COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

The Association of Overweight and Obesity with Gestational Diabetes Mellitus in Pregnant Women Attending Ante Natal Care in Selected Hospital in Addis Ababa, Ethiopia, 2019/2020

By: Yeabsra Mesfin (BSc)

A Thesis Submitted to the School of Public Health, College of Health Science, Addis Ababa University in Partial Fulfilment of the Requirement for the Degree of Masters of Public Health in Epidemiology and Biostatistics.

June 2021

Addis Ababa, Ethiopia

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ACRONYMS AND ABBREVIATIONS

ADA	American Diabetic Association
ANC	Antenatal Care
BMI	Body Mass Index
CC	Calf Circumference
CSA	Central Statistical Agency
CVD	Cardio Vascular Disease
DIP	Diabetes mellitus In Pregnancy
DM	Diabetes Mellitus
EDHS	Ethiopia Demographic and Health Survey
FPG	Fasting Plasma Glucose
GA	Gestational Age
GDM	Gestational Diabetes Mellitus
IADPSG	International Association of Pregnancy Study Group
IDF	International Diabetes Federation
IGT	Impaired glucose tolerance
IPAQ	International Physical Activity questionnaires
LNMP	Last Normal Menstrual Period
MDDW	Minimum Dietary Diversification score for women
MUAC	Mid-Upper Arm Circumference
NICE	National Institute for Health and Care Excellence
OGTT	Oral Glucose Tolerance Test
PCOS	Polycystic Ovarian Syndrome
RPG	Random plasma Glucose
T2DM	Type 2 Diabetes Mellitus
WHO	World Health Organization

ABSTRACT

Background: Gestational Diabetes Mellitus (GDM) is associated with a higher incidence of maternal, perinatal, and neonatal morbidities. Publication around the world showed that overweight and /obesity is a potential risk factor for gestational diabetes mellitus. Because of late antenatal care booking in our country and self-report of pre-pregnancy body mass index is not reliable, it's difficult to get pre-pregnancy or early pregnancy body mass index to measure overweight and obesity. Despite the increment in the incidence of overweight and obesity in our country, there is limited study showing the association of overweight and obesity with GDM in pregnant women and even the available studies lack consistency in findings.

Objective: This study aims to assess the association of maternal overweight and obesity with gestational diabetes mellitus in pregnant women in selected hospitals of Addis Ababa from March 10 to July 30, 2020.

Methods: An unmatched case-control study was conducted on 159 pregnant women with GDM (case) and 477 pregnant women without GDM (control) in selected hospitals in Addis Ababa. Each hospital had been conducted screening of GDM for high-risk pregnant women and diagnosis was made using the 2013 World Health Organization (WHO) criteria by a physician. Overweight and obesity were measured using Mid-Upper Arm Circumference (MUAC) and Calf Circumference (CC). Descriptive statistics used to present the socio-demographic profile of the study participants. Binary and multiple logistic regression analyses were done to measure the association of overweight and obesity with GDM. Finding was reported using adjusted odds ratios with 95% confidence interval and statistical difference was declared at P-value <0.05.

Result: GDM was associated with obesity (MUAC ≥33 and CC ≥39 cm) (AOR = 2.80; 95% CI: 1.58–4.90) but not with overweight (MUAC ≥ 28 cm) (AOR = 1.51; 95% CI: 0.71–3.21). Previous history of caesarean section (AOR = 1.91; 95% CI: 1.14–3.21), having inadequate minimum dietary diversification score (<5) (AOR = 3.55; 95% CI: 2.15–5.86), engaging in low and moderate physical activity (AOR = 3.56; 95% CI: 1.49–8.48) and (AOR = 1.99; 95% CI 1.17–3.40) also associated with the development of GDM.

Conclusion and Recommendation: Obesity but not overweight have found to be significantly associated with the development of GDM. Thus, screening for GDM is recommended for obese pregnant women (having MUAC ≥33 and CC ≥39 cm). Policy makers also should plan policies to decrease obesity among women of childbearing age before and in between conception. Antenatal care providers should provide information for women of childbearing age on maintaining a healthy body weight before and in between pregnancies, the need for healthy diversified food and physical activity.

Keywords

Gestational Diabetes mellitus, obesity, overweight, MUAC, CC

1 INTRODUCTION

1.1. **Background**

Hyperglycaemia (high blood glucose level) that is first detected during pregnancy is classified as either gestational diabetes mellitus (GDM) or diabetes mellitus in pregnancy (DIP). Gestational diabetes mellitus is defined as glucose intolerance first detected during pregnancy and usually diagnosed at 24-28 weeks of gestational age or at any time in pregnancy if one or more of the following criteria are met: fasting plasma glucose 5.1–6.9 mmol/L (92–125 mg/dl), 1-hour plasma glucose 10.0 mmol/L (180 mg/dl) following a 75 g oral glucose load and 2-hour plasma glucose 8.5–11.0 mmol/L (153–199 mg/dl) following a 75 g oral glucose load (1).

Diabetes mellitus in pregnancy (DIP) may either have been pre-existing diabetes (type 1 or type 2) antedating pregnancy, or diabetes first diagnosed during pregnancy. When the level of hyperglycemia first detected by testing at any time during pregnancy meets the criteria for the diagnosis of diabetes in the non-pregnant state, the condition is called DIP. Compared with gestational diabetes, DIP is more likely to be detected as early as the first trimester provided appropriate testing is undertaken (2).

Global GDM prevalence rates showed wide variations due to ethnic heterogeneity among populations tested, which are further exacerbated by the different screening and diagnostic criteria used. GDM prevalence has been reported to vary between 1% −28% (3). It is estimated by the International Diabetes Federation (IDF) that 21.3 million or 16.2% of live births to women in 2017 had some form of hyperglycemia in pregnancy. About 86.4% of those cases were because of gestational diabetes mellitus (GDM), 6.2% due to diabetes detected before pregnancy, and 7.4% due to other types of diabetes (including type 1 and type 2 diabetes) first detected in pregnancy. The vast majority (88%) of cases of hyperglycaemia in pregnancy were in low and middle-income countries, where access to maternal care is often limited (4).

GDM prevalence in Africa is 13.61%. The prevalence was highest in Central Africa 20.4%, and lowest in Northern Africa 7.57% sub-regions (5). In Ethiopia, the prevalence is different in studies ranges from 4.2% in Gondar ,Southern Ethiopia to 12.8% in Wolaita, Northwest Ethiopia (6,7).

Publications show that risk factors for GDM include ethnicity (8,9), maternal factors such as older age (10–16), high parity (17,18), overweight and obesity (12,14,18–20), excessive weight gain in the index pregnancy (14,21,22), physical inactivity before and during pregnancy (7,12,23–25), polycystic ovarian syndrome (PCOS) (14), history of diabetes mellitus in first-degree relatives (7,26–28) a history of poor pregnancy outcome (abortion, foetal loss) (6,14,18), macrosomia in previous and/or index pregnancy (12), GDM in a previous pregnancy (14,18), preeclampsia (29), vitamin D deficiency (14,30,31), Diet that is high in saturated fats, refined sugars and red and processed meats (32,33)**.**

Despite GDM usually exists as a transient disorder during pregnancy and resolves once the pregnancy ends, it is associated with a higher incidence of maternal morbidity including caesarean deliveries, birth trauma, hypertensive disorders of pregnancy (including preeclampsia), higher risk of developing GDM in subsequent pregnancies and about half of women with a history of GDM will develop type 2 diabetes within five to ten years after delivery. Babies born to mothers with GDM also have a higher lifetime risk of obesity, cardiovascular disease, and developing type2 diabetes (35–40).

Perinatal and neonatal morbidities also increase; the latter include macrosomia, shoulder dystocia birth injury, hypoglycaemia, polycythaemia, and hyperbilirubinemia (41–51).

1.2. **Statement of the problem**

Several studies in the world showed that overweight and or obesity is a potential risk factor for gestational diabetes mellitus using pre-pregnancy BMI or BIM at early pregnancy to measure overweight and obesity (53–58).

The body mass index (BMI) which is a person's weight in kilograms divided by the square of the height in meters (kg/m2) is currently widely used for measuring body fatness since is easy to measure, inexpensive, and provides standardized cut-off points for obese status (59). However, BMI is not sensitive to determining overweight and obesity in pregnancy due to its additional weight gain from foetus and placenta as well as an increase in the size of maternal organs, especially the breast and the uterus. (56) Rather, a pre-pregnancy BMI or BMI that is calculated at the initial booking visit (by 10 weeks of gestation) is used for the diagnosis of obesity in pregnancy (60).

In Ethiopia as a result of most of the pregnant women could not recall their weight before conception and only 20% of pregnant women started ANC visit (booking) during the first trimester, it is difficult to determine pre-pregnancy or early pregnancy BMI (61).

The 2016 EDHS report revealed that the proportion of women who are overweight or obese in Ethiopia has increased from 3% in 2000 to 8% in 2016 (61).

Despite this increment in the incidence of overweight and obesity in our country, there is limited study showing the association of overweight and obesity with GDM in pregnant women. Even the available limited studies were either with controversy findings on the association of overweight and obesity with GDM or had used insensitive measurements to assess overweight and obesity.

Rational and significance of the study

An increasing number of women of reproductive age are overweight and obese in our country (61), thus more women entering pregnancy are vulnerable to hyperglycaemia during pregnancy.

Due to late booking into ANC in our country and self-report of pre-pregnancy BMI is not reliable; it's difficult to get pre-pregnancy or early pregnancy BMI of pregnant women to assess obesity.

So, this study aimed at assessing the association of overweight and obesity with gestational diabetes mellitus using MUAC and calf circumference to measure overweight and or obesity in pregnant women.

These measures avoided the use of mathematical calculations, sophisticated equipment, and regular equipment standardization, which are important considerations in under-resourced settings.

Confirming that overweight /obesity has an association with gestational diabetes mellitus will provide essential information regarding the need to prevent overweight and obesity before conception and helpful to health policy and program planning in prevention strategies.

2 LITERATURE REVIEW

2.1. Socio-demographic related factors for GDM

Studies done in the different parts of the world shared the finding that advanced maternal age (≥35 age) is a possible risk factor for GDM. A cross-sectional study to assess the prevalence of gestational diabetes mellitus and its associations with social and behavioral factors, maternal body mass index (BMI), anemia, and hypertension on 2345 pregnant women from 16 hospitals in China in 2017 revealed that Pregnant women aged 36–45 years old were 4.29 times more likely to have GDM than women aged 18–25 years old (62). In line with this study another cross-sectional study to assess the association between advanced maternal age and adverse pregnancy outcomes in Malaysia, data from the registered births cards including 1415 pregnant women from 11 health clinics and 38 community clinics in Muar District showed that pregnant mothers aged > 35 are 2.32 times developed GDM than women aged 20-34 (63). Systematic review and metaregression on prevalence and risk factors of GDM in sub-Saharan Africa published in 2015 also showed maternal age>30 years is a risk for the development of GDM (12).

Studies conducted to assess the prevalence and associated factors for GDM in Ethiopia showed no significant association between maternal socio-demographic factors (age-, residence-, ethnicity-, religion-, educational status of women-, occupational status-, monthly income) and GDM (6,7). However, one unmatched case-control study conducted to assess determinants of GDM among ANC attendants from referral hospitals of Amhara regions on 567 cases and 1690 controls in 2016 found that literate women had a 40% lower risk of developing GDM than illiterate women (18).

2.2. Dietary and lifestyle related- factors for GDM

Physical activity during or before pregnancy and dietary factors was found to have a significant association with GDM in several studies.

A meta-analysis of five prospective cohorts, two retrospective case-control studies, and two cross-sectional studies aimed to systematically review and synthesize evidence on the relation between physical activity and the development of GDM in 2011 found that pre-pregnancy physically active pregnant women had a 55% lower risk of GDM, a pooled odds ratio and Exercise in early pregnancy also 44% lower risk of GDM (24). Similarly, a prospective cohort study to assess gestational diabetes mellitus risk with maternal recreational physical

activity before and during pregnancy on 909 pregnant women in Washington from 1996 to 2000 showed women who exercised physical activity ≥ 4.2 hours per week during the year before the index pregnancy experienced a 76% reduction in risk of GDM while women taking part in physical activity for ≥ 6.0 hours per week was associated with a 10% reduction in risk of GDM (23).

Two studies in Ethiopia also revealed that adequate dietary diversification and regular physical had negatively associated with the development of GDM. The previously mention unmatched case-control study to assess the determinants of GDM used dietary diversification score (DDS) recommended by (WHO) on 12 food items (If the women consume 0–2 foods, categorized under poor, if the women consume 3–5 foods her DDS score was medium and if she consumes more than six food items, her DDS score was high). It showed pregnant women with a dietary diversification score of two/poor had 2.96 times higher risk of developing GDM. This study also showed that regular physical exercise decreases the risk of developing GDM by 97% (18).

The other recent cross-sectional study conducted among 1027 pregnant women to assess the prevalence of gestational diabetes mellitus and associated factors among women attending ANC at Gondar in 2018 including one tertiary Hospital and four health centers using Food and Nutrition Technical Assistance (FANTA) 2016 version woman's minimum dietary diversity measurement tool. The MDDS of five and more was categorized as adequate dietary diversity and showed that inadequate dietary diversity was 1.9 times higher among pregnant mothers with GDM. The study also used International Physical Activity Questionnaire (IPAQ) to assess the physical activities that women do as part of their everyday lives and revealed that low physical activity increases the likelihood of developing GDM 3.36 times compared to a high level of physical activity during pregnancy (7).

2.3. **Obstetric and medical related factors**

Studies identified that high parity increases the risk of GDM. A 5-year prospective observational study in Nigeria, from January 1, 2002, to December 31, 2006, to review the antenatal complications and pregnancy outcomes among 1213 grand parous and 1213 multiparous women revealed that grand parous women 12.53 times having GDM than multiparous women (17). The unmatched cross-sectional study previously mentioned also

found that Women with parity of three and above had 1.78 folds higher risk of developing GDM (18).

History of poor pregnancy outcomes like still birth, abortion, and intrauterine foetal death (IUFD) is a risk for GDM in studies conducted in Ethiopia. The unmatched case-control study also showed the odds of GDM were five-folds higher in women with a history of abortion and women with a history of IUFD had a 3.96 times higher risk of developing GDM (18). Similarly, a cross-sectional study on the prevalence of gestational diabetes mellitus and associated factors in Southern Ethiopia Wolaita Zone published in 2019 using 75-g OGTT for universal screening of pregnant women 24-28 weeks of GA and updated WHO criteria including 518 pregnant women showed GDM was 4.8 times higher in pregnant women with a previous history of still birth and 4.2 times higher in pregnant women with a previous history of spontaneous abortion (6).

Having a macrosomic baby in previous pregnancies and a history of caesarean Section mentioned having an association with GDM. A cross–sectional study conducted in 2018 at selected health facilities in Arusha Tanzania involving 468 pregnant women who were not known to have diabetes before pregnancy using the 75 –g OGTT WHO at fasting and 2 hours showed that GDM was 2.3 times higher among pregnant women with previous delivery of babies ≥4 kg (64).

In Ethiopia previously mentioned 2 studies found that a previous history of caesarean delivery increases the risk of GDM. In the unmatched case-control study, previous caesarean section was 3.24 folds higher risk of developing GDM (18). Similarly, in the cross-sectional study in Wolaita mentioned before, the risk of GDM in pregnant women with a previous caesarean section is 7.5 times higher (6).

Family history of DM had been reported to have a significant association with GDM in all the above mentioned 3 studies in Ethiopia (the 2 cross-sectional and an unmatched case-control study) (6,7,18).

The previous history of GDM was showed significant association in studies conducted in Ethiopia (the unmatched case-control study and cross-sectional study in Gondar) with 8.21 times increase risk and 5.82 increase risk respectively (7,18).

2.4. **Overweight and obesity with GDM**

Overweight and or obesity had been identified as a risk factor for the development of GDM in several studies. Most of them use pre-pregnancy BMI, Early pregnancy Waist to hip ratio (WHR) to diagnose overweight and or obesity**.**

A prospective cohort study conducted on 2300 nulliparous pregnant women between 9–16 weeks to determine the risk of gestational diabetes (GDM) and insulin resistance (IR) in obesity is defined by body mass index (BMI), waist-to-hip ratio (WHR), or both combined. Gestational diabetes was diagnosed at 26 weeks, per the guidelines of each clinical center, measurement categorized as the normal range (WHR <0.80, BMI <25 kg/m2); overweight (WHR 0.80 – 0.84, BMI 25 – 29.9 kg/m2); and obese (WHR ≥0.85, BMI≥30 kg/m2) based on the WHO criteria. The finding was women who were overweight or obese by BMI definition (BMI≥25) regardless of their WHR had higher odds of GDM and IR compared to normal. Those who were obese by BMI ≥30 4.75 times developing GDM and 5.9 times developing IR. Those who were obese by WHR regardless of their BMI had increased odds of GDM by 2.65 times and IR by 2.63 (58).

In line with this study, a retrospective study including 1688 nulliparous women who developed GDM and 172 632 who did not to examine the individual association between advancing maternal age, body mass index (BMI), and racial origin with the development of gestational diabetes mellitus (GDM) and the interaction between these factors while BMI was calculated at the first antenatal visit (before 16 weeks of gestation) revealed that the GDM development was 1.77 times, 3.48 times 3.35 times and 7.7 times higher in Overweight White European, Black African, Black Caribbean, and South Asians respectively. For Obese groups also GDM development was 4.7 times,12.83 times,5.85 times, and 17.39 times higher for (BMI ≥30) in White European, Black African, Black Caribbean, and South Asian respectively (13).

In developing counties where pregnant mothers have late ANC visits and do not remember their pre-pregnancy weight, MUAC measurement becoming a useful measurement for diagnosing overweight and obesity in pregnancy. A cross–sectional study to assess the prevalence of hyperglycaemia in pregnancy and influence of body fat percentage and other determinants on developing hyperglycaemia in pregnancy among women in Arusha, Tanzania conducted at selected health facilities in 2018 involving 468 pregnant women who were not known to have diabetes before pregnancy using the WHO criteria at fasting and 2

hour 75-g OCTT revealed that pregnant women with MUAC ≥ 28 cm developed GDM 1.2 times (64). Similarly, A cross-sectional study conducted from 2011 through 2012 to determine prevalence of gestational diabetes mellitus in urban and rural Tanzania involving 609 urban and 301 rural pregnant women who were not previously known to have diabetes using fasting and 2 hr 75 –g OCTT test and 1999 WHO criteria to diagnose GDM showed that pregnant women with MUAC ≥28 cm developed GDM 1.9 times (28).

Studies conducted in our country also use MUAC to measure overweight or obesity during pregnancy. The previously mentioned cross-sectional study in Gondar found that Women with MUAC of ≥28 cm were 2 times more likely to develop GDM than women with MUAC < 28 cm (7). However, the other cross-sectional study conducted in Wolaita showed no significant association between pregnant women MUAC ≥ 28 and GDM (6).

Even though BMI is not sensitive to determining overweight and obesity in pregnancy, a case control study conducted to identify the determinant factors for GDM showed women with BMI >25 had 2.96 folds higher risk of developing GDM than women with BMI <25 (18).

2.5. **Specificity and Sensitivity of MUAC and CC**

Publications showed that MUAC as a reliable measure for quite stable during pregnancy and highly correlated to the BMI before conception. Pregnant women with MUAC of ≥28 and ≥ 33 cm were considered as having overweight and obesity, respectively (65–68).

A cross-sectional study conducted on 578 pregnant women receiving pre-natal care in 4 hospitals in Nigeria to measure anthropometric indices such as mid-upper arm circumference, calf circumference, waist circumference, and waist to hip ratio, for identification of obesity in pregnancy showed Sensitivity of 76%, Specificity 91%, Positive predictive value 76% and Negative predictive value of 91% for MUAC to measure obesity in pregnancy (65).

Calf circumference is also used in measuring obesity during pregnancy, since it is also stable through trimesters of pregnancy. CC value 39cm might be reliable to cut-off points for diagnoses of obesity throughout pregnancy in the absence of leg oedema (65,67). The above-mentioned cross-sectional study also showed a sensitivity of 78%, Specificity 85%, Positive predictive value of 67%, and negative predictive value of 91% for CC to measure obesity in pregnancy (65).

Similarly, another cross- sectional study conducted on 164 pregnant women attending ANC in South Africa to assess the correlation between the MUAC and BMI in pregnant women revealed that Sensitivity of 93.4%, Specificity 82.4%, Positive predictive value 90.9%, and negative predictive value of 87% for MUAC to measure overweight in pregnancy. It also showed a Sensitivity of 90.5%, Specificity 93.6%, Positive predictive value 87.2%, and negative predictive value of 95.4% for MUAC to measure obesity in pregnancy (66).

Description of the conceptual framework

In some literature, the socio-demographic characteristics of participants like age and educational status of the pregnant women are directly related to the development of GDM. These factors are also known to be associated with the weight of pregnant women due to the fact that as age increases, the weight of women may also increase for the reproductive-age women. As well as the women's educational status also determines being overweight since educational status may increase a person's health-seeking behavior. Similarly, it also associates with women's dietary and physical activities this, in turn, affect the weight of the woman.

The past obstetrics and medical history related factors directly related to the development of GDM. These factors may be affected by being overweight or obese, dietary habits of women, physical activity, and the above-mentioned socio-demographic factors.

Dietary and lifestyle-related factors like dietary diversification score and physical activity have directly related to the development of GDM. It also has a bi-directional association with overweight and obesity.

Finally, the exposures (overweight and obesity) that we want to test their association have also directly related to the development of GDM.

2.6. **Conceptual framework**

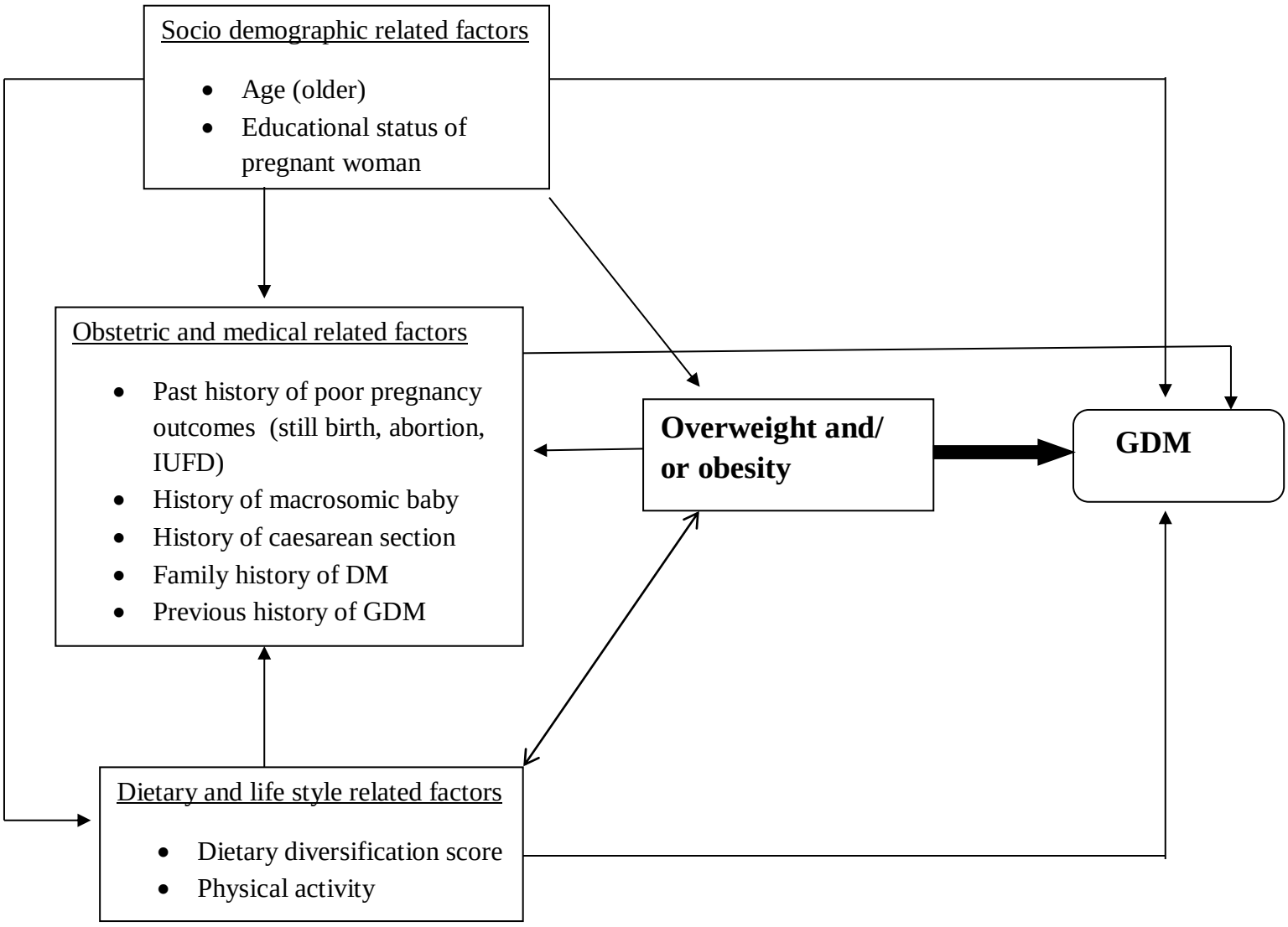

Figure1. A Conceptual framework for assessing the association of overweight and obesity with GDM on selected hospitals in AA, 2020 developed after a review of the literature.

2.7. **Hypothesis**

The hypothesis of this research work is to show that there is an independent significant association between overweight and obesity and gestational diabetes mellitus.

3 OBJECTIVE

The major aim of this study is to determine the association of overweight and obesity with gestational diabetes mellitus among pregnant women attending ANC in selected hospitals in Addis Ababa.

4 METHODS

4.1. Study area and period

The study was conducted in selected hospitals which give maternal and child health service in Addis Ababa Administrative city from March 10 to July 30, 2020. The city has 4 governmental and 8 maternal and child health provision hospitals. These hospitals primarily give maternal and child health care. The two known specialized hospitals in the city; Tikur Anbesa specialized hospital and Saint Paul's Millennium Medical College have Michu ANC clinic. The remaining hospitals are Zewditu memorial hospital, Ghandih memorial hospital, Hemen maternity and child health speciality, Brass maternal and children hospital, Grace maternal and child hospital, Anania maternal and children specialized medical center, Betsegah hospital, Dinberua maternal and child hospital, BGM maternal and child health hospital, Semah maternal and child health speciality center. Their service includes ANC, perinatal care, delivery care, post-natal, and child health care. From these hospitals only 8 of them perform screening for GDM using OGTT for all high-risk pregnant women that attend ANC and give appropriate treatment.

4.2. Study design

An unmatched case-control study design was used to assess the association of maternal overweight and obesity using MUAC & Calf Circumference measurements with gestational diabetes mellitus on selected hospitals in Addis Ababa Administrative city from March 10 to July 30, 2020. Cases were pregnant women with a gestational age of greater than 24-weeks with the diagnosis of GDM by OGTT and controls were pregnant women with a gestational age of greater than 24-weeks without gestational diabetes mellitus.

4.3. Source population

Pregnant women who attend antenatal care service in maternal and child health provision hospitals in Addis Ababa during the survey period.

4.4. Study population

The study population was pregnant women with a gestational age of greater than 24-weeks who attend antenatal care service in the selected maternal and child health service provision hospitals during the survey period.

4.5. Eligibility criteria

Inclusion criteria

Pregnant women with a gestational age of greater than 24-weeks that attend ANC in selected maternal and child health service provision hospitals.

Exclusion criteria

Pregnant women having multiple pregnancies by ultra-sound diagnosis were excluded.

4.6. Sample size determination and sampling technique

Sample size determination

The sample size was calculated using EPI Info software 7 Version, using sample size determination for proportion in two populations for case-control design. The study assuming the 95% confidence level (CL), power of 80%, with a 3:1 ratio between control to the case, an odds ratio of 2.0, taking the proportion of exposure (Overweight and/or obesity) in controls of 14.4% from the study done in Gondar, (7) and non-response rate of 10%, the study need a total of 159 pregnant women with GDM (cases) and 477 pregnant women without GDM (controls).

Sampling technique

Eight hospitals are purposively selected based on the availability of the OGTT test for screening of GDM and number of pregnant women they serve. Namely: Zewditu hospital, Tikur Anbesa specialized hospital, Saint Paul's Hospital Millennium Medical College, Dinberua Child and women hospital, and Besegah mother and child hospital, Grace maternity and child hospital, Anania maternity and child hospital, Hemen maternity and child hospital. Proportional allocation to population size was made to allocate the number of participants in each hospital. The base for proportional allocation was the last 3 month record of GDM cases in each hospital. Eligible pregnant women who were diagnosed as gestational diabetes mellitus by the physician using a 75 or 100g OGTT test considered as cases. All cases attending ANC during the data collection period were included in the study until the required sample size was reached. Three consecutively found women, who are negative for gestational diabetes mellitus, considered as controls. This procedure was continued until the required sample size was optimized.

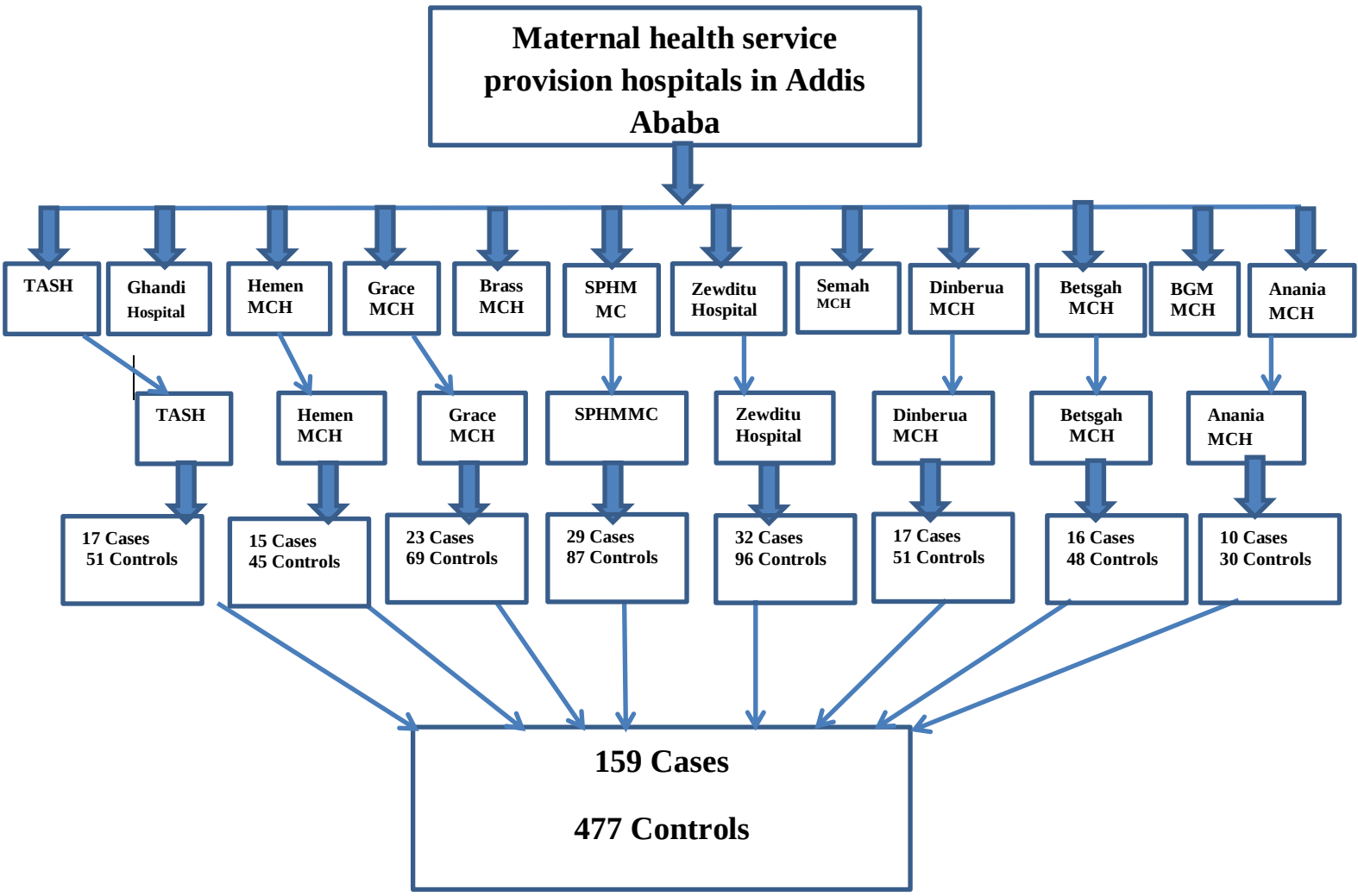

Figure 2. Sampling procedure to assess the association of overweight and obesity with GDM on selected hospitals in Addis Ababa, 2020.

4.7. Data collection instrument and procedure

Data Collection instrument

Structure questionnaire was prepared after a review of different forms of literature. The dietary and physical activity section of the questionnaire was adopted from Food and Nutrition Technical Assistance (FANTA) 2016 version woman's minimum dietary diversity measurement tool and short-form the International Physical Activity Questionnaire (IPAQ) respectively (67,68). While the outcome variable, GDM data was got from the pregnant women ANC chart. The questionnaire was prepared in English and then translated to Amharic (national language) and back-translated to English to observe consistency.

Data Collection Process

Data was collected by data collectors who have a bachelor's degree in nursing or midwifery working in the ANC of selected hospitals. The training was given for data collectors on the contents of questionnaires, how to fill the questionnaires, the way of communication with research participants, and ethical issues were also discussed during the training period.

Pre-test was done two weeks before the actual data collection period on ~3% (16) of study populations at Zewditu Memorial Hospital, TASH, SPHMMC, and Grace MCH.

A face-to-face interview was employed to fill the prepared structured questionnaires regarding socio-demographic status, current, and previous obstetric history, personal and family medical history.

The mid-upper arm circumference (MUAC) was measured on the left arm using a non-stretchable measuring tape at the midway point between the olecranon process of the ulna and the acromion process of the scapula. Calf circumference was also measured at the greatest dimension of the calf (the maximum horizontal distance around the left calf) as the subject stood upright.

Dietary diversity was assessed using a 24-h food recall method by the Food and Nutrition Technical Assistance (FANTA) 2016 version woman's minimum dietary diversity measurement tool. It contained a list of 10 food groups (starchy staples, nuts and seeds, pulses, dairy, meat, eggs, poultry and fish, dark green leafy vegetables, other vitamin-A rich fruits and vegetables, other vegetables, and other fruits). The minimum dietary diversity score (MDDS) was dichotomized based on whether women have consumed the list of defined food groups the previous day or night. The MDDS of five and more categorized as adequate dietary diversity(67).

The short-form the International Physical Activity Questionnaire (IPAQ) was used to assess the physical activities that women do as part of their everyday lives. The IPAQ was suitable for adults between 15 and 69 years of age and implemented in different countries. It assessed specific types of activity such as walking, moderate and vigorous-intensity activities done at work, as part of house and yard work, to get place to place, and in spare time for recreation, exercise or sport. Participants will be asked to recall their activities of the last 7 days preceding the interview. Data was reported as high, moderate, and low using the IPAQ

scoring protocol to considered women into a high, moderate and low level of physical activity categories (68,69).

4.8. **Operational definitions**

Overweight in pregnancy: having MUAC measurement ≥28 is considered as overweight (28,64).

Obesity in pregnancy: having MUAC measurement ≥33 and CC ≥39 (65).

High-risk pregnant women for GDM: having macrosomia (current or past pregnancy), GDM in the past, unexplained stillbirth, T2DM in a first-degree relative, history of recurrent abortion.

Presence of GDM: selected as high risk for GDM by physicians and tested using 75-g or 100-g OGTT and diagnosed as GDM by physicians according to WHO criteria 2013 on one or more of the following results recorded by routine testing after 24 weeks of gestational age:

1. fasting plasma glucose 5.1–6.9 mmol/L (92–125 mg/dl)
2. 1-hour plasma glucose 10.0 mmol/L (180 mg/dl) following a 75 g oral glucose load
3. 2-hour plasma glucose 8.5–11.0 mmol/L (153–199 mg/dl) following a 75 g oral glucose load (71)

DIP: known T1DM, Known T2DM, and diabetes first detected in pregnancy before 24 weeks of gestational age from history and ANC follow-up card if available.

HIGH on the IPAQ engage in Vigorous-intensity activity on at least 3 days **OR** 7 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities.

MODERATE on the IPAQ engage in: 3 or more days of vigorous-intensity activity and/or walking of at least 30 minutes per day **OR** 5 or more days of moderate-intensity activity and/or walking of at least 30 minutes per day OR 5 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities.

LOW level of physical activity on the IPAQ: means that you are not meeting any of the criteria for either MODERATE of HIGH levels of physical activity.

Adequate dietary diversity: If the pregnant women have consumed the list of defined food groups on the previous day or night, she got a score of 1 and if not 0. The MDDS of five and more was categorized as adequate dietary diversity.

4.9. Study variables

Dependent variable:

Gestational diabetes mellitus status

Independent variable:

Overweight and Obesity

Covariates

1. **Socio-demographic characteristics of participants:** Age, Residence, educational status of women, occupational status of women, Spouse's educational status, Spouse's occupational status, marital status, monthly income of the women
2. **Obstetrics and medical history**: gravidity, parity, birth weight of the previous child, previous stillbirth, previous abortion, previous caesarean section, previous history of GDM, family history of T2DM
3. **Dietary and lifestyle characteristics**: Dietary diversification score, Physical activity

4.10. Data processing and analysis

The collected data were coded, entered, cleaned, and checked for missing, consistency, and completeness up to the end of each data collection period Using Epi data manager 4.2 and analyzed using SPSS 21. Descriptive statistics (frequency and percentage) used to present the socio-demographic profile of the study participants. The primary method of analysis was logistic regression/ non-conditional. In the meantime, descriptive, binary, and multiple logistic regression analysis made to measure the association of overweight and obesity with GDM. The bivariate analysis was used to assess the association between covariates and the exposure variable, as well as the association between covariates and outcome variable. Variables that were associated with both the exposure and outcome variable at a P-value of $\leq$ 0.25 in the bivariate analysis were exported to the multivariate analysis to control for the potential effect of confounders. Adjusted odds ratios with 95% confidence interval calculated. Significant association between the dependent and independent variables accepted at P-value < 0.05.

4.11. **Data quality assurance**

To assure the quality of data, a properly designed data collection tool was prepared before beginning the actual data collection, and close supervision was carried out by the principal investigator, any problem faced in the time of data collection was discussed and corrective measures made immediately. The training was given for data collectors who have a bachelor's degree in nursing or midwifery.

The Pre-test was done two weeks before the actual data collection period and some modification was done on questions that affect the consistency of data. The questionnaire was reviewed and checked for completeness, accuracy, and consistency by the supervisor and investigator.

Standard measuring instruments of height, weight, MUAC, and CC were used for the physical measurement of study participants.

Weight measuring scales were calibrated, checked, and adjusted at zero levels between each measurement and it was measured to the nearest 0.5 kg with the subject standing on the weight scale. Subjects were instructed to wear minimum outwear and without footwear. Height, MUAC, and CC were measured to the nearest 0.5 cm with the subjects in an erect position against a vertical surface following the standard steps.

4.12. **Ethical considerations**

Ethical approval was obtained from the research and ethical committee of the School of Public Health, College of Health Sciences, Addis Ababa University. The chief executive director of each hospital was informed about the aim of the study and written permission was obtained before starting data collection. Written informed consent was got from each study participant. The name of the participants was not written on the questionnaire, and the confidentiality of the data was kept at each step.

4.13. **Dissemination of findings**

After the completion of the study, the finding after being defended at the School of Public Health, College of Health Sciences, Addis Ababa University will be submitted to the School of graduate studies of Addis Ababa University, principal and co-advisors of the thesis, for the medical director office of each hospital in which the study held. The result will be

disseminated through workshops, seminars and published in an international, professional high impact journal.

5 Result

5.1. Socio-demographic characteristics of participants

The study was done on 159 pregnant women with GDM (case) and 477 pregnant women without GDM (control) with a response rate of 100%. The mean (±SD) age of respondents was 31.91 (±4.84) years for cases and 29.54 (±4.83) years for controls. The majority of study subjects in cases 157 (98.7%) and controls 468 (98.1%) lived in urban. A greater number of study subjects are married in both cases 158 (99.4%) and controls 475 (99.6%). One hundred nine (68.6%) of cases and two hundred ninety-six (62.1%) of controls have a monthly income ≥ of 4000 ET birr. (Table 1)

Table 1Socio-demographic characteristics of pregnant women participated in the study to assess the association of overweight and obesity with GDM on selected hospitals in AA, 2020.

Variables	**Presence of GDM**			
	Cases	**Controls**	**Total**	**X^2**
	N (%)	**N (%)**	**N (%)**	**(p-value)**
Age group in years				
20-24	7 (4.4)	76 (15.9)	83 (13.1)	36.17 (< 0.01)
25-29	42 (26.4)	177 (37.1)	219 (34.4)	
30-35	62 (39.0)	160 (33.5)	222 (34.9)	
≥36	48 (30.2)	64 (13.4)	112 (17.6)	
Place of Residence				
Urban	157 (98.7)	468 (98.1)	625 (98.3)	0.28 (0.60)
Rural	2 (1.3)	9 (1.9)	11 (1.7)	
Marital status				
Single	0 (0)	1 (0.2)	1 (0.2)	1.01 (0.61)
Married	158 (99.4)	475 (99.6)	633 (99.5)	
Divorced	1 (0.6)	1 (0.2)	2 (0.3)	
Educational status				
Not read and write	15 (9.4)	39 (8.2)	54 (8.5)	2.73 (0.25)
Primary education	32 (20.1)	127 (26.6)	159 (25.0)	
Secondary education and above	112 (70.4)	311 (65.2)	423 (66.5)	
Occupation status of the woman				
Housewife	85 (53.5)	246 (51.6)	331 (52.0)	2.33 (0.67)
Farmer	0 (0)	1 (0.2)	1 (0.2)	
Gov't organization	37 (23.3)	95 (19.9)	132 (20.8)	

Private employee	33 (20.8)	120 (25.2)	153 (24.1)	
NGO employee	4 (2.5)	13 (2.7)	17 (2.7)	
Daily laborer	0 (0)	2 (0.4)	2 (0.3)	
Monthly Income				
<1500	8 (5.0)	37 (7.8)	45 (7.1)	2.70 (0.44)
1500 -2499	9 (5.7)	28 (5.9)	37 (5.8)	
2500 – 3999	33 (20.8)	116 (24.3)	149 (23.4)	
≥4000	109 (68.6)	296 (62.1)	405 (63.7)	

5.2. **Dietary and Lifestyle-Related Factors of Participants**

Among the study participants, 95 (59.7%) of cases and 82 (17.2%) of control have inadequate dietary diversification score (<5).

Assessment of physical activity showed that 70 (44%) of cases and 70 (14.7%) of controls were involved in low physical activity. (Table 2)

5.3. **Obstetric and Medical-Related Factors of Participants**

Of the total of 139 multi and grand gravida pregnant women with GDM, 42 (30%) had macrocosmic babies, 50 (35.7%) history of abortion/ miscarriage 17 (12.1%) history of stillbirth, 4 (2.9%) history of preterm delivery, 85 (60.7%) history of caesarean delivery, 20 (14.3%) have a history of previous GDM, only 1 (0.7%) history of delivering a baby with a congenital abnormality,10 (7.1%) history of high blood pressure in the previous pregnancy,16 (10.1%) have confirmed hypertension. (Table 2)

Again, from the total pregnant women with GDM, 90 (56.6%) had a family history of T2DM, 21 (13.2%) had first-degree relatives having GDM. (Figure 3)

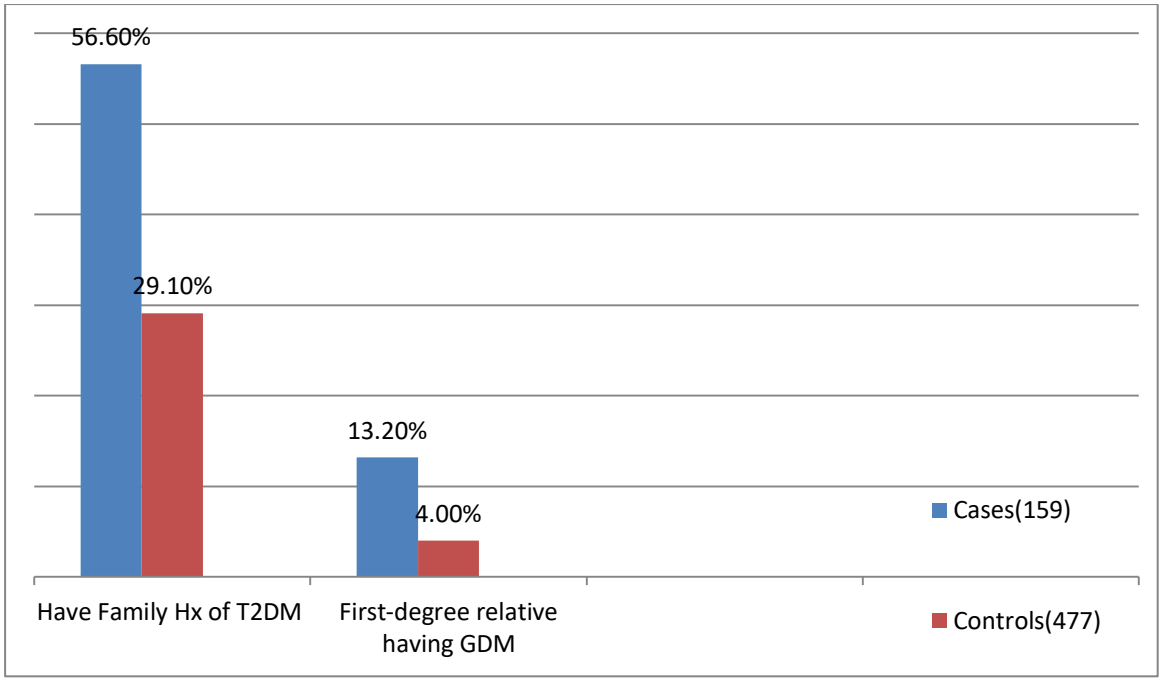

Figure 3 Percentage of Family history of T2DM and First-degree relative having GDM of the study to assess the association of overweight and obesity with GDM on selected hospitals in AA, 2020.

5.4. **Binary logistic regression**

In this study, the results of binary logistic regression analysis showed that age group, gravidity, history of delivering a macrosomic baby, history of caesarean delivery, history of abortion/miscarriage, history of stillbirth, history of previous GDM, family history of T2DM, first-degree relative having GDM, MDDS, Physical activity, overweight and obesity were found to be associated with GDM at p-value less than 0.25. (Table 2)

Table 2Binary Logistic regression for factors associated with GDM of the study to assess the association of overweight and obesity with GDM on selected hospitals in AA, 2020.

	Presence of GDM			
Variables	**Cases**	**Controls**	**COR (95% CI)**	**P-value**
Overweight				
Yes	137 (86.2)	325 (68.1)	2.91 [1.78 , 4.75]	< 0.01
No	22 (13.8)	152 (31.9)	1	
Obesity				
Yes	106 (66.7)	102 (21.4)	7.35 [4.95, 10.92]	< 0.01
No	53 (33.3)	375 (78.6)	1	
Age group				

20-24	7 (4.4)	76 (15.9)	1	1
25-29	42 (26.4)	177 (37.1)	2.58 [1.11, 5.99]	0.03
30-35	62 (39.0)	160 (33.5)	4.21 [1.84, 9.63]	< 0.01
≥36	48 (30.2)	64 (13.4)	8.14 [3.45, 19.24]	< 0.01
Gravidity				
Primigravida	20 (12.6)	115 (24.1)	1	1
Multigravida	95 (59.7)	276 (57.9)	1.98 [1.16, 3.56]	0.01
Grand multigravida	44 (27.7)	86 (18.0)	2.94 [1.62, 5.35]	< 0.01
Parity				
Nulliparous	25 (15.7)	137 (28.7)	1	1
Multiparous	130 (81.8)	328 (68.8)	2.17 [1.35, 3.48]	< 0.01
Grand parous	4 (2.5)	12 (2.5)	1.83 [0.54, 6.12]	0.33
History of macrosomic baby				
Yes	42 (30.0)	64 (17.6)	2.00 [1.28, 3.14]	< 0.01
No	98 (70.0)	299 (82.4)	1	
History of caesarean delivery				
Yes	85 (60.7)	104 (28.7)	3.83 [2.55, 5.77]	< 0.01
No	55 (39.3)	258 (71.3)	1	
History of abortion/miscarriage				
Yes	50 (35.7)	66 (18.2)	2.49 [1.61, 3.86]	< 0.01
No	90 (64.3)	296 (81.8)	1	
History of stillbirth				
Yes	17 (12.1)	30 (8.3)	1.53 [0.82, 2.87]	0.19
No	123 (87.9)	332 (91.7)	1	
History of previous GDM				
Yes	20 (14.3)	32 (8.8)	1.72 [0.95, 3.12]	0.07
No	120 (85.7)	330 (91.2)	1	
Family history of T2DM				
Yes	90 (56.6)	139 (29.1)	3.17 [2.19, 4.59]	< 0.01
No	69 (43.4)	338 (70.9)	1	
First-degree relative having GDM				
Yes	21 (13.2)	19 (4.0)	3.67 [1.92, 7.02]	< 0.01
No	138 (86.8)	458 (96.0)	1	
Minimum Dietary Divers. score				
Adequate (≥5)	64 (40.3)	395 (82.8)	7.15 [4.81, 10.63]	< 0.01
Inadequate (<5)	95 (59.7)	82 (17.2)	1	
Levels of Physical activity				
High	12 (7.5)	131 (27.5)	1	
Moderate	77 (48.4)	276 (57.9)	3.05 [1.60, 5.79]	< 0.01
Low	70 (44.0)	70 (14.7)	10.92 [5.54, 21.50]	< 0.01

5.5. **Multivariable logistic regression**

On the multivariable analysis the Omnibus Tests of Model Coefficients is significant (chi-square = 83.38, df = 1, p < 0.001), so our new model is significantly better. The model summary also shows the Nagelkerke's R^2 is 0.22, which suggests that the model explains roughly 22% of the variation in the outcome.

After adjusting for possible confounders, the multivariable logistic regression shows presence of GDM was 2.8 folds higher among obese pregnant women (MUAC ≥33 and CC ≥39 cm) (AOR = 2.80; 95% CI: 1.58–4.90). The effect of overweight on GDM has disappeared when adjusting for these confounders.

History of caesarean section in a previous delivery, engaging in low and moderate physical activity, having inadequate minimum dietary diversification score (<5) also found to be significantly associated with the development of GDM. (Table 3)

Table 3 Multivariable logistic regression for factors associated with GDM of the study to assess the association of overweight and obesity with GDM on selected hospitals in AA.

Variables	**Prevalence of GDM**		
	COR (95% CI)	**AOR (95% CI)**	**P-value**
Overweight **			
Yes	2.91 [1.78, 4.75]	1.51 [0.71, 3.21]	0.28
No	1	1	
Obesity *			
Yes	7.35 [4.95, 10.92]	2.80 [1.58, 4.90]	<0.01
No	1	1	
Age group			
20-24	1	1	
25-29	2.58 [1.11, 5.99]	1.06 [0.54, 2.05]	0.86
30-35	4.21 [1.84, 9.63]	1.05 [0.48, 2.28]	0.91
≥36	8.14 [3.45, 19.24]	1.45 [0.23, 8.90]	0.69
Gravidity			
Primigravida	1	1	
Multigravida	1.98 [1.16 – 3.56]	0.80 [0.41, 1.57]	0.52
Grand multigravida	2.94 [1.62 – 5.35]	0.0000	1
History of giving macrosomic baby			
Yes	2.00 [1.28, 3.14]	1.06 [0.59, 1.92]	0.84
No	1	1	
History of caesarean delivery			
Yes	3.83 [2.55, 5.77]	1.91 [1.14, 3.21]	0.01
No	1	1	
Family history of T2DM			
Yes	3.17 [2.19, 4.59]	1.37 [0.79, 2.36]	0.26
No	1	1	

Minimum Dietary Diversification score			
Adequate (≥5)	1	1	< 0.01
Inadequate (<5)	7.15 [4.81, 10.63]	3.55 [2.15, 5.86]	
Levels of Physical activity			
High	1	1	1
Moderate	3.05 [1.60 – 5.79]	1.99 [1.17, 3.40]	0.01
Low	10.92 [5.54, 21.5]	3.56 [1.49, 8.48]	0.001

AOR* After adjusted for covariates; Age group, Gravidity, Macrosomia, History of caesarean delivery, Family history of T2DM, Minimum Dietary Diversification score, Levels of Physical activity
AOR** Adjusted for Overweight and the above variables without obesity included in the model

6 Discussion

The study found that odds of GDM were 2.8 five folds higher in obese pregnant women (having MUAC≥33 cm and CC≥39 cm). On the other hand, the study revealed that overweight (having MUAC≥28) were not significantly associated with GDM. Contradictory to these findings, studies from Ethiopia (AOR = 2.25; 95% CI: 1.18–4.26) and Tanzania (OR 1.9, 95% CI 1.1–3.3) showed that overweight and/obesity (MUAC≥28) were significantly associated with the development of GDM (7,28). The reason for these differences is maybe because of the separate measurement of these variables, since these two studies measure overweight and obesity together by using MUAC ≥ 28 (7,28). Even though measurement used to assess obesity was different, different studies in Tanzania, South Africa, Cameron, USA, India, Malaysia, and China revealed that obesity has a significant association with the development of GDM using pre-pregnancy BMI (14,71–76). In line with this finding, systematic reviews and meta-analysis studies also showed there was a significant association between obesity and GDM using pre-pregnancy BMI (56,77,78). This can be explained by the fact that obesity leads to decreased insulin sensitivity and a higher degree of insulin resistance and contributes to GDM development (79,80).

The study also revealed that GDM was higher in pregnant women with a history of caesarean section delivery. This finding agrees with a case-control study and a cross-sectional study conducted in Ethiopia (6,18). A retrospective cohort study in Canada also showed that GDM is higher among pregnant women with a previous history of caesarean section (81).

The other finding of this study showed presence of GDM was higher among women with an inadequate minimum dietary score. Similarly, two studies in Ethiopia revealed that inadequate dietary diversity increases the risk of developing GDM (7,18). A systematic

review and Meta-Analysis also showed adherence to a diet with a high AHEI 2010 (Alternate Healthy Eating Index 2010) score was associated with a reduced risk of GDM by 83% (79), and a prospective observational study in Iceland showed adhering to a prudent dietary pattern (with positive factor loadings for seafood; eggs; vegetables; fruits and berries; vegetable oils; nuts and seeds; pasta; breakfast cereals; and coffee, tea, and cocoa powder, and negative factor loadings for soft drinks and French fries) in pregnancy were associated with a lower risk of GDM (80).

Low and moderate physical activity increases the risk of developing GDM when compared to high physical activity. This finding is supported by two studies conducted in Ethiopia (7,18) respectively. Similarly, the result agrees with finding from Vietnam, a Randomized trial from China, two systematic review, and meta-analysis studies (25,81–84). This result is explained by the fact that exercise increases insulin sensitivity, possibly by changing the adipokines profile and by upregulating antioxidant defense mechanisms (85).

7 Strength and limitation of the study

Strength

This study chooses an exposure variable and tries to assess its association with the outcome variable using case-control study design which fits goods for our outcome variable which is rare.The study also uses two measurements MUAC and Calf circumference to strengthen the assessment of obesity, which, therefore, minimizes the information bias.

Limitation

One limitation of the present study was only MUAC was used to measure overweight since the cut-off value of calf circumference to measure overweight in pregnancy could not be found.

8 Conclusions

GDM was high in obese pregnant women (having MUAC≥33 cm and CC≥39 cm), but not in overweight. Moreover, pregnant women with a previous history of caesarean section, having inadequate dietary diversification scores, and engaging in low and moderate physical activity also have a higher risk of getting GDM.

9 Recommendation

For Federal Ministry of Health of Ethiopia

The Ministry of the health of Ethiopia should develop obesity screening and prevention guidelines for women of childbearing age before conception time.

The health education program should be planned in all health facilities for women of childbearing age to encourage weight reduction programs, including dietary diversification and physical activity before attempting the first pregnancy and between subsequent pregnancies.

In our country where pregnant women usually start ANC follow-up lately, and self-report of pre-pregnancy BMI is not reliable, simpler MUAC and CC measurement can be used to assess overweight and obesity. By conducting more validation studies on the measurement and assessing obesity using MUAC and CC, it can be added to the current criteria for selective screening for GDM.

For health professionals (Especially work on ANC and Family planning services)

Provide information for women of childbearing age on maintaining a healthy body weight before and in between pregnancies, the need for healthy diversified food and physical activity.

For other researchers

Further follow-up studies needed to validate MUAC and CC measurements to determine obesity in pregnant women and cut-off points for each measurement for the development of GDM in our country can be seated.

Assurance of Principal Investigator

The undersigned agrees to accept responsibility for the scientific ethical and technical conduct of the research project and for the provision of required progress reports as per the terms and conditions of the Research Publications Office in effect at the time of Grant is forwarded as the result of this application.

Name of the student:

Date: Signature _____

Approval of the primary Advisor

Name of the primary advisor:

Date. _____ Signature _____

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ANNEXES

Annex I: Consent form for participation in research

Greetings.

Dear participant!

Hello! My name is _____, I am here on behalf of **Ms, Yeabsra Mesfin Seifu MPH** student at Addis Ababa university college of health science, School of Public Health. She is conducting research for the partial fulfilment of a Master's degree in Epidemiology and biostatistics. This study obtained ethical approval from the institutional review board of Addis Ababa University and also received permission from the medical director's office of this Hospital.

You are being invited to participate in a research study on the association of overweight and obesity with gestational diabetes mellitus.

Hyperglycaemia (high blood glucose level) that is first detected during pregnancy is classified as either gestational diabetes mellitus (GDM) or diabetes mellitus in pregnancy. Both mother and baby can experience health problems when women have GDM. Mothers with GDM may have difficult labor due to a bigger baby and may need a caesarean section. They also have a much higher chance of developing type 2 diabetes and heart disease later in life. Babies born to mothers with GDM may suffer birth injuries, breathing problems, jaundice and low blood sugar, which are very serious cases can cause brain damage.

Obesity is often defined simply as a condition of abnormal or excessive fat accumulation in adipose tissue, to the extent that health may be impaired and its prevalence is increasing in our country. Several studies in the world showed that overweight and obesity is a possible risk factor for gestational diabetes mellitus.

Confirming that there is an association between overweight and obesity and gestational diabetes mellitus provides an opportunity to improve pregnancy outcomes and women to make changes in their lifestyle to help prevent obesity as well as the development of gestational diabetes.

This research will require about 15-20 minutes of your time. During this time, you will be interviewed about your socio-demographic status like (age, education, residence,), family, medical and obstetric history. Your weight, height, MUAC and CC will be measured.

You will not pay for participating in this study. However, you will get adequate information about what is GDM, possible risk factors, complications, diagnosis and treatment access that will help for your future pregnancy as well as to share for others.

Several steps will be taken to protect your anonymity and identity. The interviews will NOT contain any mention of your name, and any identifying information from the interview will be removed. The typed interviews will also be kept in a locked filing and only the main researcher will have access to the interviews. All information will be destroyed after 5 years' time.

Your participation in this research is completely voluntary. You can withdraw from the study at any time for any reason.

The results from this study will be presented on academic thesis presentation and may published in writing in journals read by health professionals. At no time, however, will your name be used or any identifying information revealed. If you wish to receive a copy of the results from this study, you may contact the researcher at the telephone number given below.

If you require any information about this study, or would like to speak to the researcher, please call *(Yeabsra Mesfin)* at *(0945618645).*

If you have any other questions regarding your rights as a participant in this research, you may also contact the Office of Research Services at Addis Ababa University.

I have read (or have been read) the above information regarding this research study, and consent to participate in this study.

_____ (Printed Name)

_____ (Signature)

_____ (Date)

Annex II: English Version structured Questionnaires

A questionnaire prepared to assess the association of overweight and obesity with gestational diabetes mellitus in selected hospitals in Addis Ababa Ethiopia.

Date of interview:

Name of hospital:

Code of the pregnant woman:

Address of the pregnant woman:

Name of data collector:

Date of appointment for the next visit:

Section 1: Socio-demographic characteristics

No	Questions	Responses (alternative choices)	Code
101	Age of the pregnant woman in years	_____ years	
102	What is your place of residence?	1. Urban 2. Rural	
103	What is your current marital status?	1. Single 2. Married 3. Divorced 4. Widowed 5. Separated 6. Other (specify)----------	
104	What level of schooling have you completed?	1. Not read and write 2. Read and write 3. Grade1-8 4. Grade 9-12 5. Certificate 6. Diploma 7. Degree and above	

105	What is your main occupation?	1. Housewife 2. Farmer 3. Government Employee 4. Private employee 5. NGO employee 6. Daily labourer 7. Student 8. Other (Specify)----------
106	What level of schooling your spouse has completed?	1. Not read and write 2. Read and write 3. Grade1-8 4. Grade 9-12 5. Certificate 6. Diploma 7. Degree and above
107	What is your spouse's main occupation?	1. Government Employee 2. Farmer 3. Private employee 4. NGO employee 5. Daily labourer 6. Student 7. Other (Specify)----------
108	What is the amount of your monthly income?	---------- Eth birr

Section 2: Current pregnancy and obstetric history

201	Including this pregnancy, for how many times have you been pregnant (gravida)	----------
202	For how many times have you been live birth (parity)	----------
203	Gestational age (wks.) by	1. LMP-------GA----weeks+--

		days 2. By ultrasound (if available) GA----weeks+----days	

Section 3: Prior pregnancy and obstetric history

If she is primigravida, skip this section

301	Birth weight of the newborn (the most recent newborn)	---------Kg	
302	Have you ever given birth to a large size (macrosomic) baby?	1. Yes 2. No	
303	Have you ever given birth to preterm?	1. Yes 2. No	
304	Have you ever had a baby by caesarean delivery?	1. Yes 2. No	
305	Have you had abortions and/ miscarriages?	1. Yes 2. No	
306	Have you had Still birth?	1. Yes 2. No	
307	Have you delivered a baby with a congenital abnormality?	1. Yes 2. No	
308	Have you experienced GDM in previous pregnancies?	1. Yes 2. No	
309	Have you experienced high blood pressure during previous pregnancies?	1. Yes 2. No	

Section 4: General medical (personal and family) history

401	Family history of T2DM	1. Yes 2. No	
402	The first-degree relative having gestational diabetes mellitus	1. Yes 2. No	Who?, mother, sister….
403	Presence of confirmed chronic hypertension	1. Yes 2. No	

Section 5: Assessment of Minimum Dietary Diversity for Women (MDD-W)

The next question focuses on the ten women's dietary diversity or varieties of foods from the lists of food with one type or conjugates within 24 hours from yesterday 12:00 to today 12:00 o'clock**.**

No	Food group	Examples	Consumed Yes=1 No=0
501	Grains/cereals, roots & tubers	Bread, pasta, rice, biscuit, cookies or dried food made from oats, maize, barley, wheat, millet, sorghum, and others. Any food made from teff (injera, pen cake, porridge) cerifam, faffa (pre-processed baby foods) and other packed baby foods: Potato, boina/cassava, buila, kocho, beetroot, and other roots	
502	Pulses	Bean, pea, lentil	
503	Nuts and seeds	Sesame, flax, sunflower, and nuts	
504	Dairy	Milk, cheese, yogurt or other milk products	
505	Meat, Poultry and fish	Beef, lamb, goat, chicken, fish	
506	Eggs	Egg	
507	Dark green leafy vegetables	Kale/gomen, spinach, kosta, green pepper	
508	Other vitamin A-rich vegetables and fruits	Pumpkin, carrot, papaya, mango, sweet potato	
509	Other vegetables	cucumber, tomato, Green pepper, Mushroom, Zucchini, Onion	
510	Other fruits	Orange, banana, Apple, Avocado, Guava, Lemon	
	Total score		

Section 6: Assessment of physical activities

International Physical Activity Questionnaire

We are interested in finding out about the kind of physical activities that women do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question, even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get place to place, and in your spare time for recreation, exercise or sport. Now, I would like to ask you about the physical activity in the past (1) week, including today.

No.	Questions	Questions	Responses (alternative choices)	Responses (alternative choices)	Skip	Skip

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

601	During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?	1. _____ days per week 2. No vigorous physical activities	If No, Skip **Q 603**
602	How much time did you usually spend doing **vigorous** physical activities on one of those days?	1. _____ hours per day 2. _____ minutes per day 3. Don't know/Not sure	

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

603	During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.	1. _____ days per week 2. No moderate physical activities	If No, Skip **Q 605**
604	How much time did you usually spend doing **moderate** physical activities on one of those days?	1. _____ hours per day 2. _____ minutes per day 3. Don't know/Not sure	

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

605	During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?	1. _____ days per week 2. No walking	If No, Skip **Q 607**
606	How much time did you usually spend **walking** on one of those days?	1. _____ hours per day 2. _____ minutes per day 3. Don't know/Not sure	

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television

607	During the **last 7 days**, how much time did you spend **sitting** on a **weekday**?	1. _____ hours per day 2. _____ minutes per day 3. Don't know/Not sure
608	Overall level of physical activity	1. High 2. Medium 3. Low

Section 7: Anthropometric and clinical assessments

701	Current weight (kg)	---------Kg
702	Height	---------Cm
703	MUAC	---------Cm
704	CC	---------Cm
705	Blood pressure (systolic /diastolic)	SBP (mmHg)---------- DBP (mmHg)----------

706	Presence of GDM	1. Yes 2. No

Comments:

Thank you for your participation!

Annex III: Amharic version consent form

ጤና ይስጥልኝ

ውድ የዚህ ጥናት ተሳታፊ!

ስሜ _____ ይባላል ፣ በአዲስ አበባ ዩኒቨርስቲ የጤና ሳይንስ ኮሌጅ ፣ በህብረተሰብ ጤና ትምህርት ክፍል በኤፒዲሚዮሎጂ እና በባዮስታቲስቲክስ የሁለተኛ ዲግሪ ተመራቂ ተማሪ የሆኑትን ወ / ት የአብስራ መስፍን ሰይፉን ወክዬ እዚህ እገኛለሁ። ተማሪዋ የሁለተኛ ዲግሪዋን ለመፈፀም ምርምር እያደረገች ነው ። ይህ ጥናት ከአዲስ አበባ ዩኒቨርሲቲ ተቋማዊ ግምገማ ቦርድ የሥነ ምግባር ማረጋገጫ ያገኘ ሲሆን ከዚህ ሆስፒታልም የህክምና ዳይሬክተር ጽ / ቤት ፈቃድ አግኝቷል።

እርሶም ከመጠን በላይ ክብደት ባለው ወይም ከመጠን በላይ ውፍረት እና በእርግዝና የሚመጣ የስኳር በሽታ መካከል ባለው ግንኙነት ላይ በሚደረገው ጥናት ጥናት ላይ እንዲሳተፉ ተጋብዘዋል ። በእርግዝና ወቅት የሚከሰት ከፍተኛ የደም ውስጥ የስኳር መጠን በእርግዝና የሚመጣ የስኳር በሽታ እና በእርግዝና ወቅት የሚታወቅ የስኳር በሽታ ተብሎ በሁለት ተመድቧል ። ነፍሰጡር ሴቶች በእርግዝና በሚመጣ የስኳር በሽታ ሲያዙ እናትም ሆነ ሕፃን የጤና ችግር ሊያጋጥማቸው ይችላል ። እናቶች በማህፀን ውስጥ ያለው ልጅ ከመጠን በላይ በመፋፋቱ ከባድ ምጥ ሊኖራቸው ስለሚችል በቀዶ ጥገና ሕክምና ለመውለድ ያጋልጣቸዋል ። እንዲሁም ከጊዜ በኋላ በታይፕ 2 የስኳር በሽታ እና በልብ ህመም የመያዝ እድላቸው ከፍተኛ ነው ። በእርግዝና በሚመጣ የስኳር በሽታ ከተያዙ እናቶች የተወለዱ ሕፃናት በወሊድ ጊዜ ያለ ጉዳት ፣ የአተነፋፈስ ችግር ፣ የወፍ በሽታ እና የደም ስኳር መጠን ዝቅተኛ መሆን ሊያጋጥማቸው ይችላል ይህም በጣም ከባድ የሆነ የአንጎል ጉዳት ሊያስከትል ይችላል።

ከመጠን በላይ መወፈር በቀላሉ ያልተለመደ ወይም ከመጠን በላይ የሆነ የስብ ክምችት ሲሆን የጤና እክል እስከማምጣት የሚያደርስ ሁኔታ ተብሎ ይገለጻል ፣ ይህም ሁኔታ በአገራችን መጠኑ እየጨመረ ነው ። በዓለም ላይ የተደረጉ በርካታ ጥናቶች እንደሚያመለክቱት ከመጠን በላይ ክብደት እና ከመጠን በላይ ውፍረት በእርግዝና ወቅት ለሚመጣው የስኳር በሽታ አጋላጭ ሁኔታ ነው ።

ከመጠን በላይ ክብደት ወይም ከመጠን በላይ ውፍረት እና በእርግዝና ወቅት በሚመጣ የስኳር በሽታ መካከል ግንኙነት መኖሩን ማረጋገጥ የእርግዝና ውጤቶችን የተሻለ ለማድረግ እና ከ ከመጠን በላይ ውፍረትን በመከላከል በእርግዝና የሚመጣ የስኳር በሽታ እድገትን ለመከላከል ይረዳል ።

ይህ የምርምር ቃለመጠይቅ ከ15-20 ደቂቃዎች የሚሆን ጊዜዎንይፈልጋል ። በዚህ ወቅት ፣ ስለ አጠቃላይ ማህበራዊ-ስነ-ህዝብ ሁኔታዎን (ዕድሜ ፣ ትምህርት ፣ መኖርያ ፣) ፣ ስለቤተሰብ ፣ ህክምና እና የወሊድ ታሪክዎ ቃለ መጠይቅ ይደረጋል ። የደም ግፊትዎ ፣ ክብደትዎ ፣ ቁመትዎ ፣ የክንድ ባት ዙሪያዎ ይለካል።

በዚህ ጥናት ውስጥ በመሳተፍዎ ገንዘብ አይከፈሎትም ። ሆኖም ፣ በእርግዝና ስለሚመጣ የስኳር በሽታ ተጋላጭ ስለሚያደርጉ ምክንያቶች ፣ ስለሚያስከትሉት ውስብስብ ችግሮች ፣ ምርመራ እና የሕክምና ተደራሽነት ለወደፊት እርግዝናዎ ስለሚረዳ እንዲሁም ለሌሎች ለማካፈል በቂ መረጃ ያገኛሉ ።

በጥናቱ ማንነትዎን ለመጠበቅ በርካታ እርምጃዎች ይወሰዳሉ። ቃለ-ምልልሶቹ ማንኛውንም ስምዎን የሚጠቅስ ፣ እና ማንነቶን የሚለይ ማንኛውም መረጃ ይወገዳል። የተተየቡት ቃለ-መጠይቆች እንዲሁ በተቆለፈ ፋይል ውስጥ ይቀመጣሉ እናም የቃለ መጠይቆቹን መዳረሻ የሚያገኙት ዋናው ተመራማሪ ብቻ ነው ። ሁሉም መረጃዎች ከ 5 ዓመት ጊዜ በኋላ ይደመሰሳሉ ።

በዚህ ምርምር ውስጥ ያለዎት ተሳትፎ ሙሉ በሙሉ በፈቃደኝነት ነው ። በማንኛውም ምክንያት ከጥናቱ መውጣት ይችላሉ ። የዚህ ጥናት ውጤቶች በአካዳሚክ ዕንሰ-ሀሳብ አቀራረብ ላይ የሚቀርቡ ሲሆን በጤና ባለሙያዎች በሚያነቧቸው መጽሔቶች በዕሁፍ ማተም ይችላሉ ። በማንኛውም ጊዜ ግን የእርስዎ ስም ጥቅም ላይ አይውልም ወይም ማንኛቸውም የሚለይ መረጃ አይገለጥም ። የውጤቱን ቅጂ ከዚህ ጥናት ለመቀበል ከፈለጉ ተመራማሪውን ከዚህ በታች በተጠቀሰው የስልክ ቁጥር ማግኘት ይችላሉ ።

ስለዚህ ጥናት ማንኛውንም መረጃ ከፈለጉ ወይም ከተመራማሪው ጋር ለመነጋገር ከፈለጉ እባክዎን (ለያብስራ መስፍን) በ (0945618645) ይደውሉ ።

በዚህ ጥናት ውስጥ እንደ ተሳታፊ መብቶችዎን በተመለከተ ሌሎች ጥያቄዎች ካሉዎት በተጨማሪ በአዲስ አበባ ዩኒቨርሲቲ የምርምር አገልግሎት ቢሮን ማነጋገር ይችላሉ ።

ይህንን የምርምር ጥናት በተመለከተ ከላይ የተጠቀሱትን መረጃዎች አንብቤያለሁ (ወይም ተነቦልኛል) እና በዚህ ጥናት ውስጥ ለመሳተፍ ፈቃደኛ ነኝ ።

_____ (ስም)

_____ (ፊርማ)

_____ (ቀን)

Annex IV: Amharic version questionnaire

የአማርኛ መጠይቅ

ከመጠን ባለፈ የሰውነት ክብደት ወይም ከመጠን ባለፈ ውፍረት እና በእርግዝና ወቅት በሚከሰት የስኳር ህመም መካከል ያለውን ዝምድና በ አ. አ በሚገኙ የተመረጡ የእናቶችና የህፃናት ሆስፒታሎች ለማጥናት የተዘጋጀ ቃለ መጠይቅ

መጠይቅ የተወሰደበት ቀን:

የሆስፒታሉ ስም:

ለነፍሰጡር እናትዋ የተሰጠ መለያ ኮድ:

የነፍሰጡር እናትዋ አድራሻ:

መጠይቁን የሚወስደው ባለሞያ ስም:

የነፍሰጡር እናትዋ ቀጣይ ቀጠሮዋ ቀን:

ክፍል አንድ - አጠቃላይ መረጃ

ተቁ	መጠይቅ	መልስ /አማራጭ
101	የነፍሰጡር እናትዋ እድሜ	/_____/
102	የመኖሪያ ቦታ	1. ከተማ 2. ገጠር
103	አሁን ያለሽ የትዳር ሁኔታ	1. ያላገባ 2. ያገባ 3. ፈት 4. የትዳር አጋር በሞት የተለየው 5. .የተለያየ 6. ከቀረበው አማራጭ ውጪ (ይገለፅ)_____
104	የትምህርት ደረጃ	1. ማንበብና መጻፍ የማይችል 5. ዲፕሎማ 2. ማንበብና መጻፍ 6. ሰርተፊኬት 3. 1- 8ኛ ክፍል 7. ዲግሪ እና ከዛ በላይ 4. 9- 12ኛ ክፍል
105	ስራሽ ምንድን ነው?	1. የቤት እመቤት 2. ግብርና 3. የመንግስት ስራ

		4. የግል ስራ 5. መንግስታዊ ያልሆነ ተቋም ውስጥ 6. የቀን ሠራተኛ 7. ተማሪ 8. ሌሎች (ይገለፅ)_____
106	የባለቤትሽ የትምህርት ደረጃ	1. ማንበብና መጻፍ አይችልም 5. ዲፕሎማ 2. ማንበብና መጻፍ 6. ሰርተፊኬት 3. 1- 8ኛ ክፍል 7. ዲግሪ እና ከዛ በላይ 4. 9- 12ኛ ክፍል
107	የባለቤትሽ ስራ ምንድን ነው?	1. ስራ የለውም 2. ግብርና 3. የመንግስት ስራ 4. የግል ስራ 5. መንግስታዊ ያልሆነ ተቋም ውስጥ 6. የቀን ሠራተኛ 7. ተማሪ 8. ሌሎች (ይገለፅ)_____
108	የወር ገቢሽ ምን ያህል ነው?	_____ ብር
	ክፍል ሁለት - ስለ አሁኑ እርግዝናዋ እና የወሊድ ሁኔታ የሚመለከቱ ጥያቄዎች	
201	ከአሁኑ እርግዝናሽ ጋር ስንት ጊዜ አርግዘሽ ታውቂያለሽ?	_____
202	ስንት ጊዜ ወልደሻል?	_____
203	የእርግዝና ጊዜ	1. በመጨረሻው የወር አበባ ቀን የተሰላ _____ ሳምንት ከ _____ቀን 2. በአልትራሳውንድ ምርመራ የተሰላ (የተሰላ ካለ) _____ ሳምንት ከ _____ቀን
	ክፍል ሶስት - ስለ በፊት እርግዝናዋ እና የወሊድ ሁኔታ የሚመለከቱ ጥያቄዎች	
	የመጀመሪያ እርግዝናዋ ከሆነ ይህንን የመጠይቅ ክፍል ዝለል/ዪ	
301	የመጨረሻ ልጅሽ ሲወለድ ክብደቱ ምን ያህል ነበር?	_____ ኪ.. ግ
302	ክብደቱ ትልቅ የሆነ ልጅ ወልደሽ ታውቂያለሽ?	1. አዎ 2. የለም
303	ጊዜውን ያልጨረሰ/መወለጃው ጊዜ ያልደረሰ ልጅ ወልደሽ ታውቂያለሽ?	1. አዎ

		2. የለም
304	በቀዶ ህክምና ልጅ ወልደሽ ታውቂያለሽ?	1. አዎ 2. የለም
305	ፅንስ አስወርደሽ/ ፅንስ ተጨናግፎብሽ ያውቃል?	1. አዎ 2. የለም
306	ፅንስ በሆድሽ ውስጥ ሞቶ ወልደሽ ታውቂያለሽ?	1. አዎ 2. የለም
307	የአፈጣጠር ችግር ያለበት ልጅ ወልደሽ ታውቂያለሽ?	1. አዎ 2. የለም
308	ከአሁን በፊት በነበረሽ እርግዝና በእርግዝና ወቅት የሚከሰት የስኳር በሽታ አጋጥሞሽ ያውቃል?	1. አዎ 2. የለም
309	ከአሁን በፊት በነበረሽ እርግዝና የደም ግፊት መጨመር አጋጥሞሽ ያውቃል?	1. አዎ 2. የለም
	ክፍል አራት -ስላንቺና ስለቤተሰብሽ አጠቃላይ ጤንነት የሚመለከቱ ጥያቄዎች	
401	በቤተሰብ ውስጥ የስኳር ህመም ያለበት ሰው አለ?	1. አዎ 2. የለም
402	ከቅርብ ዘመድሽ በእርግዝና ወቅት የሚከሰት የስኳር በሽታ ገጥሟት የሚያውቅ አለ?	1. አዎ ካለ ማን (እናትሽ፣እህትሽ...)? 2. የለም
403	የታወቀ/የተረጋገጠ የደም ግፊት አለብሽ?	1. አዎ 2. የለም

ክፍል አምስት -ስለ አመጋገብ የሚመለከቱ ጥያቄዎች

የሚቀጥሉት ጥያቄዎች የሚያተኩሩት ነፍሰጡር እናትዋ ላለፉት 24 ሰአታት (ከትላንት ጠዋት 12 ሠአት እስከ ዛሬ ጠዋት 12 ሠአት) የተመገበችው የተለያየ የምግብ አይነቶች በ10 ምድብ ተከፍለው ምን ያህሉን የምግብ ስብጥር ዝርዝር አይነቶች እንደተመገበች የሚጠይቅ ነው

ተ. ቁ	የምግብ ምድብ	ምሳሌዎች	ተመግባለች ወይ አዎ = 1 የለም = 0
501	እህል፣ስራስር	ዳቦ፣ፓስታ፣ሩዝ፣ብስኩት፣ኩኪስ፣ከአጃ የተሰራ ደረቅ ምግብ፣በቆሎ፣ገብስ፣ስንዴ፣ማሽላ ፣ማንኛውም ከ ጤፍ የሚሰራ	

		ምግብ(እንጀራ፣ፓን ኬክ፣ገንፎ) ፣ሴሪፋም፣ፋፋ፣የታሸጉ የህፃናት ምግቦች፣ድንች፣ቡላ፣ቆጮ፣ቀይስር እና ሌሎች ስራስሮች	
502	ጥራጥሬ	ባቄላ፣አተር፣ምስር	
503	የቅባት እህሎች	ተልባ፣ሱፍ፣ለውዝ፣ኑግ	
504	የወተት ተዋፅያዎች	ወተት፣አይብ፣እርጎ፣ሌሎች የወተት ተዋፅያዎች	
505	ስጋ፣ዶሮ፣አሳ	የበሬ ስጋ፣የበግ ስጋ፣የፍየል ስጋ፣የዶሮ ስጋ፣አሳ	
506	እንቁላል	እንቁላል	
507	አረንጓዴ ቅጠላቅጠሎች	ጎመን፣ሰላጣ፣ቆስጣ፣አረንጓዴ ቃሪያ	
508	ሌሎች በ ቫይታሚን ኤ የበለፀጉ አትክልቶች እና ፍራፍሬዎች	ዱባ፣ካሮት፣ፓፓያ፣ማንጎ፣ስኳር ድንች	
509	ሎሎች አትክልቶች	ኪያር፣ቲማቲም፣አረንጓዴ ቃሪያ፣እንጉዳይ፣ዝኩኒ፣ሽንኩርት	
510	ሌሎች ፍራፍሬዎች	ብርትኳን፣ሙዝ፣ፖም፣አቮካዶ፣ሎሚ	

አጠቃላይ ድምር

ክፍል ስድስት -ስለ አካላዊ እንቅስቃሴ የሚመለከቱ ጥያቄዎች

የሚከተሉት ጥያቄዎች ነፍሰጡር እናትዋ በእለት ተእለት ህይወትዋ የምታደርገውን አካላዊ እንቅስቃሴ የሚጠይቅ ነው፣ጥያቄዎቹ ባለፉት 7 ቀናት ውስጥ ስለሰራሻቸው እንቅስቃሴዎች ምንም እንኳን በጣም ከፍተኛ ባይሆኑም እስቲ የሰራሻቸውን የሰውነት እንቅስቃሴ የሚጠይቁ ስራዎች አስታውሺ፣በቤት ውስጥ የሰራሽው የቤት ስራ ፣በጊቢሽ ውስጥ የሰራሽው ስራ፣ከቦታ ቦታ ያደረግሽው ጉዞ፣በትርፍ ሰአትሽ ለመዝናናት ያደረግሽው የአካል እንቅስቃሴ፣ስፖርት። አሁን የምጠይቅሽ ከነኚህ እንቅስቃሴዎች ውስጥ ባለፈው 7 ቀናት ውስጥ ፣ዛሬን ጨምሮ ያደረግሻቸውን ነው።

ተ. ቁ	ጥያቄዎች	አማራጭ መልሶች	
	ባለፉት 7 ቀናት ውስጥ ስለሰራሻቸው አድካሚ/ሀይለኛ አካላዊ እንቅስቃሴዎች አስታውሺ።አድካሚ/ሀይለኛ አካላዊ እንቅስቃሴዎች የሚባሉት ከባድ/አድካሚ ፣የአተነፋፈስን ስርአት ከመደበኛው የሚያፋጥኑ አካላዊ እንቅስቃሴዎች ናቸው።ከነኚህ እንቅስቃሴዎች ውስጥ ቢያንስ ለ 10 ደቂቃ የሰራሽው ካለ ብቻ አስታውሺ።		
601	ባለፉት 7 ቀናት ውስጥ ለ ስንት ቀናት አድካሚ/ሀይለኛ አካላዊ እንቅስቃሴዎች አድርገሻል? (ከባድ እቃ	1. _____ ቀናት በ ሳምንት 2. ምንም አድካሚ/ሀይለኛ አካላዊ እንቅስቃሴ አልሰራሁም	ምንም አድካሚ/ሀይለኛ አካላዊ እንቅስቃሴ ካልሰራች ወደ ጥያቄ ተ. ቁ 603 እለፊ/ፍ

	ማንሳት፣መቆፈር፣ኤሮቢክስ፣ ፈጣን የሳይክል ጉዞ....)		
602	አድካሚ/ሀይለኛ አካላዊ እንቅስቃሴዎቹን በሰራሽባቸው ቀናት ምን ያህል ሰአት እነኚህን ስራዎች በመስራት ታሳልፊያለሽ?	1. _____ ሰአታት በ ቀን 2. _____ ደቂቃዎች በ ቀን 3. አላውቀውም/እርግጠኛ አይደለሁም	
ባለፉት 7 ቀናት ውስጥ ስለሰራሻቸው መካከለኛ አካላዊ እንቅስቃሴዎች አስታውሺ። መካከለኛ አካላዊ እንቅስቃሴዎች የሚባሉት መጠናቸው መካከለኛ የሆነ ብዙም አድካሚ ያልሆኑ ፣የአተነፋፈስን ስርአት ከመደበኛው በመጠኑ የሚያፋጥኑ አካላዊ እንቅስቃሴዎች ናቸው።ከነኚህ እንቅስቃሴዎች ውስጥ ቢያንስ ለ 10 ደቂቃ የሰራሽው ካለ ብቻ አስታውሺ።			
603	ባለፉት 7 ቀናት ውስጥ ለ ስንት ቀናት መካከለኛ አካላዊ እንቅስቃሴዎች አድርገሻል? (ቀለል ያሉ እቃዎች መሸከም፣በመደበኛ ፍጥነት ሳይክል መንዳት፣ቴኒስ መጫወት) የእግር ጉዞን አያካትትም	1. _____ ቀናት በ ሳምንት 2. ምንም መካከለኛ አካላዊ እንቅስቃሴ አልሰራሁም	ምንም መካከለኛ አካላዊ እንቅስቃሴ ካልሰራች ወደ ጥያቄ ተ. ቁ 605 እለፊ/ፍ
604	መካከለኛ አካላዊ እንቅስቃሴዎቹን በሰራሽባቸው ቀናት ምን ያህል ሰአት እነኚህን ስራዎች በመስራት ታሳልፊያለሽ?	1. _____ ሰአታት በ ቀን 2. _____ ደቂቃዎች በ ቀን 3. አላውቀውም/እርግጠኛ አይደለሁም	
ባለፉት 7 ቀናት ውስጥ ስላደረግሽው የእግር ጉዞ አስታውሺ። በስራ ቦታም ሆነ በቤትሽ ውስጥ ፤ ከቦታ ቦታ ለመንቀሳቀስ፣ለመዝናናት ያደረግሻቸው የእግር ጉዞዎች፣ስፖርት፣የሚያዝናኑ አካላዊ እንቅስቃሴዎች			
605	ባለፉት 7 ቀናት ውስጥ ለ ስንት ቀናት ቢያንስ ለ 10 ደቂቃ የእግር ጉዞ አድርገሻል?	1. _____ ቀናት በ ሳምንት 2. ምንም የእግር ጉዞ አላደረኩም	ምንም የእግር ጉዞ ካላደረገች ወደ ጥያቄ 607 እለፊ/ፍ
606	የእግር ጉዞ ባደረግሽባቸው ቀናት ለምን ያህል ሰአት የእግር ጉዞ በማድረግ	1. _____ ሰአታት በ ቀን 2. _____ ደቂቃዎች በ ቀን	

	ታሳልፊያለሽ?	3. አላውቀውም/እርግጠኛ አይደለሁም	
	የመጨረሻው ጥያቄ ባለፉት 7 ቀናት ውስጥ ቁጭ በማለት ስላሳለፍሽው ጊዜ አስታውሺ።በቤት ውስጥ፣ በስራ ቦታ ፣በእረፍት ሰአትሽ ፤ በወንበር ላይ፣ከጓደኞሽ ጋር ሆነሽ፣በንባብ ላይ ሆነሽ ፣ቴሌቪዥን በመመልከት ተቀምጠሽ ያሳለፍሽውን ጊዜ ያካትታል።		
607	ባለፉት 7 ቀናት ውስጥ ምን ያህል ጊዜ በመቀመጥ አሳልፈሻል?	1. _____ ሰአታት በ ቀን 2. _____ ደቂቃዎች በ ቀን 3. አላውቀውም/እርግጠኛ አይደለሁም	
	ክፍል ሰባት -የሰውነት ክብደት እና የ ህክምና ውጤቶችን የሚመለከት መረጃ		
701	የአሁን የሰውነት ክብደት	_____ ኪ.. ግ	
702	ቁመት	_____ ሳ. ሜ	
703	ሙአክ	_____ ሳ. ሜ	
704	ካፍ ሰርከምፍረንስ	_____ ሳ. ሜ	
705	የደም ግፊት	_____ _____	
706	በእርግዝና የሚመጣ የስኳር በሽታ	1. አዎ 2. የለም	

አስተያየት ----------

በመሳተፍዎ እናመሰግናለን።

Annex V: Curriculum vitae of the principal investigator

Name: Yeabsra Mesfin Seifu

Age: 26

Sex: Female

Date of Birth: 14/11/1994

Place of Birth: Harar, Eastern Ethiopia

Marital status: Married

Phone number: +251 945 61 86 45

Email: yeabsramesfin@yahoo. com

Education and Qualifications

A. **Master of Public Health in Epidemiology and Biostatistics** (September 2018- present)

- School of Public Health, College of Health Sciences, Addis Ababa University, Ethiopia

B. Bsc in public health (2013-2016)

- College of Public Health and Medical Sciences, Wollo University, Ethiopia.

Undergraduate thesis: prevalence of condom use and factors associated with condom utilization among Wollo University students in Dessie, South Wollo zone, Amhara national, regional state, North east Ethiopia

Undergraduate over all GPA: 3.63

C. Preparatory school (2009-2011)

- Aboker preparatory Secondary school, Harar, Eastern Ethiopia. (2011-2012)

D. Secondary School (2007-2009)

- Harar Senior Secondary School (2009-2010) Harar, Eastern Ethiopia.

Employment History

A. Served as a Junior Public Health Professional at Jigjiga University Meles Zenawi Memorial Referral Hospital, Jigjiga, Eastern Ethiopia, from October 01/2015-August 30/2016 for 11 months.
B. Serving as an Assistant Lecturer at Jigjiga University, Department of Public Health, College of Medicine and Health sciences, Jigjiga, Eastern Ethiopia, from.

Research interest: Prevention and control of Non-communicable diseases (NCDs)

Conducted a thesis entitled as "The Association of Overweight and Obesity with Gestational Diabetes Mellitus in Pregnant Women Attending Ante Natal Care in Selected Hospitals in Addis Ababa, Ethiopia, 2019/2020," (Case control study on progress)

Skills:

- Proficient ability of conducting epidemiologic research
- Capable of manipulating statistical software (SPSS, STATA, Epi info, and Open epi)
- Good computer skills such as MS word, Ms Excel & Ms power point
- Expertise in designing attractive presentations and demonstrations
- Good communication skills both verbally and written

Professional trainings

1. Higher diploma program in teacher's education at Jigjiga University and accepted a certificate of graduation.
2. The 4th DAAD/PAGEL chronic disease summer school on the theme. Organized by SPH, AAU in collaboration with Martin Luther University, Germany, Addis Ababa University, from September 02-05,2019

Hobbies

Hiking, reading fiction, poem books and research articles on chronic, non-communicable diseases.

Language

Excellent reading, listening, writing and speaking in both **English** and **Amharic** languages.

References

1. **Mr Webareg Seifu (MPH, Assistant professor)**

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Annex VI: Declaration

Declaration that no portion of the work referred in the thesis has been submitted to support an application for another degree or qualification of this or any other university or other institute of learning.

Name of the student: Yeabsra Mesfin Seifu (BSc)
Date: June 2021 **Signature:** _____

Approval of the primary Advisor

Name of the primary advisor: Dr. Negussie Deyessa (MD, MPH, Ph. D.)

Date: June 2021 **Signature: _____**