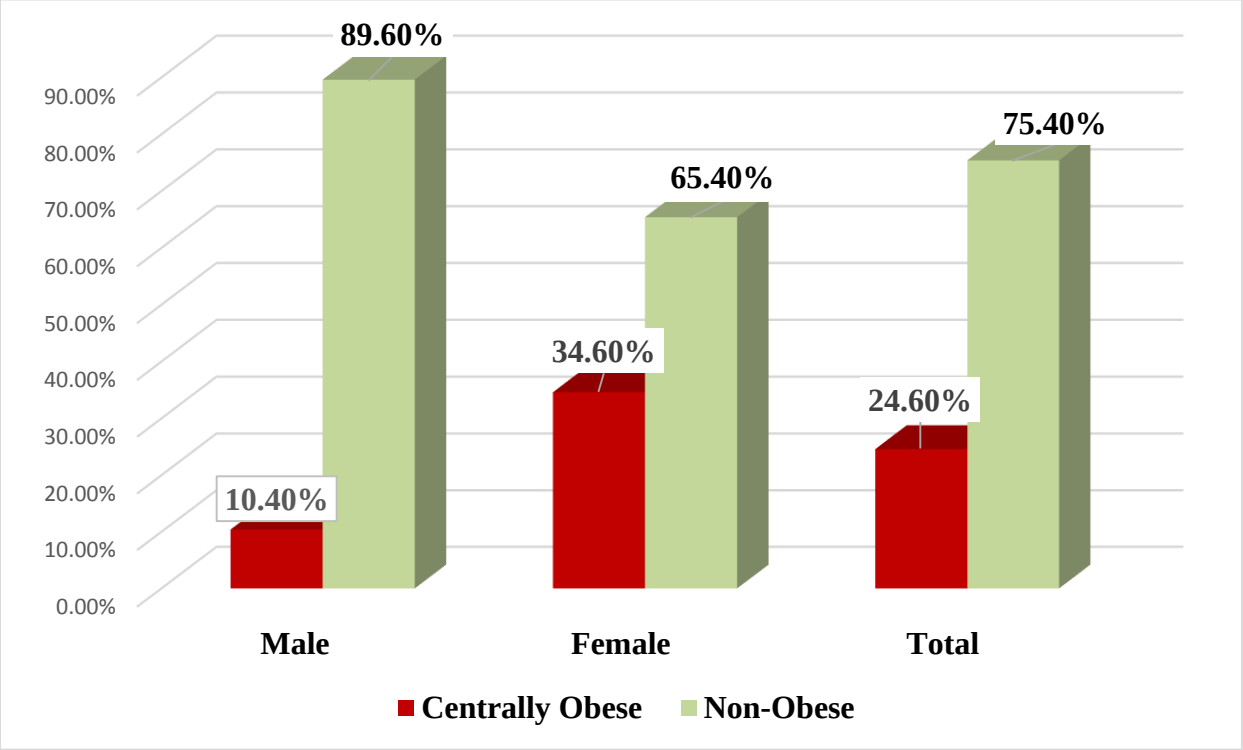

Figure 3: Prevalence of central obesity among adults in Jimma Town, 2016.

5.3. Factors associated with central obesity

Bivariate and multivariable logistic regression analysis was done using backward method to isolate factors associated with central obesity. On the bivariate analyses age, sex, educational status, ethnicity, marital status, occupation, household size, tobacco use, alcohol consumption, khat chewing, dietary diversity, snacking, eating out of home, physical activity level and wealth became candidates for entry into multivariable analyses (Table 2).

Table 2: Binary logistic regression model predicting the likelyhood of central obesity among adults in Jimma Town, 2016.

Variables		Central obesity			
		Obese	Non obese	COR	*P*
Age	18-34	90	434	1	<.001
	35-44	50	86	2.80(1.85-4.25)	<.001
	45-54	42	62	3.27(2.08-5.14)	<.001
	55-64	16	26	2.97(1.53-5.76)	.001
Sex	Male	38	328	1	
	Female	160	280	4.93(3.35-7.27)	<.001
Wealth	Low	32	232	1	<.001
	Middle	70	204	2.49(1.57-3.94)	<.001
	High	96	172	4.05(2.59-6.32)	<.001
Occupation	Gov't employee	76	236	1	<.001
	Non Gov't employee	66	206	0.99(0.68-1.45)	.979
	Student	2	72	0.07(0.02-0.36)	.001
	Unemployed	54	94	1.79(1.17-2.72)	.007
Marital status	Married	118	300	1	<.001
	Single	38	254	0.38(0.25-0.57)	<.001
	Widowed	22	20	2.79(1.47-5.31)	.002
	Divorced	20	34	1.49(0.83-2.70)	.183
Educational status	No formal schooling	12	26	1	.025
	Primary	34	150	0.49(0.23-1.07)	.074
	Secondary	68	154	0.96(0.46-2.01)	.907
	College and above	84	278	0.66(0.32-1.35)	.253
Alcohol use	No	106	406	1	
	Yes	92	202	1.58(1.14-2.19)	.007
Smoking	Never	184	500	1	.002
	Ever	4	38	0.29(0.10-0.81)	.019
	Current	10	70	0.39(0.19-0.77)	.007
Khat chewing	Never	138	332	1	.001
	Ever	4	12	0.80(0.25-2.53)	.706
	Current	56	264	0.51(0.36-0.72)	<.001
Skipping BF	Never	106	320	1	.318
	Once	16	76	0.64(0.36-1.14)	.127
	Twice	40	102	1.18(0.77-1.81)	.438
	More than Three times	36	110	0.99(0.64-1.53)	.957
Dietary Diversity	Low	49	84	1	
	High	149	524	0.48(0.33-0.73)	<.001
Snack	No	94	366	1	
	Yes	104	242	1.67(1.21-2.31)	.002
Physical activity level	Active	104	482	1	
	Inactive	94	126	1.79(1.29-2.56)	.001

On multivariable logistic analyses, after adjusting for other variables females were 11 times more likely to be centrally obese than males [AOR = 11.443(95%CI: 6.534-20.181)]. Central obesity increased with increase in age. Age group 55−64 years had 3.6 times more likely to be obese than the age group between 18-34 years [AOR = 3.576(95%CI: 1.397-9.153)]. Those who were at high rank of wealth were 3 times more likely to be centrally obese than those who were found in low wealth rank [AOR = 3.242(95%CI: 1.808-5.811)]. Similarly, alcohol drinkers were 2 times more likely to be centrally obese than non-regular daily drinkers [AOR = 2.177(95%CI: 1.390-3.409)] and individuals those who were eating a diversified diet were 48% less likely to be centrally obese than those who were eating a less diversified diet [AOR = 0.517(95%CI: 0.310-0.861)]. Likewise, individuals who had snack were 1.6 times more likely to be centrally obese than those who didn't had snack [AOR = 1.602(95%CI: 1.072-2.394)]. Physically-inactive individual were 2 times more likely to have central obesity than physically-active ones [AOR = 2.327(95%CI: 1.437-3.767)] (Table 3).

Table 3: Multivariable logistic regression model predicting the likelyhood of central obesity among adults in Jimma Town, 2016.

Variables		Central obesity			
		Obese	Non-obese	COR	AOR
Age	18-34	90	434	1	1
	35-44	50	86	2.80(1.85-4.25)	**3.26(1.87-5.69)***
	45-54	42	62	3.27(2.08-5.14)	**3.28(1.71-6.29)***
	55-64	16	26	2.97(1.53-5.76)	**3.58(1.39-9.15)***
Sex	Male	38	328	1	1
	Female	160	280	4.93(3.35-7.27)	**11.44(6.53-20.18)***
Wealth	Low	32	232	1	1
	Middle	70	204	2.49(1.57-3.94)	**2.03(1.15-3.58)***
	High	96	172	4.05(2.59-6.32)	**3.24(1.89-5.81)***
Educational status	No formal schooling	12	26	1	1
	Primary	34	150	0.49(0.23-1.07)	0.47(0.17-1.33)
	Secondary	68	154	0.96(0.46-2.01)	1.58(0.57-4.39)
	College and above	84	278	0.66(0.32-1.35)	1.86(0.62-5.58)
Marital status	Married	118	300	1	1
	Single	38	254	0.38(0.25-0.57)	0.72(0.39-1.31)
	Widowed	22	20	2.79(1.47-5.31)	1.44(0.59-3.54)
	Divorced	20	34	1.49(0.83-2.70)	1.93(0.88-4.21)
Occupation	Gov't employee	76	236	1	1
	Non Gov't employee	66	206	0.99(0.68-1.45)	1.13(0.66-1.93)
	Student	2	72	0.0980.02-0.36)	0.15(0.02-1.26)
	Unemployed	54	94	1.78(1.17-2.72)	1.19(0.62-2.30)
Khat chewing	Never	138	332	1	1
	Ever	4	12	0.80(0.25-2.53)	0.93(0.21-4.02)
	Current	56	264	0.51(0.36-0.72)	1.01(0.56-1.82)
Smoking	Never	184	500	1	1
	Ever	4	38	0.29(0.10-0.81)	1.14(0.29-4.44)
	Current	10	70	0.39(0.19-0.77)	2.34(0.91-6.01)
Alcohol use	No	106	406	1	1
	Yes	92	202	1.58(1.14-2.19)	**2.18(1.39-3.41)***
Dietary diversity	Low	49	84	1	1
	High	149	524	0.49(0.33-0.73)	**0.52(0.31-0.86)***
Snack	No	94	366	1	1
	Yes	104	242	1.67(1.21-2.31)	**1.60(1.07-2.39)***
Physical activity	Active	104	482	1	1
	Inactive	94	126	1.79(1.25-2.55)	**2.33(1.44-3.77)***

*** =Variables having statistically significant association (p-value <0.05), 1=reference group**

NB. Hosmer and Lemeshow's goodness-of-fit test has p-value of 0.67.

6. Discussion

The prevalence of central obesity in this study was 24.6 (21.5-27.7). The prevalence is higher as compared to a study done in Addis Ababa (19.6%) in 2011 (33) and the study done in Benin (15.48%) (43). This might be due to the fact that there is a considerable difference in the study periods, place and operational definition they use for central obesity. The finding also shows that the prevalence of central obesity in women is higher than in men (10.4% in men and 36.4% in women), respectively and this is supported by a study done on a group of Turkish adults with prevalence of central obesity 41.4% in women and 21.6% in men (39) and Northeast China (43.9% in women and 31.1% in men) (40). The increasing prevalence of central obesity in this population implies an increase in the metabolic syndrome and CNCDs (65), Which can be characterized by transition of low income countries undergoing major shifts in dietary and physical activity patterns (66). Eventually that predisposes individuals to extra cost related to adverse health outcomes and becoming a shackle for the development endeavor to alleviate poverty.

Women's were 11.4 times more likely to be centrally obese as compared to men [AOR=11.443(95%CI: 6.534-20.181)]. The study done in Benin also showed that women's were 3.5 times more likely to be centrally obese than men (43). The reason for the higher prevalence of central obesity on women could be that men engage in more strenuous activities than females. Moreover, in developing countries more men are employed and are engaged in more physically demanding jobs, while women are mainly housewives, with less activity to engage in. In addition, hormonal change at the time of menopause and fat that is regained after the postpartum period relatively more is stored in central part of the body additionally the cultural way of comforting women after giving birth specially in Ethiopia are the other reasons that will cause women to be centrally obese (67).

Waist circumference measurement from this study shows that central obesity is positively associated with age. The age group between 55-64 years were 3.6(95%CI: 1.397-9.153) times more likely to have central obesity as compared with those in the age group between 18-34 years. This is similar finding with the studies done in Northeast China (40) and Northern Iran (41). Such a pattern was observed in the relation between central obesity and age could be partly explained by the decrease in physical activity level which will cause a positive energy balance. In addition,

there will be a decreased basal metabolic rate with an increase in the age of individuals and hormonal changes could be some of the reasons.

Regarding the relationship between wealth status and obesity, result showed a direct association between wealth and central obesity. Individuals in the high wealth rank were 3(95%CI: 1.808-5.811) times more likely to have central obesity than those who were in the low wealth rank. This finding is similar with the study done among adults of Indians (45) and adults of Tunisia and Algeria (68). This reason could be people who have higher income may change in lifestyles and consume high energy meals with low diversity, use motorized way of mobility, while those in low wealth group are involved in an increased physical activity due to the nature of occupations and consume low energy and high fiber foods as it is less preferred and cheap in the developing country's context (30). The other possible reason might be an epigenetic effect of malnutrition driving the occurrence of central obesity due to stunting during the growing periods of life compounded with the an access to higher energy foods due to their better economy at the moment (69).

The result of this study shows that individuals with regular alcohol consumption were 2(95%CI: 1.390-3.409) times more likely to have central obesity than their counters. A similar finding was observed in a study done among Korean adults in 2010 (46), Tamale, Ghana (47) and a study done in Spain (48). The reason for this is that alcohol is an extra energy which adds to the total daily energy intake by itself and inhibition of fat oxidation occur as a consequence of the anti-lipolytic properties of metabolites from alcohol degradation thereby favoring lipid storage and hence promoting an increased risk of developing obesity (70).

In this study, eating a diversified diet decreases the odds of central obesity by 48% than eating food low in diversified diet [AOR=0.517(0.310-0.861)]. Similar finding was observed from the study in United State (51) which shows the inverse association of central obesity and DDS. The reason for this could be that DDS shows the adequacy of nutrients used by the individual which will help one to consume different kinds of food that enable to have a balanced diet and hinder from consuming the same high energy food and it is also possible that dietary variety, quality and proportionality function synergistically to reduce excess adiposity. However, there are also studies that showed a positive association with some reasons such as when a diet is composed of foods

that differ on sensory characteristics such as color flavor and shape may cause hyperphagia through increasing food intake due to the presence of more variety in a diet, and that greater dietary variety is associated with increased body weight and subsequent obesity (52). Though, this is potentially due to heterogeneity in dietary measurement (71).

Snack users had also 1.6(95%CI: 1.072-2.394) times more increase in the likelihood of central obesity. In this study snacking is positively associated with central obesity. Similarly the study in United States showed as the eating frequency increases regardless of the amount of energy central obesity also increases (54). Beyond the additionally eating frequency from the regular food which adds an energy, the type of food that is eaten during snacking mostly are energy dense foods such as caloric beverages and fried foods and low in fiber (55) complementary with alcohol use and physical inactivity it will leads to weight gain and obesity. The role of eating frequency in obesity development is debated, it is also argued that snacking may increase diet quality by increasing intakes of fruit, whole grains and fiber which could promote satiety and reduce risks for obesity (56). However, the reason for the inconsistent association between central obesity and snacking status could be due to the variation in the definition of snacking, difference in the frequency and kind of foods eaten for snacking, which was not measured in this study and the type of study design used.

Physical activity is another factor that had been explored in this study. The finding showed that physically inactive individuals were 2(95%CI: 1.437-3.767) times more likely obese than physically active ones. The finding is consistent with the study done in Ghana (59) and Nigeria (27). The reasons could be physical inactivity can leads to positive energy balance and accumulation of fat around the waist (visceral area) and once obesity was established, habitual physical activity remained extremely low, denoting low energy expenditure. In addition, urbanization characterized by increased television ownership and viewing, decreased mobility caused by using motorized way of transportation and consuming less diversified diet which also includes eating energy dense foods and refined sugars for snacking complemented by less energy demanding jobs in the urban area. Due to the cultural perceptions regarding central obesity, in most parts of Africa, individuals associate being centrally obese with prestige, happiness and good healthy living life are some of the possible reason for positive energy balance caused by physical

inactivity (72). However, it is also indicated that there is a preferential loss of fat from the central regions of the body by physical exercise (58).

As central obesity is a strong predictor of the risk of metabolic syndrome and chronic non-communicable diseases, the findings imply the need for a strong nutrition education on life style modifications both at the community and health facility level using existing community level actors including health extension workers, health development army and thorough multi-sectoral involvement.

7. Limitation

Due to the nature of the study which deals with individuals personal issues sometimes obtaining an honest response was difficult because of social desirability bias although an effort was made to minimize it during data collection. There could be differences in central obesity by season which this study was not able to assess due to its design. The study was also unable to do biochemical and other advanced method of measuring central adiposity.

Strength

The information was gathered from a community based data and has a high response rate. Principal component analyses was used for wealth index.

8. Conclusion

- The prevalence of central obesity among adults in Jimma Town was one in four (24.6).
- The prevalence was higher in females.
- Central obesity was significantly influenced by a number of factors including age, sex, wealth, alcohol consumption, snacking, eating diversified diet and physical inactivity.

9. Recommendation

For Jimma Town health office and other stakeholders

The Town Health Office should consider the increased prevalence of central obesity and should strengthen the established chronic NCDs prevention strategy by using a combination of high risk approach and general population approaches.

The Town Health Office should strengthen effort to create awareness on chronic NCDs cause by central obesity through health extension professionals.

The Town Health Office in collaboration with sports commission and responsible stakeholders should promote the community to increase their physical activity level.

For the media

Different avenues including radio, informal gatherings and other social media should be used to create awareness on the increased risk of central obesity among women as to reduce the risk of chronic NCDs burden.

For the community

The community should aware the problem of central obesity caused by the physical inactivity, eating monotones diet and regular consumption of alcohol.

For the researchers

There is a need for longitudinal study to assess the determinant factors of central obesity.

The population awareness to metabolic syndrome and cardiovascular disease risk factors should be studied.

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Annex

Questionnaire

Jimma University: Collage of Health Sciences, Department of population and family health; Human nutrition unit**.**

Questionnaire developed to assess factors associated with Central Obesity in Jimma town 2016.

Verbal Consent

Greeting….

My name is _____ I am working as data collector in a study conducted by Jimma University post graduate student on prevalence and associated factors of Central Obesity in Jimma Town. I would like to ask you a few questions about your personal characteristics; yours eating habit, your physical exercise, risk related behaviors and your willingness for whist circumference measurements. This will help us to improve the prevention and control activities of Central obesity by the information you provide us. Your response is very important and highly appreciable. I expect the interview may take about 15-30 minutes. You do not need to provide your name. Please be assured that all the information gathered will be kept strictly confidential. You can prefer not to respond to all or some of the questions and you can stop the interview at any time. Are you willing to participate in our study? Thank you for your cooperation!!!

Verbal consent obtained ..... Yes ☐ No ☐

Date of data collection _____ / _____ / _____
(Ethiopian calendar: Day Month Year)

Name of Kebele _____ HH No. _____Questionnaire code _____

Name of data collector_____ Sign_____

Name of supervisor_____ Sign _____

FIRST, I WOULD LIKE TO ASK YOU SOME QUESTIONS ABOUT YOURSELF.

A. DEMOGRAPHIC INFORMATION

A0. Unique Identification Number	**ID**_____
A1. SEX OF RESPONDENT *Circle ONLY ONE answer*	**Male ……..1** **Female ……0**
A2. Ethnic Group	**1. Amhara 2. Oromo 3. Gurage 4. Tigre** **5. Dawro 6. Yem 7. Kafa 8. Wolaita** **9. Other(specify)**_____
A3. **HOW OLD ARE YOU?** *Age in years completed at the last birthday*	_____**Years**
A4. Religion *Circle ONLY ONE answer*	**1. Orthodox** **2. Protestant** **3. Moslim** **4. Catholic** **5. Other specify**_____
A5. Which of the following best describes your **main work status** over the last 12 months? *Circle ONLY ONE answer*	**1.** Government employee **2.** Non-government employee **3.** Self-employed **4.** Non-paid **5.** Student **6.** Homemaker **7.** Retired **8.** Unemployed
A6. **WHAT IS YOUR MARTIAL STATUS?** *Circle ONLY ONE answer*	**1. Married** **2. Single-never married** **3. Widowed** **4. Divorced** **5. Separated**
A7. What is the **highest level of education** you have completed? ***.Circle ONLY ONE answer.***	**1. No formal schooling** **2**. **Primary(1-8)** **3. Secondary(9-12)** **4. College and above**
A8. How many people are there in your household?	_____Number of people

B. BEHAVIOURAL MEASUREMENTS

Tobacco Use Practice

B1. Have you ever smoked any tobacco products such as cigarettes, cigars, shisha or pipes?	**1. Yes 0. No**
B2. Do you **currently** smoke any **tobacco** products, such as cigarettes, cigars, shisha or pipes?**(*Circle ONLY ONE answer)***	**1. Yes 0. No**
B3. Do you currently smoke tobacco products **daily**?	**1. Yes 0. No**
B4. If Yes to B2, how old were you when you **first started** smoking?	_____**Years**
B5. If yes, which of the following best describes your smoking status?	1. Current smoker 0. Ex-smoker
B6. If B5 is 1, for how long you have been smoking?	_____**Years**
B7. On average, **how many cigarette sticks** do you smoke **each day/ week?**	_____No. of sticks/ day _____No. of sticks/week
B8. If B5 is 0, age at the initial onset of Smoking and Age at which smoking was quit?	_____started smoke _____stopped smoke
B9. Average number smoking per day at time of regular Smoking (**Ex-smoker**).	_____ **number of smoking**

Alcohol Use Practice

B10. Have you ever consumed any alcoholic drink?	1.Yes 0. No
B11. Have you consumed any alcohol within the **past 12 months**? **(*Circle ONLY ONE answer)***	**1. Yes 0. No**
B12. During the past 12 months, **how frequently** have you had at least one standard alcoholic drink? **(*Circle ONLY ONE answer)***	**1. Daily** **2. 5-6 days per week** **3. 3-4 days per week** **4. 1-2 days per week** **5. 1-3 days per month** **6. Less than once a month**

B18. During each of the **past 7 days**, how many standard drinks did you have each day?	**Monday** _____ **Friday** _____ **Tuesday** _____ **Saturday**_____ **Wednesday**_____ **Sunday** _____ **Thursaday**_____

KHAT Chewing

B19. Do you chew Khat?	**1. Yes 0. No**
B20. If Yes, In a typical week how many days do you chew Khat?	_____**Days**
B21. For how many years you chewed khat?	_____**years**
B22. Have you chewed khat in the last one month?	1. Yes 0. No

Dietary practices:

The next questions ask about the fruits and vegetables that you usually eat. As you answer these questions please think of a typical week in the **last year**.

B23. In a typical week, on how many days do you **eat fruit**?	_____**Days**
B24. In a typical week, on how many days do you **eat vegetables**?	_____**Days**
B25. In a typical week, on how many days do you **eat protein source foods from animals (**beef, lamb, chicken, fish, egg**)**?	_____**Days**
B26. In a typical week, on how many days do you **eat protein source foods from plants (**pea, bean, chickpea, nuts, ground nuts**)**?	_____**Days**
B27. In a typical week, on how many days do you **eat energy source foods (**cereal grains, energy rich tubers such as potato, sweet potatoes**)**?	_____**Days**
B28. In a typical week, on how many days do you **eat** milk and milk products (milk, cheese, Yogurt)?	_____**Days**
B29. In a typical week, on how many days do you **eat** fats (fats and oils)?	_____**Days**
B30. In a typical week, on how many days do you eat /drink discretionary calories (soft drinks, sugar, chocolates, honey…)	_____**Days**
B31. In a typical week, on how many days do you eat foods fried /baked in an oil (eg. Chips, Biscuits, crackers, cakes)	_____**Days**

B32. On average, how many meals per week do you eat that were not prepared at a home? By meal, I mean breakfast, lunch or dinner.	_____No of meals
B33. 'Do you skip breakfast?'	**1. Yes 0. No**
B34. How often do you skip breakfast within a week?	1. Once 2. Two times 3. Three or more times
B35. Do you eat snacks?	**1. Yes 0. No**

Physical Activity

Next I am going to ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person.

C1. Does your work involve vigorous-intensity activity that causes large increases in **breathing or heart rate like** *[carrying or lifting heavy loads, digging or construction work]* for at least 10 minutes continuously?	**1. Yes 0. No**
C2. In a typical week, on how many days do you do vigorous-intensity activities as part of your work?	_____**Days**
C3. How much time do you spend doing vigorous-intensity activities at work on a typical day?	____**Hours** ___**Minutes**
C4. Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking *[or carrying light loads]* for at least 10 minutes continuously?	**1. Yes 0. No**
C5. In a typical week, on how many days do you do moderate-intensity activities as part of your work?	_____**Days**
C6. How much time do you spend doing moderate-intensity activities at work on a typical day?	____**Hours** ___**Minutes**
Travel to and From Places The next questions exclude the physical activities at work that you have already mentioned. Now I would like to ask you about the usual way you travel to and from places. For example to work, for shopping, to market, to place of worship. *[Insert other examples if needed]*	
C7. Do you walk or use a bicycle *(pedal cycle)* for at least 10 minutes continuously to get to and from places?	**1. Yes 0. No**
C8. In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?	_____**Days**

C9. How much time do you spend walking or bicycling for travel on a typical day?	**____Hours ___Minutes**

Recreational activities

The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness and recreational activities (leisure).

C10. Do you do any vigorous-intensity sports, fitness or recreational *(leisure)* activities that cause large increases in breathing or heart rate like *[running or football]* for at least 10 minutes continuously?	**1. Yes 0. No**
C11. In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational *(leisure)* activities?	**_____Days**
C12. How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?	**____Hours ___Minutes**
C13. Do you do any moderate-intensity sports, fitness or recreational *(leisure)* activities that cause a small increase in **breathing or heart rate such as brisk walking**, *[cycling, swimming, and volleyball]* for at least 10 minutes continuously?	**1. Yes 0. No**
C14. In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational *(leisure)* activities?	**_____Days**
C15. How much time do you spend doing moderate-intensity sports, fitness or recreational *(leisure)* activities on a typical day?	**_____Hours ___Minute**

Sedentary Behavior

The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent sitting at a desk, sitting with friends, traveling in car, bus, taxi, reading, playing cards or watching television, but do not include time spent sleeping

C16. How much time do you usually spend sitting or reclining on a typical day? **____Hours ____Minutes**

D. HOUSEHOLD WEALTH

Does the household have any of the following properties? **(Circle)**		**Yes**	**No**
D1	Functioning CD player	**1**	**0**
D2	Functioning Flat screen Television	**1**	**0**
D3	Cylinder stove	**1**	**0**
D4	Refrigerator(fridge)	**1**	**0**
D5	Electric stove	**1**	**0**

D6	Bicycle	**1**	**0**
D7	Motor Cycle	**1**	**0**
D8	Cart/Gari	**1**	**0**
D11	Sofa	**1**	**0**
D12	Spring mattress	**1**	**0**
D13	Car	**1**	**0**
D14	Bajaj	**1**	**0**
D15	Taxi	**1**	**0**
D16	Own house	**1**	**0**
D17	Ipad	**1**	**0**
D18	Video camera	**1**	**0**
D19	Digital Camera	**1**	**0**
D20	Washing machine	**1**	**0**

E. PHYSICAL MEASUREMENTS

Anthropometry Measurements	
E1. Waist Circumference	WC(cm) ☐☐ - ☐_____
	WC(cm) ☐☐ - ☐_____

Declaration

Assurance of Principal Investigator:

I, the undersigned, agree to accept responsibility for the scientific Ethical and technical conduct the research project and for provision of required progress reports as per terms and conditions the health sciences in effect at the time of grant are forwarded the result of this application.

Name of the student: __Fitsum Endale____

Date_____ Signature _____

Approval of the advisors:

This thesis has been submitted with my approval as University advisor.

Name of the first advisor: ___Prof. Dr. Tefera Belachew_____

Signature _____ Date _____

Name of the second advisor: __Mr. Aderajew Negussie_____

Signature _____Date _____

Date of submission: _____