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# Dietary Risk factors of Preeclampsia Among Women Attending Antenatal and Delivery Services in Governmental Hospitals of West Gojjam Zone, North West Ethiopia, 2021

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**BAHIR DAR UNIVERSITY**

**COLLEGE OF MEDICINE AND HEALTH SCIENCES**

**SCHOOL OF PUBLIC HEALTH**

**DEPARTMENT OF PUBLIC HEALTH NUTRITION AND DIETETICS**

**DIETARY RISK FACTORS OF PREECLAMPSIA AMONG WOMEN**

**ATTENDING ANTENATAL AND DELIVERY SERVICES IN**

**GOVERNMENTAL HOSPITALS OF WEST GOJJAM ZONE, NORTH**

**WEST ETHIOPIA, 2021**

**BY**

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AND DIETETICS, BAHIR DAR UNIVERSITY, IN PARTIAL FULFILLMENT OF THE  
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Full title of the research	Dietary risk factors of preeclampsia among women attending antenatal and delivery services in governmental hospitals of west Gojjam zone, north west Ethiopia, 2021
Duration of the study	September 27-October 28, 2021
Study area	West Gojjam Zone, North West Ethiopia,

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## ABSTRACT

**Introduction:** Preeclampsia is a major cause of fetal and maternal morbidity and mortality worldwide and affects 2–8% of all pregnancies. Dietary factors can be determinative in the progress of the mechanisms for development of preeclampsia. The issue has grown controversial in light of recent reports. There is no adequate documentation of potential dietary risk factors for the increment of preeclampsia which helps to prevent an increasing incidence in Ethiopia.

**Objective:** This study aimed to assess dietary risk factors of preeclampsia among pregnant mothers attending antenatal care and delivery services in governmental hospitals of West Gojjam Zone, North West Ethiopia; by 2021.

**Methods:** An institutional-based unmatched case-control study was carried out among 262(88 cases and 174 controls) mothers from September 27-October 28, 2021. Mothers were selected using a systematic random sampling technique conducted in governmental hospitals of West Gojjam zone, northwest Ethiopia. Data were entered into Epidata version 4.6 and exported to SPSS version 23 software for analysis. Variables with a p-value of less than 0.2 in bivariate logistic regression were entered into a multivariable logistic regression and statistically significant association was declared at 95% confidence interval p-value less than 0.05 in a multivariable logistic regression model.

**Result:** total of 261(88 cases and 173controls) verbally consented mothers were enrolled in this study with a response rate of 99.6%. On the multivariable logistic regression analyses high consumption of fat related foods [AOR:3.7, 95%CI:(1.67,8.23)], increasing MUAC [AOR:1.18 at 95% CI: (1.04,1.34)], anemia (AOR:3.3,95%CI: [1.62,6.78]), and didn't receiving nutritional counseling during antenatal care follow up [AOR:2.18,95% (1.11,4.23)] were found to be risk factor for development of preeclampsia. On the other hand, frequently consuming milk products (AOR:0.39, 95% CI 0.15,0.95), and Vitamin A-rich fruits and vegetables [AOR: 0.12, 95% CI: (0.04,0.35)], were found to be preventive factors for preeclampsia.

**Conclusion and recommendations:** This study revealed that diets that are characterized by high intake of vitamin A rich fruit and vegetables, milk products and receiving nutritional counselling were significantly associated with low risk of preeclampsia. On the other hand, high intake of fatty foods, anemia and obesity were associated with the development of preeclampsia. Therefore, encouraging and promoting healthy eating habits and dietary patterns during pregnancy including vitamin A-rich fruits and vegetables and milk products can effectively prevent the incidence of preeclampsia.

## LIST OF ACRONYMS AND ABBRIVIATIONS

ANC:	-----	Antenatal Care
BDU:	-----	Bahir Dar University
BMI:	-----	Body Mass Index
CSA:	-----	Central Statistics Agency
ETB:	-----	Ethiopian Birr
E.G:	-----	Example
DHS:	-----	Demographic Health Survey
FFQ:	-----	Food Frequency Questionnaires
DBP:	-----	Diastolic Blood Pressure
DM:	-----	Diabetes Mellitus
EDHS:	-----	Ethiopian Demographic Health Survey
FMOH:	-----	Federal Ministry of Health
HELLP:	-----	Hemolysis, Elevated liver enzyme, low Platelet count
HDP:	-----	Hypertension Disorder of Pregnancy
HSTP:	-----	Health Sector Transformation Plan
HTN:	-----	Hypertension
IUFD:	-----	Intrauterine Fetal Death
KMO:	-----	Kaiser-Meyer Olkin
MEDHS:	-----	Mini Ethiopian Demographic Health Survey
mmHg	-----	Millimeters of Mercury
MUAC:	-----	Mid Upper Arm Circumference
MOH:	-----	Ministry of Health
NICE:	-----	National Institute for Health and Care Excellence
PE:	-----	Preeclampsia
PIH:	-----	Pregnancy Induced Hypertension
SBP	-----	Systolic Blood Pressure
SPSS	-----	Statistical Package for Social Science
WHO:	-----	World Health Organization

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# 1. Introduction

## 1.1 Background

Preeclampsia is a pregnancy-related condition that manifests as hypertension, proteinuria, and edema, with or without multiple organ damage, after 20 weeks of gestation (1). Hypertension is defined as the presence of systolic blood pressure (SBP) greater than or equal to 140 mm Hg or diastolic blood pressure (DBP) greater than or equal to 90 mm Hg or higher, on two occasions at least 4 hours apart (2). Studies shown that endothelial damage, immunological dysfunction, endocrine abnormalities, genetic and nutritional elements may play a role in the development of preeclampsia(3, 4). currently, endothelial cell activation is considered as the underlying pathophysiology of preeclampsia(4, 5). Free radicals are very active and tissue damaging compounds which occurs as a result of lipid peroxidation in metabolism and removed by antioxidant(6, 7). In preeclamptic patients ascorbic acid and vitamin E levels, which are the most important components of the antioxidant system, were decreased(8). In addition, free fatty acid and triglycerides were increased two-fold compared to healthy pregnant women. Increase in triglycerides and free fatty acids were aberrant even weeks or months before the disease is clinically apparent(9).

Preeclampsia is a major cause of fetal and maternal morbidity and mortality worldwide and affects 2–8% of all pregnancies(10, 11). It is a substantial public health problem in both high-income and low and middle-income countries; where, treatment may be ineffective due to late case presentation(12, 13). The most common complications of this disease include infection, bleeding, cerebrovascular disease, preterm labor, kidney disease, liver rupture, pulmonary edema, hypothyroidism, and heart disease, which ultimately increases the risk of maternal death(14, 15).

Several factors are known to increase the risk of preeclampsia. The common conditions which are considered to play influential roles in the development of preeclampsia include age, obesity, insulin resistance, pre-existing hypertension and/or renal disease, pre-existing diabetes or gestational hypertension, a family history of preeclampsia, and maternal susceptibility genes(16). Nutritional habits can be considered as an important risk factor in the development of preeclampsia (17, 18). Diets rich in vegetables and fruits or various nutrients are associated with lower levels of oxidative stress and inflammation, which are both recognized pathogenic factors for preeclampsia(19, 20). Mothers who consume high calories have a risk of experiencing preeclampsia(21). There is an effect of chronic energy deficiency and protein intake on the increase the risk of of preeclampsia in

pregnant women. Pregnant women who took less protein food have increased the risk of developing preeclampsia(22).

Maternal nutritional status during pregnancy has been investigated as a potential treatment target in the prevention of preeclampsia. Poor dietary quality in mid-pregnancy, including high energy intake has been implicated in increased risk for preeclampsia(23).

Micronutrients has been investigated in decreasing the risk of developing preeclampsia. Micronutrients have clinical antioxidant and anti-inflammatory properties and are part of the normal placentation(24). They act on placental endothelial function, oxidative stress and expression of antigenic factors and thus, contribute to the trophoblastic invasion, spiral artery remodeling and angiogenesis. The maternal environment alters placental function(25). Adaptive responses to maternal malnutrition include upregulation of specific nutrient transporters and blood flow, and dietary deficiencies are believed to be contributors to the placental insufficiency observed in obstetrical syndromes, such as preeclampsia(26).

Increased dietary fiber intake during pregnancy may offer health benefits such as increasing gut microbiome variety, lowering the risk of glucose intolerance and preeclampsia, achieving optimal gestational weight gain, and reducing constipation(27, 28).

Food fortification of staple foods with calcium and dietary counselling were recommended by WHO for all women who are considering pregnancy and promote adequate calcium intake through locally available, calcium-rich foods(29). However, dairy products are not part of all regular diets, or are not available in certain populations(29, 30). Considering the seriousness of the issue, Ethiopia has identified preeclampsia as one of the contributions of maternal death, and the government has been working on quality improvement aspects of the maternal health services and forwarding different intervention strategies. These include increasing demand for services and easier access to emergency obstetric services, providing comprehensive and routine nutritional assessments and counseling services, conducting social and behavioral change communication on maternal nutrition by promoting maternal nutrition, including adequate intake of diversified foods, daytime rest and additional meals during antenatal and postnatal periods(31-36). Regardless of the progress made, maternal mortality related to PE is still on the increase unlike that of abortion and other direct obstetrics causes of maternal mortality(37).

## 1.2 Statement of the problem

Preeclampsia has been associated with an increased risk of adverse fetal, neonatal and maternal outcomes including brain damage, blindness, pulmonary edema, cardiovascular complications, Hemolysis, Elevated liver enzyme, low Platelet count (HELLP syndrome) and seizures or other neurological manifestations. They also include kidneys and liver damage, which leads to kidney failure and liver rupture(12, 38). Fetal complications include fetal distress, intrauterine growth retardation, preterm birth, stillbirth, perinatal death and neonatal asphyxia(39).

Preeclampsia (PE) is persisted as a global burden that attributes to maternal and perinatal morbidity and mortality both in the high income and low-income countries across the globe(40-42). Around 76 000 women and 500 000 babies die each year from preeclampsia and especially women in low-income countries are at a higher risk of developing preeclampsia (PE) compared with those in high-resource countries(40). The estimation of WHO remarked that the incidence of preeclampsia is to be seven times higher in low-income countries (2.8% of live births) than in high-income countries (0.4% of live births(43). Furthermore, evidences shown that Preeclampsia alone is estimated to account for about 40% to 60% of maternal deaths in low-income countries(44). For instance, nearly one-tenth of maternal deaths in Asia and Africa and one-quarter of maternal deaths in Latin America are associated with preeclampsia (45).

In Ethiopia also, previous studies revealed that preeclampsia has shown an increasing trend with an estimated prevalence of 8.4% and ranks third among the top four causes of maternal mortality in the country(46). Preeclampsia account for 19% of maternal deaths in Ethiopia. According to Ethiopian National Emergency Obstetric and Newborn Care(EMONC) evidence, 16% of direct maternal mortality and 10% of all maternal mortality (direct and indirect) was due to preeclampsia(47).

It is obvious that pregnant women needs a healthy and adequate nutrition not only for the health of pregnant women but also for the health of the child(48, 49). There is much evidence supporting the link between poor dietary intake and adverse pregnancy outcomes including cardiovascular diseases(48). Some studies have shown that excess energy (high carbohydrates and high fat diet) intake or insufficient nutrient intake may be associated with the increased risk of preeclampsia(50-52). Studies estimated that nutritional status and dietary pattern contributed nearly 66% for the development of preeclampsia whereas other studies showed that the risk of preeclampsia can be reduced nearly 53% by reducing consumptions of unhealthy diets (49, 53-55)

Today, the use of nutritional patterns and specifying their relationship with diseases is a relatively new topic in

the field of epidemiology of nutrition. Nutritional habits can be considered as an important risk factor in the development of preeclampsia(4, 56, 57). Studies were done on the dietary factors associated with preeclampsia but these studies were done in high-income countries and these findings yielded diverse and often inconsistent results(49, 58). Intake of fruits and vegetables, legumes, cereals, fish, milk, green leafy vegetables and pulses/beans was associated with a lower odds of preeclampsia(59, 60). However, there is contradictory study findings which reported that eating of fruits and vegetables, legumes, cereals, fish, milk, green leafy vegetables, pulses/beans and meat was not associated with preeclampsia(58, 61-63). Regarding the inconsistent and inconclusive results about the effect of dietary patterns during pregnancy on the incidence of preeclampsia and its relationship with nutritional factors, suggesting a need to look at overall dietary patterns.

There is no adequate documentation of potential dietary risk factors for the increment of PE which helps to prevent an increasing incidence in Ethiopia. As far as the researchers know, only two case-control study were done in Ethiopia to assess dietary risk factors of preeclampsia. But these studies were focusing on only specific food items or single food groups which cannot account for all interactions including synergistic and/or antagonistic interactions exist between nutrients within dietary patterns and may result in erroneous conclusions(64). Furthermore, important associations may be missed, or effects may be assumed in which none exist. In addition to this the previous studies were using non-probability sampling methods to select cases, which may have low representativeness of the sample and difficult to generalizations.

Therefore, it needs a study that can fill such gaps in association of diet with preeclampsia. To fill these gaps, this study was conducted using probability sampling methods to select both cases and controls with incorporating wide range of dietary patterns and also by assessing nutritional status of mothers. Hence, the primary objective of this study was to evaluate the association between dietary patterns in pregnancy and preeclampsia, the study was tried to find dietary risk factors of preeclampsia in governmental hospitals of west Gojjam zone, northwest Ethiopia which will be used to implement informative interventional programs to reduce risk factors and develop practical solutions to improve the dietary habit among women at risk of preeclampsia.

### **1.3 Significance of the study**

Since preeclampsia's etiology remains unknown, investigation and identification of the most important risk factors including dietary risk factors are vital for policy and clinical purposes including prioritization of interventions, resource allocation, identification of high-risk pregnant women for more intensive observation and care, and development or improvement of risk management strategies. So, this study finding will help policymakers to decide on which dietary factors to intervene more to reduce the burden of preeclampsia by improving the dietary practice of pregnant women. It will also serve as an input to the ministry of health and its stakeholders to evaluate the existing nutrition program for pregnant women and make the appropriate decision for remedial actions on taking diets which is risk factors for preeclampsia. It Will serve as an input for researchers who are interested in carrying out further research in the dietary factor and its association with preeclampsia. For mothers it will help to choose a healthy diet for preventing preeclampsia. So, knowing about the dietary factors of pregnant women that exposed to preeclampsia development will help the mothers to improve their dietary habits accordingly even after delivery and recovery from preeclampsia.

## 2 Literature review

There are several maternal and clinical risk factors that either alone or in combination may contribute to the high risk of preeclampsia; genetic factors, diet, parity, gestational weight gain, maternal age, previous history of preeclampsia, maternal pre-existing conditions are considered to play influential roles in the development of preeclampsia(47, 65).

### 2.1 Pregnant women dietary factors for the development of preeclampsia

Inconsistent findings were reported about the association between diet and preeclampsia. According to a study in Australia 2020, the Mediterranean-style dietary pattern (characterized by vegetables, legumes, nuts, tofu, rice, pasta, rye bread, red wine, and fish) was inversely associated with the risk of developing preeclampsia(66). Whereas, A study done in Indonesia 2019, revealed that there was no association between energy intake, protein intake, fat intake, carbohydrate intake and nutritional status with the incidence of preeclampsia(55). Another study done in Indonesia 2020 suggested that there is an effect of chronic energy deficiency and maternal protein intake on the increase risk of preeclampsia(22).

#### **Fruits and vegetables,**

Intake of vegetables and fruit is shown to have a protective effect against the risk of preeclampsia(49, 67-69). A study done in Norway, 2019 revealed that the dietary pattern characterized by high consumption of vegetables, plant foods and vegetable oils was inversely associated with developing preeclampsia(70). A case-control study in Jordanian pregnant women 2019 findings suggested that a dietary pattern characterized by a repeated intake of plant foods, vegetables, and vegetable oils decreases the likelihood of preeclampsia(71).

According to the study done in Sira Leon inadequate fruit intake during pregnancy was risk factor for the development of preeclampsia(72). There was a positive relationship between vegetable intake with preeclampsia in third-trimester pregnant women(73).

According to a study in Ethiopia taking fruit and vegetable was reduced the development of preeclampsia(32, 49). A case-control study done in Ethiopia in 2018 showed that mothers who do not consume at all or consume fewer amounts of fruits in their diet had higher risk of developing hypertensive disorders than those who consume fruits regularly(3). Another case-control study done in Ethiopia in 2018, showed that developing preeclampsia in pregnant women who took fruit daily during pregnancy was less compared to pregnant women

who didn't take fruit during pregnancy. This study also revealed that nutritional counseling during pregnancy was associated with a reduction of preeclampsia or eclampsia development(49).

### **Cereal and Grains**

According to studies in America, Norway, and Iran cereal and grain food groups' consumption during pregnancy was associated with preeclampsia. Women who consumed grain and cereals less frequently had a higher risk of developing preeclampsia than those who consume grain and cereals frequently(52, 60, 74). In contrast to the above studies, two case-control studies done in Iran revealed that no association is found between the risk of preeclampsia and Cereals and Grains consumption(62, 75).

### **Milk and milk products**

A study done in Norway showed that intake of milk during late pregnancy was significantly associated with a lower risk of preeclampsia, while there was no significant association between pre-pregnancy milk consumption and consumption during early pregnancy(76). A other study also showed that milk intake in pregnancy was significantly associated with lower preeclampsia risk(77). The study done in Iran showed that the risk of preeclampsia is reduced in women consuming dairy products, especially milk(58). Study done in Netherlands showed an increased risk of developing preeclampsia associated with lower milk intake(78).

### **Meat**

Recent evidence suggests that long-term consumption of red meat may increase preeclampsia risk(79-81). A Case-control study done in 2015 to assess perinatal epidemiological risk factors for preeclampsia showed that dietary habits, i.e. the intake of meat and meat products were risk factors for preeclampsia(82).In contrast to the above studies, a case-control study done in China, 2021 revealed that no association is found between the risk of preeclampsia and meat consumption(80). Another case-control study in India suggested that daily consumption of chicken or meat was the risk of preeclampsia(83). A case-control study done in 2018 showed that there is no association between meat consumption and the occurrence of preeclampsia(82). A study done in Denmark in 2019 identified an association between meat and meat product diet and higher risk of preeclampsia development(63).

### **Sugar, Sweets and Soft drinks**

A case-control study done in Norway suggest that foods with a high content of added sugar were associated with preeclampsia(84). Another study conducted in Spain in 2020 revealed that increased increase consumption of processed rich in simple sugar sweetener are the responsible factor for the development of preeclampsia(85). A large study conducted in Norway showed that increased consumption of sugar-sweetened carbonated and noncarbonated drinks was associated with a higher risk for preeclampsia(86).

A case-control study conducted in Iran showed that there is no any relationship between the risk of preeclampsia and consumption of different types of soft drinks including drinking different types of caffeine(87). Case control study done in Canada showed that there is association between consumption of high sugar drinks and the risk of preeclampsia(88). Another case control study done in Brazil in 2021 suggested that high soft drink consumption seems to be a risk factor for preeclampsia, suggesting that it should be discouraged during pregnancy(20).

### **Fatty and junk food consumption**

A Case-control study done in Denmark and Norway suggests that high intakes of energy and fatty foods independently increase the risk for preeclampsia (89). Study done in Jordanian women showed that high consumption of fat was associated with the development of preeclampsia(90). However study in Chana in 2021 did not observe any significant associations between the intake of total fatty acids, saturated fatty acids, and mono-unsaturated fatty acids and the risk of developing preeclampsia(91).

### **Iron and Folate Intake**

Increasing evidence suggests that iron-containing multiple micronutrients may reduce the risk of pregnancy-induced hypertension including gestational hypertension or preeclampsia(92-95).

### **Nutritional status**

According to the study done in the United Kingdom, Zimbabwe and Ethiopia showed that there is a significant association between nutritional status of pregnant mothers and the occurrence of preeclampsia(4, 67, 96, 97). Another study done in Ethiopia revealed that women who had a MUAC value above the average 25.6 cm had an increased risk of preeclampsia(56). However, the study conducted in Indonesia 2019 showed that there is no significant relationship between nutritional status (MUAC) and the development of preeclampsia(55).

A study done in Iran in 2021 revealed that anemia can be a predisposing factor for the development of many

women with preeclampsia were having a low level of hemoglobin during their pregnancy(98). Another study done in Iran showed that the levels of hemoglobin can be used to predict preeclampsia and monitoring the pregnant women and its regular measure in 3 trimesters help us to identify women at risk for preeclampsia(99). Study done in Bangladesh, 2021 showed that serum hemoglobin level is associated with preeclampsia(100).

## **2.2 Other risk factors for the development of preeclampsia**

### **2.2.1. Socio-demographic related factors**

#### **Maternal age**

Most studies showed that the risk of developing preeclampsia increases with age particularly a study conducted in India showed that preeclampsia increases exponentially with age(101). According to a case-control studies conducted in Indian, Iran and Ethiopia maternal age is a risk factor for the development of preeclampsia (10, 96, 102-104).

#### **Educational status**

Maternal education is the risk factor for the development of preeclampsia(96). Most studies found a significant positive association between maternal education and preeclampsia(10, 102, 105, 106). However in Ethiopia, a case-control study results showed lack of association between educational level with preeclampsia or eclampsia(49).

#### **Residence**

Studies done in the united states of America, India and Ethiopia revealed that there is a significant association between the residence of pregnant mothers and the development of preeclampsia(101, 107). A study done in India found that rural residence was a significant predictor for the development of Preeclampsia(101).

#### **Occupation and Economical status**

Studies conducted in Iran, Nigeria, and Sudan revealed that there was an association between pregnant mother's occupation during pregnancy and the risk of preeclampsia(108-111). On the other hand a study done in Egypt in 2018, revealed that lack of association between the occupation of the mother and the risk of preeclampsia development(105).

### **2.2.2 health related and obstetrics factors**

#### **Parity**

Several studies reported a significant role of parity and gravidity in the development of preeclampsia(72, 103, 106, 112, 113). According to the study done in India, Nepal, China and Ethiopia nulliparous pregnant women and primi parous women were at higher risk of developing preeclampsia(104, 114, 115). Similarly, a case-control study done in Addis Ababa revealed that the odds of developing preeclampsia in nulliparous women

were higher than women with multiparty(49).

### **Gravidity**

Gestational age less than 37 weeks and twin pregnancy were both strongly linked to an increased risk of developing preeclampsia(116). Another study revealed that a gestational period of more than 30 weeks was significantly associated with preeclampsia compared to a gestational period between 20 – 30 weeks(10). However, the study done in Ethiopian 2018, revealed that there is no statistically significant difference in the occurrence of preeclampsia in primigravidae and multi-gravida women(44).

### **Nutritional counseling and ANC follow-up**

Different studies revealed that nutritional counseling during pregnancy was associated with a reduction of preeclampsia development (49, 56). A case-control study conducted in Addis Abeba and West Amhara Zones found that the risk of developing PE was lower in women who got nutritional counseling during ANC follow-up compared to those who did not(37, 49). Studies also found that women who had frequent ANC visits had a lower risk of PE than their counterpart(37, 117).

### **2.2.3 Medical history risk factors of preeclampsia**

Medical diseases such as a history of hypertension, history of diabetes mellitus (DM), family history of preeclampsia, gestational diabetes mellitus, previous history of preeclampsia have been considered to be high-risk factors for preeclampsia(81, 82). The National Institute for Health and Care Excellence in 2015 showed that high-risk women include those with preexisting hypertension, chronic kidney disease, insulin-dependent diabetics, and women with previous early-onset preeclampsia(118).

### **Hypertension**

High blood pressure and other cardiovascular risk factors before pregnancy are associated with a risk of gestational hypertension and preeclampsia(119). Studies done in Boston and Thailand by 2021 showed that pre-pregnancy hypertension was associated with the risk of preeclampsia development(120, 121). A nested case-control study done in Brazil and Auckland showed that history of weight gain rate per week, obesity, and increased diastolic blood pressure before 20 weeks of gestation were shown to be associated with preeclampsia(122). Another study conducted in Dessie Referral Hospital in Ethiopia showed that those women with a family history of hypertension had a higher risk of developing preeclampsia compared with women who did not have history of hypertension(123).

### **Diabetes mellitus**

Studies done in Indonesia, Australia and Ethiopia showed that women with a family history of diabetes mellitus

had an increased risk of developing preeclampsia as compared to those with no family history of diabetes mellitus(124, 125). A study done in China and Sweden in 2021 revealed that a history of diabetes was associated with preeclampsia and severe preeclampsia (126, 127).

### **Previous History of Preeclampsia**

Previous history of preeclampsia was also a risk factor of preeclampsia. According to studies done in India and Ethiopia pregnant women with previous history of preeclampsia were more likely to develop preeclampsia compared with women with no previous history of preeclampsia (125, 128).

### **2.2.4 Pregnant women lifestyle factors**

#### **Smoking**

Active smoking in the third trimester was associated with reduced odds of preeclampsia and gestational hypertension, with the strongest association among continuous smokers for preeclampsia(129). Prospective studies done in 2015 suggests that cigarette smoking during pregnancy is inversely associated with preeclampsia(130). A study conducted in Latin America showed that cigarette smoking during pregnancy was a protective factor in the development of preeclampsia(131).

#### **Alcohol consumption**

A Case-control study done in Japan revealed that alcohol consumption during pregnancy was the risk factor for the development of preeclampsia(132). A study conducted in Uganda showed also that alcohol consumption was the preventive factor of preeclampsia(133)

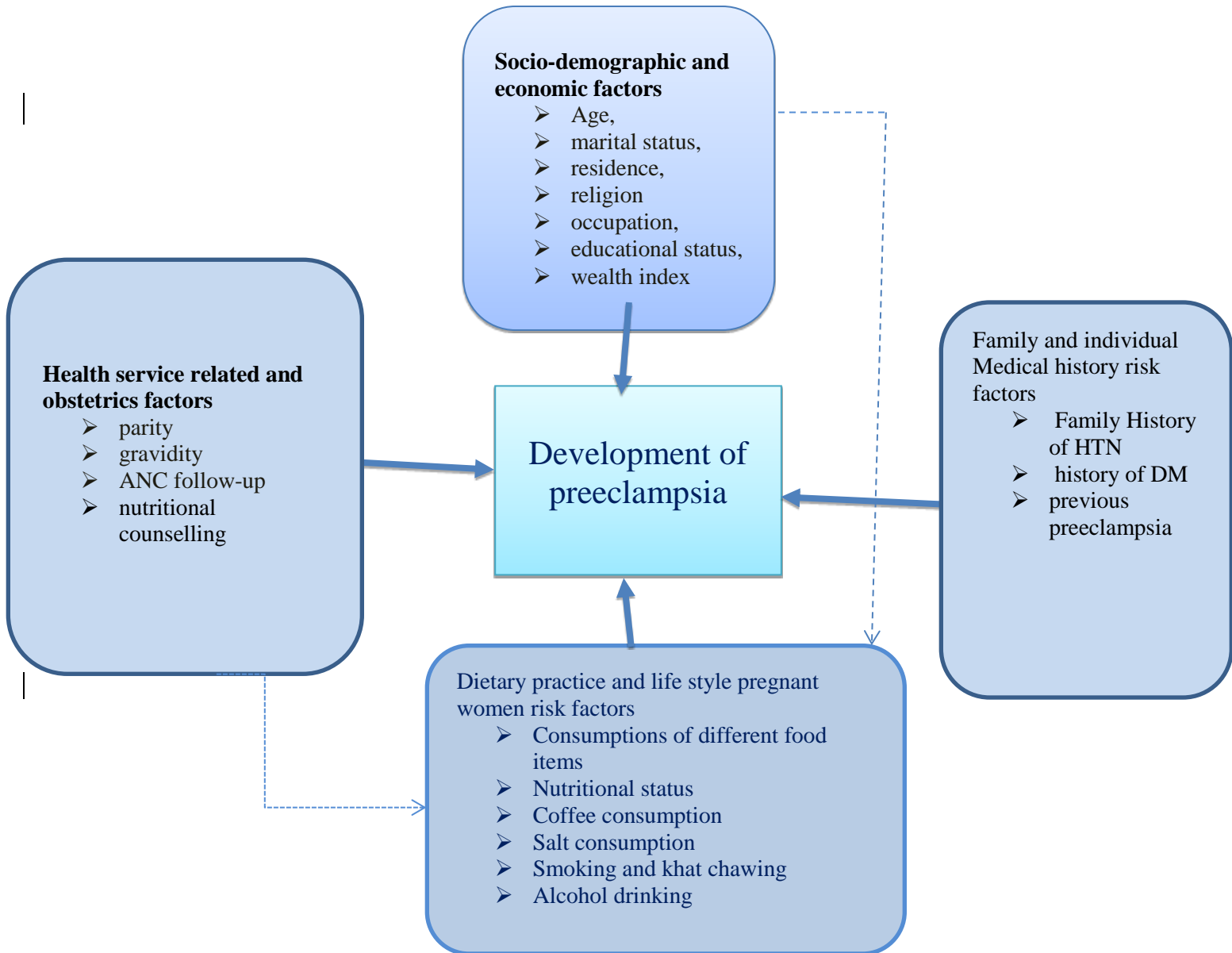
#### **Khat chewing**

A case-control study done among Yemeni pregnant mothers showed that Khat chewer pregnant women were having statistically significant risk for preeclampsia, and intrauterine fetal death(134).

#### **Coffee consumption**

A case-control study done in 2015 to assess perinatal epidemiological risk factors for preeclampsia showed that coffee and alcohol drinks were not associated factors for the development of preeclampsia(82)A case-control study done in Canada 2017 showed that drinking coffee was not a significant risk factor for the development of preeclampsia (135). A case-control study done in northwest Ethiopia revealed that Women who reported to have taken coffee daily were more likely to develop preeclampsia than those who did not(46).

## 2.3 Conceptual framework



**Figure 1** Conceptual framework for to assess dietary risk factors of preeclampsia among women attending ANC and delivery services in governmental hospitals of west Gojjam zone, north west Ethiopia, 2021(10, 12, 65, 94, 102, 105, 106, 112, 121, 133, 136, 137)

### **3 Objectives of The Study**

#### **3.1 General Objective**

- ✓ To assess dietary risk factors of preeclampsia among pregnant mothers attending ANC and delivery services in governmental hospitals of West Gojjam Zone, North West Ethiopia; by 2021.

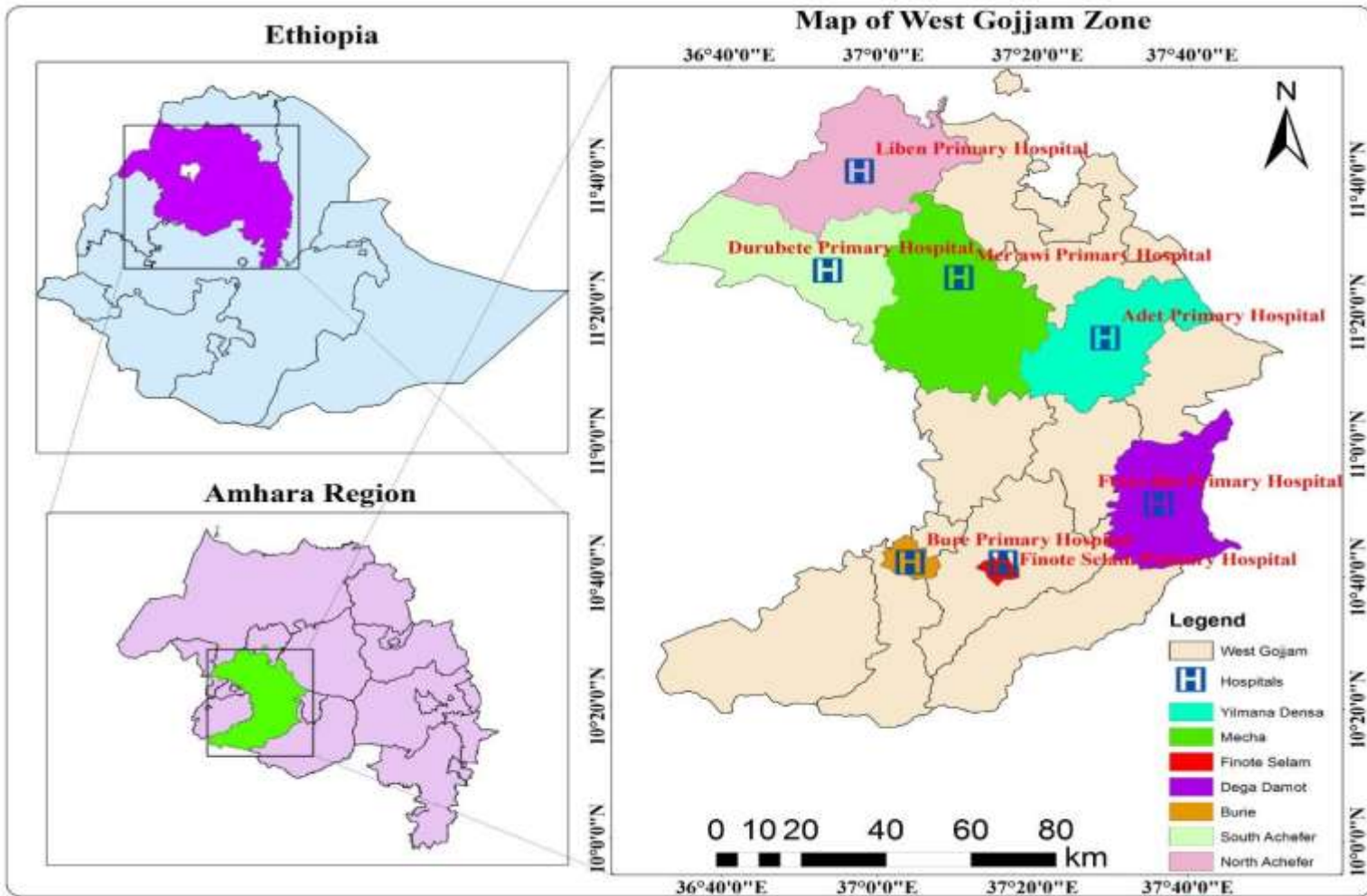
## **4. Methods and Materials**

### **4.1 Study area**

This study was conducted in the West Gojjam zone, Amhara region. Its central-town is Finoteselam, and it is located 176 kilometers from Bahir Dar. It is bounded on the south by the Abay River, which separates it from the Oromia and Benishangul-Gumuz regions, on the west by the Awi Zone, on the northwest by North Gondar, on the north by LakTana and the Abay River, which separates it from South Gondar, and on the east by East Gojjam(138). The altitude and longitude coordinates for this zone are 10.9738°N 37.4681°E, with a height of 3535 meters above sea level. It has a surface area of 13,912 square kilometers and an elevation range of 1000 to 3535 meters above sea level(138).

There are 16 woredas and 5 town administrations in this zone According to the statistics abstract for the West Gojjam Zone (2018), the total population is 2,758,806 people (male 49.5 percent and female 50.5). The population of the west Gojjam zone is served by seven hospitals, 107 health facilities, and 404 health posts. According to the Amhara region's population projection formula, there are 89,484 pregnant women in the west Gojjam zone in 2021 getting service from seven hospitals. The hospitals included Adet primary hospital, Merawi primary hospital, Durbetie primary hospital, Burie primary hospital, Finoteselam primary hospital, Liben primary hospital and Feresebet primary hospital(139).

Teff, barley, wheat maize, and sorghum are the most widely available cereal crops, according to data from the CSA agricultural sample survey 2020 (2012E.C). Beans, peas, lentils, fenugreek, and lupine are the most regularly grown pulses. Lettuce, cabbage, tomatoes, peppers, carrot, onion, potatoes, and garlic are among the most widely grown vegetables and root crops, according to the CSA statistics. Fruits grown in the west Gojjam zone include avocado, banana, lemon, mangos, oranges, papayas, and pineapples(140).



**Figure 2** Map of the study area to assess dietary risk factors of preeclampsia among women attending ANC and delivery services in governmental hospitals of west Gojjam zone, north west Ethiopia, 2021

## 4.2. Study design and period

A facility-based unmatched case-control study was conducted on mothers, attending antenatal care and delivery services in West Gojjam zone governmental hospitals, North West Ethiopia, from September 27-October 28, 2021.

### Case definition

Cases were mothers with a new onset of elevated diastolic blood pressure of 90mmHg and/or systolic blood pressure of 140mmHg on two consecutive records of four–six hours apart or highly elevated blood pressure (diastolic blood pressure  $\geq 110$ mmHg and/or a systolic blood pressure  $\geq 160$ mmHg) of a single occurrence, plus protein in the urine estimated to be 300mg per day or urine dipstick record of  $>1+$  after 20 weeks of

gestation(42).

### **control definition**

Controls were mothers who were not diagnosis preeclamsia or mothers whose blood pressure is < 140/90 mmHg and proteinuria < 300mg/24 hours or < 1+ in urine dipstick test after delivery during the study period in the same hospitals.

### **4.3. Source of population**

**The source population for cases:** The source of the population for cases were all mothers who have preeclamsia and getting ANC and delivery services in governmental hospitals of west Gojjam zone northwest Ethiopia 2021.

**The source population for controls:** The source of the population for controls were all mothers who don't have preeclamsia and getting antenatal care and delivery services in governmental hospitals of west Gojjam zone northwest Ethiopia 2021.

### **4.4 Study population**

**The study population for cases:** Pregnant women who have preeclampsia and attending antenatal care or delivery service during the study period,

**The study population for controls:** Mothers who don't have preeclampsia and who get antenatal care and skilled delivery service during the study period.

### **4.5. Eligibility criteria**

#### **4.5.1 Inclusion criteria**

**Inclusion criteria for cases:** Mothers who attend ANC or delivery service and have a blood pressure of  $\geq 140/90$  mmHg and proteinuria  $\geq 300$ mg/24 hours or  $\geq 1+$  urine dipstick test after 20 weeks of gestation were included in the study.

**Inclusion criteria for controls:** Mothers who got ANC and delivery service during the study period and have a blood pressure of < 140/90mmHg and proteinuria < 300 mg /24 hours or <1+ in urine dipstick test within 24hrs postpartum time were included in the study.

#### **4.5.2 Exclusion criteria**

**Exclusion criteria for cases:** Pregnant women who have preeclamsia with mentally ill were excluded.

**Exclusion criteria for controls:** women who have inability to respond to questions due to mental and severe illness were excluded from the study since it may be difficult to obtain information about their nutritional history.

## 4.6 Variable

### 4.6.1. Dependent variable

Preeclampsia = (Yes, No)

### 4.6.2. Independent variables

**Sociodemographic and Economic factors** (Age, marital status, residence, religion, occupation, educational status and wealth index)

**Diet and lifestyle of pregnant women risk factors** (Consumptions of different food groups, nutritional status, salt consumption, Coffee consumption, Smoking and khat chewing, Alcohol drinking).

**individual medical history risk factors** (family history of HTN, history of DM, and previous preeclampsia)

**Health service related and obstetrics factors** (parity, gravidity, ANC follow-up, getting nutritional counseling).

## 4.7 Definitions of terms and operational definitions

**Preeclampsia:** A new onset of elevated diastolic blood pressure of 90mmHg and/or systolic blood pressure of 140mmHg on two consecutive records of four–six hours apart or highly elevated blood pressure (diastolic blood pressure  $\geq$ 110mmHg and/or a systolic blood pressure  $\geq$ 160mmHg) of a single occurrence, plus protein in the urine estimated to be 300gm per day or urine dipstick record of >1+ after 20 week of gestation(42).

**Household wealth index:** A proxy measure of living standards derived from information on ownership available assets and household characteristics and household classified into five category and the wealth score were created to categorize households as poorest, poor, medium, rich, and richest(141).

**Consumer of specific food items;** The consumers of a food item were defined as when the respondents consume specific food item at least once a week (142, 143).

**Anemia:** Maternal anemia was defined when hematocrit less than 33%(hgb<11g/dl) and was classified as moderate HCT level 21-33%(hgb 7-11g/dl) or severe hematocrit level< 21% or hemoglobin less than 11g/dl(144)

**Dietary practice:** Pregnant women's eating preferences and habits of consuming various food items and beverages in diets and the frequency with which they are regularly consumed.

**Coffee consuming:** The mothers were asked to respond to a close-ended question whether they drink coffee or

not. If mothers answered less than 5 cup of coffee per day was considered as moderately coffee consumption. If mothers answered  $\geq 5$  cup of coffee per day was considered as excessive coffee consumption(145, 146).

**Khat chewing assessment.** The mothers were asked to respond to a close-ended questions concerning khat chewing. When the mother chewing chat at least once a week she was classified as habitual user while the mother chewing khat less than once in a week is classified as occasional khat user(147).

**Alcohol consuming:** consuming at least one unit (one unit is 1 shot (25mL) of spirits (areqe, gin), or 1 small glass (125mL) of wine/tej or 1 can/bottle (330mL) of beer/tela) of alcohol from any sources. If a woman reported as consuming at least one unit of alcohol from any sources (Tella, Teje, Areqe, Beer and Wine) during the current pregnancy, she was labeled as alcohol consumer. If she consumed five or more alcohol drinks in one session (one sit) during the current pregnancy, she was labeled as a binge alcohol consumer(148).

**Nutritional counseling:** If a pregnant woman was counseled or assisted to have appropriate nutritional intake by integrating information from the nutrition assessment with information about the consumption of healthy food choice and frequency of feeding during pregnancy by a health professional the mother was considered as getting nutritional counseling(149).

## **4.8 Sample size determination and Sampling procedure**

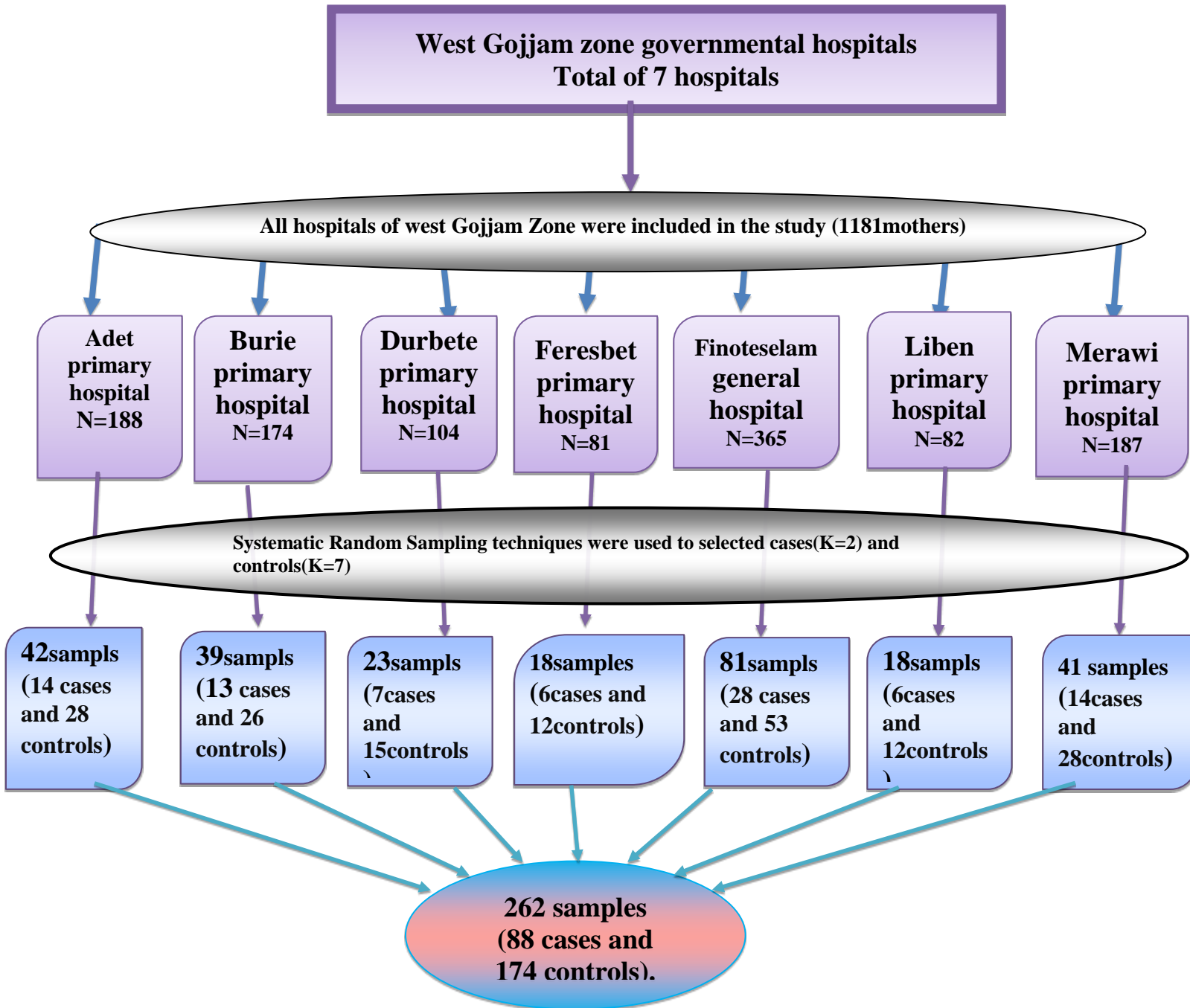
### **4.8 .1 Sample size determination**

The sample size was determined by using epi-Info version 7.2 to compute the estimated sample size using double population proportion formula by assuming coffee consumption as a factor with lowest odds ratio of 2.14 and the proportion of exposed group in controls was (38.8%) from previously published research study (57). In addition, 95% confidence interval, 5% marginal error, and 80% power were considered. The calculated sample size was 249 and after adding 5% for possible non-responses, the final sample size was estimated as 262(88 cases and 174 controls).

### **4.8.2 Sampling procedure**

To obtain an adequate sample size, the study included all seven governmental hospitals in the West Gojjam Zone. The calculated sample size (both for cases and for controls) were distributed proportionally to each institution their antenatal and delivery caseload (data obtained from west Gojjam zone health department 9-month report of 2013 EFY). Cases and controls were chosen using a systematic random sampling procedure from the ANC service and delivery service by using the delivery and ANC register. The selection of cases was carried out after the physician (general practitioner (GP) or gynecologist) had the diagnosis preeclampsia. The

first sample for cases and controls were selected by lottery method from their order of registration.



**Figure 3** sampling procedure to assess dietary risk factors of preeclampsia among women attending ANC and delivery services in governmental hospitals of west Gojjam zone, north west Ethiopia, 2021.

## **4.9 Data collection**

### **4.9.1 Types and sources of data**

The data were collected from primary and secondary data sources through record review, measurement and a face-to-face interview of mothers using a pretested questionnaire that contains sociodemographic and economic, dietary habit, lifestyle and health related and obstetrics questions. The measurement was included MUAC of the women and the recent record of hematocrit was taken from mother's medical record chart. They were interviewed about their sociodemographic and economical characteristics, medical history, obstetric factors, dietary practice and behavioral factors by trained 8 midwives (data collectors) and 2 health officers (supervisors). A questionnaire was prepared by reviewing different works of literature including, WHO, DHS, FFQ, NHANES and other documents which are related to preeclampsia and the dietary practice of pregnant women(150-153).

### **4.9.2. Data collection tools and procedures**

The questionnaires used for data collection were adapted from different previous works of literature; then were modified into our context. To check its consistency, the questionnaires were first translated from English to Amharic and then translated back to English.

#### **Measurements**

To measure the blood pressure of the participants, participants a mercury sphygmomanometer was used, and the apparatus covers the upper two-thirds arm. At the antenatal clinic and PNC unit, the record of blood pressure was performed while the women were seated in the upright position. During the procedure, the cuff was inflated at a rate of 2-3 mmHg per second. Systolic blood pressure (SBP) was noted as the first Korotkoff sound has been heard, and diastolic blood pressure (DBP) was obtained when the fourth Korotkoff sound was heard. Upon detection of abnormal or unsatisfactory measurements, the measurement was repeated at least four hours apart to confirm the diagnosis. Information about proteinuria, hematocrit and other relevant data were accessed from maternity charts and for mothers who had more than one record of HCT and other relevant investigations, the recent recorded data was taken. MUAC was measured with a non-stretchable MUAC-tape and wrap a MUAC tape around the participant's bend left arm at the midpoint between the olecranon and acromion by data

collectors to the nearest 1 mm.

### **Dietary data assessment**

The FFQ constituted different food types were divided in different food groups including Grains, white roots and tubers, and plantains, Pulses (beans, peas and lentils), Nuts and seeds, Dairy, Meat, poultry and fish, Eggs, Dark green leafy vegetables, other vitamin A-rich fruits and vegetables, other vegetables, other fruits, sweets and beverages and fast foods. Each food group contained the different number of food items. Cases and Controls were asked to recall their usual frequency of intake over the last one month. The frequency of food intake was assessed on monthly, weekly and daily basis. Items of food were listed in this FFQ and were divided into similar food groups. Respondents needed to answer only once for the frequency of intake of these foods. The food-intake pattern was then estimated using the method adapted and modified from Sauvageot Nicolas, et al 2013(154, 155). The values used for each frequency option were the following: Never = 0; one time a month=1/30; two to three times a month = 2.5/30; one times a week = 1/7; two to four times a week = 3/7; five to six times a week = 5.5/7; one time a day = 1; 2 times a day =2 and. 3 times or more a day =3.5'. The consumers of a food item were defined as when the respondents consume specific food item at least once a week(142, 143). The number of food item the women ate at least once week were counted to analyze logistic regression for each food groups. The food-intake scores for each food group were divided into three parts(tirtiles): mostly consumed foods; moderately consumed foods and rarely consumed foods.

### **4.10 Data management and analysis**

After manual checking of the filled questionnaire for completeness and cleaning, data was entered using epi-data manager and exported, cleaned and analyzed using statistical package for social science (SPSS) version 23. For all variables, data accuracy and missed values were checked with a frequency. Charts, diagrams, tables and graphs were used for major finding presentation. Crude Odds ratio (COR) with 95% confidence intervals were calculated to measure relevant variables in bivariate regression analysis and variables with p value less than 0.2 were considered to fit variables into the final multivariable regression analysis model. The predictive value of the model was assessed using Hosmer–Lemeshow goodness-of-fit test statistics, which was found 0.766. Thus, the p-value for the Hosmer and Lemeshow chi-square was greater than 0.05 which indicated the fitness of the model. Overall findings were presented in texts and tables. In multivariable regression analysis, adjusted odds ratio (AOR) and the corresponding 95% confidence intervals were calculated to see the strength of the association between the outcome and explanatory variables. Finally, independent variables with a p value of less than 0.05 were considered as a statistically significant factor of preeclampsia.

### **Wealth index data analysis**

The wealth index was constructed using different variables for urban and rural respondents related to ownership of selected household by considering latrine, water source, household assets, livestock, and agricultural land ownership via a principal components analysis to produce a common factor score for each household. A wealth index for rural and urban households was constructed separately, since the living conditions in urban and rural areas of the study population were very different.

The principal component analysis was done to construct a wealth index based on household data. Each household asset for which information was collected was assigned a weight or factor score generated through principal components analysis. The resulting asset scores was standardized in relation to a standard normal distribution with a mean of zero and a standard deviation of one. The Kesie-Myer Oklin test (KMO test) was done to evaluate the suitability of factor analysis and sampling adequacy and the result of KMO test for both urban and rural was more than 0.5. During PCA analysis variables having a commonality value of greater than 0.5 in communality output and value greater than 0.5 in anti-image output were used to produce factor scores.

By running frequency analysis, variable/asset is owned by more than 95% or less than 5% of the sample, were excluded from the analysis. Variables were binary, which were given a score of 1 for possessing of them and zero in their absence but some of the variables had multiple options so recoded to a meaningful variable with different scoring system according to their value. By taking first component wealth quintiles (from lower to higher) were obtained by assigning the household score, then ranking and dividing to 5 equal parts. Quintiles of the wealth score were created to categorize households as poorest, poor, medium, rich, and richest.

#### **4.11 Data Quality Control**

Training on data collecting techniques was prepared by the principal investigator and given to the data collectors initially, before the actual data collection. A pretest was conducted in Dangila primary hospital to check the functionality as well as reliability of the data collection tools and performance of data collectors. Some modifications were made on clarity of questions and lay out of the questionnaire. At the end of each data collection day, the data consistency, completeness and cleanliness were done with the close supervision of the principal investigator.

#### **4.12 Ethical consideration**

Ethical clearance was obtained from the ethical review board of BDU, college of medicine and health science. Then officials at different levels in the study area were communicated through letters from BDU, college of medicine and health science. Letters of permission was presented to the West

Gojjam zone health department and another official support letter was obtained from west Gojjam zone health department to all hospitals found in west Gojjam zone. After the purpose of the study explained to the different level managers of hospitals, verbal informed consent was obtained from each study subject before the interview. Confidentiality and privacy of the respondent's response was maintained during data collection, analysis and reporting of the findings.

## 6. Result

### 6.1 Socio-demographic and economics characteristics

A total of 261(88 cases and 173controls) verbally consented pregnant women who came for either antenatal follow up or skilled delivery service were enrolled in this study with a response rate of 99.6%. The mean age of case and controls was 29 years ( $\pm 5.9$  SD) and 27 years ( $\pm 6.1$  SD) respectively. Majority of the participants 250(95.8) were Orthodox Christian followers of whom 81(92%) were cases and 169(98%) were controls. About 171(98.8%) controls and 85(96.6%) of cases were Amhara in ethnicity and majority of cases 85(96.6%) and 165(95.4%) controls were married. Almost half of cases 43(48.9%) and 79(45.7%) controls were housewives. Concerning educational status, about 26(29.5%) of case and 49(28.3) of controls were can't read and write. For all respondents the mean family size was 4.13 ( $\pm 1.8$  SD) and from all respondents 60(68.2%) cases and 108(62.4%) controls had less than five family members similarly 59(67.0%) cases and 111(64.2%) controls were urban residents ( **Table 1**).

**Table 1** Sociodemographic characteristics of women attending ANC and delivery services in governmental hospitals of West Gojjam Zone, north west Ethiopia, 2021(n1= 88, n2 = 173).

Socio-demographic characteristic		Cases (88) N (%)	Control (173) N (%)
<b>Religion</b>	Orthodox	81(92.0)	169(97.7)
	Muslim	7(8.0)	4(2.3)
<b>Ethnicity</b>	Amhara	85(96.6)	171(98.8)
	Agew	2(2.3)	2(1.2)
	Tigray	1(1.1)	
<b>Marital status</b>	Married	86(97.7)	165(95.4)
	Unmarried	2(2.3)	8(4.6)
<b>Mothers' occupation</b>	housewives'	43(48.9)	79(45.7)
	Farmer	16(18.2)	38(22)
	merchant	10(11.4)	29(16.8)
	Government employee	14(15.9)	23(13.3)
	private employee	5(5.7)	4(2.3)
<b>Educational status</b>	Can't read and write	26(29.5)	49(28.3)
	Can read and write only	16(18.2)	41(23.7)
	Primary school (1-8)	20(22.7)	30(17.3)

	Secondary school (9-12)	12(13.6)	21(12.1)
	Diploma and above	14(15.9)	32(18.5)
<b>Family numbers</b>	family no less than 5	108(62.4)	60(68.2)
	family no 5 or more	65(37.6)	28(31.8)
<b>Residence of the mother</b>	urban	59(67.0)	111(64.2)
	Rural	29(33.0)	62(35.8)
<b>Wealth index</b>	poorest	17(19.3)	32(18.5)
	Poor	18(20.5)	36(20.8)
	medium	27(30.7)	45(26.0)
	rich	18(20.5)	25(14.5)
	richest	8(9.1)	35(20.2)

## 6.2 Health related, obstetrics, and behavioral factors of preeclampsia

In this study about 39(44.3%) of cases and 66 (38.2%) of controls ever drunk alcohol. Among the different types' alcohol *Tella* was more frequently drunk followed by *Arekie*. Similarly, among the study participants who were ever drunk coffee 56(63.6%) were cases and 104(60.1%) were controls (Table 2). Among all respondents only 4(1.5%) of mothers were chewed chat and 3(3.4%) were cases and there were no respondents who has history smoking through their life time.

**Table 2** health related, obstetrics, and behavioral characteristics of women attending ANC and delivery services in governmental hospitals of West Gojjam Zone, north west Ethiopia, 2021(n1= 88, n2 = 173).

Health related, obstetrics, and behavioral characteristic		Cases (88) N (%)	Control (173) N (%)
ANC service	ANC service less than 4 times	48 (54.5)	83(48.0)
	getting ANC serve $\geq$ 4 times	40(45.5)	90(52.0)
getting counselling about diet	Yes	50(56.8)	127(73.4)
	No	38(43.2)	46(26.6)
Family history of hypertension	Yes	5(5.7)	8(4.6)
	No	83(94.3)	165(95.4)
History of previous preeclamsia	Yes	10(11.4)	11(6.4)
	No	78(88.6)	162(93.6)
number of gravidities	Less than 5 times pregnancy	70(79.5)	135(78.0)
	$\geq$ 5 pregnancy	18(20.5)	38(22.0)
Number of parities	less than 5 life birth	79(89.8)	155(89.6)
	more than 5 live births	9(10.2)	18(10.4)
Drinking alcohol	Yes	39(44.3)	66(38.2)
	No	49(55.7)	107(61.8)
drinking coffee	Yes	56(63.6)	104(60.1)

	No	32(36.4)	69(39.9)
Ever chewed khat	Yes	3(3.4)	1(0.6)
	No	85(96.6)	172(99.4)

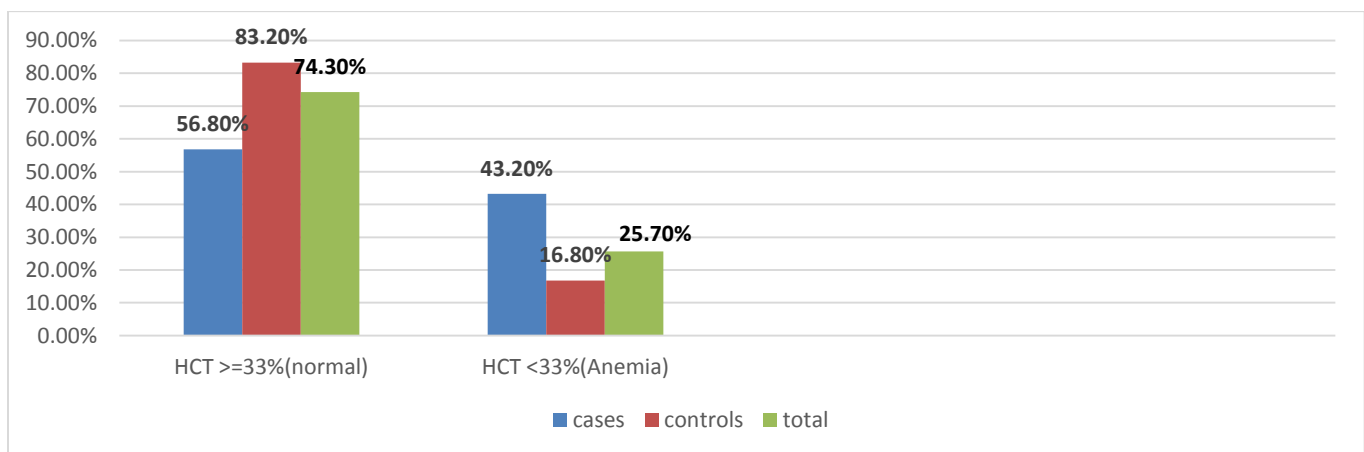
From 261 study participants 9(10.2%) cases and 18(10.4%) controls had  $\geq 5$  live births, while 18(20.5%) cases and 38(22%) controls were multigravida mothers. From all participants almost half of cases 48(54.5%) and almost half of controls 83(48.0%) had 4 times ANC visits during current pregnancy and above half 50(56.8%) cases and 127(73.4%) controls were getting counseling about their dietary habit from health professionals during their ANC follow-up (table 2).

Regarding the medical history, family history of hypertension was reported as 5(5.7%) cases and 8(4.6%) in controls. Regarding to their previous personal preeclampsia history 10(11.4%) cases and 11(6.4%) controls reported history of preeclampsia during their previous pregnancy. Similarly, two percent of cases and 1.7% of controls had personal history of diabetes mellitus.

### 6.3 Nutritional status

Regarding to nutritional status of mothers the mean ( $\pm$ ) SD of MUAC were 24.5cm  $\pm$  (2.73) and 23.1cm  $\pm$  (2.24) for cases and controls respectively.

The mean ( $\pm$ ) SD of hematocrit concentration among the study participants was 35.8  $\pm$  (5.17) among these 38(43.2%) case 29(16.8%) controls had anemia. From 261 study participants only 1 woman from control groups had severe anemia which is HCT level below 21%. From all respondents almost half of the cases 41(46.6%) and 99(57.2%) of controls take iron for 3 months (Figure 4).



*Figure 4 hematocrit level women to assess dietary risk factors of preeclampsia among women attending ANC and delivery services in governmental hospitals of west Gojjam zone, north west Ethiopia, 2021*

#### **6.4 Bivariate and multivariable logistic regression results of the study**

In bivariate analysis old age, personal history of preeclampsia, low economic status didn't get counselling about diet during pregnancy, higher MUAC, anemia (HCT less than 33%), higher consumptions of fat related foods and fast foods, less consumptions of dairy products and infrequent use of dark green leafy vegetables and other vitamin A-rich fruits and vegetables were significantly associated with preeclampsia (table 3).

In the multivariable logistic regression analysis, seven variables are identified as determinants of preeclampsia among women attending delivery and ANC services at a 5% level of significance. Having preeclampsia in previous pregnancy, lowest wealth index(poorest) and infrequent consumption of dark green leafy vegetables were significantly associated with preeclampsia in bivariate analysis but it remains insignificant in the multivariable analysis. The multivariable analysis revealed that a high consumption of fat related foods was associated with the development of preeclampsia. Women who had high consumption of fat related foods were 3.7 times more likely to develop preeclampsia compared with those mothers who did not ever eat or consumed rarely (AOR: 3.7 at 95% CI: 3.7(1.67,8.23)). This study showed that consumption of vitamin A-rich fruits and vegetables during pregnancy was associated with reduction of preeclampsia development. Pregnant women who had high consumption of other vitamin A-rich fruits and vegetables were 88% less likely to develop preeclampsia compared with those pregnant women had low preferences to vitamin A-rich fruits and vegetables rarely (AOR: 0.12 at 95% CI: 0.04,0.35) (table 3). Milk product intake during pregnancy was a protective factor for preeclampsia independently. Comparing to women who didn't eat milk products, women who ate milk products more frequently were 61% less risk of developing preeclampsia (AOR:0.39, 95% CI (0.15,0.95). The result of this study also revealed that women who had receiving nutritional counseling during antenatal care follow up was found that protective for preeclampsia compared to who hadn't receiving nutritional counseling during pregnancy (table 3). In the multivariable analysis, mothers who hadn't receive nutritional counselling were 2.18 more likely to develop preeclampsia than those who had receive counselling (AOR: 2.18, 95% CI (1.11,4.29)).

**Table 3** AOR and Crude odds ratio output of binary logistic regression of women attending ANC and delivery services in governmental hospitals of west Gojjam zone, north west Ethiopia, 2021(n1= 88, n2 = 173).

Variables	Categories	Health status		COR (95%:CI)	AOR (95%:CI)
		Cases N (%)	Controls N (%)		
<b>Wealth index</b>	Poorest	17(19.3%)	32(18.5)	1	1
	Poor	36(20.8)	36(20.8)	0.9(0.4,2.1)	1.07(0.38,3.02)
	Medium	27(30.7)	45(26.0)	1.12(0.5,2.40)	1.29(0.49,3.46)
	Rich	25(14.5)	18(20.5)	1.3(0.5,3.1)	2.21(0.74,6.67)
	Richest	8(9.1)	35(20.2)	0.4(0.2,1.1)	0.59(0.18,1.89)
<b>History preeclamsia</b>	Yes	10 (11.4)	11(6.4)	1	1
	No	78(88.6)	162(93.6)	0.5(0.2,1.3)	0.83(0.23,2.96)
<b>Receiving about Counselling</b>	Yes	50(56.8)	127(73.4)	1	1
	No	38(43.2)	46(26.6)	2.1(1.2,3.6)	2.18(1.11,4.29) *
<b>Hematocrit level</b>	Normal HCT level	50(56.8)	144(83.2)	1	1
	Anemic	38(43.2)	29(16.8)	3.8(2.1,6.7)	3.31(1.62,6.78) **
<b>Dairy products</b>	Rarely consumed	37(42.0)	47(27.2)	1	1
	Moderately	39(44.3)	55(31.8)	0.9(0.5,1.6)	1.36(0.63,2.93)
	Highly consumed	12(13.6)	71(41.0)	0.2(0.1,0.5)	0.39(0.15,0.95) *
<b>Egg</b>	Rarely consumed	25(28.4)	68(39.3)	1	1
	Moderately	52(59.1)	84(48.6)	1.6(0.9,2.9)	2.15(0.99,4.65)
	Highly consumed	11 (12.5)	21(12.1)	1.4(0.6,3.4)	1.57(0.50,4.93)
<b>Dark green leafy vegetables</b>	Rarely consumed	31(35.2)	39(22.5)	1	1
	Moderately	27(30.7)	61(35.3)	0.6(0.3,1.1)	0.85(0.35,2.03)
	Highly consumed	30(34.1)	73(42.2)	0.5(0.3,0.9)	1.38(0.52,3.69)
<b>Other vitamin A-rich fruits and vegetables</b>	Rarely consumed	35(39.8)	29(16.8)	1	1
	Moderately	46(52.3)	79(45.7)	0.5(0.3,0.9)	0.55(0.26,1.16)
	Highly consumed	7(8.0)	65(37.6)	0.08(0.03,0.22)	0.12(0.04,0.35) **
<b>fat related foods</b>	Rarely consumed	20(22.7)	74(42.8)	1	1
	Moderately	33(37.5)	54(31.2)	2.3(1.2,4.3)	2.07(0.93,4.61)
	Highly consumed	35(39.8)	45(26.0)	2.9(1.5,5.6)	3.70(1.67,8.23) **

<b>Fast foods</b>	Rarely consumed	37(42.0)	78(45.1)	1	1
	Moderately	41(46.6)	79(45.7)	1.2(0.6,1.9)	1.30(0.61,2.76)
	Highly consumed	10(11.4)	16(9.2)	1.3(0.5,3.2)	2.49(0.71,8.71)

NB: \* P< 0.05, \*\* P< 0.01 in multivariable model, 1 = reference, COR=crude odds ratio, AOR=adjusted odds ratio

This study revealed that the risk of developing preeclampsia increases with age (AOR: 1.21 at 95% CI: (1.15,1.28)). There was a significant relationship between MUAC status of mothers and development of preeclampsia. By keeping other variables constant, for every 1-cm increase of MUAC, there was 18% increase of in the risk of developing preeclampsia (AOR:1.18 at 95% CI: (1.04,1.34)) (table 3).

Anemia showed a significant association with preeclampsia among pregnant women than those who hadn't anemia. Those mothers who had anemia were 3.31 times more related to developing preeclampsia compared to who had no anemia (AOR: 3.31 at 95% CI: (1.62,6.78) (table 3).

## 7. Discussion

The aim of this study was to assess the dietary risk factors of preeclampsia and in this study consumption of vitamin A-rich fruits and vegetables, milk products and receiving nutritional counselling during pregnancy, anemia, increasing MUAC, high consumption of fatty foods and advanced age were found to be significant predictors of PE development.

The finding of this study revealed that women who reported high intake of fatty food had higher risk of developing preeclampsia than women who reported consuming fatty food rarely. This findings are supported by other studies which were conducted in Jordan, Norway, and Denmark(89, 90, 156). Even though etiology of preeclampsia is not known; several mechanisms for a biological effect of fatty food on incidence of preeclampsia may exist. It was suggested that excess fat increase plasma concentration of free radicals and shift the physiological state in the tissues toward the proinflammatory state(5, 157, 158). There is also evidence that elevated plasma concentrations of free radical oxidation products progress the development of preeclampsia(7). There are deductive data that an imbalance between antioxidant activity and oxidants may have an important role in the pathogenesis of preeclampsia, as free radicals and lipid peroxides lead to endothelial cell injury(90) and results in decreased endothelial production of prostaglandin (prostacyclin), a potent vasodilator and inhibitor of platelet aggregation. Endothelial cell injury exposes subendothelial collagen and can trigger platelet aggregation, activation, and release of platelet-derived thromboxane, a potent vasoconstrictor and stimulator of platelet aggregation which results increase the risk of preeclampsia development(5, 156).

This study revealed that mothers who had high consumption of diary product had 61% lower risk of developing preeclampsia compared to those who had consumed milk product rarely. This finding is consistent with the study conducted in Norway, Netherlands and Iran which revealed a reduced risk of preeclampsia with high milk consumption(58, 76, 78). This could be due to the fact that milk products are the main source of calcium. It is hypothesized that calcium reduced parathyroid hormon (PTH) concentration, which in turn lower the

intracellular free calcium level, finally resulting in smooth muscle relaxation and calcium also reduce the vascular sensitivity to vasopressor agents which increase the blood pressure (159, 160).

In the present study, the frequent consumption of other vitamin A-rich fruits and vegetables decreased the chance of having preeclampsia. The risk of developing preeclampsia was lowered by 88% among those who had high consumption of vitamin A-rich fruits and vegetables daily as compared to those who had consumed rarely, and similarly, the risk of preeclampsia was lowered by 50% among those who consumed green vegetables moderately compared to those who consumed rarely. This study was consistent with studies done in Ethiopia, Norway, Jordan and Sira leon(49, 67, 90, 161). In contrast to this the study done in India showed that there is no significant association between vegetable and fruit consumption and the occurrence of preeclampsia(61). This difference could be due to small sample size was used in the previous study, and cultural difference between study populations. The prevention of these vitamins from preeclampsia development is due their anti-oxidant effects. The presence of high anti-oxidants in the plasma and placenta prevents hypo perfusion. As a result, the required level of these anti-oxidants enables endothelial cell to function normally (49, 162, 163).

This study identified that women who had receiving nutritional counseling during antenatal care follow up was found that protective for preeclampsia compared to who hadn't receiving nutritional counseling during pregnancy. This study has similar finding with the studies done Ethiopia(49). During counseling on healthy diet, it addresses a wide range of nutritional values. Nutritional counseling on healthy dietary advice to consume vegetables and fruit benefit with regard to prevention of preeclampsia. Pregnancy is a period when most women are highly motivated for dietary advice. Because changes toward a healthier diet may also benefit their children(162, 164).

As maternal Mid-Upper Arm Circumference (MUAC) is considered to be relatively stable during pregnancy among women of developing countries(165) and MUAC was used to assess nutritional status of women. This study found that women who had a higher MUAC had more likely developing preeclampsia. This finding is consistent with studies conducted in Ethiopia Zimbabwe, and UK (67, 97, 166). However, the study conducted in Indonesia 2019 showed that there is no significant relationship between nutritional status (MUAC) and the development of preeclampsia(55). Such difference could be due to the variation of study design (the previous study used cross-sectional study design) and study settings.

Obesity is hypothesized to play a central role in the concept of “metabolic syndrome”(167). However less is known regarding the specific mechanisms whereby obesity poses this risk. Chronic hypertension, insulin resistance and/or hypertriglyceridemia may be present prior to conception in obese women. Insulin resistance as well as hypertriglyceridemia are risk factors for preeclampsia(168, 169), and are also important cofactors in the development of endothelial dysfunction(158). Since endothelial dysfunction is hypothesized to play a central role in the pathogenesis of preeclampsia(157), it is plausible that the pre-pregnancy presence of endothelial dysfunction by insulin resistance and/or hypertriglyceridemia may be causatively associated with the high incidence of preeclampsia in obese pregnant women(170). Obese individuals have lower blood concentrations of antioxidants(171). This could be due to reduced dietary intake of antioxidants, but increased consumption by reactive oxygen species is also possible. Ingestion of large quantities of fats or carbohydrates is associated with increased generation of leukocyte free radicals(172). Interestingly, this dietary pattern is more prevalent with obesity and during pregnancy in women who develop preeclampsia(173)

In the current study, women with anemia had 3.3 times higher to develop preeclampsia compared to women with no anemia. This finding is in line with the previous study done in Ethiopian, Iran, Bangladesh, and Sudan (99, 174, 175).The susceptibility of women with severe anemia to preeclampsia could be explained by a deficiency of micronutrients and antioxidants. Recent results indicate that reduction in serum levels of calcium, magnesium and zinc during pregnancy might be possible contributors to the development of preeclampsia(174, 176). Several studies suggested an association with anemia , ferritin is increased and transferrin is decreased in women with preeclampsia(177). Increased free iron may represent hemolysis, known to be a feature of preeclampsia. Anemia is a marker for many forms of nutritional deficiency. Increased ferritin is not only a marker of reduced iron stores but also an inflammatory marker as is also the case with reduced transferrin which results inflammatory responses and possible contribution in increased preeclampsia(93, 178, 179)

The finding of this study showed that increasing the age of the mother is associated with the occurrence of preeclampsia. This finding is also supported by other studies which were conducted in Ethiopia, India, and Iran which showed that the risk of developing preeclampsia increases with age(96, 101, 103, 175). This could be because of aging of uterine blood vessels and increased arterial stiffness leads to gradual loss of compliance of the cardiovascular vessels causing endothelial dysfunction (a characteristics of preeclampsia). In addition, this could be explained as the age increases, arteries will be clogged, which could lead to serious repercussions such as strokes or heart attacks and there will be poor diet or lack of exercise and ability of the body to process

dietary salt, which in turn causes reduced elasticity of the blood vessels and finally the women will develop preeclampsia (116, 117, 123, 164).

## **8. Strength and limitations of the study**

### **8.1 Strength of the study**

This study used validated FFQ including to assess dietary risk factors of preeclampsia. The study design used in this study is most appropriate design for the proposed research question and enabled to identify all the possible dietary risk factors of preeclampsia since preeclampsia is rare case. This study assessed the effect of wide range of dietary factors on preeclampsia. Other strength was conducting collecting the data in face-to-face interview with close monitoring and supervision. Most case-control studies select case consecutively due to small number of cases in the hospitals which exposes selection bias, but this study uses probable sampling method to select cases. The other strength of this study was controls were selected after delivery to get true controls since the development of preeclampsia during postpartum period is rare.

### **8.2 Limitation of the study**

The findings of this study should be viewed in light of the following limitations. Similar to other dietary assessment methods, social desirability bias and recall bias likely. Food frequency questionnaire was not contained portion size.

## **9. Conclusion**

In conclusion this study identified that the role of dietary factors on the prevention of preeclampsia which revealed that diets that are characterized by high intake of vitamin A rich fruit and vegetables, milk products were significantly associated with low risk of preeclampsia. High consumption of milk products has protective association with of preeclampsia. At the same time receiving nutritional counselling from health professionals was protective factor for preeclampsia. On the other hand, high intake of fatty foods was associated with the development of preeclampsia. Being obese or increasing MUAC and anemia also has significant risk association with of preeclampsia.

## **10 Recommendations**

**For health professionals:** Health professionals particularly who are doing in maternity rooms or gynecological and obstetric ward, it is better to provide counseling for the women to choose healthy dietary pattern (increasing intake of milk products, fruit and vegetables and by reducing high fatty foods) before or during ANC follow up. Since anemia play great role in the development of preeclampsia early treatment and diagnosis is very essential to reduce the burden of preeclampsia. It is better to recommended overweight mothers to lifestyle modifications, including weight control, before, during and after pregnancy because over weight mothers are at high risk of developing preeclampsia.

**For women at reproductive age groups:** Women who are pregnant or who planned to be pregnant could be better to get advice about their dietary pattern and control their weights by enhancing their dietary pattern to healthy diet and by reducing fatty foods which is better for the health of the fetus and the mother. Because complications of preeclampsia is not affecting only the mother but including the fetus. To lower the risk of preeclampsia in overweight mothers, lifestyle changes, such as weight control, are recommended before, during, and after pregnancy.

**For researchers:** Researchers better to focus on this maternal complication to find other possible causes of preeclampsia by using more strong study design such as cohort/longitudinal and experimental designs.

**For the Ethiopian government:** Responsible bodies should be aware of the health benefits of taking fruits and vegetables to reduce the risk of preeclampsia and to provide counseling and to supplement iron folate for pregnant women as preventive measures of anemia in the community. The government also better to encourage and motivate other researchers to do more findings in this area.

**For non-governmental organizations (NGOs):** Non-governmental organizations which are doing on maternal health better to focus their financial and technical support as well as collaboration with other organizations to reduce and prevent this maternal complication enhancing skills of health professionals by supporting guiding materials for counselling techniques.

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## 12. Annexes

### Questionnaires on assessment of the association of dietary practice of pregnant mothers and preeclampsia among pregnant women in Gojjam Zone Hospitals, 2021

#### Annex I: Information and Consent form (English version)

How are you? My name is ----- . I am a health personal in this ANC clinic or delivery ward of this hospital. I am going to collect data from this ANC and delivery ward to conduct research on” dietary risk factors of preeclamsia” by Mekuriaw Nibret who is MPH student in Bahr Dar University.

The study will help to assess the association of dietary practice of pregnant mothers and the risk of preeclampsia development as well as to identify risk factors of preeclampsia. It will also help to find possible prevention and intervention methods as well as to choose better contraceptive methods. The research will be used as baseline data for policymakers and other interested organizations or individuals who will study further on this area. The data which will be necessary for the study will be extracted from you and your ANC or delivery card records. Therefore, your willingness to provide this information is vital to conduct the study.

If you have any questions about this study, you may ask me or the principal investigator

(Mekuriaw Nibret Mobile: 0921286609 or email address: [mekunib@gmail.com](mailto:mekunib@gmail.com))

#### Consent form (English version)

The information that you will give will be kept confidential or couldn't be disclosed to other third parties. Your name and personal identity will not be recorded on the data collection form and used for another purpose. The participation is full of your volunteer and permission. It is your full right to refuse in responding to any question or all of the questions but the information that will be taken will be quite useful for the study. You will not face any problem if you do not allow the information to be taken from your records and you will not also be denied of getting any medical services from the hospital. On the other hand, there is no any special benefit by allowing your records to be used and being a participant in the study. It will take a maximum of 20-25 minutes to answer these questions.

Are you willing to continue to give your information to be used for this study?

1. Yes, I am willing to participate in this study (Please go to the next page)
2. No, I don't want to participate in this study. (End with thanks)

**Annex II Questionnaire English version**

Name of the hospital: -----

Date of data collection-----

Please write code into box (1 or 0) →

ID -----

**I Sociodemographic related questions**

s.no	Questions	Response category	Skip
101	What is your age?	-----years old	
102	What is your religion?	Orthodox-----1 Muslim-----2 Protestant-----3 Catholic-----4 Other (specify)-----5	
103	What is your ethnicity?	Amhara-----1 Agew-----2 Tigray-----3 Oromo-----4 Other (specify) -----	
104	What is your marital status?	Married -----1 Not married -----2 Divorced-----3 Widowed-----4	
105	What is your occupation?	Housewife-----1 Farmer-----2 Merchant-----3 Government employee-----4 Private employee-----5 Student -----6 Other(specify)-----7	
106	What is your educational level?	Can't read and write-----1 Can read and write only-----2 Primary school (1-8)-----3 Secondary school (9-12)-----4 Diploma and above-----5	
107	Numbers of family sizes in the household?	-----	

108	Where are you currently living?	Urban -----1 Rural-----2	
<b>Wealth index questionnaire</b>			
109	Ownership of the house	Private -----1 Rent -----2 2. Others specify-----3	
110	The main material of the roof	corrugated iron sheet-----1 Wood -----2 Others specify -----3	
111	The main material of the exterior walls	Stone with mud -----1 Wood with mud -----2 Stone/brick with cement -----3 Others specify ----- 6	
112	Type of fuel mainly used for household cooking	Charcoal/wood-----1 Electricity -----2 Kerosene -----3 Biogas-----4 Animal dung -----5 Others specify-----6	
113	Do you have separate rooms for animals?	Yes-----1 No-----2	
114	What is the main source of water for the house?	Piped into the residence -----1 Common pipe water -----2 Public well/borehole -----3 Well/borehole with pump in the compound -----4 From spring -----5 Others specify -----6	
115	What kind of toilet facility do members of your household usually used	Ventilated improved [VIP] pit-----1 Pit latrine with slab-----2 Pit latrines without a slab-----3 no facility/bush/field-----4	
116	<b>Does the following things available at your home?</b>		
	A radio/tape	Yes -----1 No -----2	
	A bed/Cotton/sponge/spring mattress	Yes -----1 No -----2	

	A mobile phone	Yes -----1 No -----2	
	A solar energy	Yes -----1 No -----2	
<b>117</b>	<b>Does the following animal available at your home?</b>		
	Ox	Yes -----1 number----- No -----2	
	Cow	Yes -----1 number----- No -----2	
	Woifen		
	Gider/young cow		
	Calf	Yes -----1 number ----- No -----2	
	Horse	Yes -----1 number ----- No -----2	
	Mules	Yes -----1 number ----- No -----2	
	Donkey	Yes -----1 number----- No -----2	
	Sheep	Yes -----1 number ----- No -----2	
	Goat	Yes -----1 number ----- No -----2	
	Hen	Yes -----1 number ----- No -----2	
	Beehives	Yes -----1 number ----- No -----2	
<b>118</b>	<b>Do you produce the following crop in the previous production season?</b>		
	Teff	1 Yes 2 No -----in kuntals	
	Dagusa	1 Yes 2 No -----in kuntals	
	Barley	1 Yes 2 No -----in kuntals	
	Maize	1 Yes 2 No -----in kuntals	
	Wheat	1 Yes 2 No -----in kuntals	
	Bean	1 Yes 2 No-----in kuntals	
<b>119</b>	<b>Do you have the following in your land?</b>		
	Bahrzaf	1 Yes 2 No-----in qada	
	Gesho	1 Yes 2 No-----in qada	
<b>For those urban women</b>			

120	Ownership of the house	Private -----1 Kebele -----2 Rented from individual -----3	
121	Is there any herd, livestock, poultry?	<b>Yes -----1</b> if yes livestock in number---- - Poultry in number----- <b>No-----2</b>	
122	Do you have the following materials		
	A Refrigerator?	Yes -----1 No -----2	
	Dining Table	Yes -----1 No -----2	
	Television,	Yes -----1 No -----2	
	Kitchen Cabinet	Yes -----1 No -----2	
	Washing Machine	Yes -----1 No -----2	
	Computer,	Yes -----1 No -----2	
	Cart	Yes -----1 No -----2	
	Motor bicycles?	Yes -----1 No -----2	
	Bajaj	Yes -----1 No -----2	
	Car	Yes -----1 No -----2	

<b>II. Medical illness Gynecological and obstetric history related questions</b>			
201	Have you ever had family history of hypertension?	Yes -----1 No-----2	
202	Have you ever had history of diabetes?	Yes -----1 No-----2	
203	Have you ever had preeclampsia before this pregnancy?	Yes -----1 No-----2	
204	How many times have you been pregnant in your life including this	-----times	



No	Food items	How many times do you take the foods								
		3 and above per day	2 times per day	Once a day	5--6 times/week	2--4 times/week	Once a week	2-3 times/month	Once a month	Never//not sure
	<b>Meat, egg and milk products(animal source foods)</b>	1	2	3	4	5	6	7	8	9
501	Did you get Food prepared from any meat chicken?									
502	Did you get Food prepared from any meat (sheep, goat, cow, pork)?									
503	Did you take milk?									
503	Did you take cheese?									
503	Did you take yoghurt?									
504	Food prepared from egg									
505	Food prepared from fish									
<b>Dark Green Leafy Vegetables</b>										
506	Did you take lettuces in the last months?									
507	Did you take tomatoes in the last months?									
508	Did you take Ethiopian collard greens (gomen) in the last months?									
509	Did you take cabbages in the last months?									
<b>Other vitamin A-rich fruits and vegetables</b>										
510	Did you take Pumpkin in the last months?									
511	Did you take carrots in the last months?									

512	Did you take Red oranges in the last months?									
513	Did you take papaya in the last months?									
514	Did you take mango in the last months?									
<b>Other fruits</b>										
515	Did you take avocado in the last months?									
516	Did you take banana in the last months?									
517	Did you take apple in the last months?									
518	Did you take orange in the last months?									
519	Did you take lemon in the last months?									
<b>Grains, white roots and tubers, and plantains(in the form of <i>injera</i>; porage; <i>firfr wot</i>; bread; <i>kollo</i>; <i>kita</i> and <i>attimit pasta, macaroni</i>)</b>										
520	Did you take any food made from Potatoes?									
521	Did you take any food made from sweet Potatoes?									
522	Did you take Teff in the last months									
523	Did you take dagusa (millets) in the last months?									
524	Did you take Wheat in the last months?									
525	Did you take Sorghum in the last months?									
526	Did you take Barley in the last									

	months?									
527	Did you take Rice in the last months?									
528	Did you take Maize in the last months?									
529	Did you take Oats in the last months?									
	<b>Pulses (beans, peas and lentils.....)</b>									
530	Did you take lentils in the last months?									
531	Did you take beans in the last months?									
532	Did you take peas in the last months?									
533	Did you take chickpeas in the last months?									
534	Did you take vetch in the last months?									
535	Did you take lupine in the last months?									
	<b>Nuts and seeds</b>									
536	Peanut									
537	nug									
538	Sunflower									
	<b>Fat related foods</b>									
539	Any food made with Butter?									
540	Any food made with Fat?									
	<b>Fast foods</b>									
541	Did you take									

	pasty)?									
542	Did you take cockles/ <i>bonbolino</i> ?									
543	Did you take sandwich?									
544	Did you take chips?									
	<b>Soft drinks</b>									
545	Did you take coca?									
546	Did you take pepsi?									
547	Did you take mirrinda?									
548	Did you take sprite?									
<b>Sweet foods</b>										
549	Did you take honey in the last months?									
550	cake									
551	Chocolate									
552	Candy									
553	Biscuits									
	<b>Iron folate</b>									
554	For how long did you take iron folate?	Greater than 3 months-----1 1-3 months-----2 Less than 1 month-----3 I didn't take iron folate-----4								
	<b>Salt</b>									
555	From where did you buy salt?	From retail shop -----1 From open market -----2 from super market-----3								
556	When do you add salt in the food?	During cooking-----1 After cooking-----2								
557	What type of oil do you use?	Saturated-----1 Unsaturated-----2								

**VI. Data that will be obtained by reviewing woman's record or by measurement**

s.no	Measurement	Result	remark
601	MUAC	-----Cm	Measurement
<b>From mothers' record review</b>			
602	Hematocrit level	-----	record

**Thank you**

Data collector name and signature:    signature    -----    Name -----

***Annex III information sheet and consent form (Amharic version)***

በአማራ ክልል በምዕራብ ጎጃም ዞን ውስጥ በሚገኙ ሆስፒታል የእርግዝና ክትትል ለማድረግ ወይም ለመውለድ ከመጡ ነፍሰጡር እናቶች ላይ ከ 20 ሳምንት የእርግዝና ጊዜ በኋላ የሚከሰት የደም ግፊት ከእናቶች አመጋገብ ስርዓት ጋር ያለውን ዝምድናና ሌሎች መንስኤዎችን ለመዳሰስ የተዘጋጀ ቃለ-መጠይቅ

ሀ. ለጥናቱ ተሳታፊዎች ስለጥናቱ መረጃ መስጫ ቅጽ ጤና ይስጥልን? ስሜ-----ይባላል። በዚህ ሆስፒታል ውስጥ በሚገኘው የቅድመ ወሊድ መከታተያ ክፍል፣ ለወሊድ ወይም ድህረ-ወሊድ ክፍል ውስጥ የምሰራ የጤና ባለሙያ ሃኝ።አሁን ወደዚህ የመጣሁት በዚህ ክፍል ውስጥ የእርግዝና ክትትል እያደረጉ ያሉ ነፍሰጡር

እናቶች እና ለመወለድ የመጡ እናቶችን ከ20 ሳምንት እርግዝና በኋላ የሚመጣ የደም ግፊትን በተመለከተ ክእናቶች አመጋገብ ስርዓት ጋር ያለውን ዝምድናና ሌሎች መንስኤዎችን ለመዳሰስ መረጃ ለመስጠት ነው። ጥናቱን የሚያጠናው መኩሪያው ንብረት የባህር ዳር ዩኒቨርሲቲ የድህረ-ምረቃ ተማሪ ነው።

ጥናቱ ላይ መሳተፍ አሁን ለእርስዎ ያን ያህል ጥቅም ባይኖረውም የሚሰጡኝ መረጃ ግን በማነኛውም ነፍሰጠር እናቶች ላይ በእርግዝና ጊዜ ለሚከሰት የደም ግፊት መንስኤውን ለመዳሰስ እና የተሻለ አማራጭ የመከላከያ ዘዴዎችን ለመጠቀም ጥቅም ይኖረዋል ተብል ይታሰባል። እንዲሁም የጥናቱ ውጤት በዚህ ዙሪያ መስራት ለሚፈልጉ ግለሰቦች፣ ተቋማትና ፖሊሲ አርቃቂዎች እንደግባት ይጠቅማል ተብሎ ይታሰባል።

ለጥናቱ የሚያስፈልገው መረጃ ከእርስዎ የመረጃ ካርድ እና እርስዎ ቃለ-መጠይቅ ሲጠየቁ በሚሰጡት መረጃ ነው። ስለዚህ እርስዎና የእርስዎ መረጃ ለመስጠት ፈቃደኝነት ይህን ጥናት ለማከራከር ወሳኝና በጣም አስፈላጊ ነው።

ይህን ጥናት በተመለከተ ማነኛውንም አይነት ጥያቄ እኔን ወይም የጥናቱን ባለቤት (መኩሪያው ንብረት) ከዚህ በታች በተጠቀሰው አድራሻ መጠየቅ ይችላሉ።

ስልክ ቁጥር : 0921286609 ኢ-ሜል : mekunib@gmail.com

ለ ጥናቱ ተሳታፊዎች የፈቃደኝነት መጠየቂያ ቅጽ

ከላይ በተገለጸው የጥናቱ ዓላማና ከሚሰጠው ጥቅም አንጻር እርስዎ ለጥናቱ ከሚያስፈልጉ እናቶች መካከል በጥናቱ እዲሳተፉ ተመርጠዋል። እርስዎ የሚሰጡን መረጃ በማነኛውም ሁኔታ ከእኔና ካጥኝው በስተቀር ለሌላ ሰነድ ወገን አይታይም ወይም አይሰጥም።

ስምዎና የእርስዎ ግለሰባዊ ማንነት ከመረጃ መስጠቢያው ቅጽ ላይ አይጻፍም ወይም ከጥናቱ ዓላማ ውጭ ለሌላ ጥቅም አይውልም። በጥናቱ ለመሳተፍ የእርስዎ በጎ ፈቃደኝነት ወሳኝ ሲሆን ያለመሳተፍም ወይም ጥያቄውን ሲጠየቁ በማነኛውም ጊዜ ማቆም ይችላሉ። መረጃ ለመስጠት ፈቃደኛ ባለመሆንዎም ምንም አይነት ችግር አይደርስብዎትም ወይም በሆስፒታል ውስጥ ከሚያገኙት የጤና አገልግሎት ጉዳት አይደርስዎትም። ነገር ግን ከሊይ እንደነገርንዎት እርስዎ የሚሰጡት መረጃ ለጥናቱ በጣም ጠቃሚ ነው። በሌላ በኩል በጥናቱ ለሚሳተፉት ተሳትፎ ምንም አይነት የተለየ ክፍያ ወይም ጥቅማጥቅም አይሰጥዎትም። እነዚህን ጥያቄዎች ለመመለስ ቢበዛ 20 ደቂቃ ሊወስድ ይችላል። መረጃ ለመስጠት ፈቃደኝነዎት?

- 1. አዎ ፈቃደኛ ነኝ።
- 2. ፈቃደኛ አይደለሁም።



(አመስግናለሁ)

**Annex IV Questionnaire amharic version**

የሆስፒታል ስም: ----- መረጃው የተሰበሰበበት ቀን : -----

መ/ቁጥር (ID)-----

እባክዎትን ከድ ሳጥን ውስጥ 1 ወይም 0ን ይጻፉ

→

I. ማህበራዊና ኢኮኖሚያዊ ሁኔታዎች በተመለከተ			
ተ. ቁ	ጥያቄዎች	መልሶች	ወደ
101	እዴሜዎ ስንት ነው?	-----አመት	
102	ሀይማኖትዎ ምንድን ነው?	አርቶድክስ-----1 ሙስሊም-----2 ፕሮቴስታንት-----3 ካቶሊክ-----4 ሌላ(ይገለጽ)-----5	
103	ብሔርዎ ምንድን ነው?	አማራ-----1 አገው-----2 ትግራይ-----3 አሮሞ-----4 ሌላ(ይገለጽ)-----5	
104	የጋብቻዎ ሁኔታወስ?	አግብቻለሁ-----1 አላገባሁም-----2 አግብታ የፈታች -----3 ባልዋ የሞተባት-----4	
105	ስራዎ ምንድን ነው?	የቤት አመቤት-----1 ገበሬ-----2 ነጋዴ-----3 የመንግስት ሰራተኛ-----4 የግል ተቀጣሪ-----5 ተማሪ-----6 ሌላ(ይገለጽ) -----7	
106	የትምህርት ደረጃዎ ስንት ነው?	ማንበብና መጻፍ የማይችል-----1 ማንበብና መጻፍ የሚችል-----2 1ኛ ደረጃ (1-8) -----3 2ኛ ደረጃ (9-12) -----4 ዲፕሎማና ከዚያ በላይ-----5	
107	የቤተሰብዎ ብዛት	-----	
108	ባሁኑ ሰዓት የሚኖሩት የት ነው?	ከተማ -----1 ገጠር-----2	
<b>የቤተሰብ የገቢ መጠንንና የንብረት ሁኔታን በተመለከተ ከገጠር ለመጡ እናቶች</b>			
109	የቤቱ ባለቤት ማን ነው?	የግል-----1 ኪራይ-----2 ሌላ(ይገለጽ)-----3	
110	የቤታችሁ ጣራ የተሰራው ከምንድን ነው?	ከብረት/ቆርቆሮ-----1 ከእንጨት/ከሳር-----2 ሌላ(ይገለጽ)-----3	
111	የቤታችሁ ግድግዳ የተሰራው ከምንድን ነው?	በድንጋይና ጭቃ-----1 በእንጨትና በጭቃ-----2 ሲሚንትና ብሎኬት-----3 ሌላ (ይገለጹ)-----4	

112	ቤት ወስጥ በዋናነት ምግብ ለማብሰል የምትጠቀሙት የሃይል ምንጭ?	እንጨት/ከሰል-----1 ኤሌክትሪክ-----2 ጋዝ/ነዳጅ-----3 ኩብት-----4 ሌላ (ይግለጹ)-----5	
113	ለቤት እንስሳት የሚሆን የተለየ ክፍል አለዎት?	አዎ-----1 የለም-----2	
114	ለቤታችሁ ዋናው የውሃ ምንጭ ምንድን ነው?	የግል ቧንቧ-----1 የጋራ ቧንቧ-----2 የህዝብ የጉድጓድ ውሃ-----3 የግል ጉድጓድ ውሃ-----4 ምንጭ-----5 ሌላ(ይግለጹ)-----6	
115	ለቤተሰብ አባላት የምትጠቀሙበት የሽንት ቤት አይነት ምን አይነት ነው?	የተሸሻለ ሽንት ቤት[VIP] -----1 ስላብ ያለው የጉድጓድ መጸዳጃ ቤት-----2 ስላብ ያለው የጉድጓድ መጸዳጃ ቤት-----3 ምንም አይነት መጸዳጃ ቤት አንጠቀምም-----4	
<b>115</b>	<b>የሚከተሉት ነገሮች በቤታችሁ ውስጥ ይገኛሉ?</b>		
	ራዲዮ/ቴፕ	አዎ-----1 የለም-----2	
	አልጋ ከጥጥ/ከስፖንጅ/ከስፕሪንግ ምንጣፍ ጋር	አዎ-----1 የለም-----2	
	ተንቀሳቃሽ ስልክ/ሞባይል	አዎ-----1 የለም-----2	
	የፀሃይ ሀይል/ሰላር	አዎ-----1 የለም-----2	
116	የሚከተሉት እንስሳት በቤት ውስጥ ይገኛሉ?		
	በሬ	አዎ-----1 ብዛት----- የለም-----2	
	ላም	አዎ-----1 ብዛት----- የለም-----2	
	ጊደረ	አዎ-----1 ብዛት----- የለም-----2	
	ወይፈን	አዎ-----1 ብዛት----- የለም-----2	
	ጥጃ	አዎ-----1 ብዛት----- የለም-----2	
	ፈረስ	አዎ-----1 ብዛት----- የለም-----2	
	በቅሎ	አዎ-----1 ብዛት----- የለም-----2	
	አህያ	አዎ-----1 ብዛት----- የለም-----2	
	በግ	አዎ-----1 ብዛት----- የለም-----2	
	ፍየል	አዎ-----1 ብዛት----- የለም-----2	
	ዶሮ	አዎ-----1 ብዛት----- የለም-----2	
	የንብ ቀፎ	አዎ-----1 ብዛት----- የለም-----2	
117	የሚከተሉትን ምርቶች ያመረታሉ?		
	ጤፍ	አዎ-----1 ብዛት-----ኩንታል የለም-----2	
	ዳጉሳ	አዎ-----1 ብዛት-----ኩንታል የለም-----2	

	ገብስ	አዎ-----1	ብዛት-----ኩንታል	የለም-----2	
	በቆሎ	አዎ-----1	ብዛት-----ኩንታል	የለም-----2	
	ስንዴ	አዎ-----1	ብዛት-----ኩንታል	የለም-----2	
	ባቄላ	አዎ-----1	ብዛት-----ኩንታል	የለም-----2	
118	የሚከተሉት ንብረቶች በመሬት ላይ አለዎት?				
	ባህርዛፍ	አዎ-----1	ብዛት-----ቃዳ	የለም-----2	
	ጌሾ	አዎ-----1	ብዛት-----እግር	የለም-----2	
<b>ከከተማ ለመጡ እናቶች የሚጠየቅ የቤተሰብ የገቢ መጠንና የንብረት ሁኔታን በተመለከተ</b>					
119	የሚኖሩበት ቤት የማን ነው	የግል-----1	የቀበሌ-----2	የኪራይ-----3	
120	ከብት ወይም የዶሮ እርባታ አለዎት	አዎ-----1	አዎ ከሆነ የየኩብት ባዛት ----- የዶሮ ብዛት----	የለንም-----2	
121	የሚከተሉት ንብረቶች/አቃዎች አሉዎት?				
	ፍሪጅ	አዎ-----1		የለንም----- ---2	
	ጠረጴዛ	አዎ-----1		የለንም----- ---2	
	ቴሌቪዥን	አዎ-----1		የለንም----- ---2	
	ኪቶን ካቢኔት	አዎ-----1		የለንም----- ---2	
	የልብስ ማጠቢያ ማሽን/laundry machine/	አዎ-----1		የለንም----- ---2	
	ኮምፒውተር/computer/	አዎ-----1		የለንም----- ---2	
	ጋሪ	አዎ-----1		የለንም----- ---2	
	ሞተር ብስክሌት	አዎ-----1		የለንም----- ---2	
	ባጃጅ	አዎ-----1		የለንም----- ---2	
	መኪና	አዎ-----1		የለንም----- ---2	

**II. የግልና የቤተሰብ የህክምና ታሪክ እንዲሁም የእርግዝናና ወሊድ ሁኔታን ጋር ተያያዥ ጥያቄዎች**

201	ከቤተሰብዎ የደም ግፍት ያለበት ሰው አለ?	አዎ-----1 የለም-----2 አላውቅም-----3	
202	ከዚህ እርግዝና በፊት በጤና ባለሙያ ስኳር አለብዎት ተብለው ነበር?	አዎ-----1 የለም-----2 አላውቅም-----3	
203	ከዚህ እርግዝና በፊት በጤና ባለሙያ ከእርግዝናው ጋር በተያያዘ የደም ግፊት(preeclamsia) አለብዎት ተብለው ነበር?	አዎ-----1 የለም-----2 አላውቅም-----3	
204	ይህንን እርግዝና ጨምሮ እስካሁን ስንት ጊዜ ነፍሰጡር ሁኔታዎ አለ?	-----ጊዜ	
205	እስካሁን ድረስ ስንት ጊዜ ወልደዎአል?	-----ጊዜ	
<b>III</b>	<b>የእርግዝና ክትትልን በተመለከተ</b>		

3	<b>IV. ሰነ-ባህሪን የሚመለከቱ ጥያቄዎች</b>		
3	401	ገትትላ ሲያደርጉ ሳለጡናም አመጋገብ ያምኑኛል ከገልግሎት እያገኙ ነበር? አልባል ይለዩት ስር (በረጅም ጊዜ ለረፍቶ ስር)	አዎ -----1 የቱን ነው የሚጠጡ----- አልጠጣም-----2
			403

ተ. ቁ.	የሚከተሉትን ምግቦች ተመግብዋለሁ።	ምን ያህል ጊዜ በወር በአማካኝ ይመገባሉ? (በእያንዳንዱ ምግብ ከተዘረዘሩት አማራጮች ጋር የተያያዘውን ቁጥር ያስገቡ)								
		3 ጊዜና በላይ በቀን	2 ጊዜ በቀን	1 ጊዜ በቀን	5--6 ጊዜ በሳምንት	ከ2-4ጊዜ በሳምንት	1 ጊዜ በሳምንት	ከ2-3 ጊዜ በወር	1 ጊዜ በወር	አልተመጠነም/ አላስታወስም
		1	2	3	4	5	6	7	8	9
402	አጠቃላይ ቁጥር 401 መልስዎ	“አዎ” ከሆነ ለምን ያህል ጊዜ? 1) ጠቅላላ								
504	የጸጥታ ቁጥር 403 መልስዎ	“አዎ” ከሆነ ለምን ያህል ጊዜ?								
502	ከአንስሰሳት ተዋጽኦ የተዘጋጀ ምግብ									
504	የጸጥታ ቁጥር 403 መልስዎ	1. በየቀኑ 2. በሳምንት ሲያንስ ----- ቀን 3. በወር ሲያንስ ----- ሰኞ በቀን 4. ገፍሰጠብር ከሆነው በኋላ አቅጣጫ								
503	ከአንስሰሳት ተዋጽኦ የተዘጋጀ ምግብ?								1	
505	አላይ ይመገባሉ?								2	407
506	አጠቃላይ ቁጥር 405 መልስዎ	“አዎ” ከሆነ ለምን ያህል ጊዜ?								
505	አላይ ይመገባሉ?									
<b>አረንጓዴ አትክልትና ፍራፍሬ</b>										
507	ከአንስሰሳት ተዋጽኦ የተዘጋጀ ምግብ?								1	
507	አላይ ይመገባሉ?								2	501
508	የጸጥታ ቁጥር 407 መልስዎ	አዎ ከሆነ								
509	አላይ ይመገባሉ?									
<b>ሌሎች በ ቬታሚን ኤ የበለጸጉ አትክልትና ፍራፍሬዎች</b>										
510	አላይ ይመገባሉ?									
511	አላይ ይመገባሉ?									
512	አላይ ይመገባሉ?									
513	አላይ ይመገባሉ?									
514	አላይ ይመገባሉ?									
<b>ሌሎች ፍራፍሬዎች</b>										
515	አላይ ይመገባሉ?									
516	አላይ ይመገባሉ?									
517	አላይ ይመገባሉ?									
518	አላይ ይመገባሉ?									

519	ሎሚ ይመጣል?									
<b>የእህል እና ስራ-ስር ዘሮች እና (በእንጀራ፣ ገንፎ፣ ፍርፍር፣ ወጥ፣ ደብ፣ ቆሎ፣ ቂጣ አጥሚት ፓስታ፣ መኮረር፣ እና የመሳሰሉት መልኩ የተዘገጋጀ መልኩ የተዘጋጀ)</b>										
520	ከድንች የተሰራ ምግብ									
521	ከሰካር ድንች የተሰራ ምግብ									
522	ከጤፍ የተሰራ ምግብ ይመጣል?									
523	ከዳጉሳ									
524	ከስንዴ									
525	ከማሽላ/ዘንጋዳ									
526	ከገብስ									
527	ከሩዝ									
528	ከበቆሎ									
529	ከአጃ									
	<b>ጥራጥሬና የቅባት እህሎች</b>	<b>3 ጊዜና በላይ በቀን</b>	<b>2 ጊዜ በቀን</b>	<b>1 ጊዜ በቀን</b>	<b>5--6 ጊዜ በሳምንት</b>	<b>ከ2-4 ጊዜ በሳምንት</b>	<b>1 ጊዜ በሳምንት</b>	<b>ከ2-3 ጊዜ በወር</b>	<b>1 ጊዜ በወር</b>	<b>አልተመጣ ብኩም/ አላስታወስም</b>
		1	2	3	4	5	6	7	8	9
530	ከምስር									
531	ከባቄላ									
532	ከአተር									
533	ከሽንብራ									
534	ከጉዋያ									
535	ግብጦ?									
	<b>የቅባት እህሎች</b>									
536	ከለውዝ የተሰራ ምግብ ይመጣል?									
537	ከኑግ የተሰራ ምግብ ይመጣል?									
538	ከሱፍ የተሰራ ምግብ ይመጣል?									
	<b>ሰብና ቅባት</b>									
539	ከቅቤ የተሰራ ምግብ									



	<b>ጨው</b>		
551	የምግብ ጨው የሚገዙት ከየት ነው?	ከሰቅ-----1 2 ከሱፐር ማርኬት-----3	
552	ምግብ ላይ ጨው መቸ ይጨምራሉ?	ምግብ ከመብሰሉ በፊት-----1 ምግብ በስሎ ከምድጃ ከወረደ በኋላ-----2	
553	የሚጠቀሙት የምግብ ዘይትየቱንነው?	የሚረጋውን ዘይት-----1 ፊሳሽ እና የማይረጋውን ዘይት-----2	

	<b>ከመዘገብና በመለካት የሚሞላ</b>	<b>ዉጤት</b>	<b>Remark</b>
601	የግራ የላኛው የከንድ ልኬት መጠን (MUAC)	-----ሳ.ሜ	በመለካት የሚሞላ
602	ሄማቶክሪት (Hematocrit level)	-----	ከህክምና ክርድ የሚወሰድ



**Declaration form**

I (Mekuriaw Nibret) declared that this thesis entitled "Dietary risk factors of preeclampsia among women attending antenatal and delivery services in governmental hospitals of west gojjam zone, north west ethiopia, 2021" is my original work and has never been presented in this or any other University, and that all the resources and materials used for the research, have been fully acknowledged.

**Declared by:**

Mekuriaw Nibret

*[Handwritten Signature]*

*21/05/2022*

**Principal investigator**

**Signature**

**Date**

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