

St. Paul's Hospital Millennium Medical College, Department of Public Health, Ethiopian Field Epidemiology Training Programme (EFETP)



Prevalence and risk factors of Diabetes Mellitus and impaired glucose tolerance among adults living in Ambo town, community based cross sectional study

By

Tedi Tilahun (MD)

Thesis submitted to department of Public Health, St. Paul's Hospital Millennium Medical College as a partial fulfillment for Degree of Masters in Field Epidemiology

October 2019

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DECLARATION

I hereby declare that; this thesis is my original work and has not presented for a degree another person in this or any other university and all source material used for this thesis have been duly acknowledged.

Name: Tedi Tilahun

Signature_____

Date_____

The MPH in Field Epidemiology thesis has been submitted for examination with my approval as a university academic advisor

Name:

Signature_____

Date_____

ACRONYMS

BMI.....	Body Mass Index
NCD.....	Non-Communicable Disease
DM.....	Diabetes Mellitus
FBS.....	Fasting Blood Sugar
HDL.....	High Density Lipo-proteins
HIV/AIDS.....	Human immuno deficiency virus /Acquired Immuno Deficiency Syndrome
IDF.....	International Diabetes Federation
IFG.....	Impaired Fasting Glucose
IGT.....	Impaired Glucose Tolerance
LDL.....	Low Density Lipo-proteins
MDGs.....	Millenium Development Goals
PHC.....	Primary Health Care
RBS.....	Random Blood Sugar
SPHMMC.....	Saint Paul Hospital Millennium Medical College
SPSS.....	Statistical Package for Social Science
TC.....	Total Cholestrol
TG	Triglyceride
WHO.....	World Health organization

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ABSTRACT

Background: Diabetes, one of the non-communicable diseases becoming major public health problems in Ethiopia, is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction and failure of different organs. There are few community-based studies conducted in Ethiopia. This study aimed at assessing the prevalence of impaired glucose homeostasis (diabetes and impaired glucose tolerance) and associated factors for adults older than 20 years living in Ambo town, Ethiopia.

Method: A community-based cross-sectional study was conducted in Ambo town in August 2019. Sample size was determined with single population proportion formula, considering 95% confidence interval, 5.1% of diabetes prevalence from previous study, 2% margin of error and adding 10% non response rate the final sample size was 510. Using the world health organization STEPS tool for surveillance of non-communicable diseases, data was collected by face-to-face interview and measurement of anthropometry, blood pressure, and random blood sugar using pretested questionnaire. Bi variate and multivariate logistic regression was computed using SPSS 20 and variables with P value of 0.05 and below were considered significant and results were presented with odds ratio with 95% confidence interval.

Result: The overall prevalence of impaired glucose homeostasis was 15% among study subjects. Diabetes accounts for 5.6%, and impaired glucose tolerance accounts for 9.4%. Tobacco smoking [AOR=10.1, 95% CI (2.68, 37.99)] and heavy alcohol consumption [AOR=7.23, 95% CI (2.21, 23.6)], were significantly and independently associated with impaired glucose homeostasis. Out of all person with diabetes only 14.8% were aware of the illness.

Conclusion: In this study, the prevalence of impaired glucose homeostasis was high, so is hypertension especially undiagnosed ones. This indicates the need for systematic screening and awareness program to identify the undiagnosed cases in the community and offer early treatment and regular follow up. Tobacco smoking and heavy alcohol consumption were risk factors for impaired glucose homeostasis.

Keywords: *Diabetes, prevalence, Random blood sugar, Associated factors, Ambo, 2019.*

Word count: 311

1. INTRODUCTION

1.1. Background

Diabetes mellitus is characterized by chronic hyperglycemia which becomes an emerging public health problem due to its high prevalence, association with cardiovascular diseases, and overall morbidity and mortality (1). A recent estimate indicates that more than 387 million (8.5%) of people worldwide have diabetes. Among these Africa account a 22 million (5.1%) people with diabetes which is likely to increase by 70% in 2035 (2).

Approximately 5.1 million people whose age is between 20-79 years died from diabetes in 2013, accounting for 8.4% of all global mortality among people in this age group. This estimated number of deaths is similar in magnitude to the combined deaths from several infectious diseases and is equivalent to one death in every six seconds. Almost half of deaths due to diabetes are in people under the age of 60 years (3).

Among people with diabetes mellitus in developing countries the majority were with age group of 45 to 64 years while those in developed countries are aged 65 years and above. This indicates that developing countries are losing productive age groups than developed once. This in turn brings double burden in the region; that already affected with communicable diseases such as ‘ HIV/AIDS ’, tuberculosis and other infectious diseases (4).

The impact of diabetes mellitus is bound to continue globally if nothing is done to curb the rising Prevalence of Impaired Glucose Tolerance (IGT) which is now affecting 316 million people (6.9%). The vast majority (70%) of these people live in low- and middle-income countries. By 2035, the number of people with IGT will increase to 471 million, or 8.0% of the adult population unless something is done to reduce the risk factors associated with the development of the disease (5).

Before the 1990s, diabetes mellitus was considered as a rare medical condition in Sub-Saharan Africa (6). However, currently many studies revealed that the prevalence and incidence of diabetes is rising in the region, mostly it is due to life style changes, lack of physical activities, increased rural urban migration, high calorie intake and increased life expectancy of the population (7, 8).

According to World Health Organizations global estimation of diabetes mellitus in Sub-Saharan Africa the number of diabetes cases in 2013 ranges from 4.5-5.0% (8). This could increase by 98% which is from 12.1 million in 2010 to about 23.1 million in 2030. The

impaired glucose tolerance that was reported in 2010 (26.9 million) is also expected to rise to 47.3 million in 2030 (9).

In Ethiopia it is difficult to find population-based data on the exact prevalence of diabetes. However, there are some studies done on selected population groups that showed an increase prevalence of 4.6 % and 5.1% diabetes (10, 11). It is also the second causes for patients to attend health care services in most hospital of the countries (12-15). According to the 2014 report of the International Diabetes Federation (IDF), the number of people aged 20-79 years living with diabetes in Ethiopia was estimated to be 4.9 million and more than 2.9 million (6.9%) people live with impaired glucose tolerance (2). Among these more than 1.4 million people were undiagnosed for diabetes mellitus and its prevalence is higher in urban than rural population (2).

1.2. Statement of the problem

In Ethiopia, non-communicable diseases (NCDs) cause 42% of deaths, of which 27% are premature deaths before 70 years of age. The Disability Adjusted Life Years (DALYs) increased from below 20% in 1990 to 69% in 2015. Diabetes is the leading cause of morbidity and mortality among NCDs. With no action, Ethiopia will be the first among the most populous nations in Africa to experience dramatic burden of premature deaths and disability from NCDs by 2040. However, the national response to NCDs remains fragmented with the total health spending per capita for NCDs still insignificant (16).

1.3. Significance and rationale of the study

Even though Ethiopia has made marked progress in achieving some of the health related MDGs through expansion of primary health care and the innovative health extension program at the community level the progress made in terms of providing integrated service for NCDs at PHC-level is minimal, this is due to lack of base line data regarding the exact burden of NCD in Ethiopia (17,18). Therefore, this study was conducted to determine the prevalence and identify risk factors associated with diabetes mellitus and impaired glucose tolerance in Ambo town. Based on this information intervention towards combating NCDs can be designed accordingly by stakeholders.

2. LITRATURE REVIEW

2.1. Global prevalence

Globally, diabetes especially type 2 has emerged as a public health problem of pandemic proportion within the last century. A nation-wide population based cross sectional study conducted in USA among age group above 20 years in 2016 and 2017 showed 8.5% prevalence (19).

Diabetes prevalence in European countries is heterogenous with age standardized comparative prevalence ranging from 2.4% in Moldova to 14.9% in Turkey in 2013. Overall, the raw prevalence of diabetes in Europe in 2013 is estimated to be 8.5% which corresponds to 56 million cases age 20-79 years (20).

In Asia in the past two decades, the prevalence of diabetes in urban areas has increased remarkably in most countries, the increase being phenomenal in Nepal and China. The national prevalence has increased by two-fold or more within a decade in many countries. Rural prevalence has increased considerably in India, Nepal and China (21).

2.2. Prevalence in Africa

Although only few epidemiologic studies on diabetes have been undertaken with respect to the sub saharan african region, Indicators are still that there is increasing prevalence and incidence of diabetes among urban population in recent times. The weighted prevalence of diabetes among the adults aged 50 years and above in Ghana was 3.95%, With the prevalence being insignificantly higher in females than males. Advancing education, obesity and physical inactivities were found to be independently and positively associated with prevalence of diabetes while interestingly low socio-economic status and daily alcohol consumption was associated with lower odds of developing diabetes. The study only included older adults which may not show the actual prevalence of the disease in the general population (22).

A study done in Malawi in 2009 showed prevalence of raised fasting blood glucose or currently on medication for diabetes in both men and women was 5.6% (23). Similar study done in rural Angola showed a higher prevalence of diabetes mellitus and impaired glucose tolerance in the rural province of Bengo of 2.8% and 8.1%, respectively (24).

2.3. prevalence in Ethiopia

Very few studies on diabetes have been done in Ethiopia. A community based cross sectional study conducted in Gilgel gibe field research center during 2013 among adult population showed a crude prevalence of diabetes mellitus and impaired fasting glucose of 4.4%, 0.6% self-reported vs. 3.8% newly and 9.7% respectively. Being male, being in the age group of 35-44, being current and physically inactive while having central obesity and being in the age group of 55-64 were independent predictors of diabetes mellitus and impaired fasting glucose respectively (25).

On the other hand, the prevalence of diabetes mellitus in Gonder, Ethiopia in 2014 was 2.1% in rural areas and 5.1% in urban areas. Older age and physical inactivity were significantly and directly associated with diabetes mellitus among the urban population while alcohol consumption was inversely associated with diabetes mellitus in rural areas (26).

A community based cross sectional study done in Kola Diba town, North West Ethiopia in 2015 showed prevalence of impaired fasting glucose (IFG) and undiagnosed diabetes mellitus among adults were 12% and 2.3% respectively. Overweight, obesity, hypertriglyceridemia and systolic hypertension were found to be independently associated with impaired fasting glucose. Positive family history of diabetes also showed a marginal association with impaired fasting glucose. Male sex and hypertriglyceridemia were associated with undiagnosed diabetes mellitus (27).

Similar studies done in Mizan Aman town, southwest Ethiopia in 2016 showed that the prevalence of diabetes among adult was found to be 6.5%. Of which, the proportion of previously undiagnosed diabetes mellitus was 88.5%. The prevalence of prediabetes was also found to be 15.9%. The waist circumference (WC), body mass index, smoking habit, hypertension, and total cholesterol level were significantly associated with diabetes mellitus. (28).

3. RISK FACTORS FOR DIABETES

Many risk factors are responsible for the development of type 2 diabetes globally. Sex, age, unhealthy dietary habit, smoking, excessive alcohol consumption, hypertension, obesity, overweight, increased body mass index, sedentary life style and family history of diabetes or hypertensions are the most frequently documented risk factors (29-46).

3.1. Age

In most populations, the prevalence of type 2 diabetes is low before the age of 30 years but increases with older age (29-31). A study done by Harris and et al, in the 3rd NHANES survey of 1988-94 found that the prevalence of diabetes mellitus increased from 1-2% among person in the age group 20-30 years, to 18-20 in the age group 60-74 years and the prevalence mounted at age 75 and above (29). However, studies on high risk communities, like Pima Indians of the USA, the prevalence of diabetes between ages 25-29 years (13%) reported was the same with US non-Hispanic white between ages of 60-64 years (31).

3.2. Gender

There is little evidence that type 2 diabetes risk differ between men and women when other factors are accounted (29-34). The prevalence and incidence of Type 2 diabetes vary some extent between sexes from one population to another, but these differences are relatively small and appear to be accounted for by differences in other risk factors such as obesity and physical activity (33, 34)

3.4. Family history

Most study indicates that presence of diabetes in a family member is established risk factors for type 2 diabetes (32, 33). For instance, pima Indians and Caucasians with at least one diabetes parent have a much higher incidence of type 2 diabetes than those who are equally obese but do not have a diabetic parent (30).

3.5. Tobacco smoking

Many prospective studies reported that current smoking is a risk factor for developing type 2 diabetes mellitus (35-37). In addition, Meta analysis including 25 prospective studies by Wany Y, Ji J, Liu Y-J, Derg X-He Q-q in 2013 showed that current smokers have 45% risk for developing type 2-diabetes compared to non smoker (35). On the basis of this review, it is estimated that 12% of all type 2-diabetes in the US attributed to smoking. The study by Jee et al among Korea Men and Women in 2010 also showed that the association between smoking and Type 2 diabetes is stronger for heavy smoker ≥ 20 cigarettes /day compared with light smoker or

fewer smokers (36). Study by Zhang and et al in 2011, association between passive and active smoking and incident of Type 2 diabetes in Women, suggests that smoking is strongly and independently associated with the risk of incident type 2 diabetes persisted in a dose-dependent manner (37). This study also reported that there is an increased risk of diabetes mellitus which persisted for 20 years after cessations of smoking among former active smokers. In addition, study by Kamauru M. et al in 2011 also found an increased risk of type 2 diabetes in the first two to three years after smoking cessation (38)

3.6. Alcohol consumption

In the majority of prospective study reports heavy drinkers have higher risk of type 2 diabetes than light or moderate drinkers (40, 41). A Meta-Analysis study by Koppess and et al in 2005 also reported that moderate alcohol consumption reduces approximately 30% of type 2 diabetes, whereas no risk reduction was observed in alcohol consumer of $\geq 48\text{mg/dl}$ (42).

3.7. Physical activates

Many epidemiological studies have found physical inactivity to be strong risk factor for type 2 diabetes (43, 44). In the nutritional health survey (45) each 2 hour /day increment of time spent watching television was associated with a 14% increase in diabetes risk. Each 2 hour /day increment of standing or walking around at home was associated with a 12% reduction in risk. Each 1 hour /day increment of brisk walking was associated with a 34% reduction in risk. Sedentary life style like sitting at work for prolonged time, television watching for >2 hours were associated with type 2 diabetes. There are also studies which indicate that moderate and vigours physical activities reduce the risk of developing diabetes (43). Other studies show that physical activity plays important role in the delaying or prevention of development of Type 2 diabetes in those at risk of diabetes mellitus both directly by improving insulin sensitivity and reducing insulin resistance, and indirectly by beneficial changes in body mass and body composition (44).

3.8. Body Mass Index (BMI)

Data from the third National Health and Nutrition Examination Survey (NHANES III) in USA indicated that two thirds of adults, both men and women, had BMI $>27\text{kg/m}^2$, and the prevalence of type 2 diabetes parallel to the increased prevalence of BMI (30). The study conducted by E.j-Sung, S. Sunwoo, S.W. Kim, et al, also reported that there is a strong positive relationship between body mass index (BMI) and the risk for, Type 2 diabetes in Korea adults. In this study risk of Type 2 diabetes increased with BMI greater than 23kg/m^2 after adjusting for other risk factors (46).

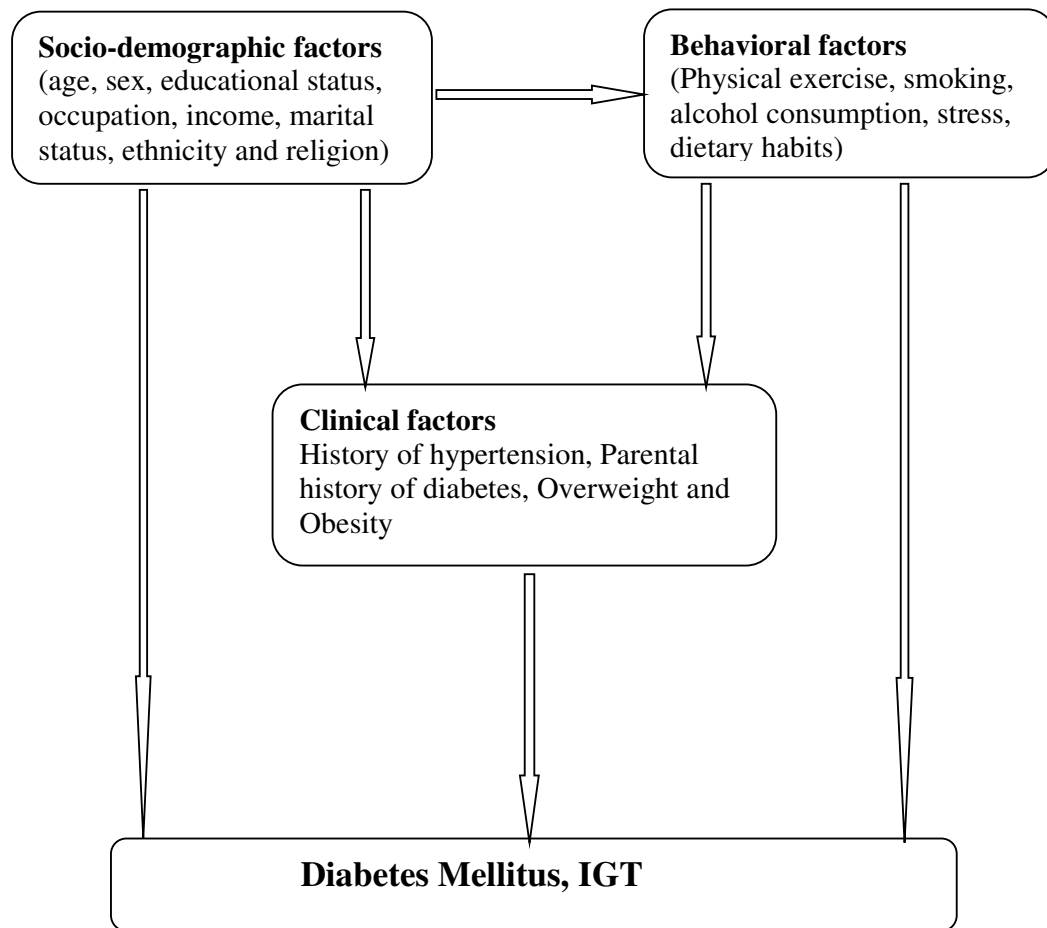


Figure 1: Conceptual frame work of the research

4. OBJECTIVES

4.1. General objective

The general objective is to determine prevalence and associated factors of diabetes mellitus and impaired glucose tolerance among adult population living in Ambo town.

4.2. Specific objectives

- To determine prevalence of DM among adults living in Ambo town
- To determine prevalence of IGT among adults living in Ambo town
- To identify factors related to DM among adults living in Ambo town
- To identify factors related to IGT among adults living in Ambo town

5. METHODS AND MATERIALS

5.1. Study Area

The study was conducted in Ambo town, located in Oromia national regional state westshoa zone Ethiopia, 110 km west to Addis Ababa. The town is divided in three kebeles, the smallest administrative unit and has a total population of 77,735(2017 population projection, 2007 census).

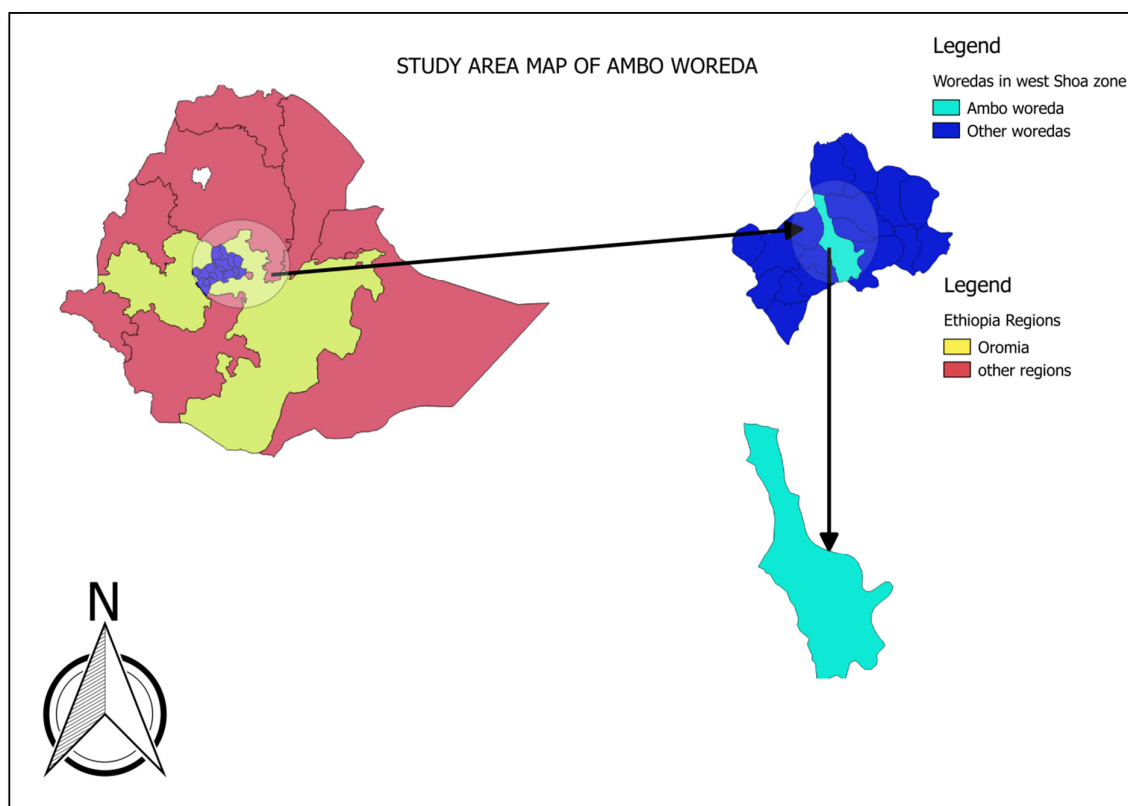


Figure 2: Map showing study area of Ambo woreda, August 2019.

5.2. Study design and period

Community based cross sectional study conducted in August 2019.

5.3. Source population

Individuals with age greater than 20 years living in Ambo town permanently and during the study period

5.4. Study unit

Eligible individuals participated in the study.

5.5. Inclusion criteria

The study included adults 20 years and above who were living permanently and in the study area, willing and able to give informed written consent.

5.6. Exclusion criteria

Pregnant women, individuals who are taking drugs with a possible impact on glucose metabolism (e.g. steroids, B-blockers, Thiazides diuretics and ART drugs) and critically ill patients who were not able to communicate were excluded from the study.

5.7. Sampling method

Two stage cluster sampling method was used to obtain samples

First stage: One kebele was selected randomly from three kebeles in the town.

Second stage: Individual households were selected randomly and study subjects were selected from a house holds randomly untill it reaches the sample size. One eligible subject was selected randomly from a household when more than one eligible subject was available.

5.8. Sample size

Sample size was determined using the single population proportion formula and considering a 5.1% prevalence of diabetes from a previous study in southwest Ethiopia and 5% level of significance, 0.02 margin of error and considering 10% non response rate sample size was 510.

$$n = \frac{(z_{\alpha/2})^2 \cdot pq}{d^2}$$

Where

n is sample size

d is margin of error

P is proportion of individuals with diabetes (from previous study)

Q is proportion of individuals with out diabetes (from previous study)

5.9. Data Collection tools and procedure

WHO STEPS tool that was translated in to the local language (Afaan Oromo) was used and consists of three steps. First step assesses demographic and behavioral characteristics like age, sex, dietary practice, alcohol consumption, physical exercise and smoking habit. Second

step assesses clinical data regarding BMI, waist circumference and Blood pressure measurement. Third step deals with biochemical parameters like blood glucose level and lipid profile.

Training and practical demonstration was given to the data collectors on the data collection procedures, confidentiality of information, respondents' rights and techniques of interview prior to the data collection.

Anthropometric and biochemical measurements were taken using standardized techniques and calibrated equipments. Subjects were weighed to the nearest 0.1 kg in light indoor clothing and bare feet or with stockings. Height was measured using a stadiometer; participants stood in erect posture without shoes, and the results was recorded to the nearest 0.5 cm. Measures were taken two times, and the average was considered in the analysis. Body mass index (BMI) was calculated as the ratio of weight in kilograms to the square of height in meters. Waist circumference was measured by placing a plastic tape to the nearest 0.5 cm horizontally, midway between the 12th rib and iliac crest on the mid-axillary line.

Blood pressure was measured using calibrated blood pressure apparatus while the participant was in sitting position and arm at the heart level and, three measurements one minute apart was recorded and the average was taken. Blood samples were collected after fingertip was cleaned with 70% alcohol and punctured with sterile lancet and a drop of blood sample poured in to test strip which is attached to the digital glucometer.

5.10. Data quality management

A pretested structured questionnaire, which was translated into afan oromo language used. Training for data collectors prior to commencement of actual survey was given, active participation of the principal investigator in the data collection process as well as regular supervision of other data collectors was made.

Checking the weight scale daily against a standard calibrated weight for accuracy each day before start of measurements, comparing blood pressure readings from the field sphygmomanometers with that normally used in the clinic and checking the glucometer and test strips periodically for accuracy using the manufacturer's recommended quality control were performed. Taking physical measurements twice, and in some cases three times, and taking the average to minimize observer error in measurements and recording.

Checking the data after collection at the end of each day for consistency, completeness, clarity and accuracy before entry. Data were entered to SPSS version 20 daily by principal investigator and analysis was carried out after checking for missing values and outliers.

5.11. Data analysis and presentation

Data analysis was carried out with SPSS version 20. Frequency distributions, percentages and ratios were computed for univariate analysis. Crosstabulations, binary logistic regression and p-values computed for bivariate and multivariate analysis, results were summerized using charts, graphs, figures and texts with odds-ratios with 95% confidence interval.

5.12. Variables for the study

5.12.1. Dependent variable

- Proportion of subjects with diabetes mellitus.
- Proportion of subjects with impaired glucose tolerance.

5.12.2. Independent Variables

- **Socio-demographic variables:** Age, sex and marital status
- **Socio-economic and behavioral variables:** Highest education attained, history of smoking, alcohol consumption, dietary consumption of fruits and vegetables, intensity of daily activity and regular physical activity.
- **Anthropometric and biochemical variables:** Previous history of raised blood pressure, history of raised blood sugar, body mass index (BMI), waist circumfrance, blood pressure measurement and random blood sugar measurement.

5.13. Result dissemination plan

The study result will be submitted to SPHMMC department of public health, Oromia regional health bureau, Ambo town health office, will be presented on meetings and conferences and will be submitted to journals for publication.

5.14. Ethical clearance

Proposal for the study was submitted to Saint Paul's Hospital Millennium Medical College, department of public health and Ethical review board for approval and the study was conducted after receiving approval from all respective bodies. Study participants were informed about the interview, participant's right, benefits and risk of the study, participants confidentiality was mentained throughout the study. Informed written consent were received from all study subjects.

6. OPERATIONAL TERMS AND DEFINITIONS

- **Random blood sugar:** Blood sugar level determined using glucometer any time during the day regardless of the time the meal or beverage was consumed (18).
- **Diabetes mellitus:** RBS greater than 200mg/dl (18).
- **Impaired glucose tolerance (IGT):** A RBS level between 140 mg/dl and 200mg/dl (18).
- **Impaired glucose homeostasis:** A serum glucose level above the normal range including IGT and DM i.e. RBS $\geq$ 140mg/dl (18).
- **Body mass index:** A ratio of body weight in kilogram to square of height in meters.
- **Normal BMI:** BMI between 18kg/m² to 24.9 kg/m² (18).
- **Under weight:** BMI less than 18 kg/m²(18).
- **Over weight:** BMI between 25 kg/m² to 29.9 kg/m² (18).
- **Obese:** BMI more than 30 kg/m² (18).
- **Smoker:** A subject who is smoking cigarette at the moment.
- **Non smoker:** A subject who never smoked cigarette.
- **Positive family history of DM:** If either or both parents or siblings of individuals were diagnosed to have DM (18).
- **Negative family history of DM:** If none of parents of subjects were never diagnosed for DM (18).
- **Heavy Alcohol Consumption:** Refers to the average consumption of more than standard alcoholic drinks per day for men ($\approx$ 30gm of alcohol) or >2 alcoholic drinks (20gm alcohol) for women. A standard alcoholic drink is the equivalent of one glass/can/bottle (330ml) of regular beer (with 3% ethanol), one glass (100ml) of wine (10% ethanol) or one glass (40ml) of distilled spirit, each of which adds up to about 10g of ethanol per drink (18).
- **Inadequate consumption of fruits and vegetables:** Is the consumption of less than one serving per day of fruits and vegetables, other than those added to foods such as soups, stews and sauces. One serving is the equivalent of one whole orange, one apple or banana, a slice of pineapple or papaya, half to one cup of diced vegetables or fruits, etc (18).
- **Sedentary lifestyle:** In this study is measured as a response of being always or usually engaged in light/leisure activities for most days of the week, or a response of sometimes/never engagement in moderate to intense physical activity outside work

for most days of the week, that would add up to at least three hours per week of moderate to intense (vigorous) physical activity (18).

- **Hypertension:** The average of casual systolic blood pressure readings ≥ 140 mmHg and/or diastolic blood pressure readings ≥ 90 mmHg (18).
- **Central Obesity:** A waist circumference greater than 102 cm for men and greater than 82 cm for women (18).
- **Waist circumference:** Waist girth measured by placing a plastic tape to the nearest 0.5 cm horizontally, midway between the 12th rib and iliac crest on the mid-axillary line
- **Risk Factor:** Any attribute, characteristic or exposure of an individual, which increases the likelihood of developing the disease of interest (18).

7. RESULT

7.1. Socio-demographic characteristics of the study participants

Out of 510 study population, a total of 480 participated in the study giving a response rate of 94%. Of the total respondents, 140(29.2%) were females and 340 (70.8%) were males, the age of the respondents ranged from 20 to 78, with mean age of 36.85($\pm$ 18.5) years, 28 (5.8%) were illiterate, 103(21.5%) have attended primary school while 174(36.3%) and 175(36.5%) attended secondary and tertiary school respectively. Majority 369(76.9%) of participants were married, while 89(18.5%) are single and the rest are divorced and widowed (table 1).

Table 1: Socio-demographic characteristics of the study participants, Ambo Ethiopia, August 2019 (n= 480)

Variables	Category	Number (n)	Percent (%)
Age (years)	20-24	103	21.5
	25-29	102	21.3
	30-34	42	8.8
	35-39	75	15.6
	$\geq$ 40	158	32.9
Sex	Male	340	70.8
	Female	140	29.2
Marital status	Single	89	18.5
	Married	369	76.9
	Divorced	7	1.5
	Widowed	15	3.1
Educational status	Not able to read or write	28	5.8
	Primary	103	21.5
	Secondary	174	36.3
	Tertiary	175	36.5

7.2. Behavioral characteristics of the study participants

Overall, 75 (15.7%) of the study participants reported that they had history of smoking cigarettes in their life time, and out of which 64 (13.3%) were current smokers. All of current smokers are daily smokers. Approximately half of current smoker just smoked cigarettes for greater than or equal to 10 years and the number of cigarettes smoked ranges from 3-15 sticks per day, with a mean of six cigarettes per day.

Among the study subjects 176 (36.6%) had ever consumed alcohol in their life and out of which 140 (29.2%) were current drinker. Of those who ever consumed alcohol, 45.1% drink alcohol less than three days a month, followed by 24.6% from 1-4 days per week. Only 1.2% of participants have a trend to consume fruits and vegetables for at least once a day. (table 2)

Table 2: Behavioral characteristics of the study participants Ambo, Ethiopia, August 2019 (n=480)

Variables	Category	Number (n)	Percent (%)
Ever smoked tobacco	Yes	75	15.7
	No	405	84.3
Currently smoking tobacco	Yes	64	13.3
	No	416	86.7
Ever consumed alcohol	Yes	176	36.6
	No	304	63.4
Low consumption of fruits and vegetables	Yes	474	98.8
	No	6	1.2
Regular physical exercise	Yes	22	4.6
	No	458	95.4

7.3. Anthropometric and clinical measurements of the study participants

Among study subjects 117 (24.4%) of participants had systolic blood pressure of greater than 140 mmHg and were found to have systolic hypertension. The mean systolic blood pressure was 129.8mmHg (± 18.6 mmHg). Of the study participants 143 (29.8%) had diastolic blood pressure greater than 90 mmHg and found to have diastolic hypertension. The mean diastolic blood pressure was 85.8mmHg (± 9.9 mmHg). In general, 177 (36.9%) of the study participants were found to have hypertension, out of these subjects, 124 (70%) were males and 53 (30%) were females. Among hypertensive subjects, only 28 (15.8%) were previously diagnosed to have hypertension and only 9.6% are on anti hypertensive medications. The ratio of diagnosed to undiagnosed hypertension was 1:6.2.

Overall, 306 (63.8%) of the study participants had body mass index (BMI) < 25 kg/m² and 177 (36.2%) of the study subjects had BMI ≥ 25.0 kg/m², out of which 128 (72.3%) were overweight and 49 (27.7%) were obese. 184 (38.3%) of the study subjects were found to

have central obesity, out of these subjects 178 (96.7%) were males and six (3.3%) were females. (figure 3)

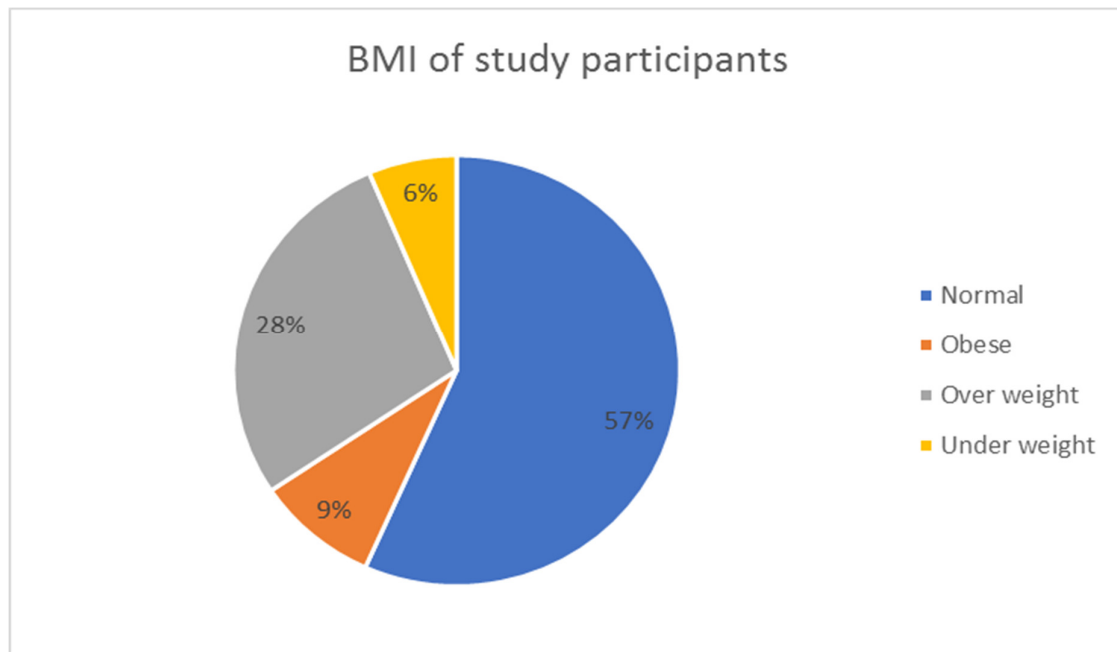


Figure 3: Body mass index of the study participants Ambo, Ethiopia, August 2019 (n=480)

7.4. Study outcome

Of the total participants who were tested, 27 (5.6%) had diabetes, while 45 (9.4%) had impaired glucose tolerance with overall impaired glucose homeostasis of 72 (15%) of the respondents. Out of study participant with diabetes six were already known diabetics and the rest did not know their blood glucose status and the ratio of diagnosed to undiagnosed diabetes was 1:3.5.

7.5. Bivariable analysis of risk factors variables with diabetes mellitus

This study assessed factors associated with the prevalence of diabetes mellitus among study subjects. In order to assess factors associated with diabetes mellitus among study subjects a binary logistic regression model was used. Variables with $p < 0.2$ in the bi variable logistics regression were selected for multi variable logistics regression.

An enter logistic regression analysis method was utilized in order to find out the association of diabetes mellitus. In bivariable analysis of socio-demographic variables with diabetes mellitus, sex ($P=0.1$), marital status ($P=0.20$) and educational level ($p=0.107$) were found to

have statistically significant association with the prevalence of diabetes mellitus. There was no stastically significant difference found in the prevalence of diabetes with age in this study (table 3)

Table 3: Bivariable assosiation of sociodemographic variables with diabetes mellitus among study participants in Ambo, Ethiopia August 2019 (n=480)

Variables	Cathegory	<u>Presence of diabetes</u>		COR (95% CI)	P value
		Yes	No		
Age (years)	20-24	3	100	1	
	25-30	6	96	2.08(0.51,8.57)	0.309
	30-34	0	42	0.00	0.998
	35-39	5	70	2.38(0.55,10.29)	0.245
	≥40	13	145	2.99(0.83,10.75)	0.094
Sex	Male	23	317	1	
	Female	4	136	0.40(0.14,1.19)	0.101
Marital status	Single, divorced and widowed	9	102	1	
	Married	18	351	0.58(0.25, 1.33)	0.200
Educational level	Illiterate	3	25	1	
	Primary	10	93	1.11(0.29,4.36)	0.875
	Secondary	8	166	0.45(0.17,1.18)	0.130
	Tertiary	6	169	0.33(0.12,0.94)	0.037

Among behavioral and clinical characteristics, smoking (P=0.000), heavy alcohol consumption (P=0.000) and inadequate consumption of fruits and vegetables (P=0.001) were associated with diabetes mellitus. But sedentary life style (P=0.998) and intensity of daily activity (P=0.997) found to have no statistically significant association with the prevalence of diabetes mellitus. Hypertension (P=0.043), priveous history of raised blood pressure (P=0.009) and history of raised blood sugar (p=0.000) were found to have statistically

significant association with diabetes among study participants, while body mass index (BMI) and central obesity have no statistical significance (table 4)

Table 4: Bivariable association of behavioral and clinical variables with diabetes mellitus among study participants in Ambo, Ethiopia August 2019 (n=480)

Variables	Category	<u>Presence of diabetes</u>		COR (95% CI)	P value
		Yes	No		
Smoking	Yes	15	401	6.17(2.74,13.89)	0.000
	No	12	52	1	
Heavy Alcohol consumption	Yes	18	122	5.43(2.37,12.40)	0.000
	No	9	331	1	
Intensity of daily activity	Moderate	27	389	1	0.997
	High	0	64	0.000	
Regular physical exercise	Yes	0	22	0.000	0.998
	No	27	431	1	
Inadequate fruits and vegetables consumption	No	3	3	18.75(3.59,97.84)	0.001
	Yes	24	450	1	
History of raised blood sugar	Yes	7	1	158.2(18.56,1348.13)	0.000
	No	20	452	1	
History of raised blood pressure	Yes	7	42	3.43(1.37,8.57)	0.009
	No	20	411	1	
BMI	Under weight	0	33	1	0.998
	Normal	18	255	11400(0.000)	
	Over weight	9	119	0.000	
	Obese	0	46	0.000	
Central obesity	Yes	9	175	0.79(0.35,1.81)	0.583
	No	18	278	1	
Hypertension	Yes	15	162	2.25(1.03,4.91)	0.043
	No	12	291	1	

7.6. Bivariable analysis of risk factor variables with Impaired Glucose tolerance

This study assessed factors associated with the prevalence of IGT among the study subjects. In order to assess factors associated with impaired glucose tolerance a binary logistic regression model was used.

An enter logistic regression analysis method was utilized in order to find out the association of IGT. Variables with $p < 0.2$ in the bi variable analysis were selected for multi variable logistics regression.

Among sociodemographic variables Sex ($P=0.02$) and marital status ($P=0.091$) were found significantly associated with IGT (table 5)

Table 5: Bivariable association of sociodemographic variables with IGT among study participants in Ambo, Ethiopia August 2019 (n=480)

Variables	Category	Presence of IGT		COR (95% CI)	P value
		Yes	No		
Age (variables)	20-24	7	96	1	
	25-29	6	96	0.58(0.20,1.66)	0.312
	30-34	3	39	1.26(0.40,3.92)	0.69
	35-39	9	66	1.43(0.56,3.63)	0.45
	≥40	20	138	0.90(0.38,2.12)	0.82
Sex	Male	25	315	1	
	Female	20	120	2.1(1.12,3.92)	0.020
Marital status	Single, divorced and widowed	15	96	1	
	Married	30	339	0.56(0.29,1.09)	0.091
Educational level	Illiterate	3	25	1	
	Primary	10	93	1.00(0.44,2.29)	0.987
	Secondary	17	157	0.872(0.376,2.020)	0.749
	Tertiary	15	160	1.116(0.285,4.364)	0.875

Intensity of daily activity (P=0.084), smoking (P=0.000), alcohol consumption (P=0.001), regular physical exercise (P=0.157), previous history of raised blood pressure (P=0.097) and hypertension (P=0.139) were found to have statistically significant association with the prevalence of IGT. (table 6)

Table 6: Bivariable association of behavioral and clinical variables with IGT among study participants in Ambo, Ethiopia August 2019 (n=480)

Variables	Category	<u>Presence of IGT</u>		COR (95% CI)	P value
		Yes	No		
Smoking	Yes	14	31	3.47(1.733,6.97)	0.000
	No	50	385	1	
Heavy Alcohol consumption	Yes	23	117	2.84(1.52,5.29)	0.001
	No	22	318	1	
Intensity of daily activity	Medium	43	373	1	
	Heavy	2	43	0.28(0.06,1.185)	0.084
Regular physical activity	Yes	4	18	2.26(0.73,6.99)	0.157
	No	41	417	1	
Inadequate fruits and vegetables intake	No	0	6	0.000	0.999
	Yes	45	429	1	
History of raised blood pressure	Yes	1	48	0.18(0.025,1.36)	0.097
	No	44	387	1	
Central obesity	Yes	17	167	0.97(0.51,1.835)	0.936
	No	28	268	1	
Hypertension	Yes	12	165	0.59(0.29,1.18)	0.139
	No	33	270	1	
BMI	Under weight	3	30	1	
	Normal	21	252	0.83(0.23,2.96)	0.79
	Over weight	16	112	1.43(0.39,5.23)	0.59
	Obese	5	41	1.22(0.27,5.50)	0.79

7.7. Multivariable analysis of risk factor variables with diabetes mellitus.

An enter logistic regression analysis method was utilized to ascertain the association and variables with $p < 0.2$ were included in this analysis and variable with $p < 0.05$ were considered significant in the multivariate.

In multivariable binary logistic regression analysis of the study participants being married were associated with 86.5% less likely of having diabetes mellitus compared to participants who were single, divorced or widowed AOR=0.135 (0.037, 0.488). Having history of raised blood sugar in the past was also associated with 100 times increased likely of developing diabetes in contrast to their counter parts, AOR=100.54 (4.599, 2198.1). Sex and age of participants did not show an independent significant association with the prevalence of diabetes.

Among the behavioural characteristics tobacco smoking and heavy alcohol consumption were found to have statistical significance association with diabetes mellitus, AOR 10.1 (2.68, 37.99) and 7.23 (2.21, 23.6) respectively. Study participants with inadequate consumption of fruits and vegetables were found more likely to develop diabetes than participant who have adequate fruits and vegetables consumption. There was no statistical significant difference found with hypertension among participants (table 7).

Table 7: Multivariable association of socio demographic, behavioral and clinical variables with diabetes mellitus among study participants in Ambo, Ethiopia August 2019 (n=480)

Variables	Category	<u>Presence of diabetes</u>		AOR (95% CI)	P value
		Yes	No		
Sex	Male	23	317	1	0.123
	Female	4	136	0.341(0.087, 1.336)	
Marital status	Single, divorced or widowed	9	102	1	0.002*
	Married	18	351	0.135(0.037, 0.488)	
Educational level	Illiterate	3	25	1	0.643
	Primary	10	93	0.713(0.176, 2.877)	
	Secondary	8	166	0.551(0.11, 2.774)	
	Tertiary	6	169	0.732(0.052, 10.391)	
Smoking	Yes	15	401	10.09(2.68, 37.933)	0.001*
	No	12	52	1	
Heavy Alcohol consumption	Yes	18	122	7.23(2.21, 23.62)	0.001*
	No	9	331	1	
Inadequate consumption of fruits and vegetables	No	3	3	143.1(11.62, 1763.8)	0.000*
	Yes	24	450	1	
Hypertension	Yes	15	162	2.85(0.827, 9.82)	0.097
	No	12	291	1	
History of raised blood pressure	Yes	7	42	3.77(0.866, 16.397)	0.077
	No	20	411	1	
History of raised blood sugar	Yes	7	1	100.5(4.599, 2198.1)	0.003*
	No	20	452	1	

* significant

7.8. Multivariable association of risk factors variables with impaired glucose tolerance

In multi variable binary logistic regression analysis, participants smoking tobacco were found to have 3 times more likely to have impaired glucose tolerance than their counter groups, AOR=3.06 (1.45, 6.48). Heavy alcohol consumption also showed an independent and significant association with the prevalence of IGT, was associated with 2.5 times more likely to develop IGT than subjects with light to moderate alcohol consumption (table 8).

Table 8: Multivariable association of socio demographic, behavioral and clinical variables with IGT among study participants in Ambo, Ethiopia August 2019 (n=480)

Variables	category	<u>Presence of IGT</u>		AOR	P value
		Yes	No		
Sex	Male	25	315	1	0.171
	Female	20	120	1.65(0.805, 3.37)	
Marital status	Single, divorced or widowed	15	96	1	0.305
	Married	30	339	0.667(0.307, 1.446)	
Regular physical exercise	Yes	4	18	0.979(0.252, 3.800)	0.976
	No	41	417	1	
Intensity of daily activity	Light to moderate	43	373	1	0.062
	Heavy	2	43	0.241(0.054, 1.075)	
Tobacco smoking	Yes	14	31	3.093(1.49, 6.38)	0.002*
	No	50	385	1	
Heavy Alcohol consumption	Yes	23	117	2.474(1.27, 4.79)	0.007*
	No	22	318	1	
History of raised blood pressure	Yes	1	48	0.238(0.031, 1.856)	0.171
	No	44	387	1	
Hypertension	Yes	12	165	0.703(0.334, 1.481)	0.354
	No	33	270	1	

* significant

8. DISCUSSION

In this study, the prevalence of DM was 5.6 % which is comparable with the finding from Northwest Ethiopia, 5.1% (47) Bishoftu, central Ethiopia, 5% (48) and sub- saharan Africa, 6.5% (49). Similarly, the prevalence was in line with the finding from Gilgel Gibe research project, southwest Ethiopia (4.4%) (50). which may be explained by inclusion of rural population. However, this finding is in contrast with estimated magnitude of 2% by IDF for Ethiopia over all urban and rural in 2013.

The ratio of newly diagnosed to previously diagnosed diabetes mellitus was 3.5:1 in this study. This ratio is high which indicates a substantial burden of undetected diabetes cases in the study community. This is probably due to low health seeking behavior since primary health care services are not comprehensive in developing countries. Hence health information dissemination about CNCs is low unlike communicable diseases and other community health issues. Additionally, access to health services in the study community might be low if they seek help and care.

This study revealed the prevalence of IGT was 9.4% and that of impaired glucose homeostasis was 15% is comparable with the study done in Jimma in 2006 which showed 15.5% of over all impaired glucose homeostasis, although the later used IFG instead of random capillary blood glucose which was used in this study (47).

Among socio demographic characteristics marital status was an independent predictor of diabetes. Married participants were 86.5% less likely to have DM compared to singles, divorced or widowed combined. In contrast to this finding study in Iran showed being never married was an important risk factor for hypertension and tended to be a significant risk factor for mortality in men. However, among women being widowed was associated with a lower risk of diabetes (51).

We now know that smoking causes type 2 diabetes. Infact smokers are 30-40% more likely to develop diabetes than non smokers (52). Several studies have shown smoking was associated with both increased incidence and complication of DM. This study showed that tobacco smoking was associated with 10 times more likely to develop DM compared to non smokers, cohort study in south korea has reported that past and current smoking was associated with 1.5 times increased likelihood of developing diabetes mellitus (53).

Evidence regarding the association between alcohol consumption and type 2 diabetes risk remain inconsistent. Further more literatures are lacking in developing countries. Moderate alcohol consumption was associated with lower risk of diabetes (54, 55, 56, 57) In this study heavy alcohol consumption was associated with increased risk of developing diabetes which is in line with study done in Finnish population which showed 2 times increased likely hood of developing diabetes in both sexes (58).

This study pointed out that consumption of less than one serving of fruits and vegetables per day was associated with significant chance of developing diabetes. Similarly a higher intake of fruits, especially berries, and green leafy vegetables, yellow vegetables, cruciferous vegetables or their fiber is associated with a lower risk of type 2 diabetes (59, 60, 61).

The prevalence of hypertension was high and vast majority were undiagnosed. Bivariate analysis revealed that hypertension and educational status were positively associated with DM in this study, although after adjustment for other variables, their effect was not statistically significant. Many researchs in different part of the world showed hypertension as a significant risk factor for both IGT and overt diabetes. (62, 63, 64).

Impaired glucose tolerance also known as pre diabetes is a condition where a person has a blood sugar level above normal range but not high enough to be diagnosed as diabetes. IGT is one of the most important risk factors for overt diabetes and can bring complications on various organs as diabetes, with early diagnosis, proper treatment and life sytle change this condition can be reversed to normal state. Both diabetes and IGT share the same risk factors including heavy alcohol consumption, tobacco smoking, obesity, low fruits and vegetables intake and physical inactivity. In this study heavy alcohol consumption and tobacco smoking were indipendent risk factors for IGT with 2.5 and 3 times more likey to have IGT respectively.

Bi variate analysis showed that being male, heavy daily activity and regular physical activity were inversly associated while hypertension and previous history of raised blood pressure were negatively associated with the incidence of IGT, although after adgustment for other variables there was no statistically significant association with these variables in multivariate logistic regression.

9. LIMITATION OF THE STUDY

Abnormal lipid metabolism is one of the risk factors for the development of diabetes mellitus, due to inaccessibility of the test in the town and financial constraint the study didn't include measurement of lipid profile (TC, TG, LDL&HDL).

Due to resource limitation the oral glucose tolerance tests were not performed which may decrease the strength of the study.

As mentioned in many literatures genetic susceptibility is one of the risk factors for the development of impaired glucose homeostasis. This study didn't try to see the link between genetic predisposition and the development of impaired glucose homeostasis.

The study didn't collect information on subtypes of diabetes namely type 1DM and type 2 DM. Further more, it included only adults greater than 20 years of age which could mask the prevalence of type 1DM which can affect any one at any age even younger than 20 years.

10. CONCLUSION

This study has found a high prevalence of impaired glucose homeostasis comparable with previously reported in urban population. Large majority of diabetic cases in the study identified were not previously diagnosed and treated. Hypertension was also found to be prevalent and remains largely undiagnosed although, not associated with impaired glucose homeostasis in this study. Tobacco smoking and heavy alcohol consumption were an independent predictors in both IGT and DM.

All participants with abnormal blood glucose level and newly recognised hypertensive individuals were advised and informed to visit health institutions for further work up, treatment and follow up.

Further investigation is warranted to unravel association of diabetes with hypertension, obesity, physical inactivity and other known risk factors.

11. RECOMMENDATIONS

Diabetes mellitus along with other chronic non-communicable diseases are no more a disease of the westerns and developed countries alone. This study pointed out the high prevalence of diabetes, impaired glucose tolerance and hypertension.

The federal ministry of health need to implement either cheap or free screening programme for diabetes and hypertension at primary health unit for adults in general.

Health information dissemination for increasing awareness and bringing behavioral changes on healthy life styles such as having regular physical exercise during leisure time and quitting of cigarette smoking and avoiding harmful use of alcohol has to be carried out by the town's disease prevention and health promotion unit. Additionally, where resources are available, screening of high-risk groups is recommended to early detect and prevent the occurrence of diabetes mellitus and its complications in the study community.

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Annexes:

Annex 1: STUDY INFORMATION SHEET AND CONSENT FORM

Questionnaire serial number _____

Introduction

My name is I am a data collector for a student of Master of Public Health in Field epidemiology at Saint Paul's Hospital Millennium Medical College (SPHMMC), Public Health Department. This questionnaire is designed for research works which was approved by SPHMMC department of public health and Oromia Regional health bureau to be conducted in partial fulfillment of a master degree in Field Epidemiology. The purpose of this study is to find out how many adults greater than 20 years in Ambo town have diabetes and prediabetes. Diabetes is a potentially serious long-term condition, which can result in severe disability or even death if not properly managed. However, early detection and control of the blood sugar level have been found to markedly reduce the risk of complications and this is what we hope to do here.

Confidentiality and consent form

I would like to request your participation in this study that will involve asking you some questions and conducting some tests. Before we proceed, I will request you to listen carefully to what I am going to read to you about the purpose of this study and what it involves and tell me whether you are willing to participate in this research or not. The survey will be made up of three parts as follows:

1. Ask you some questions that have been found to be associated with the disease.
2. Take some body measurements such as weight, height and blood pressure.
3. Do a simple blood test to check your blood sugar level, and so determine if you are at risk of developing the disease now or in future.

The whole test will take about one hour and we would like to assure you that the information obtained will be strictly for our research use only. Your name will not be used in our report and the information obtained will not be used in any way that will identify you. The interview is voluntary.

Would you be willing to participate?

Yes

No

If you are willing to participate, please continue to respond to the questions.

Thank you very much for your cooperation

Interviewer's name

Signature

Date of interview

Supervisor's name

Signature

If you need additional information you can contact Principal investigator

Name: Dr. Tedi Tilahun Tel.No; +251 931 578 072

Annex 2: Data collection tool for prevalence and risk factor of diabetes mellitus and IGT in Ambo town West shoa zone Ethiopia 2019.

Survey information

Location and Date			Code
1	Cluster/Centre/Village ID	_____	I1
2	Cluster/Centre/Village name		I2
3	Interviewer ID	_____	I3
4	Date of completion of the instrument	_____	I4

Participant Id Number _____			
Consent, Interview Language and Name		Response	Code
5	Consent has been read and obtained	Yes 1 No 2 IF NO, END	I5
6	Interview Language <i>[Insert Language]</i>	English 1 <i>[Add others]</i> 2 <i>[Add others]</i> 3 <i>[Add others]</i>	I6
7	Time of interview (24 hour clock)	_____ : _____	I7
8	Family Surname		I8
9	First Name		I9

Record and file identification information (I5 to I9) separately from the completed questionnaire.

Demographic information

CORE: Demographic Information			
Question		Response	Code
10	Sex (Record Male / Female as observed)	Male 1 Female 2	C1
11	What is your date of birth?	<i>If known, Go to C4</i>	C2
12	How old are you?	Years	C3
13	In total, how many years have you spent at school or in full-time study (excluding pre-	Years	C4

Step 1 behavioral information

CORE: Tobacco Use			
Now I am going to ask you some questions about various health behaviors. This includes things like smoking, drinking alcohol, eating fruits and vegetables and physical activity. Let's start with tobacco.			
Question		Response	Code
14	Do you currently smoke any tobacco products , such as cigarettes, cigars or pipes? <i>(USE SHOWCARD)</i>	Yes 1 No 2 <i>If No, go to T6</i>	T1
15	Do you currently smoke tobacco products daily ?	Yes 1 No 2 <i>If No, go to T6</i>	T2
16	How old were you when you first started smoking daily?	Age (years)	T3
17	Do you remember how long ago it was? <i>(RECORD ONLY 1, NOT ALL 3) Don't know 77</i>	In Years <i>If Known, go to T5a</i>	T4a
		OR in Months	T4b
		OR in Weeks	T4c
18	On average, how many of the following do you smoke each day? <i>(RECORD FOR EACH TYPE, USE SHOWCARD) Don't Know 77</i>	Manufactured cigarettes	T5a
		Hand-rolled cigarettes	T5b
		Pipes full of tobacco	T5c
		Cigars, cheroots, cigarillos	T5d
		Other <i>If Other, go to T5other</i>	T5e
		Other (please specify): <i>Go to T9</i>	T5other

CORE: Alcohol Consumption			
The next questions ask about the consumption of alcohol.			
Question		Response	Code
19	Have you ever consumed an alcoholic drink such as beer, wine, spirits, fermented cider or <i>[add other local examples]</i> ? (USE SHOWCARD OR SHOW EXAMPLES)	Yes 1 No 2 <i>If No,</i> <i>go to D1</i>	A1a
20	Have you consumed an alcoholic drink within the past 12 months ?	Yes 1 No 2 <i>If No, go to D1</i>	A1b
21	During the past 12 months, how frequently have you had at least one alcoholic drink? (READ RESPONSES, USE SHOWCARD)	Daily 1 5-6 days per week 2 1-4 days per week 3 1-3 days per month 4	A2
22	Have you consumed an alcoholic drink within the past	Yes 1 No 2 <i>If No, go to D1</i>	A3
23	During the past 30 days, on how many occasions did you have at least one alcoholic drink?	Number Don't know 77 _ _ _	A4
24	During the past 30 days, when you drank alcohol, on average , how many standard alcoholic drinks did you have during one drinking occasion?	Number Don't know 77 _ _ _	A5
25	During the past 30 days, what was the largest number of standard alcoholic drinks you had on a	Largest number Don't Know 77	A6
26	During the past 30 days, how many times did you have for men: five or more for women: four or more	Number of times Don't Know	A7

CORE: Diet

The next questions ask about the fruits and vegetables that you usually eat. I have a nutrition card here that shows you some examples of local fruits and vegetables. Each picture represents the size of a serving. As you answer these questions please think of a typical week in the

Question		Response	Code
27	In a typical week, on how many days do you eat fruit ? (USE SHOWCARD)	Number of days Don't Know 77 If Zero days, go to D3	D1
28	How many servings of fruit do you eat on one of those days? (USE SHOWCARD)	Number of servings Don't Know 77	D2
29	In a typical week, on how many days do you Eat vegetables ? (USE SHOWCARD)	Number of days Don't Know 77 If Zero days, go to D5	D3
30	How many servings of vegetables do you eat on one of those days? (USE SHOWCARD)	Number of servings Don't know 77	D4

CORE: 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. Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study/training, household chores, harvesting food/crops, fishing or hunting for food, seeking employment. <i>[Insert other examples]</i>			
Question	Response		Code
Work			
31	Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like <i>[carrying or lifting heavy loads, digging or construction work]</i> for at least 10 minutes continuously?	Yes 1 No 2 <i>If No, go to P 4</i>	P1
32	In a typical week, on how many days do you do vigorous-intensity activities as part of your work?	Number of days	P2
33	How much time do you spend doing vigorous-intensity activities at work on a typical day?	Hours : minutes : hrs mins	P3 (a-b)
34	Does your work involve moderate-intensity activity, that causes small increases in breathing or heart rate such as brisk walking <i>[or carrying light loads]</i> for at least 10 minutes continuously?	Yes 1 No 2 <i>If No, go to P 7</i>	P4
35	In a typical week, on how many days do you do moderate-intensity activities as part of	Number of days 	P5
36	How much time do you spend doing moderate-intensity activities at work on a typical day?	Hours : minutes : hrs mins	P6 (a-b)
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. <i>[Insert other examples if needed]</i>			
37	Do you walk or use a bicycle (<i>pedal cycle</i>) for at least 10 minutes continuously to get to and from places?	Yes 1 No 2 <i>If No, go to P 10</i>	P7
38	In a typical week, on how many days do you walk or bicycle for at least 10 minutes	Number of days	P8
39	How much time do you spend walking or bicycling for travel on a typical day?	Hours : minutes : hrs mins	P9 (a-b)

CORE: Physical Activity, Continued			
Question		Response	Code
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), <i>[Insert relevant terms]</i> .			
40	Do you do any vigorous-intensity sports, fitness or recreational (<i>leisure</i>) activities that cause large increases in breathing or heart rate like <i>[running or football]</i> for at least 10	Yes 1 No 2 <i>If No, go to P 13</i>	P10
41	In a typical week, on how many days do you do vigorous-intensity sports, fitness or	Number of days	P11
42	How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?	Hours : minutes : hrs mins	P12 (a-b)
43	Do you do any moderate-intensity sports, fitness or recreational (<i>leisure</i>) activities that cause a small increase in breathing or heart rate such as brisk walking, <i>[cycling, swimming, volleyball]</i> for at least 10 minutes continuously?	Yes 1 No 2 <i>If No, go to P16</i>	P13
44	In a typical week, on how many days do you do moderate-intensity sports, fitness or	Number of days	P14
46	How much time do you spend doing moderate-intensity sports, fitness or recreational (<i>leisure</i>) activities on a typical day?	Hours : minutes :	P15 (a-b)

CORE: History of Raised Blood Pressure			
Question		Response	Code
47	Have you ever had your blood pressure measured by a doctor or other health worker?	Yes 1 No 2 <i>If No, go to H6</i>	H1
48	Have you ever been told by a doctor or other health worker that you have raised blood pressure or hypertension?	Yes 1 No 2 <i>If No, go to H6</i>	H2a
49	Have you been told in the past 12 months?	Yes 1 No 2	H2b

CORE: History of Diabetes			
Question		Response	Code
50	Have you ever had your blood sugar measured by a doctor or other health worker?	Yes 1 No 2 <i>If No, go to M1</i>	H6
51	Have you ever been told by a doctor or other health worker that you have raised blood sugar or diabetes?	Yes 1 No 2 <i>If No, go to M1</i>	H7a
52	Have you been told in the past 12 months?	Yes 1 No 2	H7b

Physical measurement step 02

CORE: Height and Weight			
Question		Response	Code
53	Interviewer ID		M1
54	Device IDs for height and weight	Height Weight	M2a
55	Height	in Centimeters (cm)	M3
56	Weight <i>If too large for scale 666.6</i>	in Kilograms (kg)	M4
57	For women: Are you pregnant?	Yes 1 <i>If Yes, go to M 8</i> No 2	M5
CORE: Waist			
58	Device ID for waist		M6
59	Waist circumference	in Centimeters (cm)	M7
CORE: Blood Pressure			
60	Interviewer ID		M8
61	Device ID for blood pressure		M9
62	Cuff size used	Small 1 Medium 2 Large 3	M10
63	Reading 1	Systolic (mmHg)	M11a
		Diastolic (mmHg)	M11b
64	Reading 2	Systolic (mmHg)	M12a
		Diastolic (mmHg)	M12b
65	Reading 3	Systolic (mmHg)	M13a
		Diastolic (mmHg)	M13b
66	During the past two weeks, have you been treated for raised blood pressure with drugs (medication) prescribed by a doctor or other health worker?	Yes 1 No 2	M14

Biochemical measurement step 03

CORE: Blood Glucose			
Question		Response	Code
67	During the past 12 hours have you had anything to eat or drink, other than water?	Yes 1 No 2	B1
68	Technician ID		B2
69	Device ID		B3
70	Time of day blood specimen taken (24 hour clock)	Hours : minutes :	B4
71	Random blood glucose <i>Choose accordingly: mmol/l or mg/dl</i>	mmol/l	B5
		Mg/dl	
72	Today, have you taken insulin or other drugs (medication) that have been prescribed by a doctor or other health worker for raised blood	Yes 1 No 2	B6

Thank you

Annex 3: Afan oromo questionnaire

Lakk	Gaaffii	Deebi	kodi
1	Ganda		I1
2	Maqaa qa'ee		
3	Interviewer ID		I3
4	Guyyaa xumurame		
5	Eyyame Mallatesaniru	Eyyeen 1 Lakkii 2 Lakkii taanan xumuri	I5
6	Qooqa gaaffin gaggefamu	Afaan oromo, Amariffa	I6
7	Sa'aa gaffin gaggefamu		I7
8	Maqaa abbaa		I8
9	Maqaa jalqabaa		I9

Lakk	Gaaffii	Deebii	Koodi
10	saala	Dhira 1 dhalaa 2	C1
11	Guyyaa dhalotaa		C2
12	Umuri	Waggaan	C3
13	Mana barumsatti wagga meeqa dabarsite	Waggaan	C4

Sadarkaa 1ffaa Gaffii tambo ilaalchisee kan armaan gaditi (14-18)

Lakk	Gaaffii	Deebii	Koodi
14	Yeroo ammaan tamboo ni fayadamta?	Eyyeen 1 Lakkii 2 Lakkii taanaan gara T6	T1
15	Yeroo ammaa tamboo guyyaa guyyaan fayadamtaa?	Eyyeen 1 Lakkii 2 Lakkii taanaan gara T6	T2

16	Yeroo jalqabaa tamboo yo fayadamtu umuriin ke meeqa turee?	Waggaan	T3
17	Yeroo jalqabaa tambo yo fayadamtu waggaa meqaan dura?	Waggaan	T4a
18	Guyyaati hammam fayadamta?		T5a

Gaaffii dhugaati alkoolii ilaalchisee kan armaan gaditi (19-26)

Lakk	Gaaffii	Deebii	Koodi
19	Dhugaati kan akka biraa, waynii, dadhii fayadamte bektaa?	Eyyeen 1 lakkii 2 Lakki taanaan gara D1	A1a
20	Ji'oota 12 darban keessa dhugaati alkoolii fayadamte bektaa?	Eyyeen 1 lakkii 2 Lakkii taanaan gara D1	A1b
21	Ji'oota 12 derban keessa haal kamiin dhugaati fayadamaa turte?	Guyyaa guyyaan 1 Torban kesaa guyyaa 5-6 2 Torban kessaa guyyaa 1-4 3 Torban kesaa guyyaa 1-3 4	A2
22	Guyyota derban 30 kessaa dhugaati fayadamte jirta?	Eyyeen 1 lakkii 2 Lakkiii taanaan gara D1	A3
23	Guyyota darban 30 kessaa si'a meeqa dhugaati fayadamte?		A4
24	Guyyoota darban 30 kessaa si'a tokkon dhugaatii meeqa fayadamte?		A5
25	Guyyota darban 30 kessaa si'a tokkon dhugaati bay'inaan meeqa fayadamte?	Issa guddaa	A6
26	Guyyota darban 30 kessaa si'a meeqa Dhiraaf 5 fi sanaan ol Dhalaaf 4 fi sanaan ol Si'a tokkon dhugaati fayadamte?		A7

Gaaffii nyaata fudura fi muduraa ilaalchisee kan armaan gaditi (27-30)

Lakk	Gaaffii	Deebii	Koodi
27	Torban kessaa guyyaa meeqa fuduraa fayadamta?	Zeroo tanaan gara D3	D1
28	Guyyota fuduraa fayadamtu kessaa guyaatti si'a meeqa fayadamta?		D2
29	Torban kessaa guyyaa meeqa kuduraa faydamtaa?	Zeroo tanaan gara D5	D3
30	Guyyoota kuduraa fayadamtu kessaa guyyati si'a meeqa fayadamtaa?		D4

Gaaffii haala hooji ilaalchise kan armaan gaditi (31-36)

Lakk	Gaaffii	Deebii	Koodi
31	Hooji hojeetu baaayyee ni dhamaasaa Kan akka waanta ulfata baachuu,	Eyyeen 1 lakkii 2 Lakkii taanaa gara P4	P1
32	Torban kessaa guyyaa meeqa hooji ulfata hojjettaa?		P2
33	Guyyaatti sa'aa meeqa hoji ulfaataa hojjetta?	Sa'aa	P3 (a-b)
34	Hojii gidugallessa ni hojjettaa?	Eyyeen 1 lakkii 2 Lakkii taanaan gara P7	P4
35	Torban kessaa guyya meeqa hooji gidu gallessa hojjettaa?		P5
36	Guyyatti hooji gidu gallessa sa'aa meqaaf hojjettaa?	Sa'aa	P6 (a-b)

Gaaffii adeemsa millaa ilaalchise kan arman gaditi (37-39)

Lakk	Gaaffii	Deebii	Koodi
37	Iddoo dha gara iddooti demuf millaan demu yokin saykila fayadamtaa	Eyyeen 1 lakkii 2 Lakkii taanaan gara P10	P7
38	Torban kessaa yo xiqqate daqiqaa 10 f guyyaa meeqa millan yokin saykilaan fayadamtaa?	Guyyaa	P8
39	Guyyaati sa'a meeqaaf millaan yokin saykilan fayadamtaa?	Sa'aa daqiqaa	P9 (a-b)

Gaaffii sporti ilaalchise kan armaan gaditi (40-45)

Lakk	Gaaffii	Deebii	Koodi
40	Sportii ulfaataa kan akka kubbaa milla, figicha ni hojjeetta?	Eyyeen 1 lakkii 2 Lakkii taanaa gara P13	P10
41	Torban kessaa guyyaa meeqa sporti ulfaataa hojjettaa?	Guyyota ...	P11
42	Guyyaati sa'aa meeqa sporti ulfaataarati dabarsita?	Sa'aa... daqiqaa.....	P12 (a-b)
43	Sporti gidu gallesaa kan akka bishaan daakaa, sayklii fi kubbaa saphanaa ni hojjettaa?	Eyyeen 1 lakkii 2 Lakkii taanaan gara P16	P13
44	Torban kessaa guyyaa meeqa sporti gidu gallesaa hojjettaa?	Guyyoota	P14
45	Guyyaati sa'aa meeqa sporti gidu dallesaratti dabarsitaa?	Sa'aa.... Daqiqaa.....	P15 (a-b)

Gaaffii dhibbaa dhigaa ilaalchisee kan armaan gaditi (46-48)

Lakk	Gaaffii	Deebii	koodi
46	Kanaan dura dhibbaa dhigaakee ogessa fayyaatin lakkawame bekaa	Eyyeen 1 lakkii 2 Lakkii taanaan gara H6	H1
47	Kanaan dura dhibbaan dhigaakee ogessa fayyaatin olka'aa dha jedhamte bekta	Eyyeen 1 lakkii 2 Lakkii taanaan gara H6	H2a
48	Jioota 12 darban kessaa dhibbaa dhigaa olka'ee siti himame jiraa?	Eyyeen 1 lakkii 2	H2b

Gaaffii dhibee sukaaraa ilaalchisee kan armaan gaditi (49-51)

Lakk	Gaaffii	Deebii	Koodi
49	Kanaan dura ogessa fayyaatin sakatainsa dhibee sukaaraa siif godhamee beekaa?	Eyyeen 1 lakkii 2 Lakkii taanaan gara M1	H6
50	Kanaan dura ogeessa fayyatin sukkarri ke ol ka'aadha jedhamtee beektaa?	Eyyeen 1 lakkii 2 Lakkii taanaa gara M1	H7a
51	Jioota 12 darban kessaa sukkaarike olka'aadha jedhmate beektaa?	Eyyeen 1 lakkii 2	H7b

Sadarkaa 2faa

Lakka'insa ulfaatinaafi hojjaa kan arman gaditi (52-56)

Lakk	Gaaffii	Deebii	Koodi
52	Interviewer ID		M1
53	Lakkofsa meshaa kan ulfatinaafi hojjaa	Kan ulfaatinaa Kan hojjaa	M2a M2b
54	Hojjaa	Sentimetraan	M3
55	Ulfaatina	Kilogramaan	M4
56	Dhalaaf ulfaa?	Eyyeen 1 lakkii 2 Eyyeen taanaan gara M8	M5

Nannawaa mudhii illalchise kan arman gaditi (57fi 58)

Lakk	Gaaffii	Deebii	Koodi
57	Lakkofsa meshaa naannawaa mudhii		M6
58	Naanawwaa mudhii	Sentimetraan	M7

Dhibbaa dhigaa ilaalchise kan armaan gaditi (59-65)

Lakk	Gaaffii	Deebii	Koodi
59	Interviewer ID		M8
60	Lakkofsa meshaa dhibbaa dhigaa		M9
61	Bal'ina meshaa dhibbaa dhigaa	Xiqqaa 1 Gidu gallesa 2 Guddaa 3	M10
62	1ffaa	Systolic	M11a
		Diastolic	M11b
63	2ffaa	Systolic	M12a
		Diastolic	M12b
64	3 ffaa	Systolic	M13a
		Diastolic	M13b
65	Torban lamaan darban kessa qoricha dhibbaa dhigaa ogessa fayyaatin ajajame fudhatani beekt?	Eyyeen 1 lakkii 2	M14

Dhibee sukaaraa ilaalchise kan armaan gaditi (66-71)

Lakk	Gaaffii	Deebii	Koodi
66	Sa’aa 12 darban kessa bishaan ala waanta nyatamu yokin dhugamu fudhatanirtu?	Eyyeen 1 lakkii 2	B1
67	Technician ID		B2
68	Lakkofsa meshaa		B3
69	Sa’aa dhiga fudhatamee	Sa’aa daqiqaa	B4
70	Lakkofsa sakata’insa sukaaraa irraa argame	Mg/dl	B5
71	Har’a insulini yokin qoricha sukaaraa ogeessa fayyaatin ajajame fudhatani jirtu?	Eyyeen 1 lakkii 2	B6

GALATOMAA