FACTORS ASSOCIATED WITH OVERWEIGHT AND OBESITY IN ADULTS AT GILGEL GIBE FIELD RESEARCH CENTER, SOUTHWEST ETHIOPIA: A SECONDARY ANALYSIS OF DATA.

By;

GIRMA YAZEW TADESSE (BSc)

A thesis submitted to the College of Public Health and Medical Sciences of Jimma University, department of Epidemiology in partial fulfillment for the requirement of master's degree in Public Health in Epidemiology (MPHE).

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Jimma, Ethiopia.

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BY:

GIRMA YAZEW TADESSE (BSc)

ADVISORS:

FESSAHAYE ALEMSEGED (MD, MPHE; ASSOCIATE PROFESSOR)

TSEGAYE TEWELDE (BSc, MPHE)

June, 2013

Jimma, Ethiopia.

ABSTRACT

Background: Overweight and obesity increase the risk of premature death and cause serious chronic conditions that reduce the overall quality of life and decrease productivity. Studies on factors associated with overweight and obesity are lacking. Determining the factors associated with overweight and obesity has paramount importance in health policy making and health care delivery system.

Objective: The objective of this study is to assess factors associated with overweight and central obesity in adults at Gilgel Gibe Field Research Center.

Methods and Materials: Source of data was from a community based cross-sectional study conducted at Gilgel Gibe Field Research Center from late September 2008 to end of January 2009 using WHO stepwise of stratified random sampling method. All study participants of age 15 to 64 years, who had anthropometric measurements (weight, height, waist and hip circumferences) were included in this study. Data were entered into the computer using EPI-Data version 3.1 and analyzed by SPSS Windows version 16.0 software. Binary logistic regression analysis was carried out to see the association between variables and a statistically significant association was considered at p-value less than 0.05.

Results: Respondents of age, 45-54yrs, 55-64yrs and female sex were more likely to develope an overweight and central obesity [(AOR= 5.0; 95%CI, 1.28-19.36), (AOR= 8.3; 95%CI, 2.080-33.20), (AOR= 3; 95%CI, 1.37-6.98)] and [(AOR= 2.1; 95%CI, 1.45-3.06), (AOR= 2.5; 95%CI, 1.71-3.670), (AOR= 12; 95%CI, 4.27-20.46)] respectively. Higher educational status, urban residence, employee and merchant were more likely to be overweight [(AOR= 6.2; 95%CI, 2.12-17.95), (AOR= 4.2; 95%CI, 2.170-8.180), (AOR= 5.9; 95%CI, 1.66-21.03) and (AOR= 5.4; 95%CI, 1.65-14.8)], but higher educational status and chewing chat were less likely to became central obesity [(AOR= 0.36; 95%CI, 0.210-0.736) and (AOR= 0.44; 95%CI, 0.359-0.548)] respectively.

Conclusion: Older age, female sex and higher educational status were independent predictors of overweight and central obesity. Also current smoker and chewing chat for central obesity and merchant, employee and urban residence for overweight were independent predictors. Woreda Health Office should encourage health facilities to promote prevention and control of overweight and central obesity among females and urban residents.

Key words: *Overweight, Central obesity, Gilgel Gibe Field Research Center.*

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LIST OF ABBREVIATIONS

AOR	Adjusted Odds Ratio
BMI	Body Mass Index
CNCD	Chronic Non Communicable Diseases
DALY	Disability Adjusted Life Years
EDHS	Ethiopian Demographic and Health Survey
GGFRC	Gilgel Gibe Field Research Center
ICMR	Indian Council of Medical Research
JU	Jimma University
JUSH	Jimma University Specialized Hospital
LFVI	Low Fruit and Vegetables Intake
MET	Metabolic Equivalent Task
OR	Odds Ratio
WHO	World Health Organization
WHR	Waist to Hip Ratio

1. INTRODUCTION

1.1 Background

Globally non-communicable diseases are the leading causes of death, 60% of all deaths and nearly 80% of non-communicable disease deaths occur in low and middle income countries. Of the 57 million deaths that occurred globally in 2008, 36 million (63%) which is two thirds were due this diseases, comprising cardiovascular diseases, , diabetes, cancers and lung diseases. Deaths from such diseases are projected to increase by a further 17% over the next 10 years. But the greatest increase (27%) is expected to be seen in the African region [1, 2].

Tobacco use, excessive alcohol intake, low fruit and vegetable intake, being overweight, obese or physically inactive are risk factors for the main chronic diseases like cardiovascular disease, diabetes, and cancers which are on the rise in many African countries including Ethiopia [3, 4, 5]. When energy input is equal to energy output, fat cells (lipocytes) don't have to expand to accommodate excess energy. When more calories are taken in than used that the extra fat is stored in the lipocytes and the person begins to accumulate fat and become overweight and obese in which Body Mass Index (BMI) is between 25 and 29.9 and $\geq$ 30 respectively [6, 7, 8]. Overweight and obesity are associated with insulin resistance and the metabolic syndrome. However, Central obesity is more highly correlated with the metabolic risk factors than an elevated body-mass index (BMI) [9].

Five out of the top ten chronic diseases are related directly to overweight and obesity which are diabetes, heart disease, hypertension, stroke and cancer. Increased consumption of diet that is rich in saturated fat leads to overweight and obesity which decrease the sensitivity of cells to insulin. When a person gains weight, blood levels increase, causing the heart to pump more blood and also cause a person's blood pressure to rise because it can increase cholesterol level, which may lead to a further straining and hardening of the blood vessels and heart. It also causes narrowing of the arteries that feed the heart and high cholesterol is a risk factor for stroke and heart disease [6].

1.2 Statement of the problems

Overweight and obesity are a results of positive energy balance over an extended period of time, when intake of energy exceeds expenditure of energy. Even though there are specific genetic disorders that give rise to overweight and obesity, epidemiological trends show that the rise in overweight and obesity is a result of environmental and behavioural changes [6, 7, 9].

Worldwide, 35% of adults aged 20 years and older were overweight (BMI $\geq$ 25 kg/m^2) (34% men and 35% of women) in 2008. In 2008, 10% of men and 14% of women in the world were obese (BMI $\geq$30 kg/m^2), compared with 5% for men and 8% for women in 1980. An estimated 297 million women and 205 million men over the age of 20 were obese in 2008. Overweight and obesity are increasing worldwide due to changes in diet and increasing physical inactivity [10, 11].

In the World Health Organization (WHO), European Region, the Eastern Mediterranean and the Region of the Americas, over 50% of women were overweight. For all three regions, roughly half of overweight women are obese (23% of women in Europe, 24% in the Eastern Mediterranean, 29% in the Americas)**.** The overall prevalence of obesity is 33% in America, 2% in South East Asia and 6% in Africa. While overweight is 70% in America, 22% in South East Asia and 30% in Africa [12]. In the African, South-East Asian and Eastern Mediterranean Regions, women had roughly doubled the obesity prevalence of men [1, 5]. According to the 2005 Ethiopian Demographic and Health Survey (EDHS) prevalence of overweight and obesity were 3.7% and 0.7% in females respectively [13]. In Addis Abeba prevalence of central obesity was 13% and 6.7% for the males and females respectively and also overweight was 20.2% and 37.7% for the males and females respectively [14]. In a study conducted in Jimma area the prevalence of overweight and central obesity were 2.6% and 33.3% respectively [15].

Worldwide; at least about 2.8 million (4.8%) of total deaths and an estimated 36 million (2.3%) of total disability adjusted life years (DALYs) each year, as a result of being overweight and obese [10, 12, 16]. Globally, 44% of diabetes burden, 23% of ischemic heart disease burden and 7–41% of certain cancer burdens are attributable to overweight

and obesity in which prevalence of overweight and obesity were statistically significant for those with diabetic, asthma, arthritis, Cardiovascular diseases and osteoporosis [12, 1]. In high income countries 0.7 million death (8.4%) of total deaths and in middle income countries 1.6 million deaths (6.7%) of total deaths attributed to overweight and obesity. Percentage of DALYs attributed to overweight and obesity by country and income level that in high income countries 8 million (6.5%) of total DALYs and in middle income countries 21 million (3.6%) of total DALYs. In both South East Asia and Africa, 41% of deaths caused by high BMI occur under age 60, compared with 18% in high-income countries [12, 17].

The health consequences of overweight and obesity range from increased risk of premature death and to serious chronic conditions that reduce the overall quality of life. Increases the risks for the coronary heart disease, type 2 diabetes, Cancers (endometrial, breast, prostate and colon), hypertension (high blood pressure), dyslipidemia (for example, high total cholesterol or high levels of triglycerides), stroke, liver and gallbladder disease, Sleep apnea and respiratory problems, Osteoarthritis (a degeneration of cartilage and its underlying bone within a joint) and gynecological problems (abnormal menses, infertility) [5, 8, 18]. Overweight and obese women have a greater risk of hormone dependent cancers, including endometrial, ovarian, cervical and postmenopausal breast cancer [7]. Overweight or obesity among children increases with increasing BMI of the mother, from one percent among children of mothers who are thin to four percent among children of mothers who are overweight/obese (BMI >25) in Ethiopia [19].

Overweight and obesity places an economic burden on the health care system as well as contributing to the costs associated with decreased productivity and increase mortality. Overweight and obesity may be influencing absenteeism and preventing workers from staying in the workforce through its association with chronic disease and injury [8, 18, 20, 21]. The psychological consequences of overweight and obesity in adults is highly stigmatized in Western cultures [7, 18]. Overweight and obese people often face discrimination; negative stereotyping and negative attitudes [7]. Emotional suffering may be among the most painful aspects of obesity. Many think that obese individuals are lazy or greedy, even though this is false. As a result, obese people often face partiality or

discrimination in the work place, school, and social situations. Feelings of rejection, shame and depression are common [18, 22].

Different studies done on overweight and obesity revealed that several factors associated with overweight and obesity (central obesity). Accordingly, socio-demographic and economic factors such as sex, age, educational status, marital status, household income, occupational status and behavioural risk factors such as low fruit & vegetable consumption, alcohol consumption, physical inactivity and biological risk factors such as elevated fasting blood glucose and high total cholesterol and also familial obesity history were associated with overweight and obesity (central obesity) [23 -28].

There were a few studies done on the prevalence of overweight and obesity in Ethiopia. Fore example, prevalence of overweight and central obesity were high in Gilgel Gibe Field Research Center area. However, factors associated with overweight and central obesity were not assessed. Therefore, this study have its own contribution to identify the factors associated with overweight and central obesity in a study area.

2. LITERATURE REVIEW

Several studies conducted on associated factors (behavioral risk factors and socio-demographic) with overweight and obesity in different areas of the world including Ethiopia. So these studies are trying to discuss as follows.

2.1 Socio-demographic factors

Several studies conducted on association of age with overweight and central obesity show that increasing age has association with being overweight and central obesity. But some studies indicate that age has no association with overweight and central obesity. According to cross-sectional study conducted in Kerala of India on a sample of 6579 individuals of age 30 to 74 years and Indian Council of Medical Research (ICMR) on a total of 7449 individuals in 2005 indicate that the overweight and central obesity increased with age ($p < 0.05$), adjusting for other factors including sex and the place of residence. But not according to finding from South Africa showed there were no association between age and central obesity [29 - 31]. Another community based study done among adults in Zambia in 2007 and a cross sectional study conducted in Tanzania on individuals age 18-65 of 1249 subjects indicate increasing age is consistently significant association with central obesity (Adjusted Odd Ratio (AOR)= 0.39; 95%CI: 0.23, 0.67) and (Odd Ratio (OR)= 5.1; 95%CI: 2.5, 10.4), $p < 0.001$ respectively. But according to finding from cross-sectional study done in 2007 at the Jimma University Specialized Hospital (JUSH) on a total of 950 randomly selected patients on follow-up indicates the age have no significantly associated with obesity (OR= 1.04; 95%CI, 0.44, 2.42) [32 - 34].

A studies done in different areas of the world revealed that overweight and central obesity have association with sex in which overweight and obesity are common in females. According to studies done in Kerala in India, ICMR and a cross-sectional study undertaken in South Africa on 107 males and 530 females, aged ≥ 18 years old indicate female sex is consistently significant association with overweight and central obesity, adjusting for other socio-demographic characteristics (AOR= 1.8; 95%CI: 1.5, 2.2), (AOR= 1.71; 95%CI: 1.49, 1.96) & (AOR= 3.03; 95%CI: 2.66, 3.46) and (AOR= 0.08; 95%CI: 0.04, 0.14) & (AOR= 0.09; 95%CI: 0.05, 0.15) respectively in which female were more likely to be

overweight and central obesity as compared to male [29 - 31]. Other studies done in Zambia, Tanzania and JUSH revealed that female sex is consistently significant association with obesity (AOR= 0.45; 95%CI: 0.29, 0.69), (OR= 3.6; 95%CI: 2.2, 5.4), $p < 0.001$ and (OR 4.17; 95%CI: 1.94, 8.97) respectively [32 - 34]. In addition study conducted in Addis Abeba indicates female sex is significantly associated with overweight and central obesity [14].

In different studies done on association of overweight and central obesity with place of residence show that urban residence is positively associated with overweight and central obesity. According to studies done in Kerala of India and JUSH urban residence is consistently significant association with central obesity. In which finding of India indicates compared to urban residence, rural residence was associated with lower odds of overweight/central obesity (AOR= 0.47; 95%CI: 0.41, 0.52) and JUSH showed rural residence persons were 37% as less likely to be obese as compared to urban residents (AOR= 0.37; 95%CI: 0.16, 0.87). A study done in ICMR showed that urban residence is consistently significant association with overweight and central obesity in which rural individuals were less likely to be overweight and central obesity (AOR= 0.47; 95%CI: 0.41, 0.52) & (AOR= 0.71; 95%CI: 0.64, 0.80) respectively [29, 30, 34].

According to studies done in Kerala of India housewives had higher risk to develop central obesity by (OR= 1.7; 95%CI: 1.4, 2.2) but has not significant association with other categories of occupational status of respondents. A cross-sectional study undertaken in South Africa showed that those who were unemployed had a lower risk of being overweight/central obesity (OR= 0.37; 95%CI: 0.15, 0.92) in which other categories of occupational status has not significant association with overweight/central obesity [29, 31].

Several studies done in association of overweight and central obesity revealed that being overweight and central obesity increases with education level. But some studies indicate education level has no association with overweight and obesity. According to studies done in Kerala of India and Zambia showed increase education level is consistently significant association with overweight and central obesity in which higher education level respondents is higher risk to develop overweight and central obesity with (AOR= 2.0; 95%CI: 1.5, 2.6) and (AOR= 2.22; 95%CI: 1.21, 4.07) but not according to studies done in

South Africa, Tanzania and JUSH in which educational status have no significantly associated with obesity [29, 31, 32, 33, 34].

2.2 Behavioural risk factors

Several studies conducted on association of overweight and central obesity revealed that alcohol intake is associated with overweight and central obesity. But other studies indicate as no association. In studies done in Kerala state of India and ICMR show alcohol intake is significantly associated with overweight and central obesity in which alcohol users were more likely to be overweight and central obese (AOR= 1.26; 95%CI: 1.01, 1.56) and (AOR= 1.49; 95%CI: 1.20, 1.84) respectively as compared to non-users. But not according to studies done in Zambia in which alcohol use is insignificantly associated with overweight and central obesity [29, 30, 32]. In a study conducted at the JUSH revealed that alcohol use is insignificantly associated with obesity [34].

Some study done shows that tobacco use has negatively associated with overweight and central obesity. According to study done in Kerala state of India, ICMR in India and Zambia indicate tobacco use is consistently associated with overweight and central obesity in which tobacco users were less likely to be Overweight and central obese as compared to non-user of tobacco (AOR= 0.65; 95%CI: 0.54, 0.78) & (OR= 0.50; 95%CI: 0.42, 0.60) and (AOR= 0.65; 95%CI: 0.54, 0.78) & (AOR= 0.50; 95%CI: 0.42, 0.60) and (AOR = 0.33; 95% CI: 0.12, 0.95) respectively. But not according to finding from study done at JUSH in which current smokers is insignificantly association with obesity [29, 30, 32, 34].

According to studies done in Kerala state of India and ICMR in India revealed that physical inactivity is consistently significant association with overweight and central obesity in which physical inactive individuals were more likely to be overweight and central obese (OR= 2.51; 95%CI: 1.94, 3.25) & (OR= 2.79; 95%CI: 2.18, 3.57) and (OR= 2.51; 95%CI: 1.94, 3.25) & (OR= 2.79; 95%CI: 2.18, 3.57) respectively as compared to vigorous activity [29, 30]. A study conducted in Tanzania showed respondents who did vigorous activities had a 60% reduces the risk for central obesity as compared to those who did light activities, (OR= 0.4; 95%CI: 0.2, 0.8), p =0.005. Another's studies done in Zambia, South Africa and JUSH show vigorous intensity activities are consistently insignificantly association with

central obesity [31, 32, 34]. In a study conducted at the JUSH revealed that khat chewing is insignificantly associated with obesity [34].

2.3 Biological risk factors

A several studies done in different areas revealed that diabetes mellitus and fasting blood glucose have an association with central obesity. According to population-based cross-sectional study conducted in Finland during October 2004 and January 2005 on a total of 4500 individuals aged 45–74 years, in ICMR, a cross-sectional comparative study conducted in Southern Ethiopia at Sidama Zone from October 2008 on total sampled of 222 individuals and in JUSH showed that type two diabetes mellitus is consistently significant association with high waist circumference (central obesity) [(AOR= 4.93; 95%CI: 3.24, 7.51), (AOR= 2.82; 95%CI: 1.95, 4.06), (AOR= 3.96; 95%CI: 1.76, 8.92) and (AOR= 6.08; 95%CI: 1.52, 24.23)] respectively [30, 34, 35, 36]

According to the study conducted in ICMR fasting blood glucose has association with overweight and central obesity. But not according to a cross-sectional study conducted on total sampled of 1,853 individuals in Addis Ababa, Ethiopia during the months of December 2009 and January 2010 and in JUSH [30, 34, 37].

Different studies conducted showed that high total cholesterol have association with overweight and central obesity. A cross-sectional study conducted in Vietnam in 2005 showed that high total cholesterol is significantly associated with overweight (AOR= 3.95; 95%CI: 2.36, 6.59) [38].

The studies done in ICMR, Tanzania and Zambia didn't include all socio-demographic variables. Occupational status was not included in studies conducted in India,Tanzania and Zambia. Whereas educational status and place of residence were not included in studies conducted in India and Zambia respectively, in the analysis to see the association with overweight and central obesity. From the studies done in Kerala state of India, ICMR and Tanzania association of all behavioral risk factors with overweight and central obesity didn't analyzed, in which low fruit and vegetable intake was not included in studies conducted in Kerala state of India, ICMR and Tanzania and also tobacco use in study conducted in Tanzania. So this study was aimed to assess the association of these socio-

demographic variables and behavioural risk factors including chat chewing with overweight and central obesity.

According to studies done in South Africa and Tanzania males were underrepresented in which males were selected only in the absence of eligible women in the household and men were not at home during these work hours. So in this study the primary target of the study was all individuals of both sexes are equally participating in a study. In a study done in JUSH was hospital based (on diabetic patients) and the findings may not be applicable to the general population. So this study can filled the gap of generalizable of the study since thi study was done on the population based cross sectional study.

Conceptual framework

This conceptual framework was developed after reviewing different articles and adapted from study conducted by Méjean C. et al in 2007 [39]. The conceptual framework of this study consists of categories: independent variables (socio-demographic, behavioral risk factors and biological risk factors) associated with the dependent variables (overweight and central obesity). These independent variables are, age, sex, educational status, occupational status, residence, alcohol intake, tobacco use, physical activity, fruit and vegetable consumption, chat chewing, fasting blood glucose/diabetes mellitus and total cholestrol.

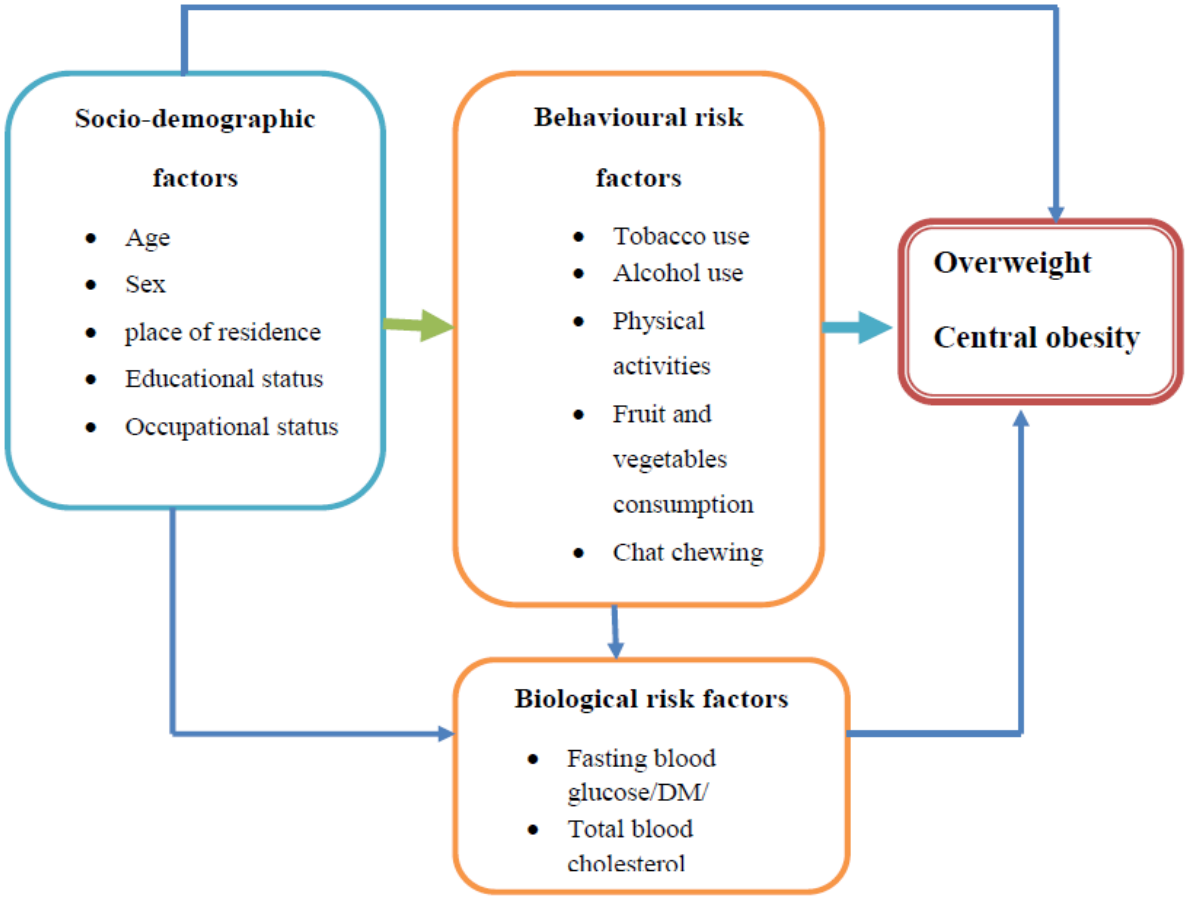

Figure: 1 Conceptual framework for overweight and central obesity

2.4 Significance of the study

Identifying the risk factors which are lead to chronic non-communicable diseases are important for the prevention and control of CNCDs. In addition to identifying risk factors of chronic non-communicable diseases; determining the factors associated with overweight and central obesity in the general population have a role in the design and implementation of promotive and preventive measures for the major CNCDs. Even though the prevalence of obesity and overweight are considerably varied among developed and developing countries; they are currently considered as main public health problems worldwide. These problems are caused by different socioeconomic and other associated behavioral factors.

Therefore, the aim of this study was to assess factors associated with overweight and central obesity among age 15-64 years of individuals at Gilgel Gibe Field Research Center (GGFRC) of Jimma University (JU).

The premise for this study is anchored, the evidence indicating that as awareness in the community improved and more people have access to knowledge about the negative health impacts of obesity and overweight to reduce their exposure against associated risk factors.

Generally, the result of this study will contribute for the health policy makers, researchers and health managers to apply lesson learned to ensure a successful strategy to fight chronic non-communicable diseases associated with overweight and central obesity, in addition, it helps as information for further analytical study.

3. OBJECTIVE

3.1 General Objective

- To assess factors associated with overweight and central obesity in adults at Gilgel Gibe Field Research Center.

3.2 Specific Objectives

- ✓ To identify socio-demographic factors associated with overweight and central obesity in adults age 15-64 years at GGFRC,
- ✓ To identify behavioral risk factors associated with overweight and central obesity in adults age 15-64 years at GGFRC,
- ✓ To identify biological risk factors associated with overweight and central obesity in adults age 15- 64 years at GGFRC.

4. METHODS AND MATERIALS

4.1 Data source

Source of data for this study was from the study done at Gilgel Gibe Field Research Center (GGFRC) area of Jimma University (JU) from late September 2008 to end of January 2009. The study was conducted for the determination of magnitude of Chronic Non Communicable Diseases (CNCDs), risk factors of CNCDs, immunological and hematological value determination. The GGFRC survey sample represents population between the ages of 15 to 64 years and includes data from in home interviews with 5500 people. The GGFRC is a center serves as health and demographic surveillance system for the Jimma University and comprises of eight rural and two urban kebeles (the lowest administrative unit). The study area comprised about 11,000 households with a total population of 50,000 in the center and out of the total population; age group of 15 to 64 years comprised about 49%. There was one health center, two health stations and four health posts in the center and also two trained health extension workers from 2008 to 2009 year in each kebele. In this study, data was compiled and extracted from February 29 to March 20, 2013. A detailed description of original study is published on Ethiopian Journal of Health Science [40]. Data which included anthropometric measurement taken from study participant who completed the survey were included in this study.

4.2 Study design

Community based cross-sectional study was utilized.

4.3 Source population

All individuals' aged 15 to 64 years resident in all kebeles' of Gilgel Gibe Field Research Center area.

4.4 Study population

A two thousand five hundred and thirty seven(2537) study participants of age 15 to 64 years (1210 male and 1327 female) who had anthropometric measurements.

4.4.1 Inclusion criteria

The data which included, an individual within 15-64 years of age, who is permanent resident in the GGFRC area and who had an anthropometric measurement values about (weight, height, waist circumferences and hip circumferences) were included in this study.

4.4.2 Exclusion criteria

Pregnant women, handicapped and severly sick individuals.

4.5 Sample size determination

In the previous study, the sample size was determined based on the WHO STEPS guideline [41], which has three steps for stepwise assessment of risk factors for CNCDs. Step one, step two and step three were used to assess the risk factors through interviewing, physical measurement and biochemical tests respectively. The population was stratified by age (15-24 years, 25-34 years, 35-44 years, 45-54 years and 55-64 years), sex and residential area (urban and rural) and such stratification was considered in the sample size calculation. For interviews and physical measurement 250 individuals from each age and sex stratum were taken giving a sample size of 2500. However, due to further stratification by residential area, the sample size was doubled to 5,000 and taking 10% non-response rate, the total sample size became 5,500 [15]. In this study, two thousand five hundred and thirty seven (2537) study participants, who had anthropometric measurements was included.

4.6 Sampling procedure

Stratified random sampling technique was used to select study participants from each stratum and sample was allocated to each age, sex and residential area stratum proportional to its size. The list of the population and households of ten kebeles of 2008 updated census was used as the sampling frame. Taking 25% urban and 75% rural population distribution in the center, the total sample distributed proportionally in which 1376 from urban (688 males and 688 females) and 4124 from rural (2062 males and 2062 females). Then, the sample distributed to each kebele proportional to their population size. Using the sex and age stratified sampling frame obtained from the census list, individuals were selected randomly [15]. All anthropometric measured (height, weight, waist circumference and hip circumference) study participants were included in this study.

Schematic presentation

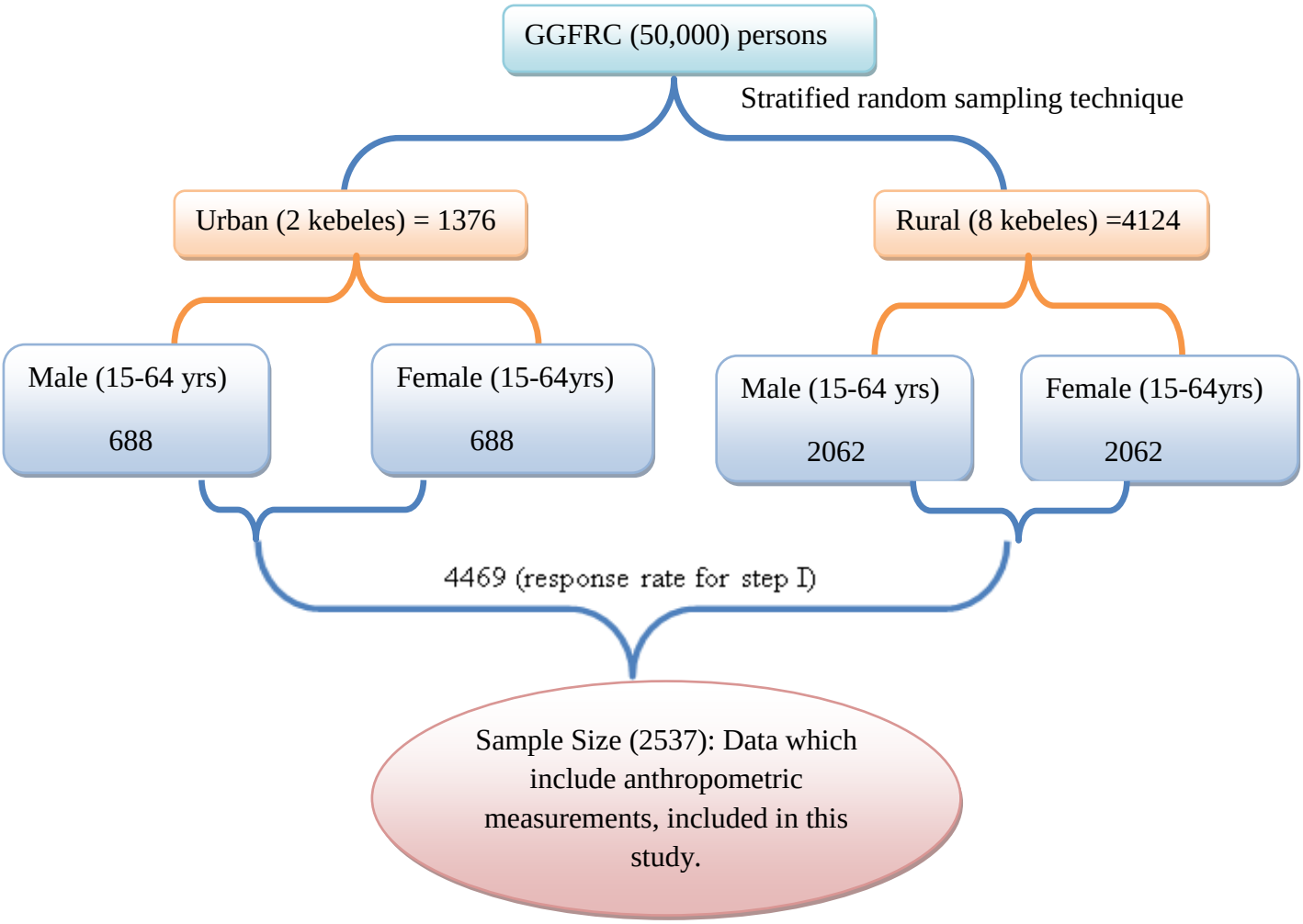

Figure: 2 Schematic presentation of sampling procedure

4.7 Study variables

4.7.1 Dependent variables

Overweight and central obesity.

4.7.2 Independent variables

Socio-demographic factors such as age, sex, educational status, occupational status and urban residence. Behavioural risk factors such as physical activities, tobacco use, fruit and vegetable consumption, alcohol use and chat chewing. Biological risk factor such as fasting blood glucose/diabetes mellitus and total blood cholesterol.

4.8 Data collection and instruments

In the previous study, data collection instruments were adapted from WHO STEPS instruments [41]. The instruments were structured and contained questionnaire for Step one and recording formats for step two and step three. The questionnaire for step one comprised questions about socio-demographic variables and questions for assessing behavioral risk factors for CNCDs including smoking cigarette, alcohol intake, fruit and vegetable intake, chat chewing, and physical activities. The recording formats were used to record physical measurement values of step two such as weight, height, waist and hip circumference, and values for biochemical tests of step three such as fasting blood sugar and total blood cholesterol level [15].

Fifteen interviewers, six physical measurement recorders and three supervisors who completed at least high school and competent in local languages were recruited and trained on how to obtain consent, use equipment and how to perform and record the physical measurements for data collection [15]. For this study the data were requested from GGFRC using a request form letter includes a template which contain step one (socio-demographic and behavioural measurement), step two (anthropometric measurement) and step three (biochemical measurement) variables. Data extractor was extract the limited data set based on the requested data using template includes list of variables, questions and specific objectives.

4.9 Data quality assurance

Data collection instruments were adapted from WHO STEPS instrument and translated into local languages (Amharic and Afan Oromo). Pre-test was conducted on the interview and measurement sections of the study instrument. After the pre-test investigators, supervisors, data collectors and discussed on identified gaps. Standardized measuring instruments for anthropometric measurement was used. Daily supervision was made in the field during data collection by field supervisors and investigators. Data collectors and supervisors were check for data completeness and consistency on a daily basis and data collectors returned to interviewers if the data were incomplete and inconsistent [15].

4.10 Data processing and analysis

Data were entered into the computer using EPI-Data version 3.1 and analyzed by SPSS Windows version 16.0 software. The entered data were exported to SPSS version16.0 software for the analysis [15]. Univariate analysis was performed to see the distribution of variables. Data were checked for completeness, inconsistency, outliers and missing values by looking at their distribution. Incomplete, inconsistent and missing value data were excluded from the analysis. Outcome variables was dichotomies as overweight and normal weight and also central obesity and no central obesity based on BMI and WHR indicator calculated from anthropometric measurement values (weight, height, waist and hip circumference). Bivariate analysis was run to see the association and strength of association between dependent and independent variables separately. Unadjusted odds ratios (COR) with 95% confidence interval for the bivariate analysis was presented and all variables with p-value less than 0.25 were considered as candidate variables for multivariate analysis. After multicollinarity (correlation matrix) and effect modifier/interaction (test of homogeneity of odds ratio) were checked for all candidate variables, multivariate logistic regression analysis was performed relating overweight and central obesity with selected characteristics. Adjusted odds ratios (AOR) with 95% confidence interval for multivariate analysis was reported and p-value of less than 0.05 was considered as a statistically significant. The results of the study was presented in tables and narrative form.

4.11 Ethical considerations

Ethical clearance for the study was obtained from the Health Research and Postgraduate Coordinating Office of College of Public Health and Medical Sciences. Official support letter from the department of Epidemiology was written to GGFRC of Jimma University. The obtained data were handled and managed carefully to keep anonymity and also honestly used only for the analysis.

4.12 Dissemination plan

The finding of the study will be submitted to the College of Public Health and Medical Sciences, department of Epidemiology and the GGFRC of Jimma University and also, distributed to the Jimma Zone health department. In addition to this, the finding will be

presented in different workshops, seminars and published in a national or international journals.

4.13 Operational definitions

The following operational definitions were used in this study.

Current tobacco user: currently smoke any tobacco products, such as cigarettes, cigars, or pipes [41,42].

Alcohol use: consumed an alcoholic drink in the past 12 months [41, 43].

Daily smoker: currently smoke daily any tobacco products, such as cigarettes, cigars, or pipes [41].

Chat chewer: chewing chat in the lifetime.

Low fruits and vegetables intake (LFVI): defined as frequency of serving fruit and vegetable less than five per day [44].

Physical activity: the total time spent in physical activity during a typical week (total physical activity level); *Inactive:* inactive at work, transport and leisure time or less than 600 Metabolic Equivalent Task (MET)- minutes/week; *Medium:* having a moderate activity or at least 600 MET-minutes per week and *Vigorous:* vigorous activity at work, transport or leisure time or at least 1,500 MET-minutes/weeks [45].

Overweight: define as body weight in kilograms divided by the square of the height in meters (BMI of $\geq$ 25 kg /m^2) [15, 41].

Central obesity: defined as waist to hip ratio (WHR) greater than one for men and greater than 0.85 for women [41, 42].

Fasting blood glucose level: defined as level of fasting blood glucose (in mg/dl) was separated into normal (< 110mg/dl) and elevated ($\geq$ 110mg/dl) [42, 43].

Total blood cholesterol: defined as high cholesterol as blood cholesterol level 5.22mmol/L or more [15].

5. RESULTS

5.1 Study sample charecteristics

5.1.1 Socio-demographic characteristics

Out of the 2653 study subjects who had data on anthropometric measurements, 2537 (95.6%) were included in the study, other data were excluded based on exclusion criteria and missing data on outcome variables. The mean age of the study participants was 40.1±13.9 years and 563(22.2%), 521(20.5%), 550(21.7%), 498(19.6%) and 405(16.0%) were 35-44, 45-54, 55-64, 25-34 and 15-24 years of age respectively. One thousand three hundred and twenty seven (52.3%) were female and 2168(85.5%) were rural residents. Two thousand and thirty eight (80.3%) were uneducated while 499(19.7%) had an at least attended primary school. One thousand two hundred and forty nine (49.5%) were farmers and 900(35.6%) were housewife (**table 1**).

Table: 1 Study sample: socio-demographic characteristics at GGFRC, September 2008 - January 2009**.**

Socio-demographic characteristics		Sex		Total (N (%))
		Male (N (%))	Female (N (%))	
Age in years	15 -24	187(15.5)	218(16.4)	405(16.0)
	25-34	223(18.4)	275(20.7)	498(19.6)
	35-44	263(21.7)	300(22.6)	563(22.2)
	45-54	262(21.7)	259(19.5)	521(20.5)
	55-64	275(22.7)	275(20.7)	550(21.7)
Residence	Urban	143(11.8)	226(17.0)	369(14.5)
	Rural	1067(88.2)	1101(83.0)	2168(85.5)
Educational status	uneducated	878(72.6)	1160(87.4)	2038(80.3)
	1-4 grade	161(13.3)	57(4.3)	218(8.6)
	5-8 grade	116(9.6)	67(5.0)	183(7.2)
	9 or above	55(4.5)	43(3.2)	98(3.9)
Occupational status	Farmer	949(78.8)	300(22.7)	1249(49.5)
	Employee	41(3.4)	15(1.1)	56(2.2)
	Merchant	42(3.5)	41(3.1)	83(3.3)
	Daily laborer	43(3.6)	18(1.4)	61(2.4)
	Student	55(4.6)	41(3.1)	96(3.8)
	Unemployed	42(3.5)	38(2.9)	80(3.2)
	Housewife	-	-	900(35.6)
Total		1210	1327	2537

5.1.2 Behavioural charecteristics

The study sample characteristics, on behavioural risk factors are presented in **table 2**. Nearly 21% and 70% of males were current smoker and chat chewer respectively. Ninety one percent (91.1%) of current smokers were daily smokers and 65% of oil and fat used in the home was grain oil.

Table: 2 Study sample: behavioural charecteristics at GGFRC, September 2008 - January 2009.

Behavioural characteristics		Sex		Total (N (%))
		Male (N (%))	Female (N (%))	
Alcohol consumption	No	1128(93.5)	1266(95.6)	2394(94.6)
	Yes	79(6.5)	58(4.4)	137(5.4)
Chewing chat	No	366(30.2)	1076(81.1)	1442(56.8)
	Yes	844(69.8)	251(18.9)	1095(43.2)
Physical activity level	Inactive	290(24.7)	364(29.4)	654(27.1)
	Moderate	401(34.2)	495(40.0)	896(37.2)
	Vigorous	482(41.1)	378(30.6)	860(35.7)
Number of serving fruit and vegetables	$\geq$ 5 serving	872(72.1)	918(69.2)	1790(70.6)
	< 5 serving	338(27.9)	409(30.8)	747(29.4)
Current smoker	No	959(79.3)	1310(98.7)	2269(89.4)
	Yes	251(20.7)	17(1.3)	268(10.6)
Daily smoker	No	20(8.4)	3(16.7)	23(8.9)
	Yes	245(91.6)	15(83.3)	245(91.1)
Use oil and fat	Vegetable oil	190(15.7)	218(16.4)	408(16.1)
	Grain oil	788(65.1)	862(65.0)	1650(65.0)
	Butter	24(2.0)	20(1.5)	44(1.7)
	None in particular	194(16.0)	208(15.7)	402(15.8)
	None used	14(1.2)	19(1.4)	33(1.3)
Frequency of drinking alcohol last 12months	Daily	9(11.4)	2(3.4)	11(8.0)
	5-6 days/wk	9(11.4)	9(15.5)	18(13.1)
	1-4 days/wk	26(32.9)	13(22.4)	39(28.5)
	$\leq$ 3 days/month	35(44.3)	34(58.6)	69(28.5)

5.2 Factors associated with overweight and central obesity

Different variables assumed to be associated with overweight and central obesity were included in the study. These include socio-demographic factors such as age, sex, place of residence, educational status and occupational status; behavioural characteristics such as tobacco use, chewing chat, alcohol use, physical activity, fruit & vegetable consumption and use of oil and fat in the home and biological characteristics such as fasting blood glucose/diabetes mellitus and total blood cholesterol were included. The association of these factors with overweight and central obesity were seen using binary logistic regression.

On bivariate analysis, variables such as sex, educational status, occupational status, place of residence and chewing chat were found to have a statistically significant association with overweight at p-value less than 0.05, but age, current smoker, daily smoker, fruit and vegetable consumption, physical activity, alcohol use, frequency of alcohol intake and use of oil and fat were didn't show any association. Regarding central obesity, age, sex, educational status, occupational status, current smoker, chewing chat, fruit and vegetable consumption, use of oil and fat and physical activity were found to have a statistically significant association with central obesity at p-value less than 0.05, but place of residence, alcohol use, frequency of alcohol intake and daily smoker were didn't show any significant association with central obesity on bivariate analysis (**tables 3 and 4**).

5.2.1 Socio-demographic characteristics of respondents

Based on bivariate analysis done to show an association between socio-demographic characteristics with overweight and central obesity. Female sex, merchant, housewife and employee were found to have higher risk of overweight and central obesity. Attended education above nine grades, attended education up to eight grades and urban residence were more likely to be overweight. On the other hand, respondents of age 25-34, 35-44, 45-54 and 55-64 years had higher risk of having central obesity. However, attended education up to grade four, up to grade eight and above grade nine had lower risk of central obesity (**table 3**).

Table: 3 Results of bivariate logistic regression analysis of overweight and central obesity with socio-demographic characteristics at GGFRC, September 2008 – January 2009.

Socio-demographic characteristics		Overweight		Central obesity	
		N (%)	COR (95%CI)	N (%)	COR (95%CI)
Age in years	15-24	4(1.0)	1	116(28.6)	1
	25-34	12(2.4)	2.25(0.721-7.043) *	185(37.1)	1.57(1.17-2.10) **
	35-44	12(2.1)	1.98(0.636-6.209) *	215(38.2)	1.64(1.23-2.18) **
	45-54	13(2.5)	2.34(0.755-7.219) *	205(39.3)	1.72(1.29-2.29) **
	55-64	14(2.5)	2.38(0.778-7.298) *	228(41.5)	1.88(1.41-2.49) **
Sex	Male	16(1.3)	1	79(6.5)	1
	Female	39(2.9)	2.26(1.26-4.065) **	870(65.6)	27(21.13-35.15)**
Education	Uneducated	31(1.5)	1	849(41.7)	1
	1-4 grade	5(2.3)	1.52(0.585-3.950)	46(21.1)	0.36(0.26-0.53) **
	5-8 grade	7(3.8)	2.6(1.120-5.930) **	37(20.2)	0.36(0.24-0.52) **
	9 or above	12(12.2)	9.03(4.48-18.20) **	17(17.3)	0.29(0.17-0.49) **
Occupation	Farmer	9(0.7)	1	262(21.0)	1
	Housewife	24(2.7)	3.8(1.75-8.160) **	591(65.7)	7.21(5.94- 8.74)**
	Employee	9(16.1)	26(10.0 - 69.51) **	8(14.3)	0.63(0.29 -1.344)*
	Merchant	10(12)	18(7.44- 47.88) **	27(32.5)	1.82(1.13- 2.93)**
	Daily laborer	6(1.6)	2.3(0.29 - 18.42)	15(24.6)	1.23(0.675- 2.24)*
	Student	6(1.0)	1.5(0.18 - 11.57)	12(12.5)	0.54(0.290- 1.00)*
	Unemployed	6(1.2)	1.7(0.218 - 13.9)	28(35.0)	2.03(0.856- 3.28)*
Residence	Rural	25(1.2)	1	806(37.2)	1
	Urban	30(8.1)	7.58(4.40-13.06) **	143(38.8)	1.07(0.852-1.341)

***P-value < 0.05, *p-value < 0.25; COR- crude odds ratio; CI- confidence interval, N (%)- frequency and percentage of overweight and central obesity within socio-demographic variables.*

5.2.2 Behavioural characteristics of respondents

Physical inactivity, low fruit and vegetable consumption, use of butter and grain oil were found to have higher risk of having central obesity. On the other hand, chewing chat had lower risk of overweight and central obesity and current smoker had lower risk of central obesity (**table 4**).

Table: 4 Results of bivariate logistic regression analysis of overweight and central obesity with behavioural charecteristics at GGFRC, September 2008 – January 2009.

Behavioural characteristics		Overweight		Central obesity	
		N (%)	COR (95%CI)	N (%)	COR (95%CI)
Alcohol use	No	49(2.0)	1	905(37.7)	1
	Yes	6(4.4)	2.12(0.92-5.22)*	44(32.1)	0.78(0.54-1.13)*
Frequency of alcohol use	Daily			3(27.3)	0.70(0.17-2.89)
	5-6 days/wk		NA	5(27.8)	0.72(0.23-2.26)
	1-4 days/wk			11(28.2)	0.74(0.31-1.73)
	≤ 3 days/month			24(34.8)	1
Current smoker	No	54(2.4)	1	923(40.7)	1
	Yes	1(0.4)	0.15(0.02-1.12)*	26(9.7)	0.2(0.12-0.24)**
Daily smoker	No		NA	5(20.8)	1
	Yes			21(8.6)	0.36(0.12-1.05)
Chat chewing	No	39(2.7)	1	731(50.7)	1
	Yes	16(1.5)	0.5(0.29-0.96)**	218(19.9)	0.24(0.2-0.29)**
Number of serving fruit and vegetable	≥5 servings/day	44(2.5)	1	640(35.8)	1
	<5 servings/day	11(1.5)	0.59(0.31-1.12)*	309(41.4)	1.3(1.06-1.51)**
Use of oil and fat	Vegetable oil	9(2.2)	1	125(30.6)	1
	Grain oil	30(18.2)	0.82(0.39-1.74)	625(37.9)	1.4(1.09-1.74)**
	Butter	2(4.5)	2.1(0.44-10.09)	21(47.7)	2.1(1.10-3.87)**
	None in particular	13(3.2)	1.48(0.63-3.51)	164(40.8)	1.6(1.17-2.08)**
	None used	1(3.0)	1.39(0.17-11.3)	14(42.4)	1.67(0.81-3.43)
Physical activity level	Inactive	12(1.8)	0.79(0.38-1.62)	277(42.4)	1.6(1.29-1.98)**
	Moderate	21(2.3)	1.01(0.54-1.87)	335(37.4)	1.3(1.07-1.59)**
	Vigorous	20(2.3)	1	270(31.4)	1

***p-value <0.05, *p-value <0.25, NA – Not applicable due to sample inadequacy in cells; N (%)- frequency and percentage of overweight and central obesity within behavioral characteristics; COR- crude odds ratio; CI- confidence interval.*

5.2.3 Biological characteristics of respondents

However, biological characteristics such as fasting blood glucose, diabetes mellitus and total blood cholesterol were didn't show any significant association with overweight and central obesity on bivariate analysis (**table 5**).

Table: 5 Results of bivariate logistic regression analysis of overweight and central obesity with biological charecteristics at GGFRC, September 2008 – January 2009.

Biological characteristics		Overweight		Central obesity	
		N (%)	COR (95%CI)	N (%)	COR (95%CI)
Fasting blood sugar	< 110mg/dl	19(1.5)	1	471(37.8)	1
	≥ 110mg/dl	6(3.1)	2.05(0.808-5.195)	75(38.5)	1.03(0.753-1.405)
Diabetes	No	54(2.1)	1	939(37.3)	1
	Yes	1(4.8)	2.28(0.300-17.29)	10(47.6)	1.03(0.808-1.352)
Total cholesterol	< 5.22mmol/L	2(0.7)	1	114(37.5)	1
	≥ 5.22mmol/L	24(1.6)	2.51(0.591-10.69)	564(38.5)	1.53(0.652-3.341)

N (%)- frequency and percentage of overweight and central obesity within biological characteristics; CI- confidence interval.

Sex, age, educational status, occupational status, place of residence, alcohol use, current smoker, chewing chat and fruit and vegetable consumption were selected for multivariate analysis, for overweight. As well as sex, age, educational status, occupational status, current smoker, alcohol use, fruit and vegetable consumption, physical activity, chewing chat and use of oil and fat were candidates for multivariate analysis for central obesity. Before including variables in the multivariate analysis, multicollinarity and interaction or effect modifier were checked for all variables candidate for multivariate analysis. As a result, multicollinarity and interaction or effect modifier were not found. Proceeding, checked of multicollinarity and interaction or effect modifier, multivariate analysis was run to identify independent predictor variables for overweight and central obesity.

5.2.4 Factors independently associated with overweight and central obesity

In multivariate logistic regression analysis, evaluating the association of selected characteristics with overweight and central obesity results are shown in **table 6**. Accordingly, older age, female sex, urban residence, merchant, employee and higher educational status were found to be independently associated with overweight [hosmer and lemeshow test for the model fitness, $\chi^2 = 3.72$, df = 8, p = 0.882]. Moreover, Females had three times higher risk of having overweight as compared to male (AOR= 3.1; 95%CI, 1.37-6.98), adjusting for other socio-demographic characteristics. The risk of overweight was four times higher in urban residents and six times higher in higher educational status as

compared to counterparts (AOR= 4.2; 95%CI, 2.170-8.180) and (AOR= 6.2; 95%CI, 2.120-17.95), respectively, adjusting for other factors including sex and age. On the other hand, respondents of age 25-34, 45-54 and 55-64 years had nearly four, five and eight times more likely to have overweight as compared to youngest age (AOR= 3.8; 95%CI, 1.021-14.50), (AOR= 5.0; 95%CI, 1.280-19.36) and (AOR= 8.3; 95%CI, 2.080-33.20), respectively, adjusting for other factors including sex and place of residence. As well as employee and merchant had nearly six and five times higher risk of having an overweight as compared to farmers (AOR= 5.9; 95%CI, 1.660-21.03) and (AOR= 5.0; 95%CI, 1.650-14.82), respectively, adjusting for other socio-demographic characteristics. But, current smoker, alcohol use, low fruit and vegetable consumption were insignificantly associated with overweight (**table 6**).

Regarding central obesity, older age, female sex, higher educational status, student, current smoker, chewing chat and use of butter and grain oil were found to be independent predictors of central obesity [hosmer and lemeshow test for the model fitness, $\chi^2 = 8.37$, df = 8, p = 0.398]. Furthermore, the risk of central obesity was about three times higher in subjects aged 55-64 years (AOR= 2.5; 95%CI, 1.713-3.671), two times higher in subjects age 45-54 years (AOR= 2.12; 95%CI, (1.451-3.060), about two times higher risk in subjects aged 35-44 years (AOR= 1.73; 95%CI, 1.210-2.460) and subjects age 25-34 years had a 63% increased (AOR= 1.6; 95%CI, 1.120-2.290) compared to the youngest subjects, adjusting for other socio-demographic factors. Females had twelve times higher risk of having central obesity as compared to male (AOR= 12; 95%CI, 4.27-20.46), adjusting for other factors including age and place of residence. Student, current smoker, chat chewer and higher educational status had 59%, 86%, 56% and 64% lower the risk of central obesity than their counterparts (AOR= 0.41; 95%CI, 0.184-0.930), (AOR= 0.14; 95%CI, 0.095-0.219), (AOR= 0.44; 95%CI, 0.359-0.545) and (AOR= 0.36; 95%CI, 0.213-0.736), respectively, adjusting for other factors. On the other hand, the use of butter as oil in the home was about five times higher risk of central obesity as compared to the use of vegetable oil (AOR= 4.84; 95%CI, 1.920-12.184). However, alcohol use, physical inactivity, low fruit and vegetable consumption were insignificantly associated with central obesity (**table 6**).

Table: 6 Multivariate logistic regression analysis relating overweight and central obesity with selected characteristics at GGFRC, September 2008 – January 2009.

Independent variables		Overweight		Central obesity	
		%	AOR (95%CI)	%	AOR (95%CI)
Age in years	15-24	1.0	1	28.6	1
	25-34	2.4	3.8(1.021-14.50)*	37.1	1.60(1.12-2.290)*
	35-44	2.1	3.6(0.930-13.94)	38.2	1.73(1.21-2.460)**
	45-54	2.5	5.0(1.280-19.36)*	39.3	2.12(1.45-3.060)***
	55-64	2.5	8.3(2.080-33.20)**	41.5	2.51(1.71-3.670)***
Sex	Male	1.3	1	6.5	1
	Female	2.9	3.1(1.37-6.98)**	65.6	12(4.27-20.46)***
Education	Uneducated	1.5	1	41.7	1
	1-4 grade	2.3	1.95(0.670-5.672)	21.1	1.04(0.660-1.630)
	5-8 grade	3.8	2.22(0.807-6.090)	20.2	0.58(0.360-0.940)*
	9 or above	12.2	6.2(2.120-17.95)**	17.3	0.36(0.210-0.736)**
Occupation	Farmer	0.7	1	21	1
	Employee	16.1	5.9(1.660-21.03)**	14.3	0.85(0.308-2.370)
	Merchant	12.0	5.0(1.650-14.82)**	32.5	0.85(0.443-1.648)
	Daily laborer	1.6	0.45(0.050-4.120)	24.6	1.18(0.511-2.706)
	Student	1.0	1.60(0.140-17.70)	12.5	0.41(0.184-0.930)*
	Housewife	2.7	1.49(0.590-3.770)	65.7	1.12(0.858-1.508)
	Unemployed	1.2	0.43(0.050-3.920)	35	0.78(0.393-1.566)
Residence	Rural	8.1	1		
	Urban	1.2	4.2(2.170-8.180)***		NI
Current smoker	No	2.4	1	40.7	1
	Yes	0.4	0.38(0.050-2.990)	9.7	0.14(0.095-0.219)***
Chewing chat	No	2.7	1	50.7	1
	Yes	1.5	1.09(0.541-2.180)	19.9	0.44(0.359-0.545)**
Number of serving fruit and vegetable	≥ 5 serving/day	2.5	1	35.8	1
	<5 serving/day	1.5	0.50(0.250-1.040)	41.4	1.15(0.902-1.470)
Physical activity Level	Inactive			42.4	1.105(0.827-1.477)
	Moderate		NI	37.4	0.92(0.706-1.193)
	Vigorous			31.4	1
Use of oil and fat	Vegetable oil			30.6	1
	Grain oil			37.9	1.75(1.23-2.340)***
	Butter		NI	47.7	4.8(1.920-12.18)***
	None in particular			40.8	2.14(1.46-3.140)***
	None used			42.4	1.73(0.616-4.84)
Alcohol use	No	2.0	1	37.7	1
	Yes	4.4	0.82(0.310-2.160)	32.1	1.17(0.703-1.944)

***** *p-value < 0.05,* ****** *p-value <0.01,* ******* *p-value <0.001* NI - Not included

% - percentage of overweight and central obesity within independent variables. AOR- Adjusted odds ratio.

6. DISCUSSION

This study revealed two major findings. Firstly, in the study population increasing age, female sex, higher educational status, urban residence, merchant and employee were significantly associated with overweight. Secondly, increasing age, female sex, higher educational status, student, current smoker, chewing chat and use of butter and grain oil were significantly associated with central obesity.

Older age was positively associated with overweight as compared to youngest age in this study. This is in line with the studies done in a Kerale state of India and ICMR [29, 30]. The explanation could be the youngest age group may be more conscious of their body image such that they may take healthy diet or physical activity measures to control their weight. Regarding central obesity, increasing age was found to be associated with an increased risk for central obesity. This is similar to findings from the study done in Kerala state of India, ICMR, Zambia and Tanzania [29, 30, 31, 32]. The explanation could be the youngest age group may be more conscious of their body image such that they may take healthy diet or physical activity measures and also fact that as age increase physical activities is decreasing.

Female sex was significantly associated with an increased risk for overweight and central obesity as compared to male in this study. This is similar to findings from the study done in Kerala in India, ICMR, South Africa and Addis Abeba [14, 29, 30, 31]. This observation could be due to females are more exposed to the effects of excess adiposity and also use of a lower threshold for central obesity in females [46].

Urban residence was a positively associated with overweight in the current study. This finding is similar with the finding from the study done in Kerala in India and ICMR [29, 30]. This indicates that rural residents are involved in agricultural activities and also higher risk of overweight among urban residents could be explained due to epidemiological transition that results from urbanization [47]. Employee (government and non-government) and merchant were associated with an increased risk for overweight. This is inconsistent with finding from the studies done in Kerala in India and South Africa [29, 31]. This could

be due to the difference in occupational status categorization, in which the farmers were included in this study.

Higher educational status was associated with an increased risk for overweight in the current study. This is observed in the study done in Kerala state of India and Zambia [29, 32]. This is may be due to lifestyle difference, in which there is an epidemiological transition of lifestyle and urbanization [47]. According to this finding, higher educational status was found to be negatively associated with an increased of central obesity. This is similar to findings from the study done in Kerala state of India and Zambia [29, 32]. The explanation is the fact that higher educational attainment is associated with increased knowledge that in turn enables an individual to make healthy choices.

The use of butter and grain oil were significantly associated with an increased for central obesity as compared to vegetable oil in the present study. In this study, the tobacco use was negatively associated with central obesity. This is in line with the findings from the study done in Kerala state of India, ICMR of India and Zambia [29, 30, 32]. The explanation for this finding could be tobacco use has an effect on gastrointestinal of the metabolic system, responsible for digestion of food and absorption of nutrients [48]. But**,** tobacco use was insignificantly associated with overweight which is inconsistent with the above studies and alcohol use was insignificantly associated with overweight. This is inconsistent with findings from the study done in Kerala state of India and ICMR [29, 30]. The reason could be due to the population distribution in the study area is not diverse in religion, in which the religion determines alcohol use.

Chewing chat was negatively associated with central obesity in the present study. This is inconsistent with findings from the study done in JUSH [34]. The observed finding, indicates that chat has an effect of gastrointestinal system that decreased food consumption, decreased absorption of food and induced anorexia and constipation [49]. The inconsistency could be due to the difference in study characteristics, in which this study is in a community setting and the comparative one is an institutional based study.

Physical inactivity was insignificantly associated with overweight and central obesity in the current study. This is inconsistent with studies done in a Kerale state of India, ICMR and Tanzania [29, 30, 31]. This is might be explained by a higher physical activity rate in rural resident adults involved in this study, in which about 85% study subjects included in this study are from rural residents.

7. STRENGTH AND LIMITATION OF THE STUDY

7.1 Strengths of the study

The strengths of this study are sampling procedure undertaken to select the study subjects considered the sample representative of a minority group by stratified sampling technique and the instruments used for the data collection were adapted from the WHO stepwise approach manual.

7.2 Limitations of the study

A number of limitations in this study need to be noted. Firstly, data were collected cross sectional, in which cross-sectional nature of the data limits temporality and causality interpretation. Therefore, we cannot ascribe causation on the relations of the variables found associated with the outcome measure (overweight and central obesity). Secondly, One of the limitation of secondary analysis of data is restricted by original study or data, in which information on marital status and familial obesity were not available and this finding might have been biased if marital status and familial obesity were a confounding factor. Thirdly, there might have been an interobserver variation during anthropometric measurements. Although the research team followed the WHO STEPS Guideline, it is impossible to avoid the interobserver variation in the measurements. Fourthly, social desirability may be present due to the respondents would like to have acceptance of persons. Lastly, the social distribution of our study population of the smaller towns Assendabo, Deneba and Dimtu included in this study cannot be taken to represent the urban population in its strict sense and the majority of our study population were subsistence farmers who involved in more strenuous activities compared with urban population. For this reason, the association of physical inactivity with overweight and central obesity might have been biased.

8. CONCLUSION

On the basis of the information collected from the two thousand five hundred and thirty seven (2537) individuals and taking into account the above limitations, this study has come up with the following plausible conclusion. Socio-demographic characteristics, old age and female sex were positively independent predictors of overweight and central obesity. In addition higher educational status, employee and merchant occupational status and urban residence were positively independent predictors of overweight, but higher educational status and student occupational status were negatively independent predictors of central obesity. Use of butter and grain oil was positively independent predictors of central obesity, but current smoker and chewing chat were negatively independent predictors. These findings are crucial for evidence based decision making and it will help policy makers for planning of preventive and control measures of these risk factors. Also these data may serve to propel multisectoral efforts to lower the community burden of NCD risk factors in Ethiopia in general, and in GGFRC area, in particular.

9. RECOMMENDATION

To reduce the burden of overweight and central obesity in the community we recommend.

- Woreda Health Office should encourage health facilities to promote prevention and control of overweight and central obesity among females, urban residents, attended higher education persons, merchants, government and non-government employee.
- Health facilities should encourage health proffesionals and urban health extension proffesionals to promote healthy life style in the community.
- Females should improve their lifestyle through increased physical activities and improved dietary intake. This could be through increasing their physical activities, for instance by walking or jogging.
- Highly educated persons and employee should control their body weight regurly to prevent them selves from being overweight.
- Urban residents should improve their lifestyle through preventing urbanization lifestyle.
- Researchers should conduct further and similar studies aimed on assessing the overweight and central obesity in the community setting.

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ANNEX

Annex:1 List of questions

In the original research conducted at GGFRC the data collection instruments were comprised of questions on socioeconomic and demographic variables and questions for assessing behavioral risk factors for CNCDs including cigarette smoking, alcohol drinking, dietary habit, level of physical activity and khat chewing and also chronic diseases which was used as independent variables in this study. The recording formats used to record anthropometric measuremens values such as (weight, height, waist ,hip circumference) in which anthropometric measurement values was used as parameters for the calculation of BMI and WHR. Also, blood collection for biochemical test (Fasting blood glucose and total cholesterol) was conducted. These data were collected from a study paticipants by interview, physical measurements and blood collection. From the questionnaire and recording formats used in the originl study a list of questions presented bellow was used to extract Limited Data Set(LDS) ues in this study.

Step 1: Demographic Information

201. Sex (male and female).
202. Age (15-24, 25-34, 35-44, 45-54 and 55-64 years).
203. Ethnicity (Oromo, Amhara, Yem, Gurage, Dawuro, others and refused).
206. Educational status (read and writes, complete grade and basic education in school).
207. Occupational (work) status over past 12 months (farmer, government employee, non-government employee, merchant, self-employed, non-paid, student, housewife, homemaker, retired, unemployed, others and refused to answer).
208. Number of person above 18 years of old live in households (in numbers).
209. Average earnings of the household income (per month and per year (in birr); teff, maize and cheese (in quintile) and refused to answer.

Step 1: Behavioural Measurements

2. Tobacco Use

301. Currently smoke any tobacco products, such as cigarettes, cigars or pipes (yes and no)
302. Daily Current smoke tobacco products (yes and no).
303. Age at first started smoking daily (in years).

304. Duration after started smoking daily (years ago, month ago and week ago).

305. On Average, number of smoked each day (manufactured cigarettes, hand-rolled cigarettes, pipes full of tobacco and others).

306. Ever smoke daily in the past (yes and no).

307. Age at stopped smoking daily (in years).

308. Duration after stop smoking daily (years ago, month ago and week ago).

3. Alcohol Consumption

309. Ever consumed an alcoholic drink such as beer, wine, spirits, fermented cider, tej and telle (yes and no).

310. Frequently had at least one alcoholic drink during the past 12 months (daily, 5-6 days per week, 1-4 days per week, 1-3 days per month and less than once a month).

311. Average number of drinks in one day (in numbers of standard measurement).

312. Consumed an alcoholic drink within the past 30 days (yes and no).

313. Number of standard drinks of any alcoholic drink has in each 7 past day.

314. Largest number of drinks had on a single occasion in the past 12 months (largest number).

4. Diet

315. Number of days eats fruit in a typical week (type of fruit and number of days).

316. Number of servings of fruit eats on one of those days (type of fruit and quantity of serving).

317. Number of days eats vegetables in a typical week (type of vegetable and number of days).

318. Number of servings of vegetables eats on one of those days (type of fruit and quantity of serving).

319. Type of oil or fat is most often used for meal preparation in your household (oil grain, butter, vegetable oil, others, and none in particular and none used).

5. Physical Activity

320. Involved vigorous-intensity activity work (yes and no).

321. Number of days does vigorous-intensity activities as part of your work in a typical week (in number of days).

322. Time spend on doing vigorous-intensity activities at work on a typical day (in hours and minutes).

323. Involved moderate-intensity work activity (yes and no).

324. Number of days does moderate-intensity activities as part of your work in a typical week (in number of days).

325. Time spend doing moderate-intensity activities at work on a typical day (in hours and minutes).

326. Walk or use a bicycle *(pedal cycle)* for at least 10 minutes continuously (yes and no).

327. Number of days does walk or bicycle for at least 10 minutes continuously in a typical week (in number of days).

328. Time spend walking or bicycling for travel on a typical day (in hours and minutes).

329. Doing any vigorous-intensity sports, fitness or recreational *(leisure)* activities (yes and no).

330. Number of days does vigorous-intensity sports, fitness or recreational *(leisure)* activities in a typical week (in number of days).

331. Time spend doing vigorous-intensity sports, fitness or recreational activities on a typical day (in hours and minutes).

332. Doing any moderate-intensity sports, fitness or recreational *(leisure)* activities (yes and no).

333. Number of days do you do moderate-intensity sports, fitness or recreational *(leisure)* activities in a typical week (in number of days).

334. Time spend doing moderate-intensity sports, fitness or recreational *(leisure)* activities on a typical day (in hours and minutes).

335. Time usually spend sitting or reclining on a typical day (in hours and minutes).

6. Khat chewing

336. Ever chewed khat (yes and no).

337. Duration of chewed khat (year, month and week).

338. Are you chewing khat (yes and no)?

339. Number of days chews khat in a typical week (in number of days).

340. Time chew khat on a typical day (in hours and minutes).

341. Number of ‘Zorba’ of khat do you use in a typical day (in zorbas).

342. Age at first started chewing khat (in years).

343. Duration after started chewing khat (year, month and week).

344. Duration after stop chewing khat (year, month and week).

7. Chronic disease: History of diabetes

345. Ever been told by a doctor or other health worker that you have diabetes (yes/no).

346. During the past 12 months, ever been told by a doctor or other health worker that you have diabetes (yes/no).

347. Currently receiving any of the following treatments for diabetes prescribed by a doctor or other health worker as well as any advice.

- Insulin (yes/no).
- Oral drug (medication) that you have taken in the last 2 weeks (yes/no).
- Special prescribed diet (yes/no).
- Advice or treatment to lose weight (yes/no).
- Advice or treatment to stop smoking (yes/no).
- Advice to start or do more exercise (yes/no).

348. During the past 12 months saw a traditional healer for diabetes (yes/no).

349. Currently taking any herbal or traditional remedy for your diabetes (yes/no).

Step 2: Physical and blood pressure measurements record

8. Anthropometric measurement

505. Weight (in Kg).

506. Height (in cm).

507. Waist circumference (in cm).

508. Hip circumference (in cm).

Step 3: Biochemical measurements

10. Form I. Blood collection recording format

711. Fasting blood glucose (in mg/dl).

11. Form II. Biochemical measurements recording format

807. Total cholesterol (in mg/dl).

Annex: 2 Letter of data request form

To Gilgel Gibe Field Research Center of Jimma University

Data requesting for the secondary analysis

My name is Girma Yazew, I am student of Epidemiology department and as I tried to mention above I kindly request the data for the analysis of factors associated with overweight and central obesity in adults: secondary data analysis from a community based cross sectional study conducted at GGFRC. Based on the attached template on this letter which includes step one (*socio-demographic and behavioural measurements*), Step two (*anthropometric measurements*), history of diabetes mellitus and biochemical test (*fasting blood sugar and total cholestrol*) variables were required for this analysis.

Thank You!!

Girma Yazew
Student of MPH in Epidemiology

Data requesting template

S.N.	Category of Variable	Data on variable
1	Socio-demographics	Sex
		Age
		Residence
		Ethnicity
		Religion
		Educational status
		Occupational status
		Monthly income
		Marital status
2	Behavioural risk factors	Tobacco use
		Alcohol use
		Chat chewing
		Physical activity
		Diet habits(fruit and vegetables intake)
3	Chronic disease	History of diabetes mellitus
4	Anthropometric measurements	Height (in cm)
		Weight (in Kg)
		Waist circumferences (in cm)
		Hip circumferences (in cm)
5	Biochemical test	Fasting blood glucose (in mg/dl)
		Total blood cholesterol (in mg/dl)

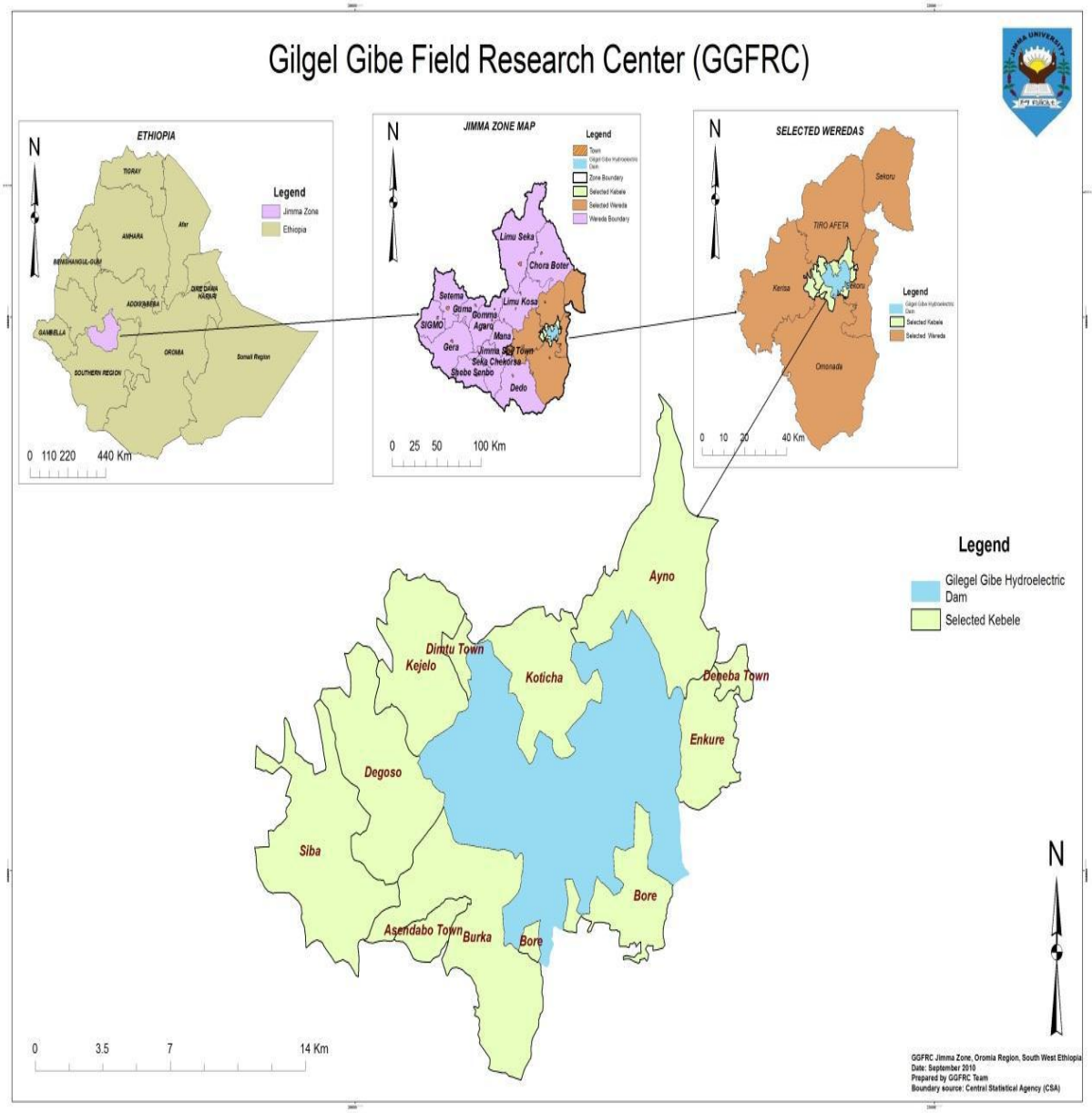

Figure 3: Location map of the study area: Gilgel Gibe Field Research Center.

Annex: 3 SPSS output

```
LOGISTIC REGRESSION VARIABLES BMICat.Overweight
  /METHOD=BSTEP(COND)
  /SAVE=PRED PGROUP
  /PRINT=GOODFIT CI(95)
  /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

Dependent Variable Encoding

Original Value	Internal Value
less than 25 kg/m^2	0
25kg/m^2 or more	1

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	4.830	8	.776
2	4.743	8	.785
3	3.719	8	.882
4	3.719	8	**.882**

```
LOGISTIC REGRESSION VARIABLES WHRCat.Central.obesity
  /METHOD=BSTEP(COND)
  /SAVE=PRED PGROUP COOK
  /PRINT=GOODFIT CI(95)
  /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

Dependent Variable Encoding

Original Value	Internal Value
Less than one and 0.85 for male and female respectively	0
One and 0.85 or more for male and female respectively	1

Block 1: Method = Backward Stepwise (Conditional)

Omnibus Tests of Model Coefficients

		Chi-square	Df	Sig.
Step 1	Step	1104.032	24	.000
	Block	1104.032	24	.000
	Model	1104.032	24	.000
Step 2[a]	Step	-.181	1	.671

	Block	1103.852	23	.000
	Model	1103.852	23	.000
Step 3[a]	Step	-.365	1	.546
	Block	1103.487	22	.000
	Model	1103.487	22	.000
Step 4[a]	Step	-.326	1	.568
	Block	1103.161	21	.000
	Model	1103.161	21	.000
Step 5[a]	Step	-1.818	2	.403
	Block	1101.343	19	.000
	Model	1101.343	19	.000
Step 6[a]	Step	-7.931	6	.243
	Block	1093.412	13	.000
	Model	1093.412	13	.000
Step 7[a]	Step	-1.283	1	.257
	Block	1092.128	12	.000
	Model	**1092.128**	**12**	**0.001**

a. A negative Chi-squares value indicates that the Chi-squares value has decreased from the previous step

Hosmer and Lemeshow Test

Step	Chi-square	Df	Sig.
1	9.853	8	.275
2	11.050	8	.199
3	10.776	8	.215
4	7.922	8	.441
5	7.221	8	.513
6	9.272	8	.320
7	**8.367**	**8**	**0.398**