COLLEGE OF DEVELOPMENT STUDIES
CENTER FOR FOOD SECURITY STUDIES

DETERMINANTS OF DIETARY DIVERSITY AND NUTRITIONAL STATUS OF PREGNANT WOMEN ATTENDING ARMED FORCES COMPREHENSIVE SPECIALIZED HOSPITAL, ADDIS ABABA, ETHIOPIA

BY:
ALEMTSEHAY TESHOME TOLLA

JUNE, 2019
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A THESIS SUBMITTED TO CENTER OF FOOD SECURITY STUDIES OF THE COLLEGE OF DEVELOPMENTAL STUDIES, ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN FOOD SECURITY AND DEVELOPMENT

JUNE, 2019
ADDIS ABABA, ETHIOPIA

Addis Ababa University

School of Graduate Studies

Declaration

This thesis is my original work and has not been presented for a degree in any other University and that all the sources and materials used for the thesis have been properly acknowledged.

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As advisor of the thesis, I certify that I have read and evaluated the thesis prepared by **Alemthehay Teshome Tolla** entitled *'Determinants of Dietary Diversity Consumption and Nutritional Status of Pregnant Women Attending Armed Forces Comprehensive Specialized Hospital, Addis Ababa, Ethiopia'* and recommended for open defense as fulfilling the requirement for the degree of **Master of Science in Food Security and Development.**

Dr Abebe Haile _____ _____

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As members of the Examining Board of this thesis open defense, we certify that we have read and evaluated the thesis prepared by **Alemtsehay Teshome Tolla** entitled '*Determinants of Dietary Diversity Consumption and Nutritional Status of Pregnant Women Attending Armed Forces Comprehensive Specialized Hospital, Addis Ababa, Ethiopia'* and recommend that it is acceptable as a thesis required for the degree of Masters of Science in Food Security and development.

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Final approval and acceptance of this thesis is contingent upon the candidate's submission of the final copy of the thesis, incorporating all the comments by Examining Board, to the Council of Graduate Studies (CGS) through the Center Academic Committee (CAC) of the center.

_____

Chair person of the center of graduate program coordinator

Dedication

This thesis is dedicated to my husband Mr Kibrom Mehari, and my son Elbarkot Kibrom. You are the reason for everything. Thank you for believing in me. You are the greatest inspiration I have ever got; my love for you is priceless. You always find time to give guidance and direction, your wisdom is invaluable and always timely.

Acknowledgment

I owe my gratitude to the Almighty God in whom, and through whom all the work that went into this thesis was made possible. I therefore wish to acknowledge all the people who participated to make this thesis a reality. First of all, I am indebted and very grateful to my advisor Dr Abebe Haile, for his dedication and tireless efforts in making sure that the thesis was successfully completed and also for all staffs at center of Food Security for your kind support, special thanks to Dr Messay Mulget.

My appreciation goes to the Management Team of Armed Forces Comprehensive Specialty Hospital and staffs specially to Mr. Tadesse Lemma, Mrs. Selamawit Kebede and the Anti natal care team. Also I wish to acknowledge my research assistants for their availability and dedication during the entire period of data collection and analysis.

Very exceptional thanks goes to, Emahoy Mechegiyash and Mr. Eshetu Sileshi for your endless support starting from childhood till today. Besides my sisters Mrs. Woinshet Sileshi and Miss Helen Teshome with all your family, my brothers Mr. Aklile Sileshi and Mr. Orion Ayele with your family my aunt Mrs. Genet Sileshi, my uncles Mr. Ayele Sileshi and Mr. Mesfin Sileshi, cousins, nephews and all the family around me thank you and thank you. My friends starting from childhood till today specially Miss Hana Yeshitila, Miss Lensa Girma and Miss Habil Adamu my hard working friends thank you for your support.

Moreover my mom Mrs. Almaz Sileshi, my dad Mr. Teshome Tolla to my aunt Mrs. Belaynesh Sileshi and to my uncle Mr. Solomon Sileshi, whom they were encouraging each and every work of mine and are the reason to seek knowledge and wisdom, in heaven. They were always striving for better education. Finally, I wish to thank all the respondents who agreed to participate in the study and all the people whose names I am not able to mention. God bless all of you with his grace.

June, 2019
Addis Ababa, Ethiopia

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Abbreviation

ANC	:	Antenatal Care
AFCSH	:	Armed Forces Comprehensive Specialized Hospital
DDS	:	Dietary Diversity Score
EDHS	:	Ethiopia Demographic and Health Survey
FANTA III	:	Food and Nutrition Technical Assistance II Project
FAO	:	Food and Agriculture Organization of the United Nations
FFQ	:	Food Frequency Questionnaire
FGD	:	Focus Group Discussion
FSNP	:	Food Security and Nutrition Policy
IDDS	:	Individual Dietary Diversity Score
MDG	:	Millennium Development Goals
MUAC	:	Mid Upper Arm Circumference
WDDS	:	Women Dietary Diversity Score
WFP	:	World Food Program
WHO	:	World Health Organization
WRA	:	Women of Reproductive Age
UNICF	:	United Nations Children's Fund

Abstract

The nutritional status of a woman during pregnancy is important as a suboptimal diet impacts negatively on the health of the mother, the fetus and the newborn. There is limited knowledge in the area of malnutrition and factors' affecting it among pregnant women despite evidence showing that maternal nutrition has important direct and/or indirect consequences for all other age. The objective of the study was to assess the determinants of dietary diversity and nutritional status of pregnant women attending antenatal clinic at Armed Forces Comprehensive Specialized Hospital. The study was cross-sectional and conducted by using both quantitative and qualitative methods. A multistage sampling procedure was employed to draw 320 samples, pregnant women. The women were selected in random through balloting among the first five pregnant women to arrive at the antenatal clinic and thereafter systematic sampling was used and every fourth woman that arrived were sampled until the sample size is met. The data were analyzed by using a software STATA version 14. Descriptive statistics to determine the dietary diversity and nutritional status were done and also to characterize the nutritional status. The statistical model namely, logistic and ordered logistic regression was used for factors affecting the dietary diversity and nutritional status. A P value of < 0.1 was considered statistically significant. According to the logistic model interpretation, negative relation implies that the dependent and independent variables are inversely related; while the positive association is the outcome and independent variable have direct relations. The findings of the descriptive analysis indicated that low dietary diversity was experienced by 61.56 percent of the respondents and the rest of the study population was in a high dietary diversity. Based on Mid-upper arm circumference cut-offs 0.31 percent were severely malnourished, while 3.44 percent were moderately malnourished and 96.25percent were well nourished. Findings from logistic regression revealed that income, meals that were eaten in the last 24 hours, and anemia have positively and significantly affects dietary diversity while not taking iron-fortified foods affects negatively. The results from the ordered logit model indicate that severe undernutrition is determined by not taking micronutrient daily positively where ever income and cleaning utensil properly impact negatively, although moderate undernutrition is associated with not taking micronutrient daily positively and negatively with cleaning utensil properly. Though being nourished is affected by not taking micronutrient daily negatively and positively by cleaning utensil properly. Whereas by World Health Organization hemoglobin cut-offs 2.50 percent, 11.56 percent, and 85.94 percent were in severe anemia, moderate anemia, and normal hemoglobin level respectively. The results from the multinomial regression model reveal that severe anemia is negatively associated with dietary diversity. At the same time, moderate anemia is affected positively by not taking micronutrient daily and negatively by age, dietary diversity score and morbidity status of the pregnant women. Similarly being in normal hemoglobin cut-off was affected positively by age, dietary diversity and morbidity, negatively affected by not taking micronutrient daily. Finally, the findings conclude that dietary diversity and nutritional status were very poor and socio-demographic, socio-economic, micronutrient supplementation, morbidity, environmental factors, and dietary diversity influence the nutritional status of pregnant women. It is recommended that promotion of dietary diversity and modification of diets be carried out through practical demonstrations in the community and health facilities and there should be income generation practices and entrepreneur encouragements should be practiced.

Keywords: *Antenatal clinic, under nutrition, anemia, hemoglobin, Mid-upper arm circumference*

CHAPTER ONE: INTRODUCTION

1.1. Background of the study

Malnutrition is a lack of healthy foods in the diet or an excessive intake of unhealthy foods which leads to physiological harm. Maternal undernutrition is a serious developmental challenge contributing a large share to the global disease burden. It is a major reason for the increased risk of adverse pregnancy outcomes, poor infant survival, and elevated risks of chronic diseases at later stages of life (Mulugeta *et al*., 2014). The majorities likely to suffer from deficiencies include infants and young children, adolescent girls and women of reproductive age (WRA) (Arimond *et al.,* 2010). These in danger populations have been found to switch to cheaper foods that will give a feeling of completeness in their stomachs without regard to how nutritious the foods are (Bain *et al*, 2013). In developed countries, many studies are linking dietary diversity to nutrient ingestion, particularly among adults.

Pregnancy is the period during which a woman carries unborn offspring inside her body, from fertilization to birth. It is a unique and critical stage of life during which extensive anatomical, physiological, biochemical and several other related changes take place. Maternal individual, genetic and environmental factors determine whether this dynamic change ends with healthy or adverse outcomes. Dietary diversity (DD) is the consumption of an adequate variety of food groups; human health is heavily dependent upon the intake of adequate quantity and quality of food (Bukania *et al.,* 2014). As dietary factors are associated with increased risk of chronic diseases and undernutrition, local and international dietary guidelines recommend improving the diversity of the diet. Macro and micronutrient deficiencies are major public health concerns in most developing countries including Ethiopia, partly due to a monotonous, cereal-based diet that lacks diversity.

Deficient in variety has been identified by other studies to be particularly a severe problem among poor populations in the developing world, whose diets are predominantly starchy staples and the consumption of animal products, seasonal fruits and vegetables are generally absent or minimal (Becquey *et al.,* 2009). The elevated nutrient demands of pregnancy put women of reproductive age at high risk because of use of low-quality, repetitive diets and thus these women will have a risk of a variety of micronutrient deficiencies (Saaka, 2012). During the third

trimester of pregnancy, in particular, the requirements for energy and some nutrients like iron, zinc, calcium, folic acid and others increases (Kramer & Kakuma, 2003).

An expectant woman requires a selective and diversified diet to meet her nutritional requirements and thus improve her nutritional status. It has been noted that a suboptimal diet that comprises inadequate intake of calories and nutrients, combined with a heavy workload, has adverse impacts on the health of the mother, the developing fetus and the newborn. Besides, the mother is often the last to benefit in a household even when there is an improvement in household income, but the first to sacrifice. This creates a cycle of disease and illness. Even when enough food is available, the majority of women do not receive adequate nutrients during pregnancy attributable to poor knowledge of what constitutes an adequate diet (Ahmed *et al*., 2012). Lack of education and awareness leads women to believe that they have eaten enough without considering the dietary requirements. Simple, rapid, and useful proxy measures and indicators like the FAO's scoring system for measuring Women's Dietary Diversity Score (WDDS) have shown to be valid proxy indicators for various nutritional monitoring activities. However, little is known on whether the WDDS is associated with maternal anemia and pregnancy outcomes.

Ethiopia has an inappropriately high burden of maternal and neonatal morbidity and mortality rates (WHO, 2013). High level of various micronutrient deficiencies and thinness (underweight) among mothers, childhood stunting and wasting are key malnutrition associated features suggesting the extent and depth of nutritional problems in the country. High burden of adverse perinatal outcomes such as low birth weight, preterm, and stillbirth are common (Gebremedhin *et al*., 2014). Dietary intakes of precise nutrients in pregnancy have been reported to lead to a poor maternal nutrition status resulting in a variety of poor maternal and infant outcomes (Black *et al.,* 2008). Some factors influence the nutrition status of a pregnant woman, for instance, iron status in pregnancy are influenced by the demands of the fetus, momentary changes in blood volume and body mass, alterations in absorptive capability, and on the bioavailability of iron in a largely vegetarian diet (Duggan, 2003).

Too little nutrient intake may affect maternal health and the health of the infant. For example, inadequate intake of iron in pregnancy can lead to maternal anemia and increased risks of maternal mortality if the anemia is severe (Cheng *et al.,* 2009). Universal, anemia contributes to

20 percent of all maternal deaths and is responsible for 40 to 60 percent of maternal deaths in non industrialized countries (Saha *et al.,* 2007). It is estimated that anemia accounts for 3.7 percent and 12.8 percent of maternal deaths during pregnancy and childbirth in Africa and Asia, respectively. Anemia has also been found to lead to premature births, low birth weight, fetal impairment and infant deaths (Gautam *et al.,* 2008).

Maternal factors have been linked with intrauterine development jointly with infant nutrition. It has been associated with reduced capacity in adult life, including reduced stature, lower bodily work capacity, impaired cognitive function and educational attainment for the fetus while for the women there is an increased risk of low birth weight in the next generation (Abriha *et al.,* 2014). There is evidence to show that improving dietary quality for the mother increases fetal growth. It is therefore important for the diet to be varied to adequately provide the required nutrients and avert maternal malnutrition which impacts the health of the mother and may lead to mortality.

1.2. Statement of the problem

Malnutrition has been identified as the leading global developmental challenge affecting nearly half of the world's population and also the major underlying contributing factor for nearly half (45%) of all child and a fifth of maternal deaths (Middleton, 2013). Studies showed that nutrition during pregnancy was the single most significant factor predicting preterm birth, intrauterine growth restriction, reproductive loss through stillbirths and factor for the risk of giving birth to low birth weight infants. Typically, most of the women in parts of sub-Saharan Africa, including Ethiopia, enter pregnancy with poor nutrition status (Potdar, 2014).

Nutrition during pregnancy is among the leading factors strongly associated with adverse pregnancy and prenatal outcomes (Abu-saad & Fraser 2010). For a pregnancy to have a healthy outcome, the nutritional status of a woman before and during pregnancy needs to be good (Black *et al.,* 2008). A non-diversified diet can have negative consequences on individuals' health, well-being, and development, mostly by reducing physical capacities and resistance to infection. Besides, cognitive development, reproductive and even social capacities may also be impaired (Savy *et al.,* 2005).

Maternal undernutrition ranges from 10 to 19 percent in most countries across the world. A solemn problem of maternal undernutrition is obvious in most countries in sub-Saharan Africa,

South-central and Southeastern Asia, and in Yemen, where more than 20 percent of women are malnourished (Black *et al.,* 2008). Across Africa, it is estimated that 27-51 percent of women of reproductive age are underweight (Conceição *et al.,* 2011). Nutritional and hormonal factors in pregnancy pressure, not only direct fetal effect but also morbidity and mortality in afterward life (Duggan, 2003).

In Ethiopia nationwide, nearly 17% of women are anemic from this 22% are pregnant which is an indicator of the presence of malnutrition (EDHS, 2016). However, little is known about the causes, determinants, and responses to maternal malnutrition and the associated adverse outcomes in Ethiopia. The aim of this study was determining dietary diversity and nutritional status and factors influencing the consumption and the nutritional status among pregnant women attending at Armed Forces Comprehensive Specialized Hospital to increase knowledge in the area and thus improve the practice.

1.3. Objective of the study

1.3.1. General objective

The overall purpose of the study was to assess determinants of dietary diversity and nutritional status among pregnant women attending antenatal clinic at the Armed Forces Comprehensive Specialized Hospital (AFCSH).

1.3.2. Specific objectives

The specific objectives of the study were to:

- ✓ evaluate nutritional status of pregnant women at the study area.
- ✓ assess dietary diversity of pregnant women at the study area.
- ✓ examine the determinant factors of dietary diversity and nutritional status of pregnant women at the study area.

1.4. Research questions

- ✓ Why malnutrition is prevalent among pregnant women?
- ✓ Is there relationship between socio economic, demographic, morbidity, environmental and cultural factors nutritional status among pregnant women?
- ✓ What are the determinants of dietary diversity and nutritional status?

1.5. Significance of the study

The findings of the study may be used as a contribution for information by Ministry of Health and other organizations working in the promotion of maternal health to implement programmes aimed at improving dietary diversity among pregnant women as a way to improve maternal nutritional status in the city and other areas with similar circumstances. The study will also contribute to knowledge on dietary diversity and factors related to it. On top of this, the findings of the study may lead to other relevant research topics with further refinement.

1.6. Scope and limitation of the study

The scope of the study is to determine the dietary diversity and the nutritionally affected pregnant women at the study area based on MUAC and hemoglobin level. The study was carried out among pregnant women attending antenatal clinic at Armed forces comprehensive specialty hospital in Addis Ababa and thus the research findings can only be applied to institutions with similar characteristics. The study was cross sectional and thus data collected does not show variation in dietary practices by seasons of the year.

1.7. Organization of the paper

This paper is organized as follows into five chapters. Chapter two covers review of the literature which consists of theoretical, empirical, research gap and conceptual framework of the study. Description of the study area, research methodology, sampling procedure and ethical consideration is discussed in the third chapter. Chapter four, is about analysis, discussions and findings of the study which constitutes the main body of the document. Conclusions and recommendations are presented in the final chapter five. Finally, the reference materials and annexes are also included.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2.1. Nutritional related theoretical literature review

Determinants of nutrition: - There are immediate, underlying and basic determinants of undernutrition among pregnant women. The most common immediate determinants of malnutrition are inadequate dietary intake which might be caused by an inadequate supply of food, not taking micronutrient supplementation and infectious disease which may result from the lack of or low utilization of health services, inadequate water supplies, and sanitary facilities, poor food hygiene or (WHO, 2013). Whereas, the basic cause of malnutrition is the unequal distribution of resources in a society. Furthermore, causes of malnutrition are the result of resource available and the political ideology affecting how these resources are used which can be reflected at the country level (Alene *et al*., 2014).

Social cognitive theory and nutrition behavior

Self-regulation theory (SRT) is a system of conscious personal management that involves the process of guiding one's thoughts, behaviors, and feelings to reach goals. Self-regulation consists of several stages, and individuals must function as contributors to their motivation, behavior, and development within a network of reciprocally interacting influences (Luszczynska *et al*., 2004). Accepting the need for and accessibility to healthier foods have not enhanced the overall diets of the population. Social cognitive theory (SCT) may clarify how other variables, such as self-regulation and self-efficacy, maybe factor in integrating healthier nutrition into lifestyles.

Bandura's social cognitive theory (SCT) characterizes the accepted sources and mediators of behavior and behavior change. Self-efficacy refers to an individual's confidence in the ability to exert control over one's motivation, behavior, and social environment (Bandura *et al.*, 2003). Bandura predicted that when behavior change requires regular performance of familiar behaviors, self-regulatory efficacy supersedes performance self-efficacy. With the growing proliferation of good-tasting and affordable lower-fat foods, fruits and vegetables, and whole-grain foods, individuals' confidence in their abilities to buy and prepare healthier foods becomes less important to establishing a healthy diet. Instead, individuals' confidence in their abilities to get themselves to make healthy food choices daily even when it is difficult will determine to a large extent one's success in achieving healthy nutritional balance.

The perceived support for healthy eating from important others, such as family and friends (a precursor to self-efficacy in SCT), will help for better nutrition behaviors. Social, physical, and self-evaluative outcomes expected of behavior are dependent on the individuals' efficacy beliefs and serve as incentives for healthier food choices. Satisfaction with the cost and taste of healthier foods could contribute beyond self-efficacy. Self-regulation within SCT, self-efficacy and outcome expectations are posited to influence behavior directly and through the development and use of self-regulatory behaviors. Among people who desire a healthy diet and who have access to healthy foods, the content their diets will be determined largely by how well they set goals, plan, and monitor self-regulatory what they buy and eat.

Self-regulatory behavior (especially goal setting) has been associated with healthier eating and with promoting healthier fat, fiber, and fruit and vegetable intake in adults. In addition to delineating the variables essential to healthy nutritional balance, SCT specifies how these variables relate to each other. Self-efficacy (which stems from personal variables including, among others, the individual's age, gender, and socioeconomic status, and environmental variables including social support is the preeminent social cognitive determinant of consistent healthful eating. Stronger efficacy beliefs lead individuals to expect to reap the benefits and avoid the difficulties associated with healthy nutrition. Individuals with higher self-efficacy and more favorable outcome expectations will ultimately be more likely to implement the self-regulatory strategies essential to adopting and maintaining healthier eating patterns.

2.2.Empirical literature review

2.2.1. Assessment and importance of dietary diversity

Dietary diversity which is defined as the consumption of an adequate variety of food groups has been accepted as an aspect of dietary quality and can indicate nutritional adequacy. Increasing the variety of foods and food groups in the diet helps to ensure adequate intake of essential nutrients and promotes good health. Dietary diversity can be determined by using numerous methods such as a household or individual dietary diversity questionnaire in which dietary diversity score is used (FAO, 2007). Dietary diversity scores are created by adding either the number of individual food items that have been consumed over a reference period or the various food groups. Women Dietary Diversity Score (WDDS) uses 9 food groups which include. Starchy staples, Dark green leafy vegetables, and red palm oil if applicable, another vitamin A

rich fruits and vegetables, other fruits and vegetables, organ meat, meat and fish, eggs, legumes, nuts and seeds, milk and milk products (FANTA, 2006). The WDDS aims to capture nutrient adequacy and studies have shown that an increase in individual dietary diversity score is related to increased nutrient adequacy (Foote *et al.,* 2004).

Maternal dietary diversity indicators are well-known to be a sign of population-level adequacy for mothers. It has been also related to average household nutrient adequacy and infants in the same (Nguyen *et al*., 2013). More importantly, it is cheap, rapid and effective to study nutritional quality at a population level (UN, 2008). However, as there is limited information on dietary diversity among pregnant women, this study aimed to determine the determining factors for the consumption of dietary diversity and its effect on pregnancy in the study area.

2.2.2. Nutrient adequacy of pregnant women's diets

In a woman's life cycle, there is no time where nutrition is more important than before and during pregnancy. Requirements for almost all nutrients are increased during pregnancy compared to adult or non-reproducing age women. Particularly, the need for macronutrients (energy and protein) and several micronutrients, including: Iron, Iodine, Zinc Magnesium, Selenium Folate, Vitamin B6, Niacin, Riboflavin, Thiamine, Pantothenic acid, Vitamin C, , Vitamin A, Vitamin B-12 and Choline) is increased from 6 - 50%, in descending order. But, the need for few micronutrients like Biotin, Vitamin D, Vitamin E, Vitamin K, Calcium, Phosphorus and Fluoride remains the same (Potdar *et al*., 2014). For maternal stores not to get depleted, the mother's diet should provide adequate nutrients (Khoushabi and Saraswathi, 2010). However, developing countries such as Bangladesh, China, Sudan, Nigeria, and Ethiopia have reported inadequacy of macronutrient and micronutrient intake among pregnant women (Sukchan *et al.,* 2010, Gebremedhin *et al*., 2012).

2.2.3. Importance of consuming diversified diets

A diversified diet has been associated with several improved outcomes in areas such as birth weight, child anthropometric status and improved hemoglobin concentrations (Prentice *et al.,* 2016). A more diversified diet has been highly correlated with such factors as caloric and protein adequacy, percentage of protein from animals' sources which are considered as high quality protein, and household income (Ladipo, 2000). Use of a large variety of foods is an internationally accepted advice for a healthy diet which has seriously been associated with

positive health outcomes such as reduction in the incidence of cancer or mortality (Drescher *et al.,* 2007). A study done by De Sa and his collages in Democratic Republic of Congo identified the need to emphasize the diversification of diets by pregnant women as a way to improve nutritional status and in turn the health of the fetus (De Sa *et al.,* 2012) In addition, it has been found that the consumption of a varied diet leads to a reduced risk of developing a deficiency or excess of any one nutrient and is therefore associated to the dietary nutrient quality (Desta *et al.,* 2019). The study desired to establish the level of consumption of a varied diet.

2.2.4. Nutritional status of pregnant women

Sufficient nutrition before and during pregnancy has the potential for the promotion of the long term health of the mother and her child (Khoushabi and Saraswathi, 2010). Maternal nutritional factors account for approximately 5% of intrauterine growth retardation in developing countries and the weight of an infant is dependent on the mother's health and nutrition during pregnancy (Muthayya, 2009). Assessment of nutritional status among pregnant women may be done by use of MUAC or pre-pregnancy weight however, MUAC has been recommended as it has been found as a potential indicator of nutritional status. In a study done, MUAC was positively correlated to birth weight and crown heel and thus it has been recommended over pre-pregnancy weight to assess women at risk of poor pregnancy outcome (Ricalde *et al.,* 1998). Another study done in Ethiopia by Assefa *et al* found that women with low MUAC were more likely to give birth to low birth weight infants (Assefa, Berhane, and Worku, 2012).

Malnutrition in women results in reduced productivity increased susceptibility to infections, slow recovery from illness, and heightened risks of adverse pregnancy outcomes. Maternal diets during pregnancy need to provide energy and nutrients for the mother as well as for fetal growth (Cheng *et al.,* 2009). Inadequate nutrient intake can lead to maternal anemia, increasing the risk for other maternal morbidities and mortality, fetal growth retardation and low fetal birth weight (Sukchan *et al.,* 2010). A study done by Khousabi and Sawarathi in Zahedan City, Iran, established that hemoglobin level and energy intake of pregnant women were considered as predictor factors of birth weight of neonates (Khoushabi and Saraswathi, 2010). This study assessed the nutritional status of pregnant women who attend at Armed Forces Comprehensive Specialized Hospital.

Anemia is the most common micronutrient deficiency and affects about one-third of the global population with (over 2 billion). It is estimated that 52 % of pregnant women in developing countries are anemic (Gautam *et al.,* 2008). It has further been found that the prevalence of anemia in developed countries among pregnant women is 14 % (Kalaivani, 2009). Anemia during pregnancy is associated with adverse infant outcomes including low birth weight, preterm delivery and higher perinatal morbidity and mortality (Zerfu *et al.,* 2016). A review done by Kalaivani, in 2009, indicated that severe anemia may weaken uterine muscular strength or lower resistance to infectious diseases, contributing to postpartum hemorrhage and subsequent maternal mortality (Kalaivani, 2009).

Control of anemia among pregnant women is done through micronutrient supplementation of iron and folic during the ANC attendance. Review of literature has shown that low or moderate dose supplementation in early pregnancy has a positive effect on fetal growth in women with both adequate and deficient iron status (Rodriguez-Bernal *et al*., 2012). In another study in Ethiopia western Amhara zone, taking iron tablets was found to significantly and positively correlate with hemoglobin concentration in pregnant women (Taye *et al.,* 2015).

2.2.5. Consequences of poor dietary diversity on maternal nutrition status

Shortage of access to adequate and diversified diet has been known as one of the severe problems among poor populations especially in countries where resources are limited and the results various forms of nutrition problems (Ekesa *et al*., 2011**)**. It has been found out that chronic energy deficiency, inadequate energy intake and micronutrient deficiencies are the top priority nutritional problems that affect women of reproductive age. In addition, other studies have shown that when energy and protein deficiency occurs in the mother it is associated with intrauterine growth retardation. According to Kennedy *et al.,* 2007 micronutrient malnutrition has remained a difficulty of public health concern in most developing countries, somewhat due to the consumption of dull, cereal-based diets that lack diversified. Low micronutrient intake has been found to be a problem even in countries undergoing transition in terms of development and has been a dominant problem in many of the poorest regions across the world (Arimond *et al.,* 2010).

Maternal under nutrition, including chronic energy and micronutrient deficiencies, is prevalent in many regions, especially in South-Central Asia, where in some countries more than 10 percent of

women aged 15–49 years are shorter than 145 cm (Black *et al.,* 2008). Women who suffer from chronic energy deficiency have an increased risk of obstructed labor as a result of a contracted pelvis which is more common when malnutrition is prevalent. The study hunted to give information on the pregnant women in AFCSH who have different culture and status to consume a diversified diet thereby reflecting the population at risk of adverse outcome of non diverse diets.

2.2.6. Socio-economic factors and their effect on dietary diversity and nutritional status

Dietary diversity has been strongly associated with socioeconomic status (SES) of a household (Arimond and Ruel, 2004). A study done among Mexican women by Ponce, Ramirez and Deslie in the year 2006, found that a higher socioeconomic status was associated with higher dietary diversity and better micronutrient adequacy. Another study which was done by Murakami *et al* in 2009 among Japanese pregnant women found that individuals with a higher socio economic position were found to consume diets that were considered to be of a higher quality than those with a lower socio economic position. Other studies have shown that families which have greater incomes and resources tend to have more diverse diets as food access is determined by income and the prices of foods (Brinkman *et al.,* 2009, Woldemariam *et al.,* 2016).

2.2.7. Maternal factors and their effect on dietary diversity and nutritional status

According to a study done by Me´jean *et al.,* 2010 maternal factors (age, marital status, education level, parity, gestation age) have been shown to influence the dietary diversity. A low education level and unemployment are associated with an unhealthier diet. In addition, dietary pattern have been shown to vary according to demographic profiles, including gender, marital status and acculturation. Less education, specifically, regardless of other factors, is directly associated with poorer food choices due to lack of the necessary knowledge and also lack of the resources. As a result of the low education particularly among women who are charged with the responsibility of food choice and preparation, there is less dietary diversity **(**Mazur *et al*., 2003). A study done among Japanese women found that women with higher education tended to have changes in diet. On the other hand higher education was found to be associated with favorable dietary intake patterns such as a higher intake of protein and other micronutrients such as iron; vitamins A, D, E, and C; and folate (Murakami *et al.,* 2009). The study was focus on maternal factors mentioned above and how they affect dietary diversity.

2.2.8. Cultural factors and their effect on dietary diversity and nutritional status

Culture is the suitable way of life of a community or individuals and has been found to be very diverse across the world (Lopez, 2008). There have been long term changes in terms of values, norms and even behavior by individuals and the changes include changes in diet and lifestyle (Mazur *et al*., 2003). Pregnant women in various parts of the world are forced to abstain from nutritious foods due to traditional food habits even if the foods are available in abundance. For example, in a study done by Patil *et al*., in India in 2010, 63.7 percent of the study population said that some vegetables/fruits should be avoided during pregnancy (Patil *et al*., 2010). Another study done in Tanzania in 2008, found that even though women have some knowledge about some foods and importance they may not necessarily consume the foods. The study indicated that women having some knowledge about Vitamin A-rich foods were neither healthier nor consumed a greater variety of vegetables than other women (Keding and Krawinkel, 2008). This study explored the cultural beliefs among pregnant women in AFCSH and how it affects their diets.

2.2.9. Morbidity status and its relationship with nutritional status

Morbidity directly affects the nutritional status of an individual and has been found to be an immediate cause of malnutrition. Pregnant women with IPIs were 2.5 times more likely to be anemic compared to their non-infected counterparts (Kefiyalew et al., 2014). When an individual is sick, their dietary intake and diversity is affected due to symptoms of the illnesses and side effects of the drugs that may be taken as treatment for the disease. Pregnant women have dietary preferences and choices due to nausea and vomiting which are experienced early in pregnancy and this not only affect their dietary diversity but also their intake. Malaria one of the most common illnesses is a leading cause of morbidity and mortality in Nigeria and pregnant women living in malaria endemic regions have been found to be particularly vulnerable (Agan *et al.,* 2010) and, it was found that there were statistically significant association between severity of parasitemia and degree of anemia . According to a study done by Finkelstein *et al.,* among pregnant women attending antenatal clinic (ANC) in Dar es Salaam, Tanzania , malaria was associated with a two-fold increase in the risk of anemia (Finkelstein *et al.,* 2011).

2.3. Research gap

The magnitude of dietary diversity cannot be unseen considering the fact that it significantly influences both the nutritional status of the mother and the fetal outcome. Socio-economic factors, low educational level, and low income have been shown to be strongly related to low consumption of certain food groups. Literature review has also shown that maternal factors such as age, parity, education levels of the mother and employment status affect dietary diversity and nutritional status. Though the importance of dietary diversity as an indicator of nutrient adequacy has been shown, as far as the researchers knowledge there is limited knowledge especially on its determinants and association with the nutrition status of pregnant women. The study therefore determined the dietary diversity and the nutritional status and factors affecting of pregnant women in Armed Forces Comprehensive Specialty Hospital.

2.4. Conceptual framework

The conceptual framework used for this study was adopted and modified from UNICEF's conceptual framework on the determinants of malnutrition (UNICEF, 1998). Maternal health status is greatly influenced by the dietary diversity. Dietary diversity is in turn influenced by maternal demographic factors such as age, parity, gestation age, level of education, and morbidity or physiological status of the mother and environmental factors which are the immediate causes. When the dietary diversity is poor it affects the woman's morbidity status as there is reduced immunity and increased chances of developing infections. On the other hand, morbidity status in pregnancy, affects dietary diversity either due to poor appetite which leads to only likable foods being selected which affect nutrient intake. Socio-economic as measured by income and occupation has been found as a factor that influences the dietary diversity and in turn the nutrition status. Cultural factors and individual food security situation have been identified as underlying factors that influence the nutritional status (Me´jean *et al.,* 2010). Environmental factors such as source of water, latrine and sanitation, and food safety are a common cause of disease by affecting the immune system and have an effect on nutritional status.

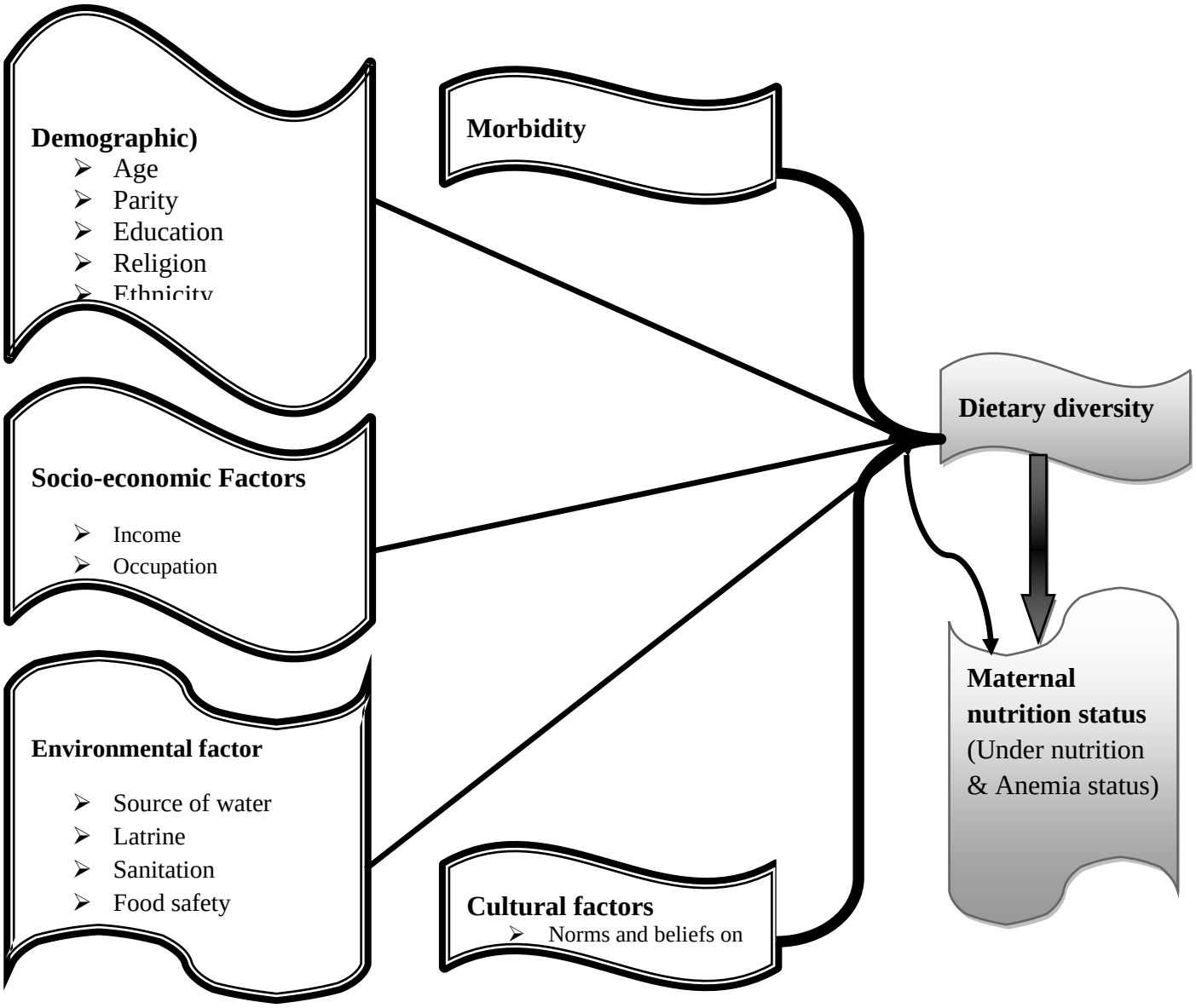

Figure 1 Conceptual framework on factors affecting dietary diversity

Source: researcher's work modified from UNICEF (1998).

CHAPTER THREE: DESCRIPTION OF THE INSTITUTION AND THE METHODS

3.1. Description of the institution (study area)

Addis Ababa is the capital city of Ethiopia. The total number of Hospitals in Addis Ababa city is 51 Health indicators, (FMOH; EFY, 2001) out of the total 41 hospitals, about 10 of them are public, the rest, about 31 hospitals, are run by private investors and non-profit organizations. This research is selected to be carried out at Armed Forces comprehensive specialized Hospital. Which is formerly, known as Princess Tsehay Memorial Hospital founded by Emperor Haile Selassie in memory of his daughter. She died of illness in 1942. AFCSH got its current name after the 1974 revolution. The hospital is found in lideta sub-city which is one of the 10 sub-cities in Addis Ababa. In this sub-city there are two governmental and 5 non-governmental hospitals. As of 2019 its population was 214,496 from this 102,513 are male and 112,283 are female, (CSA, August, 2019). The district is located in the central-western area of the city, nearby the centre.

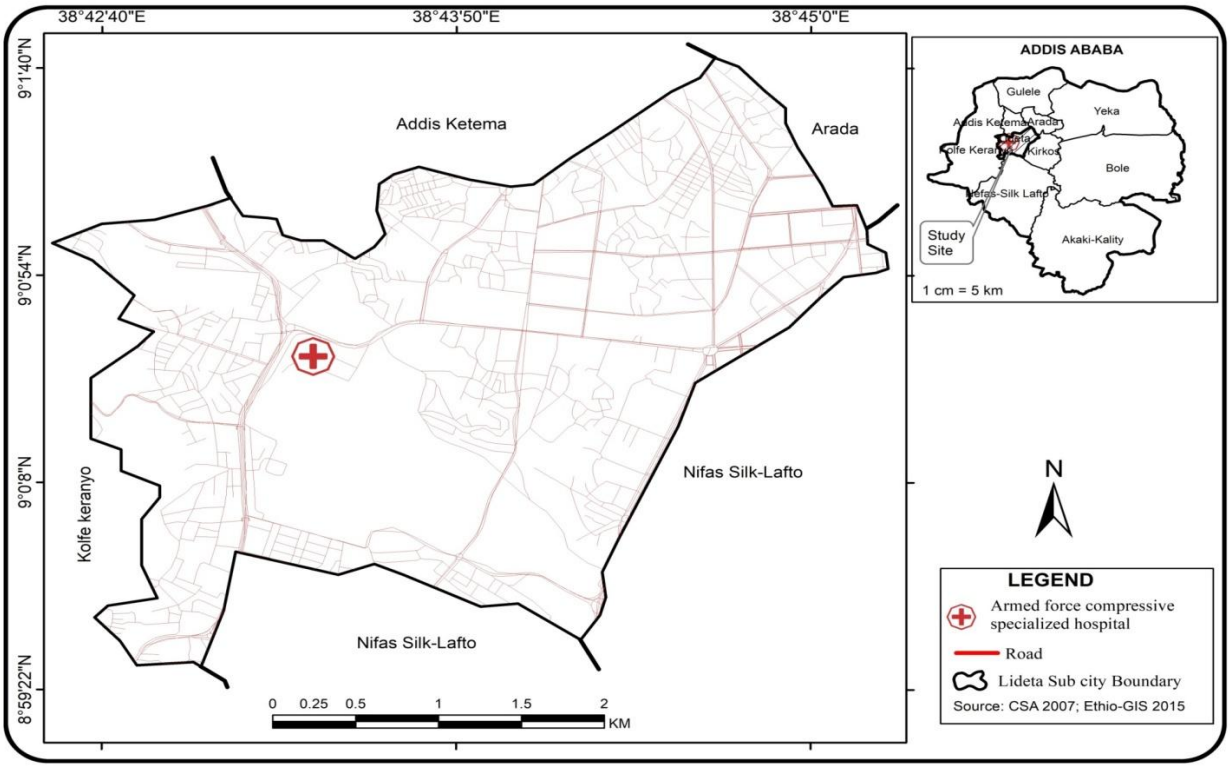

Figure 2: Map of the study area

Source: CSA, 2007, Ethio-GIS 2015

It borders with the districts of Addis Ketema, Arada, Kirkos, kolfe-keraniyo and nifas silk-lafto sub-city. The hospital facility have different departments like Emergency Room, Surgical, medical, Intensive Care Units (ICUS),Pediatric and Maternity wards, Radiology, Anesthesiology, Pathology, and Rehabilitation. In Armed Forces comprehensive specialized Hospital approximately 50 pregnant women attend each day at ANC.

3.2. Study design

The study used institutional based cross sectional analytical design. This methodology was chosen as it would show the dietary diversity status, factors affecting it and also the nutritional status of the pregnant women at a point in time. The study design was used both qualitative and quantitative research approach to assess the complex variables of the dietary diversity and nutrition status of pregnant women at the study area.

3.3. Study variables

There were two variables in the study

3.3.1. Response variable

Dietary diversity and Nutritional status of pregnant women was shown by dietary diversity score, mid upper arm circumference (MUAC) and hemoglobin level.

3.3.2. Explanatory variables

The determining factors for dietary diversity and nutritional status of pregnant women were composed of socio economic and demographic (Mothers age, Gestation age, Parity, Occupation, Level of education, ethnicity, religion), morbidity pattern, environmental and Cultural factors are used as independent variables.

3.4. Data sources

The data was collected from primary and secondary data sources. Primary data was collected from the sample respondents through questioner and focus group discussion. Secondary data was obtained from patient registration and medical history review. And also data was collected from statistical report like EDHS and official world wide websites like WHO, FAO, MoH official websites.

3.4.1. Source population

The source population was pregnant women attending at armed forces comprehensive specialized hospital

3.4.2. Target population

The study population was pregnant women attending antenatal clinic at armed forces comprehensive specialty hospital. The reason for this is during pregnancy there will be high nutritional demand due to the progressive development of the fetus and the mother.

3.5. Inclusion and exclusion criteria

3.5.1. Inclusion criteria

The inclusion criteria were pregnant women who was volunteer to participate in the study and who are at follow up in Armed Forces Comprehensive Specialized Hospital.

3.5.2. Exclusion criteria

The Exclusion criteria was pregnant women with disabilities and chronic diseases such as hypertension, diabetes, Tuberculosis and HIV/AIDS; those enrolled in intervention programs such supplementary feeding or general food distribution as this intervention would have an impact on the nutrition status and dietary diversity and thus bias the results of the study.

3.6. Sample size determination and sampling techniques

Armed Force Comprehensive Specialty Hospital was purposively chosen because it is the main hospital in the City it combines both the army family and the civilian family. We used Hospital records of the previous three years preceding the study and calculate the average monthly attendance. The antenatal attendance at the Hospital was averagely 1200 pregnant women per month. We used formula by Cochran (1963:75), to determine the sample size.

$$\boldsymbol{n_0 = \frac{Z^2 pq}{e^2}}$$

Where; $\boldsymbol{n_0}$- the desired sample size;

Z - the standard normal deviate at 95% confidence level (1.96);

P – the proportion of the target population estimated to have characteristic being measured;

q - 1-p; and

e - the level of statistical significance set

The prevalence of under nutrition among women in the study site has no reference to use as p-value. Then when such evidence is not available 50% is considered as maximum prevalence of under nuorished mothers. So taking 50% as p-value with 95% confidence interval, 5% marginal error and none responsive rate of 10%. At 95% the z was 1.96.

$$n = \frac{(1.96)^2(0.5)(1-0.5)}{(0.05)^2} \approx 384$$

Finite population correction was done to produce a sample size that was proportional to the population therefore the sample size was calculated as;

$$n = \frac{\boldsymbol{n_0}}{1 + \frac{(\boldsymbol{n_0} - 1)}{N}}$$

Where = $\boldsymbol{n_0}$desired sample size

N = the estimate of the population size (1200 ANC attendants per month)

$$n = \frac{384}{1 + \frac{(384-1)}{1200}} \approx 291$$

A sample size of 291 pregnant women was calculated for the study. Due to the possibility of non - response 10% was added to make a sample of 320.

AFCSH was purposively chosen because it is the main hospital in the City it combines both the army family and the civilian family. The first respondent was selected randomly through balloting from among the first five pregnant women to arrive at the antenatal clinic and thereafter systematic sampling was used. To find the sampling interval, the average monthly attendance (1200) was divided by the required sample size of 320 which gives us 3.75. Based on the value above, every 4th pregnant woman to arrive were interviewed until the sample size achieve. This was done daily during the weekdays for one month until the target sample size meet from. Data was collected within a month to avoid bias which would be brought by pregnant women who would revisit the clinic for follow up in the following month.

3.7. Selection and training of research assistants

Two research assistants were nurses recruited to assist in the study. The researcher trained the research assistants for two days and the third day was used for practical experience. They were trained on the objectives of the research and data collection procedures. They were taken through the questionnaire, by reading through question by question by the researcher to ensure familiarization and clarity of the responses. Any questions and clarifications were done. They were also taken through taking of MUAC using the actual tapes which were to be used for the study. Interview techniques and confidentiality were also discussed during the training. Several methods of training were used during the training such as demonstrations where the researcher demonstrated how to take the MUAC measurements.

3.8. Tools of data collection

3.8.1. Questionnaires

An individual dietary diversity questionnaire recommended by FAO (2007) was adopted and modified to collect data on dietary diversity, socio demographic and other factors influencing nutritional status. The questionnaire was divided into: socio-demographic information, 24 hour recall, dietary diversity, micronutrient supplementation, ANC attendance and morbidity, socioeconomic characteristics, environmental factors, cultural beliefs and anthropometry in which MUAC and hemoglobin levels were measured and used to determine the nutritional status of the pregnant women. The socio-demographic data required were: - age, parity, gestation in weeks, marital status, level of education and main occupation of the respondent and the husband if married.

24 hour dietary recall was administered and was used as it minimizes recall bias and it conforms to recall time period used in many other studies (Kennedy *et al.,* 2007, Savy *et al.,* 2005, Arimond and Ruel, 2004). The 24 hr dietary recall involved asking the respondents to recall all the drinks and food eaten the previous day in chronological order starting with the food eaten in the morning through the day up to the time the respondents went to sleep. Probing was done to ensure no foods or drinks were omitted. In addition, the respondents were asked to provide information on whether they ate outside the home.

3.8.2. Focus group discussion guides

A focus group discussion (FGD) guide was used to collect information on attitudes and beliefs of pregnant women on foods, how the beliefs affected food choices and dietary diversity practices so as to give an in-depth understanding on the status of dietary diversity and explain or complement some of the quantitative findings. Two focus group discussions were held with selected groups of women at the end of the study period. The discussion was held in a private room with just the participants, researcher, research assistant and observer from the nurses at ANC clinic present. Participants were assured that the information they shared during these discussions is confidential and was encouraged to give their answers as freely as possible. The two groups that participated in the focus group discussions consist of 10 women and the discussion took up to 50 minutes. Any questions that are raised during the discussion were answered as adequately as possible.

3.8.3. Other equipment

Standard Mid Upper Arm Circumference (MUAC) adult tapes was used to take measurements and the ANC follow up lab-chart was used to determine the ANC attendance and hemoglobin levels of the pregnant women to assess their nutritional status.

3.9. Data validity and reliability

3.9.1. Reliability

The questionnaires were pre-tested to check on the length, content, question wording and language. The questionnaire was administered to 32 respondents (10 percent of the sample size), who are attending ANC at AFCSRH. This allowed modifications on the questionnaires by correcting mistakes and inclusion of foods that have been missed out or elimination of foods that are not applicable in the community. Ambiguous questions was corrected to ensure clarity and to elicit the required information therefore enhancing reliability.

3.9.2. Validity

To ensure validity, the questionnaire was tested and validated by advisors peers and other technical persons so as to ensure that the questions elicited the required answer.

3.10. Data collection procedures and techniques

Data were collected on a daily basis during the five working days i.e. Monday to Friday. The research team reported to the ANC and with assistance of the nurse on duty, identified and sampled the target population. The respondents were interviewed after they had received their routine clinic services in a private room. Anthropometry measurements of MUAC were taken using a standard MUAC tape and this was used to determine nutritional status. MUAC of the left arm was taken to nearest 0.1 cm with no clothing on the arm and this was done twice for each respondent to ensure accuracy. The left arm was used as it shows malnutrition while the right arm which is frequently used will show lean muscle mass as a result of work. The results for hemoglobin levels of each respondent were collected from recorded clinical data with a permission of the patient and the staffs.

Two focus group discussions were held with purposively selected groups of women at the end of the study period. The discussions were held in a private room with just the participants, researcher, research assistant and observer (the head nurse) present. Participants were assured that information shared during these discussions was confidential and thus they were encouraged to give their answers as freely as possible. The two groups that participated in the focus group discussions consisted of 10 and discussions took 50 minutes. Any questions that were raised during the discussion were answered as adequately as possible.

3.11. Techniques of data analysis

Completed questionnaires were checked daily for accuracy and completeness in recoding of responses. Data was entered by using SPSS version 20 and then imported to STATA version 14. For dietary diversity analysis, Women Dietary diversity were categorized as: - consumption of foods from <4 food groups were considered as low dietary diversity, while consumption of food items from ≥ 4 food groups in 24 hours prior to the interview was considered as high dietary diversity (FAO, 2007). Responses from FGDs were arranged in general categories identified in the discussion guideline then were coded.

There is no clear definition of low MUAC or established universally accepted international MUAC cutoffs for pregnant women. However, because MUAC is simpler to measure than other indicators and is not affected by pregnancy status, several countries have established their own

cutoffs for classifying malnutrition in women who are pregnant. Although there is limited evidence to support these cutoffs, they help determine eligibility for nutrition support programs. Currently, there are no specific recommendations for MUAC cutoffs for pregnant adolescents, and several countries stipulate that their cutoffs for pregnant women also apply to pregnant and postpartum adolescents. Ethiopia also has her own MUAC cutoffs for pregnant women which is MUAC measurement < 180 mm is considered Severe Malnutrition, while ≥ 180mm to < 210 mm is Moderate Malnutrition and ≥ 210 mm Normal (FANTA, 2018). According to World Health Organization (WHO), pregnant women with hemoglobin levels >11mmols/l are normal <11.0 mmols/l are considered anemic while those with hemoglobin levels of <7.0 mmols/l were considered to have severe anemia and therefore these cut offs will be used in this study (WHO, 2007).

3.11.1. Descriptive analysis

Descriptive statistics such as frequencies and percentages for discrete data (non-continuous) and the mean values for continuous data was computed. Chi square tests were done to assess differences between the categorical variables with groups. T-test was done to compare means between groups. A P value of <0.1, 0.05 and 0.01 was used as the criterion for statistical significance.

3.11.2 Econometric model specification

Binary logistic regression model is used when the dependent variable is articulated in two categories and multinomial logistic regression model is useful when the dependent variable is expressed by more than two categories (Gujarati, 2004). Regression methods such as linear, logistic, and ordinal regression are useful tools to analyze the relationship between multiple explanatory variables. These methods also permit researchers to estimate the magnitude of the effect of the explanatory variables on the outcome variable. Both binary and multinomial logistic regressions were used to estimate the relationship between dependent and independent variables of the study.

Multinomial logistic regression is preferred when multiple classes of the dependent variable ranked and we use ordinal logistic regression. The application of the ordinal regression model is dependent, in large part, on the measurement scale of the variables and the underlying assumptions. Ordinal logistic regression model is a type of logistic regression model that are

used to analyze ordinal dependent variables. For instance, if the dependent variable (outcome variable) is in ordinal scale (ordered pregnant women nutritional status as normal, moderate and severe malnutrition as in this study), the ordinal regression model is a preferred modeling tool which does not assume normality or constant variance, but requires the assumption of parallel lines across all levels of the outcome variable.

When the dependent variable has a dummy form, taking 0 and 1 values, there is a need of a probability model that fulfill these two features: (1) as Xi increases, Pi = E(Y = 1 | X) increases but never predict values outside the 0-1 intervals and (2) the relationship between Pi and Xi is nonlinear (Gujarati, 2004).

3.11.3. Model specification

Binary logistic model

Binary Logit - preferred to others because it gives standard result for discrete choice estimation.

$$logit(p_i) = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \cdots + \beta_n x_{ni} + e_i$$

Where: p_i - the probability that the i^{th} value of the dependent variable, X - the i^{th} value of the independent variable, e_i - the "error" variability of the dependent variable not explained by the independent variable; n - the number of independent variables.

Thus, the Logit (Natural log of odds) of the unknown binomial probabilities are modeled as a linear function of the *Xi*:

$$logit(p_i) = ln\left(\frac{p_i}{1+p_i}\right) = \beta_0 + \sum_{j=1}^{n} \beta_j x_{ji}$$

The Logit model assumes that underlying stimulus index *Logit* (p_i) is a random variable, which predicts the probability of being nutritional diversify. *Pi* - the probability of being in high dietary diversity, while *(1-Pi)* - the probability of low dietary diversity.

Probability of being dietary diversify $p_i = \left(\frac{1}{1+e^{-logit(p_i)}}\right) = \left(\frac{e^{logit(p_i)}}{1+e^{logit(p_i)}}\right) = \left(\frac{e^z}{1+e^z}\right)$

Where; Z - cumulative function, $\beta_1 + \beta_2 x_i$ that ranges from - ∞ to + ∞, while P_i ranges between 0 and 1. The maximum likelihood estimation approach was used to estimate the equation. STATA Version 14 software was employed to compute estimates.

Ordinal regression model

The application of the ordinal regression model is dependent, in large part, on the measurement scale of the variables and the underlying assumptions. Ordinal logistic regression model is a type of logistic regression model that are used to analyze ordinal dependent variables. For instance, if the dependent variable (outcome variable) is in ordinal scale (ordered nutritional status as severely undernourished, moderately undernourished, and nourished as in our case), the ordinal regression model is a preferred modeling tool which does not assume normality or constant variance, but requires the assumption of parallel lines across all levels of the outcome variable (McCullagh and Nelder, 1989).

The ordinal logistic regression procedure empowers one to select the predictive model for ordered dependent variables. It describes the relationship between an ordered response variable and a set of explanatory variables which may be continuous or discrete Ordinal regression model is embedded in the general framework of generalized linear models for analyzing ordinal response variables. Different models can be resulted from the use of different link functions. Among different link functions, *logit* and *cloglog* links are the two major link functions.

In this particular study, we would use *logit* link function. The *logit* link is generally suitable for analyzing the ordered categorical data when all categories are evenly distributed. The *cloglog* link may be used to analyze the ordered categorical data when higher categories are more probable. If the logit link is applied, the general form of ordinal regression model may be written asfollows:-

$$f\big(y_i(x)\big) = log\left(\frac{f\big(y_i(x)\big)}{1 - f\big(y_i(x)\big)}\right) = log\left(\frac{pr(y \le j \backslash x)}{pr(y > j \backslash x)}\right) = \propto_j + \beta x, j = 1, \dots k - 1$$

$$\boldsymbol{y_j(x) = \frac{e^{\propto_j + \beta x}}{1 + e^{\propto_j + \beta x}}}$$

Where j indexes the cut-off points for all categories (*k*) of the response variable, the function $f\big(y_i(x)\big)$ is the link function that connects the systematic components (i.e. $\propto_j + \beta x$) of the linear model, the alpha *j* a represents a separate intercept or threshold for each cumulative probability and b represents the regression coefficient (McCullagh and Nelder, 1989). If multiple explanatory variables are applied to the ordinal regression model, b*X* is replaced by the linear combination of $(\alpha_j+\beta_1 x j_1+\beta_2 x_{j2}+\ldots+\beta_p x_{jp})$.

Definition of variables

Malnutrition in the study is defined as a state when the body does not have enough of the required nutrients (under-nutrition). Malnutrition is a state in which the physical function of an individual is impaired to the point where he or she can no longer maintain adequate bodily performance process such as growth, pregnancy, lactation, physical work and resisting and recovering from disease (WFP, 2005).

Maternal factors in the study included age**,** parity education, occupation, ANC attendance.

Age and Parity of the mothers: - Women's age and parity are important factors that affect maternal depletion, especially in high fertility countries. Both are continuous variable and measured in years and number of children alive respectively. Local studies in Ethiopia also showed that women in the youngest age group (15-19) and women in the oldest age group surveyed (45-49) are the most affected by under nutrition (Teller and Yimar, 2000).

Gestation age

Education: - It is a continuous variable measured in number of years in schooling. Women who receive even a minimal education are generally more aware than those who have no education of how to utilize available resources for the improvement of their own nutritional status and that of their families. Education may enable women to make independent decisions, to be accepted by other household members, and to have greater access to household resources that are important to nutritional status. A study in the Ethiopia showed that the higher the level of education, the lower the proportion of undernourished women (Abrha *et al.,* 2010).

Occupation: - Women's employment increases household income, with consequent benefit to household nutrition in general and the woman's nutritional status in particular. Employment may increase women's status and power, and may bolster a woman's preference to spend her earnings on health and nutrition. Though employed, women without control over their income and decision making authority within the household are deprived of economic and social power and the ability to take actions that will benefit their own well-being (Kefyalew *et al*.,2018).

Marital status: - Marital status of the women is associated with household headship and other social & economic status of the women that affects their nutritional status. Nutritional and social security could be endangered by a negative change in marital status. A study showed that

women's malnutrition is significantly associated with marital status indicating that compared to married women malnutrition is higher among unmarried rural and divorced/separated urban women compared to married ones (Teller and Yimar, 2000).

Women dietary diversity score: - defined as the number of different foods or food groups consumed over a given reference period (FAO, 2007). In the study will be created by summing up the number of food groups consumed over a 24 hour period by an individual.

Morbidity patterns: - it is a dummy variable in this study that directly affects the nutritional status of an individual and has been found to be an immediate cause of malnutrition. Pregnant women with IPIs were 2.5 times more likely to be anemic compared to their non-infected counterparts (Kefiyalew et al., 2014).

Socio-economic factors in the study were defined by proxy indicators such as occupation, income.

Household income: - It is treated as a continuous variable measured in the amount of money a given household generates from different work participation. The economic status of a household is an indicator of access to adequate food supplies, use of health services, availability of improved water sources, and sanitation facilities, which are prime determinants of maternal nutritional status. A study in the Southern Nations, Nationalities and Peoples Region (SNNPR) of Ethiopia (Teller and Yimar, 2000) showed that women from low economic status households were the most affected by malnutrition.

Cultural factors: - are dummy and categorical variable refer to beliefs and norms about foods and dietary diversity practices.

Environmental factors: - this category has categorical and dummy variable. Unfavorable health environment caused by inadequate water and sanitation can increase the probability of infectious diseases and indirectly cause certain types of malnutrition. In Ethiopia studies showed that unprotected water source and non-availability of latrine were associated with low nutritional status.

Nutritional status is a measurement of the extent in which individuals physiological needs for nutrients are being met and was measured using MUAC.

Anemia in pregnancy is defined as a hemoglobin (Hb) concentration of < 11 g/dL of blood and in this study it was determined by using the hemoglobin levels (WHO, 2013).

Table 1: Summary of variables

Independent variable	Nature of variable	Outcome	Statistical test
Mothers age	Continuous	+	Means, standard deviation(SD), Frequencies, percentages, Logistic and Ordinal regression
Gestation age	Categorical	+	
Parity	Continuous	+	
Marital status	Categorical	+	
Level of education	Continuous Categorical	+	
Occupation	Categorical	-	
Occupation of Husband	Categorical	-	
Women dietary diversity score	Continuous Categorical	+	
micronutrient supplementation	Categorical/dummy	+	
Morbidity patterns	Continuous/Categorical/dummy	-	
Household income	Continuous/ Categorical	+	
Cultural factors		-	
Environmental factors	categorical	+	
Hemoglobin/MUAC	Continuous Categorical		

3.12. Ethical consideration

Permission was acquired from the graduate school of AAU and approval to carry out the research was granted. Ethical clearance was obtained from Armed Forces Comprehensive Specialty Hospital. The questionnaires administered to the respondents upon obtaining an informed written or thumb print consent. Before consent was obtained, the researcher and the research assistants explained the purpose of the study and respondents were assured of confidentiality of the information they give then require their permission. To ensure privacy, names and other means of identity was not used during the data collection. The researcher ensured that all information obtained will be kept in strict confidence and will be used only for the purpose of the study.

CHAPTER FOUR: RESULTS AND DISCUSSIONS

Presented in this chapter are the study findings as per the objectives as follows: demographic and socio-economic characteristics of the study population comprising pregnant women attending ANC at Armed forces Comprehensive Specialty hospital, Addis Ababa; Dietary diversity of the study population; Nutritional status of the study population; and relationships between nutrition status and factors influencing the dietary diversity and nutritional status. Data will be presented in tables.

4.1. Descriptive results of the respondents

4.1.1. Socio-demographic characteristics and undernutrition

Socio-demographic categorical variables of the study are gestation in weeks, marital status, level of education, the main occupation of the respondent, the main occupation of the husband, and religion were analyzed by using a chi-square test for a possible difference between severe, moderate and normal nutritional status. The finding of the results shows only gestational age was statistically significant. Based on the gestation categories, a woman is considered to be in the first, second or third trimester when she is at her 0-12 weeks, 13-28 weeks and 29-40 weeks pregnant respectively. Data on the gestation in weeks were collected from the ANC book.

In this study from the sampled women 320, 87(27.19%) of them were found to be in their third trimester, 75(23%) of them were found in the second trimester and about 158(49.38%) of the respondents were in their first trimester (Table 2). Of those in the third trimester, 1(1.15%) of women was found severely undernourished and the other 86(98.85%) were in normal range. Of the women who were in their second trimester, 6(8%) were moderately anemic and 69(92%) had normal hemoglobin level. While, those who found in their first trimester 5(3.16%) and 153(96.84%) experienced moderate and normal range for hemoglobin, respectively. The result showed gestational age is statistically significant at 5% level of significance and this showed there is a possible difference in pregnant women being in severe, moderate and normal anemia with a p-value of 0.033(table 2).

Table 2: Chi-square test results of the respondents based on MUAC

Name of Variable		Severe under nutrition		Moderate under nutrition		Normal		total		
	category	count	%	count	%	count	%	Total count	Total%	**p-value**
Gestation	0-12	0	0.00	5	45.45	153	49.68	158	49.38	0.033**
	13-28	0	0.00	6	54.55	69	22.40	75	23.44	
	29-40	1	100.00	0	0.00	86	27.92	87	27.19	
Morbidity	yes	1	100.00	1	9.09	35	11.36	37	11.56	0.021**
	no	0	0.00	10	90.91	73	88.64	283	88.44	
water source	Pipe	0	0.00	11	100.00	281	91.23	292	91.25	0.018**
	Public tab	1	100.00	0	0.00	27	8.76	28	8.75	
Waste Dispose	Filed	0	0.00	0	0.00	8	2.60	8	2.50	0.041**
	Dump pit	0	0.00	10	90.91	272	88.31	282	88.13	
	Burn	1	100.00	1	9.09	28	9.09	30	9.38	

Source: analyzed from own survey data (2019)
Note: ** is significant at 5%

4.1.2. ANC attendance and morbidity and nutritional status

ANC attendance and morbidity category of the interview categorical and dummy variables were morbidities, type of illness, seeking medical assistance, and type of medical institution. They were analyzed by using a chi-square test for a possible difference between severe, moderate and normal nutritional status only morbidity status was found significant. The proportions of pregnant women who have been sick during the pregnancy time was 37(11.6%), the remaining were not sick.

As presented in table 2 from the pregnant women who have been sick (n=37), 1(2.7%) was severely malnourished, 1(2.7%) moderately malnourished and 35(94.6%) were found in the normal range as measured by MUAC. Among those who have not been sick, none were in a range of severe malnutrition, 10(3.5%) out of the 283 were moderately malnourished and the

remaining 273(96.5%) were in the normal category of the MUAC interpretation for nutrition. Moreover, the Chi-square test of the respondent pointed out that there a 5% statistically significant difference in the morbidity status of the respondent and the MUAC measurement with a P-value of 0.021(table 2).

4.1.3. Environmental factors and undernutrition

Main water source for drinking, type of toilet, household waste disposal, cleaning food preparation materials, storage for fresh perishable foods, and handwashing practice were the environmental factors that have been analyzed for chi-square test to assess the possible differences between the study population with undernutrition and the variables that shows difference was source of drinking water and west disposal practice.

When asked about the source of drinking water a total of 292(91.25) respondents use pipe water for drinking while 27(8.4%) of them use public water and the rest of the respondents use other sources as options. As we can see from the table 2 the respondents who use pipe water experienced moderate undernutrition by 3.8% (11), the rest 281(96.2%) of them were in normal MUAC measurement. The study population who prefer to use the public water 1(3.7%) out of the 27 have severe malnutrition and the 26(96.3%) were in normal measurement. Source of water for drinking and its access is the major cause of being affected by a disease that is more communicable and will be a reason for seeking medical assistance and may cause the mother and the fetus at risk. The result shows the source of drinking water is statistically significant with a p-value of 0.018.

Another significant variable with a p-value of 0.018 is the type of waste disposal. 8(2.5%) out of 320 pregnant women dispose of their west material on the field, while 282(88.13%) of them use a dump pit and the 30(9.37%) women burn their waste products. 1(0.31%) women found in severe anemia, 11(3.44%) of them were in moderate anemia and 308(96.25%) of them were at a normal level. This shows us there is a possible difference between the women regarding undernutrition.

4.2. Descriptive results of the categorical variable with anemia

Dummy and categorical explanatory variables were analyzed by using the chi-square test to establish for possible differences between respondents with severe anemia, moderate anemia and

Table 3: Chi square test results of the respondents based on hemoglobin

Name of variable		Severe anemia		Moderate		normal		Total		p-value
		N	%	N	%	N	%	Total N	Total%	
education	Don't attend	1	12.50	1	2.70	5	1.82	7	2.19	0.061 (*)
	Primary	0	0.00	5	13.51	34	12.36	39	12.19	
	Secondary	2	25.00	20	54.05	92	33.45	114	35.63	
	Diploma	1	12.50	3	8.11	63	22.91	67	20.94	
	Degree & above	4	50.00	8	21.62	81	29.45	93	29.06	
	Total	8	100.00	37	100.00	275	100.00	320	100.00	
Micronutrient supplementation	Yes	6	75.00	24	64.86	222	80.73	252	78.75	0.083 (*)
	No	2	25.00	13	35.14	53	19.27	68	21.25	
	Total	8	100.00	37	100.00	275	100.00	320	100.00	
morbidity	Yes	3	37.50	6	16.22	28	10.18	37	11.56	0.038 (**)
	No	5	62.50	31	83.78	247	89.82	283	88.44	
	Total	8	100.00	37	100.00	275	100.00	320	100.00	
Type illnesses	Worm infection	1	33.33	0	0.00	3	11.54	4	11.76	0.007 (***)
	Respiratory	2	66.67	5	100.00	23	88.46	30	88.24	
	Total	1	33.33	0	0.00	3	11.54	4	11.76	
seek medical assistance	yes	2	25.00	3	42.85	15	68.18	20	54.05	0.073 (*)
	no	6	75.00	4	57.14	7	37.81	17	45.94	
	Total	8	100.00	7	100.00	22	100.00	17	100.00	
Place of medical assistance	Private	0	0.00	10	83.33	4	80	14	70	0.041 (**)
	Gov't	3	100.00	2	16.67	1	20	6	30	
	Total	3	100.00	12	100.00	5	100.00	20	100.00	
Wall of the house made of	Iron	1	12.50	5	13.51	20	7.27	26	8.13	0.016 (**)
	Mud	1	12.50	11	29.73	53	19.27	65	20.31	
	Cement	6	75.00	15	40.54	191	69.45	212	66.25	
	Mud and Cement	0	00	6	16.22	11	4.00	17	5.31	
	Total	8	100.00	37	100.00	275	100.00	320	100.00	0.011
Floor of the house	mud	0	0.00	2	5.41	7	2.55	9	2.81	(**)
	Cement	8	100.00	35	94.59	268	97.46	311	97.19	
	Total	8	100.00	37	100.00	275	100.00	320	100.00	
type of toilet	Flush	5	62.50	12	32.43	157	57.09	174	54.37	0.074 (*)
	Pit Latrine	3	37.50	25	67.57	118	42.91	146	45.62	
	Total	8	100.00	37	100.00	275	100.00	320	100.00	
Where to store fresh foods	refrigerator	5	62.50	30	81.08	211	76.73	246	76.88	0.091 (*)
	Covered	2	25.00	0	0.00	12	4.36	14	4.38	
	Separated	1	12.50	7	18.92	52	18.90	60	18.75	
	Total	8	100.00	37	100.00	275	100.00	320	100.00	

Source: analyzed from own survey data (2019)

Note: *** is 1%, ** is at 5% and * is 10% significant

normal hemoglobin level. Independent variables that show a difference at 1% significant was type illnesses, 5% significant level was morbidity, Place of medical assistance, type of wall of the house made of, and type of floor of the house. On the other hand, variables that show a difference at 10% significant level were educational level, micronutrient supplementation seek medical assistance, type of toilet, and where to store fresh foods. The results are presented in Table 3.

4.2.1. Socio-demographic results and anemia

Gestation in weeks, marital status, level of education, the main occupation of the respondent, the main occupation of the husband, and religion were analyzed for a possible difference between pregnant women with anemia by using the chi-square test the finding of the results shows the level of education were statistically significant (Table 3). From the study population 7(2.19%) of them don't attend formal school because of different reason, 39(12.19%) of them attended primary school, 114(35.63%) have attended secondary school, 67(20.94%) have earned their diploma, and 93(29.06%) have got their degree and above degree. Out of the respondents who don't attend primary school 1(14.90%), 1 (14.90%) and 5(71.43%) were in a severe, moderate and normal hemoglobin range respectively.

There were 5(12.82%) moderately anemic respondents found from primary attended women and the other 34(87.18%) were in normal hemoglobin reading. Secondary school attended women who experienced severe anemia were 1.75% (2), while 20(17.54%) of them experienced moderate anemia and 95(80.70%) of them were in the normal range of hemoglobin cut-off. Out of the interviewed population who awarded diploma 1(1.49%), 3(4.48%) and 63(94.02%) were in severe, moderate and in the normal levels of anemia respectively. The degree and above owner who presented with severe anemia were 4(4.30%), and 8(8.60%), 87.09% were in moderate and normal range. Educational level was statistically significant with a p-value of 0.061 by a chi-square test and the result reveals that there is a difference between respondents.

4.2.2. Micronutrient supplementation and anemia

The categorical and dummy variable in this category computed by using chi-square for possible differences are micronutrient supplementation, type of micronutrient, dosage, the reasons for not taking the nutrients and access to fortified foods and the statistically significant variable found was micronutrient supplementation.

Of the pregnant women that were interviewed, 252(78.75%) had received and were consuming micronutrient supplements while 68(21.25%) have not received the supplements due to different reasons. Mainly iron and folic pills were the supplements being consumed as reported by 67.2% of the respondents. From the respondent who has been taking the supplements (78.75%), 6(2.38%) of them were in severe anemia, 24(9.5%) were in moderate anemia and 222(88.10%) were in normal hemoglobin reading. Of those who have not been taking the iron supplementation, 2(2.94%) of them were anemic, 13(19.2%) of them were moderately anemic and 53(77.94%) are in the normal range. The micronutrient supplementation during pregnancy has shown a 5% statistically significant possible difference among the respondents with anemic status with a p-value of 0.083. Iron supplementation of women during pregnancy has been found to protect the mother and infant against anemia.

4.2.3. ANC attendance, morbidity and anemia

Descriptive analysis by using chi square for a potential difference of categorical variables from ANC attendance and morbidity with nutritional status shows type illnesses, seeking medical assistance, and Place of medical assistance was found significant. The outcome of this study shows that from a total of 320 respondents, the proportion of pregnant women who have been sick during the pregnancy time is 37(11.6%) the others 283(88.4%) of them were not sick. The study population who have been sick found to be in sever anemic category 3(8.10%), in a moderate category 6(16.21%) and in a normal category 28(75.67%). The respondents who have not been sick were found to be severely anemic 5(1.77%), moderately anemic 31(10.95%) and in normal hemoglobin 247(87.28%). The morbidity status is statistically significant with a p-value of 0.038and shows a likelihood of differences among respondents.

The second significant variable with a p-value of 0.007 in this category is the type of illnesses that the women got. Two types of disease, worm infection and respiratory diseases are the ones that the women mentioned. Respondents who suffer worm infection were 4(11.76%) and that of respiratory infection is 30(88.24%). Prevalence of anemia in a respondents who experience worm infection is 1(25%) severe anemia, and 3(75%) in a normal redings. Of the women who experience respiratory infections 2(6.67%) of them found to be in severe anemia 5(16.67%) in moderate anemia and 23(76.67%) were in a normal reading of hemoglobin levels (Table 3).

Similarly, the other statistically significant independent variable with a p-value of 0.073 is seeking medical assistance. As a result in table 3 shows from the study population who have been sick n=37, 20(54.05%) of them show at medical assistance while the rest 17(45.94%) were not. Out of the respondents who seek medical advisory, 2(10%) of them were in severe anemia, 3(15%) of them were in moderate anemia while 15 (75%) of them were in a normal reading for hemoglobin level. For those who didn't seek assistance, 6(35.29%) found to have severe anemia, 4(23.53%) moderate anemia and 7(41.18%) were found to have normal readings for hemoglobin.

The place of medical assistance is another statistically significant variable with a p-value of 0.041. Out of the women who were found to seek assistance 14(70%) of them attend private clinics while 6(30%) seek medical advice at government healthcare centers. The respondents who attend the private hospitals 10(71.43%) have been in moderate anemia and 4 (28.57%) were in a normal range of hemoglobin levels. Of those who attend government hospital 3(50%) of them were severely anemic, 2(35%) of them were moderately anemic, and 1(15%) of them were in a normal anemic condition.

4.2.4. Socio-economic characteristics and anemia

Type of residence, type of wall of the house, type of roof, type of floor, the main source of cooking, the main source of lighting are the categorical and dummy variables that have been analyzed for possible differences among the study population with respect to anemic status. The statistically significant variables are the type of wall of the house, and the type of floor the house made of. The wall of the house that the study population is living 26(8.13%), 65(20.31%), 212(66.25%) and 17(5.31%) are made of iron, mud, cement, and both (mud and cement) respectively. Out of the population that have iron made wall, 1(3.85%) is severely anemic, 5(19.23%) are moderately anemic and 20(76.92%) of them are in the normal range.

The study shows the ones who have their wall made of mud found to have 1(1.54%) severely anemic, 11(16.92%) moderately anemic and 53(81.54%) of them are in normal anemic level. The groups who have their walls made of cement have severe anemia 6(2.83%), moderate anemia 15(7.07%), and normal 191(90.09%). The women who live in a both mud and cement have experienced 6(35.29%) of them were moderately anemic and the rest 11(64.70%) were in a normal hemoglobin level. The type of wall of the house is statistically significant with a p-value of 0.016.

The type of floor of the house is another significant variable with a statistical significance a p-value of 0.011. The floor of their house is mainly made of mud and cement. The once that said it's made from mud are 9(2.81%) and the majority of the 311(97.19%) were made of cement. Out of the 9 respondent, 2(22.22%) were found in moderate anemia while 7(77.78%) of them were in the normal category. Out of the informants who live in a floor which is made of cement 8(2.57%) was in severe anemia, 35(11.25%) was in moderate anemia and 268(86.17%) of them was in a normal reading of hemoglobin level.

4.2.5. Environmental factors and anemia

As table 3 shows results from the analysis of the chi-square test of the environmental factors to differentiate for possible differences with anemia, the variable that shows a statistical difference were the type of toilet and storage for fresh perishable foods. The majority of the respondents 174(54.37%) use flushed toilets and the rest of them 146(45.63%) use a pit latrine toilet. Most of the respondents 157(90.23%) who use the flush toilet were in normal hemoglobin reading while 12(6.90%) of them was in a moderate category and 5(6.87%) were in severe anemia. The respondents who use pit latrine toilet experienced severe anemia 3(2.05%) moderate anemia 25(17.12%) and 118(80.52%) were normal. The type of toilet is significant at a p-value of 0.074.

Similarly, the other significant categorical variable storage for fresh perishable foods is statistically significant with a p-value of 0.091. Most of the respondents 246(76.88%) use a refrigerator to protect their food from contamination, whereas 14(4.38%) of them put their foods covered and 60(18.75%) of them put the food in a separate place for protection. The respondents who use refrigerators the bunch of them 211(85.77%) found to be in normal range, the other 30(12.20%) of them moderate, and 5(2.03%) of them severely anemic. The women who put their food covered 12(84.71%) of them were normal and 2(14.29%) of them were in severe anemia. From the study population who put their foods separated 1(1.67%) found severely anemic, 7(11.67%) moderately anemic and the rest 52(86.67) found to be in a normal range.

4.3. Descriptive results for continuous variable

All continuous explanatory variables namely age, parity, educational level, the income of the household, women dietary diversity score, ANC follow up and pay for house rental were analyzed by using a t-test to prove for a possible mean difference between pregnant women with

anemia and normal hemoglobin levels have been shown some significant results. From the seven variables three of them age is 5% significant, educational level 10% significant and women's dietary diversity score come with a 1% significant level. The results are presented in Table 4.

Table 4: t-test for continuous variable and anemia

	Anemic		**Normal**		**Total**			
Name of variable	Mean	SD	Mean	SD	Mean	SD	**T-value**	**p-value**
Age	27	4.745	28	4.267	28	4.361	-2.2142	0.0275**
parity	1.86	1.025	2	1.001	2	1.004	-1.0586	0.2906
education	10.96	3.646	11.9	3.327	11.7	3.383	-1.7642	0.0787*
income	4211	1639	4698	2257	4631	2186	-1.3754	0.1700
WDDS	3	.9947	3	1.199	3	1.191	-3.2352	0.0013***
ANC follow-up	3	1.69	3	1.551	3	1.570	-0.7805	0.4357
House rental	1118	1444	1581	1986	1517	1925	-1.4841	0.1388

Source: analyzed from own survey data (2019)
Note: *** is significant at 1%** is significant at 5% and * is significant at 10%

The mean age of the study population for anemia was 27 and normal range was 28.8. There has been a 5% statistical significant mean difference with a p-value of 0.0275. Educational status is the second variable that was found to have a statistical mean difference with a p-value of 0.0787. The mean educational level that had anemia was 10.9 and normal range was 11.9. This result shows that there is a mean difference between the respondents and dependent variables. Women's dietary diversity score was another variable that shows a mean difference. Dietary diversity score mean for anemic women was 2 and for non anemic were 3. The women dietary diversity is significant with a p-value of 0.0013.

4.4. Nutrition status of respondents by MUAC

Prevalence of undernutrition

From the total sample of the respondent 320, 12(3.75%) of respondents were undernourished from them 1 (0.31%) of the respondents was found to be severely undernourished while 11(3.44%) of them are moderately undernourished and the remaining 308(96.25%) found

normal. Maternal undernutrition has been linked to poor pregnancy outcomes such as poor fetal development, preterm births, small for gestational age, and low birth weight. In turn, these outcomes lead to increased infant morbidity and mortality. In low-resource settings, mid-upper arm circumference (MUAC) has been widely accepted as a measure of fat-free mass, and changes in MUAC tape measure can be a useful indicator of protein-energy malnutrition or starvation.

Table 5: Nutrition status of the respondents based on MUAC

Nutrition status	**Count**	**%**
Severe undernourished (<180mm)	1	0.31
Moderately undernourished (≥ 180 to < 210mm)	11	3.44
Normal (≥ 210 mm)	308	96.25
Total	320	100.00

Source: analyzed from own survey data 2019, MUAC- mid-upper arm circumference

4.4.1. Nutrition status by hemoglobin levels

Prevalence of anemia

In this research, from the total respondents 14.6% were anemic with hemoglobin factors less than 11 mmol/l out of this 8(2.5%) of respondent were severely anemic with a level of <7 mmol/l and 37(11.56%) were presented with moderate anemia a level between 7mmols/l and 11mmols/l. While 275(85.94%) found to be normal with hemoglobin factors greater than 11mmols/l. Anemia during pregnancy is defined by the Centers for Disease Control and Prevention (CDC) and World Health Organization (WHO) as a hemoglobin concentration less than11 g/dl (mmol/l). Also, anemia is considered as a condition in which the number and size of red blood cells, or the hemoglobin concentration, falls below an established cut-off value, as a result, leads to impairment of the capacity of the blood to transport oxygen around the body.

Anemia is observed as an indicator of both poor nutrition and poor health. It impairs health and well-being in women and increases the risk of maternal and neonatal adverse outcomes. During pregnancy anemia is responsible for a lot of complications in women. Some of those associated problems are less exercise tolerability, puerperal infection, thrombo-embolic problems,

postpartum hemorrhage, pregnancy-induced hypertension, placenta praevia, cardiac failure, low birth weight, preterm delivery, and prenatal death. Even if anemia is a worldwide public health problem affecting numerous people in all age groups, particularly then the burden of the problem is higher among pregnant women.

Table 6: Nutrition status of the respondents based on Hemoglobin

Anemia	**count**	**Percent**
Severe Anemic(<7mmols/l)	8	2.50
Moderately Anemic (≥ 7mmols/l to 11mmols/l)	37	11.56
Normal (>11mmols/l)	275	85.94
Total	320	100.00

Source: analyzed from own survey data (2019)

Anemia and dietary diversity

As the research finding shows from the pregnant women attending antenatal clinic at the study area 197(61.56%) of them are in the category of low dietary diversity that means they consumed less than 4 food groups, while the rest 123(38.44%) is in a higher dietary diversity score category which is greater than or equal to 4 food groups per 24hrs out of the nine food groups recommended for women dietary diversity scores (WDDS) see on table 7.

Out of the 197 women, 7(3.6%) of them found to be severely anemic, 31(15.7%) were moderately anemic and 159(80.7%) were in a normal range of hemoglobin level. The women who diversify their diet more than and equal to four have experienced 1(0.8%) severe anemia, 6(4.9%) moderate anemia, 116 (94.3%) a normal range category for anemia. As we observe from the above table the chi-square test results show that dietary diversity statistically significant with a P-value of 0.003 with anemia status of the mothers.

Table 7: Dietary diversity and anemia

WDDS	**Anemia**				
	severe	Moderate	normal	Total	%
less than four food group	7	31	159	197	61.56
greater than equal to four food group	1	6	116	123	34.44
Total	8	37	275	320	100.00

Source: analyzed from own survey data (2019)

4.5. Dietary diversity and dietary intake of the respondents

Consumption of foods based on food groups

A total of 312(97.5%) of the study population had consumed cereals in the previous 24 hours which is predominant. The main cereal consumed was teff and wheat in the form of injera and bread respectively. Dark green leafy vegetables are consumed by 92(28.75%) of the study population. As we continue our assessments 119(37.2%) consume Vitamin A rich fruits White tubers and roots. Fruits and vegetables were consumed by 129(40.3%) of the respondents. During the focus group discussions held with the pregnant women, they affirmed that:

"Most people consume teff mainly because it's the most preferable food to bake injera the cultural favorable food. This is what easily available but those who have money may eat some meat as meat is considered as the sign of being wealthy." (Respondents)

Despite the high requirements for the intake of iron during pregnancy 9(2.8%) of the study population, had consumed organ meats which are presumed to be iron rich and contribute to the formation of blood and is expected to improve the hemoglobin status of an individual. Flesh meats, Fish were taken by 36(11.25%) of the respondents. Eggs were consumed by 53(16.6%) of pregnant women. 80.9 % (n=259) of the study population were reported taken legumes, nuts and seeds and milk and milk products were consumed by over 19% (n=53). The consumption of organ meats iron-rich foods, flesh meats, and eggs which are good sources of the heme iron that is readily absorbed was very low and this, therefore, may explain the high prevalence of anemia among pregnant women. It is noticeable that the consumption of animal-based proteins was very low. During the FGDs, one respondent had the following to say concerning the consumption of meat:

"... Most of the time, we slaughter animals or meat from the market when there is a special occasion such as holidays, wedding ceremonies, mehaber (socially gathered groups traditional) and special guests. However, some families slaughter especially those who are rich. But women will not eat organ meat because it is not recommended to eat raw meat at the time of pregnancy." (Respondent)

Table 8: Dietary diversity by food groups

Food group	**count (N=320)**	**%**
Starchy staples (Cereals and Vitamin A rich vegetables tubers)	312	97.5
Dark green leafy vegetables	92	28.75
Vitamin A rich fruits White tubers and roots	119	37.2
Fruits and vegetables	129	40.3
Organ meat (iron rich)	9	2.8
Flesh meats Fish	36	11.25
Eggs	53	16.6
Legumes, nuts and seeds	259	80.9
Milk and milk products	63	19.7

Source: analyzed from own survey data (2019)

Women dietary diversity score based on 24 hour recall

The results (Table 5) shows that from the pregnant women attending antenatal clinic at the study area 197(61.56%) of them are in the category of low dietary diversity that means they consumed less than 4 food groups, while the rest 123(38.44%) are in a higher dietary diversity score category which is greater than or equal to 4 food groups per 24hrs out of the nine food groups recommended for women dietary diversity scores (WDDS). According to FAO 2011 dietary diversity below 4 groups in 24hrs is considered as low dietary diversity range and equals or greater than 4 in 24hrs is considered as high score or normal dietary diversity.

Table 9: Women dietary diversity categorized according to FAO, 2007.

WDDS	**Count**	**%**
less than four food group	197	61.56
greater than equal to four food group	123	38.44
Total	320	100.00

Source: analyzed from own survey data (2019)

4.6. Statistical analysis and discussion

The researcher further investigates the collected data with logistic and ordered logistic regression to determine if the variables affect dietary diversity and nutritional status respectively.

4.6.1. Model diagnosis test results

Multi-co linearity is a statistical phenomenon in which there exists a perfect or exact relationship between the predictor variables. When there is a perfect or literal connection among the predictor variables, it is difficult to come up with consistent estimates of their coefficients. This finally results in false conclusions about the relationship between the outcome variable and predictor variables.

There are several ways of diagnosing the presence of multi-co linearity: Examination of Correlation Matrix, link test, the goodness of fit test, Variance Inflation Factor (VIF) and Eigensystem Analysis of Correlation Matrix. In this study, we used a Correlation Matrix, link test, goodness of fit and variance inflation factor. According to Gujarati (2004) by the rule of thumb is that if the correlation coefficient between two explanatory variables is high, say, above of 0.8 and below -0.8, then multi-co linearity is a serious problem. With this approach correlation coefficient between two explanatory variables found to be by far below 0.8 in absolute terms indicating no serious problems of multi-co linearity between variables. Another use of correlation test is employed before regression (annex 5).

The model goodness of fit test of the logistic regression justifies that the model is robust enough to explain the dependent variable. The Pseudo R2 statistic of the model is 0.5094 which lies between 0 and 1 an evidence that the variable is well fit for the model and the independent variable could explain the dependent variable

Link test for model specification error is performed for the other ordered dependent variable with a null hypothesis shows there is no model specification error. If the p-value of hatsq is not significant then we reject the null hypothesis and confirm that our model is correctly specified. For factors affecting dietary diversity the p-value is 0.739 this indicates that the value is not significant and we fail to reject the null hypothesis and accept that there is no model specification error. For the determinants of under nutrition the p-value is 0.222 this implies that the value is not significant and we reject the null hypothesis and confirm that there is no model specification

error. Similarly, for determinants of nutrition by hemoglobin level, the p-value is 0.975 and also we reject the null hypothesis and accept that the model specification has no error at the same time.

Table 10: Diagnostic test result for regression models

Tests	**Test name**	**Determinants of WDDS (Logit)**	**Determinant of anemia ordered logit**	**Determinant of under nutrition ordered logit**
Gof	Pearsons (chi^2)	0.5094	_	_
corr	Multi collinarity	Min = -0.1476	Min = -0.3637	Min = -0.1559
		Max = 0.2517	Max = 0.6376	Max = 0.6
Link test	hatsq	0.739	0.975	0.222
vif	Mean vif	1.08	1.32	1.18

Source: analyzed from own data (2019)

Lastly, the VIF measures how much the variance of an estimated regression coefficient increases if your predictors are correlated. A VIF around 1 is very good. There are some guidelines we can use to determine whether VIFs are in an acceptable range. A rule of thumb commonly used in practice is if a VIF is > 10, you have high multi co-linearity. In this case, with values around 1, we are in good shape and can proceed with our regression. In all the three models VIF value of 1.08, 1.32 and 1.18 for determinants of dietary diversity, for determinants of anemia and for determinants of undernutrition, respectively. Therefore, it can be concluded that there is no multi co-linearity between our variable.

4.6.2. Determinants of dietary diversity

The influence of independent variables on the probability of being in high and low dietary diversity was analyzed by using logistic regression. In other words, the variables age, frequency of meals per 24hrs, income, type of food consumed come from, antenatal follow-up, how to wash utensils, hemoglobin level, morbidity, and handwashing practice were computed to see if they are a factor for low and high dietary diversity.

The finding of the logistic regression shows (table 11) that income, meals that were eaten in the last 24 hours, taking iron-fortified foods and anemia are the determinant factors.

Table 11: Logistic regression for determinants of dietary diversity

Dietary diversity	Coef.	Std. Err.	Z	P>z	Marginal effect (dy/dx)
Age	-.0332291	.0069	-1.11	0.266	-.0076756
Income	.0000978	.00001	1.71	0.088*	.0000226
inthelast24hours	.7962723	.04716	3.90	0.000***	.1839311
The food consumed	-.2174324	.07653	-0.66	0.512	-.0502248
morbidity	-.2475938	.09346	-0.61	0.541	-.0571917
Iron-fortified food	-.5428589	.06131	-1.84	0.041**	-.1253951
Anti-natal clinic	-.1219145	.01894	-1.66	0.137	-.0281611
How to clean utensils	.158987	.06203	0.59	0.554	.0367244
The steps to wash hand	.1443558	.04104	0.81	0.417	.0333448
Hemoglobin	1.068671	.08807	2.80	0.005***	.2468526

Source: analyzed from own data (2019)

NB: ***p<0.01 **p<0.05and *p<0.1

The marginal effect result reveals that as the meals that are eaten in 24 hours increases by one the likelihood of the food being diversified also increases by 16.17%. This implies that access to have more meals per day has a positive and significant outcome on dietary diversity. A study was done by Me´jean *et al., (*2010) consumption of fewer than three daily meals was found to have an impact on dietary diversity. This shows us the result found from the study population similar to their study findings.

The same result is obtained from this research. The fact that income contributes positively to the dietary practice of the participant is a remarkable outcome of this study. It is found that the probability of highly diversified increases when income increases by one. This result is in line with Woldemariam *et al.,* (2016) which has found out that income has statistically positive significant outcomes. Researchers found out those families which have greater incomes and resources tend to have more diverse diets as food access is determined by income and the prices of foods (Brinkman *et al.,* 2009).

Research done by prentice *et al.,* (2016) found out that fortified iron foods are consumed less when there is organic diversified diet consumption. The results obtained from this study also imply the same as their findings. Iron-fortified foods are negatively associated with dietary diversity. When the women has the chance of consuming iron-fortified foods by one the probability of the women being in high dietary diversity decreases by 12.53%. This is maybe because the mothers are less introduced to iron-fortified foods or maybe they prefer to get foods that are not processed. The other reason behind also could be when the study population prefer to eat diversified diets there would be a likelihood of getting each and every nutrient that they need from the food they consume.

Similarly, the hemoglobin level of the respondents shows a positive relationship with dietary diversity. This finding of this study is the same as the result obtained in a study done by Desta *et al.,* (2019). If hemoglobin increases by one the probability of the diet to be highly diversified also increases by 24.68%. This result shows us the more diversified the diet the more the women become healthy. A diversified diet has been associated with several improved outcomes in areas such as birth weight, child anthropometric status, and improved hemoglobin concentrations.

4.6.3. Determinants of nutritional status

Determinants of anemia

Age, educational level, occupation, occupation of husband, income, women dietary diversity score, micronutrient supplementation, taking the supplement daily, antenatal follow-up, morbidity, type of west disposal, how to wash utensils, and handwashing practice were computed to see if they are a factor for nutritional status by hemoglobin level. Sever, moderate, and normal anemia are nutritional indicators (table 12).

The marginal effect shows that age is negatively related to moderate anemia. This implies that when age increase by one the probability of being moderately anemic decreases by 0.5%. From the findings, we also can see the results of the marginal effect and they show that age is positively related to normal anemia or being nourished. In this research, it's found that when age increases by one the probability of being nourished decreases by 0.6%. Maternal factors like age have been shown to influence the dietary diversity and intern the anemic status the study done by Me´ jean *et al., (*2010) has a similar finding with the study results.

The finding of this study reveals women's dietary diversity is one of the factors for anemia. As the marginal effect result shows, the WDDS is both negatively and positively associated with anemia. This tells when WDDS increases by one the probability of being in a severe anemia decreases by 2.57% and the probability of being in moderate anemia decreases by 10.66%. But, a different effect is observed in the other result which is the probability of being in a normal range of hemoglobin level is positively associated with dietary diversity. That is, when WDDS increases by one the likelihood of being nourished also increases by 13.24%. The result findings are similar to research by Zerfu *et al*., (2016). The findings were women dietary diversity during pregnancy is associated with reduced risk of maternal anemia.

In this research, the marginal effect shows that when the probability of not taking iron supplementation daily increase by one the likelihood of being in moderate anemia also increases by 0.09%. In another way round it means not taking iron supplements daily has a negative impact on anemic status. A different effect had been seen on being in normal anemic status. The variable is positively related means when the probability of taking iron supplements increases the likelihood of the mother being in normal range increases by 0.1%. This research finding relates to the findings of Taye *et al*., (2015). The findings were limited adherence is thought to be a major reason for the low effectiveness of iron supplementation programs.

Finally, the marginal effect reveals that the Morbidity status is both negatively and positively related to anemic status. The result shows when the probability of the mother being sick increases by one the probability of the mother being in moderate malnutrition decreases by 7.3%. This shows a negative relationship. Another finding was that when the probability of morbidity status increases by one the likelihood of the mother being in normal anemic status or nourished increases by 9.4%. This shows a positive relationship. This result is also in conformity to founding of (Agan *et al*., 2010).

Table 12: Ordered regression result for nutritional status by aneamia

Variables	Marginal effect Severe aneamia	Marginal effect Moderate aneamia	Marginal effect Normal
Age	-0.0015(0.0009)	-0.0054(0.0032)*	0.0069(0.0041)*
Education	-0.0036(0.0042)	-0.0129(0.0152)	0.0165(0.0192)
Occupation	-0.0029(0.0023)	-0.0107(0.0070)	0.0136(0.0091)
Occupation of husband	0.0001(0.0031)	0.0002(0.0114)	-0.0003(0.0145)
Income	-7.96e-07(1.73e-06)	-2.90e-06(6.17e-06)	3.69e-06(.7.88e-06)
WDDS	-0.0258(0.0109)***	-0.1067(0.0281)***	0.1325(0.0338)***
Micronutrient supplementation	0.0005(0.0132)	0.0019(0.0481)	-0.0024(0.0613)
How to take Micronutrient	0.0003(0.0002)	0.0009(0.0006)*	-0.0012(0.0007)*
Antenatal follow-up	-0.0003(0.0027)	-0.0010(0.0098)	0.0013(0.0126)
Morbidity	-0.0203(0.0143)	-0.0739(0.0402)*	0.0943(0.0527)*
Waste disposal	-0.0096(0.0134)	-0.0348(0.0463)	0.0444(0.0409)
How you clean utensils	0.0019(0.0090)	0.0072(0.0319)	-0.0092(0.0242)
Hand washing practice	-0.0030(0.0053)	-0.0111(0.0190)	0.0141(0.2216)

Source: analyzed from own data (2019)

NB: ***p<0.01, ** p<5 and *p<0.1 respectively

Standard error in parentheses

Determinants of undernutrition

Malnutrition in women results in reduced productivity, increased susceptibility to infections, slow recovery from illness, and heightened risks of adverse pregnancy outcomes. Maternal diets during pregnancy need to provide energy and nutrients for the mother as well as for fetal growth. As per the objective of the study we had been studding the determinant factors for under nutrition. Variables age, parity, income, taking the supplement daily, morbidity, how to clean

utensils, type of residency, source of fuel for food preparation, how to store fresh foods, dietary diversity score, and west disposal were computed for determinants of malnutrition or undernourished. Table 13 shows the results from ordered logistic regression.

Table 13: Ordered regression for determinants of undernutrition

Variables	**Marginal effect (dy/dx) Severe under nutrition**	**Marginal effect (dy/dx) Moderate under nutrition**	**Marginal effect (dy/dx) Normal**
Age	0.0002(0 .0003)	0.0018(0.0019)	-0.0019(0.0022)
Parity	-0.0021(0.0026)	-0.0217(0.0172)	0.0238(0.0187)
Income	-7.04e-07(5.02e-07)*	-7.18e-06(5.00e-06)	7.88e-06(4.95e-06)
Taking supplement	0.00003(0.00005)**	0.0004(0.0002)*	-0.0004(0.0002)*
morbidity	-0.0024(0.0047)	-0.0249(0.0264)	0.0273(0.0307)
How you clean utensils	-0.0023(0.0022)**	-0.0236(0.0125)*	0.0259(0.0128)**
Type of residency	-0.0013 (0.0017)	-0.0129(0.0194)	0.0143(0.0207)
Food preparation	0.0007(0.0014)	0.0073(0.0086)	-0.0081(0.0098)
How to store fresh foods	-0.0017(0.0024)	-0.0174(0.0166)	0.0191(0.0181)
Dietary diversity score	-0.0002(0.0009)	-0.0019(0.0095)	0.0022(0.0105)
West disposal	0.0028(0.0047)	0.0293(0.0234)	-0.0322(0.0276)

Source: Analyzed from own data (2019)
NB: ** p<5 and *p<0.1
Standard error in parentheses

The finding of the study shows that income, morbidity, and taking a supplement daily are the significant factors at different levels of significance.

The result of the study shows that income has been the determinant factor for undernutrition. The marginal effect shows that when income increases by one unit the likelihood of the women being severely malnourished decreases at a 10% significant level. And this shows income is negatively significant to undernourishment. The result is supported by research which had shown that families which have greater incomes and resources tend to have more diverse diets as food access is determined by income and the prices of foods (Ramirez and Delisle, 2006).

In another hand, not taking micronutrient supplementation daily is also a determinant factor for undernutrition. Severe undernutrition is positively related to not taking supplementation of micronutrient with a statistical significant p-value of 0.05. This implies that when a chance of not taking micronutrients daily increases by one the probability of pregnant women being in under nutrition also increases. Similarly, while the probability of not taking micronutrient daily increases by one the chance of being in moderate undernutrition also increases and has a significant p-value of 0.1. Moderate malnutrition is positively associated with taking micronutrient daily. In another way, the marginal effect shows that as the probability of taking micronutrient increases by one the probability being nourished also increases at10% significant level. Researchers found out that Low micronutrient intake has been found to be a problem even in countries undergoing a transition in terms of development (Arimond *et al.,* 2010). This result has also a similar finding with the finding of the study.

Finally, Table 13 shows the way to clean utensils after preparing food is one of a factor that was determining undernutrition for mothers. Cleaning utensils properly has a positive significant association with undernutrition. When the chance of the utensils being clean increases, the likelihood of being severely undernourished decreases by 0.23% at 5% significant level and this tells that they are positively associated. The chance of being moderately undernourished also decreases by 0.24% at a 10% significant level when the probability of the utensil being cleaning increases. This also shows the variable is negatively associated with under nourishment. Different observation results have been shown on the independent variable that is a negative association with nourishment at 5% significant level. This implies that when the likelihood of the utensils being clean increases the probability of being nourished decreases.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusion

The aim of the study was to assess determinants of dietary diversity consumption, and nutritional status among pregnant women and it was conducted at Armed Forces Comprehensive Specialty Hospital. Determinants of dietary diversity and nutritional status of pregnant women were unknown to fill the information, literature and methodology gaps for the academia, the government, ministry of health, hospitals, and the people

The findings of the study indicate that the nutritional status of pregnant women especially anemia and undernutrition is middling although it was prevalent by 14.6% and 3.76% respectively. This result is lower than the national and from the findings of anemia and malnutrition in Addis Ababa. The prevalence of anemia indicates that there could be a high proportion of the population that is at risk of maternal and fetal consequences of anemia and thus the need for further investigation. The incidences have a serious implication with regard to the micronutrient status of pregnant women because there was a lack of consistency in taking micronutrient supplementation. The malnutrition rate among pregnant women in the study area is a concern as there are risks that are associated with undernutrition in pregnancy. Women and their children risk consequences such as chronic illnesses in later years.

Dietary diversity of the pregnant women was underprivileged and low as such there is a need to scale up interventions geared towards addressing nutrition status among pregnant women. It's mainly a cereal-based diet as of the national findings revealed it's a monotonous cereal based diet. The low consumption of iron-rich foods such as eggs, flesh meats and organ meats which also have highly bioavailable iron is of concern as the foods were readily available in the community. The pregnant women are therefore at high risk of anemia which can be prevented. The high prevalence of anemia indicates that there could be a high proportion of the population that is at risk of maternal and fetal consequences of anemia and thus the need for further investigation. The dietary diversity of women needs to be improved in order to ensure dietary quality and reduce the consequences of poor dietary diversity. The low dietary intake by the pregnant women implies that future generations are threatened given that the pregnant women could be giving birth to low birth weight infants as a result of which the worsening cycle of malnutrition shall continue to exist among the population.

The result of logistic regression analysis indicated that among the independent variables that are associated with dietary diversity include household income, meals frequency per day and hemoglobin levels which have a positive statistically significant effect. While iron-fortified diet has a negative effect on dietary diversity. The determinants of nutritional status by hemoglobin level (anemia) were analyzed by ordered logistic regression and show that the age of the pregnant women, dietary diversity, micronutrient supplementation, and morbidity status are the associated factors. The findings show that age was negatively related to moderate anemia. Alike it's positively related to normal anemic level. The other significant factor dietary diversity is negatively related to sever and moderate anemia and positively related to being in normal anemic status. Not taking supplements daily has a positive effect on moderate anemia and a negative effect on normal anemia. Lastly, morbidity status has also both positive and negative impact on moderate and on normal anemia.

Whereas, income, micronutrient supplementation, and the way to clean utensils after food preparation is significant factors and show linkage with MUAC. Income is negatively related to sever undernutrition at a 10% statistical significant level. Accordingly not taking supplements daily have a positive effect on severe undernourishement and moderate undernourishement and a negative effect on normal status. Finally, the way to clean utensils after food preparation is negatively related to sever and moderate under nutrition and positively related with nourished. It can, therefore, be concluded that socio-demographic, socio-economic, micronutrient supplementation, morbidity, and environmental factors influence dietary diversity and also the nutritional status of pregnant women.

5.2. Recommendations

Accordingly, based on the finding of the study, the following recommendations have been suggested for critical consideration in light of the discussions drawn hereinbefore and the findings summarized above. The specific recommendations are listed hereunder:

- ✓ There is a need for screening malnutrition in pregnancy as part of nutrition services mothers receives in the antenatal clinic so as to identify any nutritional risks in time for correction. In the course of refreshment awareness creation programs for health care providers by health facilities.

- ✓ Encouragement of dietary diversity and modification of diets through demonstrations in the community by community health workers which are considered as level one and the maternity clinics in all health facilities with an aim to get better dietary diversity and thus the dietary quality of the pregnant women. There have to be need for screening for malnutrition in pregnancy as part of the nutrition services mothers receive in the antenatal clinic so as to identify any nutritional risks in time for correction.
- ✓ The rates of anemia may be reduced by diversification of diets through diet modifications and use of locally available foods. There is a need to promote behavioral changes among pregnant women with regard to the intake of micronutrient supplementation. There should also be an effort to create awareness in the community and especially among the women of reproductive age on the problem of prevalence of malnutrition and anemia with a focus on early prevention. Increase knowledge about healthy foods in pregnancy through the promotion of health education and awareness program on nutrition at the health facilities.
- ✓ Nutritional status by MUAC shows a relationship with income, micronutrient supplementation, and the way to clean utensils after food preparation. Monthly household income is a strongly significant factor for dietary diversity and malnutrition. Thus, Addis Ababa city administration Enterprise and Entrepreneurs Office and NGOs should be weight and work on income-generating activities by providing priority to households who have a limited income source to enhance household income that helps to improve the mother's nutrition and intern the health of the fetus.
- ✓ There is a need for further investigation into the major causes of anemia so as to know the proportion of each cause and thus put a mechanism in place to address the cause. Further research on the impact of anemia on the infants born of anemic mothers is needed. More studies need to be done to compare the nutritional status and dietary diversity status of pregnant women in other arid areas in order to construct locally standardized methodologies of assessing the same. The researcher recommends a study to be conducted on the dietary diversity and nutritional status of HIV infected pregnant women. A comparative study between anemia amongst HIV-positive and healthy pregnant women can also be carried out.

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Annexes

Annex 1. Logistic regression for determinant of dietary diversity

Multi colinearity

```
. corr dietaerydiversityscore newHemoglobin agec income inthelast24hours sickthelasttwoweek ironfortified prepareddinnerkichine describeste
> phowyouwash thefoodconsumed antinatalclinic
(obs=320)
```

	dietae~e	newHem~n	agec	income	inthel~s	sickth~k	ironfo~d	prepar~e	descri~h	thefoo~d	antina~c
dietaerydi~e	1.0000										
newHemoglo~n	0.1832	1.0000									
agec	-0.0222	0.1116	1.0000								
income	0.1444	0.0534	0.0687	1.0000							
inthelast2~s	0.2517	0.1240	0.0739	0.1289	1.0000						
sickthelas~k	0.0245	0.1323	0.1144	0.0491	0.1394	1.0000					
ironfortif~d	-0.1179	-0.0337	-0.1476	-0.0889	-0.0990	-0.0148	1.0000				
prepareddi~e	0.0516	-0.0168	0.0021	-0.0221	0.0929	-0.0518	-0.0359	1.0000			
describest~h	0.0959	0.0514	-0.0075	0.1499	0.0582	0.0824	0.1110	0.0624	1.0000		
thefoodcon~d	-0.0618	-0.0861	0.0343	-0.0871	0.0238	-0.0687	-0.0502	-0.0602	-0.3053	1.0000	
antinatalc~c	-0.0551	0.0327	0.1648	0.0368	0.0877	-0.0184	-0.1471	0.0365	-0.1540	-0.0204	1.0000

logistic regression

```
. logit dietaerydiversityscore newHemoglobin agec income inthelast24hours sickthelasttwoweek ironfortified prepareddinnerkichine describest
> ephowyouwash thefoodconsumed antinatalclinic

Iteration 0:   log likelihood = -213.17291
Iteration 1:   log likelihood = -191.56972
Iteration 2:   log likelihood = -191.14435
Iteration 3:   log likelihood = -191.14282
Iteration 4:   log likelihood = -191.14282

Logistic regression                             Number of obs     =        320
                                                LR chi2(10)       =      44.06
                                                Prob > chi2       =     0.0000
Log likelihood = -191.14282                     Pseudo R2         =     0.1033
```

dietaerydiversityscore	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
newHemoglobin	1.068671	.3873122	2.76	0.006	.3095534	1.827789
agec	-.0332291	.0298993	-1.11	0.266	-.0918306	.0253724
income	.0000978	.0000573	1.71	0.088	-.0000145	.00021
inthelast24hours	.7962723	.2058922	3.87	0.000	.3927309	1.199814
sickthelasttwoweek	-.2475938	.4047225	-0.61	0.541	-1.040835	.5456477
ironfortified	-.5428589	.2657557	-2.04	0.041	-1.063731	-.0219874
prepareddinnerkichine	.158987	.2686366	0.59	0.554	-.367531	.6855051
describestephowyouwash	.1443558	.1777181	0.81	0.417	-.2039652	.4926768
thefoodconsumed	-.2174324	.3313605	-0.66	0.512	-.866887	.4320222
antinatalclinic	-.1219145	.0820349	-1.49	0.137	-.2826999	.0388709
_cons	-4.549759	2.053604	-2.22	0.027	-8.574748	-.5247701

Marginal effect

```
. mfx

Marginal effects after logit
      y  = Pr(dietaerydiversityscore) (predict)
         =  .36212389
```

variable	dy/dx	Std. Err.	z	P>|z|	[	95% C.I.	]	X
newHem~n	.2468526	.08807	2.80	0.005	.074236	.419469		2.83438
agec	-.0076756	.0069	-1.11	0.266	-.021201	.00585		28.5938
income	.0000226	.00001	1.71	0.088	-3.3e-06	.000049		4631.89
inthel~s	.1839311	.04716	3.90	0.000	.091495	.276367		3.30938
sickth~k	-.0571917	.09346	-0.61	0.541	-.240369	.125986		1.88437
ironfo~d	-.1253951	.06131	-2.05	0.041	-.245558	-.005233		1.65625
prepar~e	.0367244	.06203	0.59	0.554	-.084844	.158293		2.90313
descri~h	.0333448	.04104	0.81	0.417	-.047091	.11378		3.5
thefoo~d	-.0502248	.07653	-0.66	0.512	-.200229	.099779		1.81875
antina~c	-.0281611	.01894	-1.49	0.137	-.065284	.008961		3.19062

Goodness of fit test for dietary diversity

```
. estat gof

Logistic model for dietaerydiversityscore, goodness-of-fit test

      number of observations =       320
 number of covariate patterns =       319
           Pearson chi2(308) =       306.75
                 Prob > chi2 =         0.5094
```

Variance inflation factor for dietary diversity

```
. estat vif
```

Variable	VIF	1/VIF
describest~h	1.18	0.846565
thefoodcon~d	1.13	0.884733
antinatalc~c	1.08	0.922444
inthelast2~s	1.08	0.927107
agec	1.07	0.930999
ironfortif~d	1.07	0.938418
sickthelas~k	1.06	0.945071
income	1.06	0.945784
newHemoglo~n	1.05	0.954191
prepareddi~e	1.03	0.975446
Mean VIF	1.08	

Link test for dietary diversity

```
. linktest
```

Source	SS	df	MS	Number of obs	=	320
				F(2, 317)	=	22.62
Model	9.45768597	2	4.72884298	Prob > F	=	0.0000
Residual	66.264189	317	.209035297	R-squared	=	0.1249
				Adj R-squared	=	0.1194
Total	75.721875	319	.237372649	Root MSE	=	.4572

dietaerydi~e	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	.8591032	.4487433	1.91	0.056	-.0237883	1.741995
_hatsq	.201405	.6051394	0.33	0.739	-.9891921	1.392002
_cons	.0184628	.0836897	0.22	0.826	-.1461948	.1831203

Annex 2. Ordinal regression for nutritional status by anemia

Multi co-linearity for anemia

```
. corr agec educationcat ocupation ocupationhusband income dietaerydiversityscore areyoutakinganymicronutrient doyoutake antin
> atalclinic sickthelasttwoweek dispose prepareddinnerkichine describestephowyouwash
(obs=320)
```

	agec	educat~t	ocupat~n	ocupat~d	income	dietae~e	areyou~t	doyout~e	antina~c	sickth~k	dispose	prepar~e
agec	1.0000											
educationcat	0.0337	1.0000										
ocupation	0.0063	-0.5081	1.0000									
ocupationh~d	0.0263	-0.1055	0.2155	1.0000								
income	0.0687	0.4684	-0.3637	0.1145	1.0000							
dietaerydi~e	-0.0222	0.1715	-0.1583	-0.0619	0.1444	1.0000						
areyoutaki~t	-0.0796	-0.0665	0.1211	-0.1088	-0.0594	-0.0650	1.0000					
doyoutake	-0.0950	-0.1109	0.1684	-0.1047	-0.0832	-0.0422	0.6376	1.0000				
antinatalc~c	0.1648	0.0254	-0.0080	-0.0135	0.0368	-0.0551	-0.2631	-0.1835	1.0000			
sickthelas~k	0.1144	-0.0168	-0.0593	0.0664	0.0491	0.0245	-0.0272	0.0200	-0.0184	1.0000		
dispose	-0.0936	0.0191	-0.0641	0.1036	0.0352	-0.0467	0.0074	-0.0663	-0.1193	0.0447	1.0000	
prepareddi~e	0.0021	-0.0331	0.0970	0.1004	-0.0221	0.0516	-0.0221	-0.0644	0.0365	-0.0518	-0.0355	1.0000
describest~h	-0.0075	0.0037	-0.0789	0.1641	0.1499	0.0959	-0.0496	-0.0602	-0.1540	0.0824	0.0961	0.0624

	descri~h
describest~h	1.0000

Variance inflation factor for anemia

```
. estat vif
```

Variable	VIF	1/VIF
areyoutaki~t	1.80	0.554773
doyoutake	1.75	0.572792
educationcat	1.58	0.631688
ocupation	1.55	0.646258
income	1.43	0.699983
ocupationh~d	1.17	0.852328
antinatalc~c	1.15	0.869138
ddscore	1.12	0.891787
describest~h	1.11	0.902920
agec	1.06	0.947632
sickthelas~k	1.05	0.953733
prepareddi~e	1.04	0.965671
Mean VIF	1.32	

Ordered logit for anemia

```
. ologit newHemoglobin agec educationcat ocupation ocupationhusband income i.dietaerydiversityscore areyoutakinganymicronutrie
> nt doyoutake antinatalclinic sickthelasttwoweek dispose prepareddinnerkichine describestephowyouwash,r

Iteration 0:   log pseudolikelihood = -151.01117
Iteration 1:   log pseudolikelihood = -138.33944
Iteration 2:   log pseudolikelihood = -136.57756
Iteration 3:   log pseudolikelihood =  -136.5695
Iteration 4:   log pseudolikelihood =  -136.5695

Ordered logistic regression                     Number of obs     =        320
                                                Wald chi2(13)     =      31.22
                                                Prob > chi2       =     0.0031
Log pseudolikelihood =  -136.5695               Pseudo R2         =     0.0956
```

newHemoglobin	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
agec	.0634158	.038318	1.65	0.098	-.0116861	.1385176
educationcat	.1510779	.1769505	0.85	0.393	-.1957388	.4978945
ocupation	.1247569	.0840323	1.48	0.138	-.0399434	.2894571
ocupationhusband	-.002431	.1330023	-0.02	0.985	-.2631106	.2582487
income	.0000339	.0000722	0.47	0.639	-.0001076	.0001754
1.dietaerydiversityscore	1.4156	.4193892	3.38	0.001	.5936123	2.237588
areyoutakinganymicronutrient	-.0216959	.5622371	-0.04	0.969	-1.12366	1.080269
doyoutake	-.0113805	.0066723	-1.71	0.088	-.024458	.001697
antinatalclinic	.012214	.1155241	0.11	0.916	-.2142091	.2386371
sickthelasttwoweek	.8644063	.4828998	1.79	0.073	-.0820599	1.810873
dispose	.4071878	.5489187	0.74	0.458	-.6686731	1.483049
prepareddinnerkichine	-.0842323	.3735677	-0.23	0.822	-.8164115	.647947
describestephowyouwash	.1294081	.2216161	0.58	0.559	-.3049515	.5637677
/cut1	1.943638	2.463556			-2.884843	6.772119
/cut2	3.904887	2.487163			-.9698625	8.779636

Marginal effect one for outcome one(sever anemia)

```
. margins, dydx(*) predict(outcome(1))

Average marginal effects                        Number of obs     =        320
Model VCE    : Robust

Expression   : Pr(newHemoglobin==1), predict(outcome(1))
dy/dx w.r.t. : agec educationcat ocupation ocupationhusband income 1.dietaerydiversityscore areyoutakinganymicronutrient
               doyoutake antinatalclinic sickthelasttwoweek dispose prepareddinnerkichine describestephowyouwash
```

	dy/dx	Delta-method Std. Err.	z	P>|z|	[95% Conf.	Interval]
agec	-.0014903	.0009975	-1.49	0.135	-.0034454	.0004648
educationcat	-.0035504	.0041654	-0.85	0.394	-.0117144	.0046135
ocupation	-.0029319	.002331	-1.26	0.208	-.0075005	.0016368
ocupationhusband	.0000571	.0031257	0.02	0.985	-.006069	.0061833
income	-7.96e-07	1.73e-06	-0.46	0.645	-4.18e-06	2.59e-06
1.dietaerydiversityscore	-.02576	.0109407	-2.35	0.019	-.0472034	-.0043166
areyoutakinganymicronutrient	.0005099	.0132381	0.04	0.969	-.0254363	.026456
doyoutake	.0002674	.0001631	1.64	0.101	-.0000521	.000587
antinatalclinic	-.000287	.0027177	-0.11	0.916	-.0056137	.0050396
sickthelasttwoweek	-.0203141	.0143822	-1.41	0.158	-.0485027	.0078746
dispose	-.0095692	.013487	-0.71	0.478	-.0360031	.0168648
prepareddinnerkichine	.0019795	.0090227	0.22	0.826	-.0157046	.0196636
describestephowyouwash	-.0030412	.0052607	-0.58	0.563	-.013352	.0072697

Note: dy/dx for factor levels is the discrete change from the base level.

Marginal effect two for outcome two (moderate anemia)

```
. margins, dydx(*) predict(outcome(2))

Average marginal effects                        Number of obs     =        320
Model VCE    : Robust

Expression   : Pr(newHemoglobin==2), predict(outcome(2))
dy/dx w.r.t. : agec educationcat ocupation ocupationhusband income 1.dietaerydiversityscore areyoutakinganymicronutrient
               doyoutake antinatalclinic sickthelasttwoweek dispose prepareddinnerkichine describestephowyouwash
```

	Delta-method dy/dx	Std. Err.	z	P>|z|	[95% Conf.	Interval]
agec	-.0054251	.0032367	-1.68	0.094	-.0117689	.0009186
educationcat	-.0129245	.015194	-0.85	0.395	-.0427041	.0168552
ocupation	-.0106728	.0070447	-1.52	0.130	-.02448	.0031345
ocupationhusband	.000208	.0113779	0.02	0.985	-.0220924	.0225083
income	-2.90e-06	6.17e-06	-0.47	0.639	-.000015	9.20e-06
1.dietaerydiversityscore	-.1066919	.02807	-3.80	0.000	-.1617081	-.0516757
areyoutakinganymicronutrient	.0018561	.0480833	0.04	0.969	-.0923855	.0960976
doyoutake	.0009736	.0005884	1.65	0.098	-.0001796	.0021268
antinatalclinic	-.0010449	.0098686	-0.11	0.916	-.0203869	.0182972
sickthelasttwoweek	-.0739487	.0402298	-1.84	0.066	-.1527976	.0049003
dispose	-.0348343	.0462866	-0.75	0.452	-.1255544	.0558858
prepareddinnerkichine	.0072059	.0318884	0.23	0.821	-.0552941	.069706
describestephowyouwash	-.0110707	.0190143	-0.58	0.560	-.048338	.0261967

Note: dy/dx for factor levels is the discrete change from the base level.

Marginal effect three for outcome three (nourished or normal anemic status)

```
. margins, dydx(*) predict(outcome(3))

Average marginal effects                        Number of obs     =        320
Model VCE    : Robust

Expression   : Pr(newHemoglobin==3), predict(outcome(3))
dy/dx w.r.t. : agec educationcat ocupation ocupationhusband income 1.dietaerydiversityscore areyoutakinganymicronutrient
               doyoutake antinatalclinic sickthelasttwoweek dispose prepareddinnerkichine describestephowyouwash
```

	Delta-method dy/dx	Std. Err.	z	P>|z|	[95% Conf.	Interval]
agec	.0069154	.0040807	1.69	0.090	-.0010827	.0149135
educationcat	.0164749	.0191651	0.86	0.390	-.0210879	.0540377
ocupation	.0136046	.0091307	1.49	0.136	-.0042912	.0315004
ocupationhusband	-.0002651	.0145035	-0.02	0.985	-.0286915	.0281613
income	3.69e-06	7.88e-06	0.47	0.639	-.0000117	.0000191
1.dietaerydiversityscore	.1324519	.0338391	3.91	0.000	.0661284	.1987754
areyoutakinganymicronutrient	-.0023659	.0613202	-0.04	0.969	-.1225513	.1178194
doyoutake	-.001241	.0007226	-1.72	0.086	-.0026573	.0001753
antinatalclinic	.0013319	.0125844	0.11	0.916	-.023333	.0259968
sickthelasttwoweek	.0942627	.0527053	1.79	0.074	-.0090377	.1975632
dispose	.0444035	.0593353	0.75	0.454	-.0718916	.1606986
prepareddinnerkichine	-.0091855	.0408857	-0.22	0.822	-.0893199	.070949
describestephowyouwash	.0141118	.0241618	0.58	0.559	-.0332444	.0614681

Note: dy/dx for factor levels is the discrete change from the base level.

Annex 3. Ordered logistic regression for undernutrition

Multi co-linearity for MUAC

```
. corr agec parity education income doyoutake sickthelasttwoweek prepareddinnerkichine  socioeconomicyoulive foodpreparat howyoustorfreshfood di
> etaerydiversityscore dispose
(obs=320)
```

	agec	parity	educat~n	income	doyout~e	sickth~k	prepar~e	socioe~e	foodpr~t	howyou~d	dietae~e	dispose
agec	1.0000											
parity	0.6000	1.0000										
education	0.0645	-0.0887	1.0000									
income	0.0687	-0.0869	0.4125	1.0000								
doyoutake	-0.0950	-0.0666	-0.0803	-0.0832	1.0000							
sickthelas~k	0.1144	0.0435	0.0293	0.0491	0.0200	1.0000						
prepareddi~e	0.0021	0.0153	-0.0201	-0.0221	-0.0644	-0.0518	1.0000					
socioecono~e	0.1833	0.2178	0.0126	-0.2749	0.0684	-0.0392	-0.0160	1.0000				
foodpreparat	-0.0014	-0.0284	0.2168	0.1185	-0.0327	0.0271	0.0497	0.0115	1.0000			
howyoustor~d	-0.0767	-0.0807	-0.0591	-0.1410	0.0025	-0.1090	-0.0787	0.0232	-0.1559	1.0000		
dietaerydi~e	-0.0222	-0.0867	0.1961	0.1444	-0.0422	0.0245	0.0516	-0.0709	0.0553	-0.0302	1.0000	
dispose	-0.0936	-0.1040	0.0128	0.0352	-0.0663	0.0447	-0.0355	0.0205	-0.0759	0.0015	-0.0467	1.0000

Ordered logit regression for MUAC

```
. ologit newMUAC agec parity income doyoutake sickthelasttwoweek prepareddinnerkichine socioeconomicyoulive foodpreparat howyoustorfreshfood DDS dispose, r

Iteration 0:   log pseudolikelihood = -54.615137
Iteration 1:   log pseudolikelihood =   -51.2158
Iteration 2:   log pseudolikelihood = -48.623727
Iteration 3:   log pseudolikelihood = -48.595492
Iteration 4:   log pseudolikelihood = -48.595463
Iteration 5:   log pseudolikelihood = -48.595463

Ordered logistic regression                     Number of obs     =        320
                                                Wald chi2(11)     =      24.76
                                                Prob > chi2       =     0.0099
Log pseudolikelihood = -48.595463               Pseudo R2         =     0.1102
```

newMUAC	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
agec	-.0562425	.0603104	-0.93	0.351	-.1744488	.0619638
parity	.6965614	.5475563	1.27	0.203	-.3766292	1.769752
income	.0002307	.0001332	1.73	0.083	-.0000304	.0004918
doyoutake	-.0130337	.006637	-1.96	0.050	-.0260419	-.0000255
sickthelasttwoweek	.7995226	.8749021	0.91	0.361	-.915254	2.514299
prepareddinnerkichine	.7600344	.3384939	2.25	0.025	.0965984	1.42347
socioeconomicyoulive	.4177767	.5998198	0.70	0.486	-.7578486	1.593402
foodpreparat	-.235821	.2758927	-0.85	0.393	-.7765608	.3049187
howyoustorfreshfood	.5585148	.5321624	1.05	0.294	-.4845043	1.601534
DDS	.0631357	.3071672	0.21	0.837	-.538901	.6651723
dispose	-.9432279	.7609105	-1.24	0.215	-2.434585	.5481293
/cut1	-3.334246	3.817227			-10.81587	4.147381
/cut2	-.7484765	4.28064			-9.138376	7.641423

Marginal effect one for outcome 1(sever under nutrition)

```
. margins, dydx(*) predict(outcome(1))

Average marginal effects                        Number of obs     =        320
Model VCE    : Robust

Expression   : Pr(newMUAC==1), predict(outcome(1))
dy/dx w.r.t. : agec parity income doyoutake sickthelasttwoweek prepareddinnerkichine socioeconomicyoulive foodpreparat howyoustorfreshfood DDS dispose
```

	Delta-method					
	dy/dx	Std. Err.	z	P>|z|	[95% Conf.	Interval]
agec	.0001717	.0002918	0.59	0.556	-.0004003	.0007436
parity	-.0021263	.0026284	-0.81	0.419	-.0072778	.0030252
income	-7.04e-07	5.02e-07	-1.40	0.161	-1.69e-06	2.80e-07
doyoutake	.0000398	.0000451	0.88	0.378	-.0000487	.0001283
sickthelasttwoweek	-.0024406	.0046753	-0.52	0.602	-.011604	.0067228
prepareddinnerkichine	-.00232	.0022166	-1.05	0.295	-.0066644	.0020243
socioeconomicyoulive	-.0012753	.0016877	-0.76	0.450	-.004583	.0020325
foodpreparat	.0007199	.0013641	0.53	0.598	-.0019538	.0033935
howyoustorfreshfood	-.0017049	.0023545	-0.72	0.469	-.0063197	.0029099
DDS	-.0001927	.0009772	-0.20	0.844	-.0021079	.0017225
dispose	.0028792	.004743	0.61	0.544	-.0064169	.0121753

Marginal effect two for outcome two (moderate under nutrition)

```
. margins, dydx(*) predict(outcome(2))

Average marginal effects                        Number of obs     =        320
Model VCE    : Robust

Expression   : Pr(newMUAC==2), predict(outcome(2))
dy/dx w.r.t. : agec parity income doyoutake sickthelasttwoweek prepareddinnerkichine socioeconomicyoulive foodpreparat howyoustorfreshfood DDS dispose
```

	Delta-method					
	dy/dx	Std. Err.	z	P>|z|	[95% Conf.	Interval]
agec	.00175	.001936	0.90	0.366	-.0020445	.0055445
parity	-.0216737	.0171602	-1.26	0.207	-.0553071	.0119596
income	-7.18e-06	5.00e-06	-1.44	0.151	-.000017	2.62e-06
doyoutake	.0004055	.0002181	1.86	0.063	-.0000219	.000833
sickthelasttwoweek	-.0248774	.026419	-0.94	0.346	-.0766576	.0269028
prepareddinnerkichine	-.0236487	.0124815	-1.89	0.058	-.0481121	.0008146
socioeconomicyoulive	-.0129993	.0194285	-0.67	0.503	-.0510784	.0250798
foodpreparat	.0073377	.008559	0.86	0.391	-.0094377	.024113
howyoustorfreshfood	-.0173784	.0165535	-1.05	0.294	-.0498226	.0150659
DDS	-.0019645	.0095382	-0.21	0.837	-.020659	.0167301
dispose	.0293489	.0234349	1.25	0.210	-.0165827	.0752804

Marginal effect three for outcome three (nourished)

```
. margins, dydx(*) predict(outcome(3))

Average marginal effects                        Number of obs     =        320
Model VCE    : Robust

Expression   : Pr(newMUAC==3), predict(outcome(3))
dy/dx w.r.t. : agec parity income doyoutake sickthelasttwoweek prepareddinnerkichine socioeconomicyoulive foodpreparat howyoustorfreshfood DDS dispose
```

	Delta-method dy/dx	Std. Err.	z	P>|z|	[95% Conf.	Interval]
agec	-.0019217	.0021745	-0.88	0.377	-.0061836	.0023402
parity	.0238	.018667	1.27	0.202	-.0127867	.0603868
income	7.88e-06	4.95e-06	1.59	0.112	-1.83e-06	.0000176
doyoutake	-.0004453	.0002382	-1.87	0.062	-.0009122	.0000216
sickthelasttwoweek	.027318	.0306968	0.89	0.374	-.0328466	.0874825
prepareddinnerkichine	.0259688	.0128018	2.03	0.043	.0008778	.0510598
socioeconomicyoulive	.0142745	.0206782	0.69	0.490	-.026254	.0548031
foodpreparat	-.0080575	.0097615	-0.83	0.409	-.0271896	.0110746
howyoustorfreshfood	.0190833	.0181487	1.05	0.293	-.0164875	.0546541
DDS	.0021572	.0104958	0.21	0.837	-.0184141	.0227286
dispose	-.0322281	.0275519	-1.17	0.242	-.0862288	.0217726

Linktest for MUAC(under nutrition)

```
. linktest

Iteration 0:   log likelihood = -54.615137
Iteration 1:   log likelihood = -48.776048
Iteration 2:   log likelihood = -47.979814
Iteration 3:   log likelihood = -47.947515
Iteration 4:   log likelihood = -47.947276
Iteration 5:   log likelihood = -47.947276

Ordered logistic regression                     Number of obs     =        320
                                                LR chi2(2)        =      13.34
                                                Prob > chi2       =     0.0013
Log likelihood = -47.947276                     Pseudo R2         =     0.1221
```

newMUAC	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.651004	.817599	2.02	0.043	.0485396	3.253469
_hatsq	-.1498298	.1683374	-0.89	0.373	-.4797649	.1801054
/cut1	-2.90722	1.275848			-5.407835	-.4066041
/cut2	-.2986077	.8930681			-2.048989	1.451774

Variance inflation factor for under nutrition

```
. estat vif
```

Variable	VIF	1/VIF
agec	1.65	0.604341
parity	1.64	0.610118
income	1.20	0.836750
socioecono~e	1.16	0.860594
howyoustor~d	1.07	0.935126
DDS	1.06	0.942273
foodpreparat	1.05	0.951534
sickthelas~k	1.05	0.954295
doyoutake	1.04	0.958077
dispose	1.04	0.964213
prepareddi~e	1.02	0.978758
Mean VIF	1.18	

```
.
```

Annex 4. Questionnaire in English

Letter of Introduction

Hello. My name is Alemtsehay Teshome and I am a student at Addis Ababa University. I am conducting a study on Determinants of Dietary Diversity consumption and Nutritional Status of pregnant women attending at antenatal clinic of Armed Forces Comprehensive Specialized Hospital Addis Ababa Ethiopia.

I and my research assistants will ask you questions about your health and will also measure your Mid Upper Arm Circumference. The questionnaire usually takes 45-60 minutes. Whatever information you shall provide will be kept strictly confidential and will not be shown to any other persons. Participation in the study is voluntary and you can choose not to answer any individual question or all of the questions.

Letter of consent to the pregnant women

By signing below, I accept that I can take part in this research study.
I hereby declare that:

- I have been informed about the research and I have understood the benefits and the risks involved.
- I have had the chance to ask questions and all my questions, have been adequately answered.
- I understand that my participation in this study is voluntary and I have not been pressured to take part in it.
- I understand that I may choose to leave the study at any time and that I will not be penalized or prejudiced in any way.
- I have been assured of confidentiality on any information that will be given by me.

..... ……

Signature of respondent: Date

…….....…..... **.....**

Signature of researcher Date

INDIVIDIVUAL QUESTIONNAIRE FOR PREGNANT WOMEN

Address	Sub-city	Kebele	Questionnaire ID No	Date of Interview (dd /mm/ yy)	Name of interviewer

SECTION 1: SOCIO- DEMOGRAPHIC INFORMATION

No	Questions and Response option	Answer
1.1	Age of mother in completed years	
1.2	Parity	
1.3	Gestation in weeks 1. **First trimester** 2. **Second trimester** 3. **Third trimester**	
1.4	Marital status(enter code) 1. Married 2. Single 3. Divorced 4. Separated 5. Widow	
1.5	Level of education	
1.6	Main Occupation (enter code) 1. Employed (salaried) 2. Waged Labour (Casual) 3. Unemployed 4. Student 5. Merchant trader 6. Housewife **7.** Others	
1.7	Main Occupation of Husband (enter code) 1. Employed (salaried) 2. Waged Labour (Casual) 3. Unemployed 4. Student	

	5. Merchant trader 6. Others	
1.9	**Religion**	

SECTION 2: 24 HOUR RECALL

24 HOUR RECALL QUESTIONNAIRE

Q. No. (code).....

Now I would like to ask you about the types of foods that you ate yesterday during the day and at night.

Tick day of week that you are recalling.

Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday	

STEP 1:			Step 2:	
Food/Drink eaten/drank during the day		content	Forgotten Foods(Prompted)	content
Breakfast				
Snack				
Lunch				
Snack				
Dinner				
Snack				

WOMEN DIETARY DIVERSITY SCORE

No	Food group	Examples	1=Yes 2=No
1.	Starchy staples (Cereals and Vitamin A rich vegetables tubers)	bread, biscuits, cookies or any other foods made from sorghum, maize, spaghetti, pasta, rice, teff wheat, porridge or pastes or other locally available grains pumpkin, carrots, yellow fleshed sweet potatoes	
2.	Dark green leafy vegetables	Spinach, cabbages ,cassava leaves, indigenous green vegetables	
3.	Vitamin A rich fruits White tubers and roots	ripe mangoes, white potatoes, cassava, bananas	
4.	Fruits and vegetables	banana, oranges, Avocado Tomato, onion	
5.	Organ meat (iron rich)	liver, kidney, heart or other organ meats	
6.	Flesh meats Fish	beef, pork, lamb, goat, chicken, or other birds Fresh or dried fish,	
7.	Eggs	eggs	

8.	Legumes, nuts and seeds	beans, peas, lentils, groundnuts	
9.	Milk and milk products	milk, cheese, yogurt or other milk products	
Did you eat anything (meal or snack) outside of the home yesterday?			

Food Availability (food consumption score)

S no		
1.	In the last 24 hours how many meals did you have	
2.	Average number of meals an adult member of the family has per day	
3.	The food consumed at home comes from which of the following sources 1. Home production (Locally produced) 2. Purchased in the shops 3. Borrowed from other people 4. Food aid	

SECTION 3: MICRONUTRIENT SUPPLEMENTATION

No	**Questions and Response option**	**Answer**
3.1	Are you taking any Micro nutrient supplements currently? 1. Yes 2. No **(IF NO, SKIP TO 3.4)**	
3.2	If Yes, Which ones 1. Iron and Folic pills 2. Multiple Micronutrient tablets 3. Others (Specify).....	
3.3	Do you take the supplements daily? 1. Yes 2. No **(IF YES, SKIP TO 3.6)**	
3.4	If no, Why? 1. Bad taste 2. Forget 3. Does Not see importance 4. Not available at the clinic 5. Completed dose	

	6. Others (Specify).....	
3.5	Do you have access to fortified iron fortified foods (Multiple answers possible) Specify**.....**	

SECTION 4: ANC ATTENDANCE AND MORBIDITY

No	Questions and Response option	Answer
4.1	How many times have you attended Ante Natal Clinic? 1. Once 2. Two times 3. Three times 4. Four times **5.** More than 4 times	
4.2	Have you been sick in the last two weeks? 1. Yes 2. No **(If No, SKIP TO 5.0)**	
4.3	What illness were you suffering from? 1. Malaria 2. Anemia 3. Worm infestation 4. Respiratory tract infections 5. Sexually transmitted illnesses **6.** Others	
4.4	Did you seek medical assistance? 1. Yes 2. No **3. (If No, SKIP TO 5.0)**	
4.5	If Yes, where did you seek medical assistance? 1. Private Clinic 2. Government Disp/Hosp 3. Bought medicine from Kiosk 4. Traditional Healer **5.** Others	

SECTION 5: SOCIO-ECONOMIC CHARACTERISTICS OF THE HOUSEHOLDS

No	Questions and Response option	Answer
5.1	Household income	
5.2	Where do you live? 1. Rented house 2. Own house **(IF ANSWER IS 2, SKIP TO 5.3)**	
5.3	If rented how much do you pay per month?	
5.4	Number of Rooms in the dwelling place	

5.5	What is the wall of the house made of? 1. Iron sheets 2. Mud and wooden poles 3. Cement/stone blocks 4. Burnt bricks 5. Mud and cement 6. Others specify.....	
5.6	What is the Roof of the house made of? 1. Iron sheets 2. Tiles 3. Grass thatched 4. Other Specify.....	
5.7	What is the floor of the house made of? 1. Mud 2. Cement 3. Other Specify…….....	
5.8	What is your main source of cooking fuel? 1. Firewood 2. Charcoal 3. Kerosine 4. Gas 5. Electricity 6. Others (Specify).....	
5.9	What is your main source of lighting? 1. Kerosene 2. Electricity 3. Solar 4. Candle 5. Others specify.....	

SECTION 6: ENVIRONMENTAL FACTORS

No	**Questions and Response option**	**Answer**
6.1	What is the main Water source for drinking? 1. Pipe water 2. Public tap 3. Unprotected dug well 4. Protected dug well 5. Rain water 6. Other(Specify)_____	
6.2	What type of toilet do you have? 1. Flush	

	2. Pit Latrine 3. No facilities or bush/field 4. Other(Specify)_____	
6.3	Where is your household dispose waste? 1. Field 2. Dump pit 3. Burn	
6.4	After you have prepared food, kitchen surfaces, pots, pans, plates and utensils are dirty. Can you describe how you clean them usually? 1. Scrape excess food into rubbish bin 2. Wash with hot water 3. Wash with detergent 4. Don't know/no answer	
6.5	How do you store perishable fresh foods such as raw meat, poultry and seafood? 1. In the refrigerator (below 5 °C)/cool box 2. Covered (protected from insects, rodents, pests and dust) 3. Separated from cooked or ready-to-eat foods 4. Other 5. Don't know/no answer	
6.6	Could you please describe step by step how you wash your hands? 1. Washes hands in a bowl of water (sharing with other people) — poor practice 2. With someone pouring a little clean water from a jug onto one's hands — appropriate practice 3. Under running water — appropriate practice 4. Washes hands with soap or ashes 5. Other 6. Don't know/no answer	

SECTION 7: ANTHROPOMETRY

MUAC (To Nearest 0.1cm)	
Haemoglobin Reading(mmols/l)	

SECTION 8: **CULTURAL PRACTICES**

9.1. Are there any foods that are prohibited for pregnant women?
1- Yes [ ] 2- No [ ]
9.2. If yes, which foods **(Use list of food groups)**

FOCUS GROUP DISCUSION INTERVIEW GUIDE

1. Which are the most commonly consumed foods in this area?
2. What are the main factors which determine the choice of food you eat?
3. Are there any special foods for pregnant women? If yes, which ones are they?
4. When are the above foods consumed? During pregnancy/immediately after delivery?
5. Are there any foods that are prohibited during pregnancy?
6. What are the sources of information on various foods to be eaten?
7. Do you belief that pregnant women consume adequately diverse diets in this community? Explain
8. Do you have suggestions on how to improve dietary diversity?
9. Suggest possible ways and means you consider appropriate to reducing the level of malnutrition in pregnant women in your area?
10. What community organizations are working in your community, to reduce the level of malnutrition in pregnant women?
11. Which are the areas that require priority intervention as far as maternal and child health is concerned?

Annex 5. Amharic translation

ተያያዥዎች 1 መጠይቅ

የመግቢያ ገጽ

ሰላም የእኔ ስም አለምጸሐይ ተሾመ ይባላል በአዲስ አበባ ዩኒቨርሲቲ ተማሪ ነኝ፡፡ የጦር ኃይሎች ጠቅላላ ሆስፒታል አዲስ አበባ ኢትዮጵያ የሚገኙትን ነፍሰጡር ሴቶች የአመጋገብ ስርዓት አጠቃቀምን የሚወስኑ ሁኔታዎችን እና የአመጋገብ ሁኔታ በሚል ርዕሥ ጥናት ማካሄድ ላይ ነኝ፡፡

እኔ እና የምርምር ረዳቶች ስለርስዎ ጤንነት ጥያቄዎች እንጠይቁዎታለን እንዲሁም የእርስዎን መካከለኛው የላይኛው ክንድ እርከን ዙሪያ ይለካሉ. መጠይቁ ብዙ ጊዜ 45-60 ደቂቃዎችን ይወስዳል. ማንኛውንም የሚሰጡት መረጃ በምንም አይነት መልኩ በምስጢር የተጠበቀ እና ለሌሎች ሰዎች እንዲታይ አይደረግም. በጥናቱ ውስጥ የሚሳተፍ በፈቃደኝነት ስለሆነ ለማንም ግለሰብ ወይም ለጥያቄዎች መልስ ላለመስጠት መምረጥ ይችላሉ.

ለነፍሰ ጡር ሴቶች ስምምነት

ከዚህ በታች በመፈረሜ በዚህ የምርመራ ጥናት ላይ መሳተፍ እችላለሁ.

ይህንን እገልጻለሁ

- ስለ ምርምሩ ተረድቼያለሁኝ እና የተካተቱትን ጥቅሞች እና አደጋዎች ተረድቻለሁ.
- ጥያቄዎቼን ሁሉ የመጠየቅ እድሉ አግኝቻለሁ.
- በዚህ ጥናት ተሳትፎ በፍቃደኝነት ላይ የተመሰረተ መሆኑን እና ተካፋይ እንድሆን ጫና አልተደረገም.
- በማንኛውም ጊዜ ጥናቱን ለመተው እንደምችል እና በማንኛውም መልኩ ቅጣት ወይም ምንም ዓይነት ጭፍን ጥላቻ እንደማይፈጥር እገነዘባለሁ.
- በምሰጠው መረጃ ላይ ሚስጢራዊነት እንዳለ እርግጠኛ ነኝ.

....

ምላሽ ሰጪ ፊርማ: ቀን

…..... .....

የተመራማሪው ፊርማ ቀን

ለርጉዝ ሴቶችን በግል የሚመለከት ጥያቄ

አድራሻ	ክፍለ ከተማ	ቀበሌ	የመጠይቅ ቁጥር	ቀን (ቀን / ወር/ዓም)	የቃለ መጠይቅ ስም

ክፍል 1 ማህበራዊ የስነ ሕዝብ መረጃ

ተ.ቁ	**መልስ እና የመልስ አማራጭ**	**መልስ**
1.1	ዕድሜ በተጠናቀቁ ዓመታት የእናት	
1.2	ስንተኛ ዕርግዝናሽ ነው	
1.3	ዕርግዝና በሳምንት	
1.4	የጋብቻ ሁኔታ (ኮድ ያስገቡ) 1. ያገባ 2. ያላገባ 3. የፈታ 4. ተለያይቷል 5. መበለት	
1.5	የትምህርት ደረጃ	
1.6	ዋና ስራ (ኮድ ያስገቡ) 1. ተቀጥሯል (ደመወዝተኛ) 2. ደሞዝ ሰራተኛ (አልፎ አልፎ) 3. ስራ አጥ 4. ተማሪ 5. የነጋዴ ነጋዴ 6. የቤት እመቤት **7. ሌሎች**	
1.7	የባል ዋና ሥራ (ደመወዝተኛ) 1. ተቀጥሯል (ተቀናሾች) 2. ደሞዝ ሰራተኛ (አልፎ አልፎ) 3. ስራ አጥ 4. ተማሪ 5. የቤት እመቤት 6. ሌሎች	

1.9	ሃይማኖት	

ክፍል 2: 24 ሰዓት የማስታወስ ጥያቄ

የ 24 ሰዓታት የማስታወስ ጥያቄን ይጠይቁ

የመጠይቅ ቁጥር (ኮድ) .....

አሁን ትናንትና ከቀን ጀምሮ እስከ ምሽቱ ድረስ የበሉት ምግቦች ልጠይቅዎ እፈልጋለሁ?

እየታወሰ ያለውን የሳምንት ቀን ምልክት ያድርጉ.

ሰኞ		ማክሰኞ		እሮብ		ሐሙስ		አርብ		ቅዳሜ		እሁድ	

ደረጃ 1;			ደረጃ 2	
በቀን ውስጥ ምግብ / ፈሳሽ ይበሉ / ይጠጣሉ		ይዘት	የተረሱ	ይዘት
ቁርስ				
መክሰስ				
ምሳ				
መክሰስ				
እራት				
መክሰስ				

የአመጋገብ ስርጭት

ተ.ቁ	የምግብ ቡድን	ምሳሌዎች	1 አዎ 2 አይ
1.	ስታርች ስቴፕል (ሰብሎች እና ቫይታሚ ኤ የበለጸጉ አትክልቶች እንዲሁም ተክሎች)	ዳቦ፤ ብስኩት ወይንም ከማሽላ፤ በቆሎ፤ ስፓጌቲ፤ ፓስታ፤ ሩዝ፤ ስንዴ፤ ገንፎ ወይም ሌሎች በአካባቢው ከሚገኙ እህልች የተሰሩ ምግቦች ዱባ፤ ካሮት፤ ስኳር ድንች እና የመሳሰሉት	
2.	ጥቁር አረንጓዴ ቅጠላማ አትክልቶች	ስፒናች፤ ጎመን፤ የካሳቫ ቅጠሎች እና ሀገር በቀል አረንጓዴ አትክልቶች የመሳሰሉት	
3.	ተክሎች እና ሥሮች ቫይታሚ እጅግ የበለፀጉ ፍሬዎች	ድንች፤ ካሳቫ፤ ሙዝ፤ የበሰለ ማንጎ የመሳሰሉት	

4.	አትክልቶች አና ፍራፍሬዎች	ቲማቲም፤ ሽንኩርት፤ ሙዝ፤ ብርቱካን፤ አቮካዶ፤ የመሳሰሉት	
5.	የህዋስ ስጋ (ኦርጋን ሚት)	ጉበት፤ ኩላሊት፤ ልብ ወይም ሌሎች የሰውነት ክፍሎች ናቸው	
6.	ስጋ አሳ	የበሬ፤ የአሳማ፤ የጠቦት፤ የፍየል፤ ዶሮ፤ ዓሣ ወይም ሌሎች	
7.	እንቁላልች	እንቁላል	
8.	ጥራጥሬዎች	ባቄላ፤ አተር፤ ምስር፤ ምስር የመሳሰሉት	
9.	ወተት እና የወተት ምርቶች	ወተት፤ አይብ፤ እርጎ ወይም ሌሎች የወተት ምርቶች	
ትላንትና ከቤት ውጭ ማንኛውንም ነገር (ምግብ ወይም መክሰስ) በልተዋልን?			

የምግብ አቅርቦት

ተ.ቁ	**መልስ እና የመልስ አማራጭ**	**መልስ**
1	ባለፉት 24 ሰዓታት ውስጥ ስንት ጊዜ ምግብ በልተዋል?	
2	አንድ በቤተሰብ ውስጥ ያለ አዋቂ ሰው በየቀኑ ምን ያህል ጊዜ ምግብ ይመገባል? በቁጥር	
3	በቤት ውስጥ የሚቀርበው ምግብ ከሚከተሉት ምንጮች የሚወጣ ነው? 1. በቤት ዉስጥ የተመረተ (በአካባቢው የተመረተ) 2. ከሱቅ የተገዛ 3. ከሌሎች ሰዎች መዋጮ የተደረገ 4. ባእርዳታ የተገኘ	

ክፍል 3: በእንክብል መልክ የሚሰጡ ተጨማሪ ንጥረ-ነገሮች

ተ.ቁ	**መልስ እና የመልስ አማራጭ**	**መልስ**
3.1	በአሁኑ ጊዜ ማናቸውንም ተጨማሪ በእንክብል መልክ የሚሰጡ ንጥረ-ነገሮች ይወስዳሉ ወይ? 1. አዎ 2. አይ **(ካልሆነ ወደ 3.4 ይዝለሉ)**	
3.2	አዎ ከሆነ, የትኛው ነው 1. የብረት እና የፎሊን እንክብሎች 2. በርካታ ንጥረ-ነገሮች እንክብሎች 3. ሌሎች (ዝርዝር ይግለጹ)	
3.3	ተጨማሪ እንክብሎች በየቀኑ ይወስድዋቸዋል? 1. አዎ 2. አይ	

	3. **(አዎ ከሆነ, ወደ 3.6 ይዝለሉ)**	
3.4	ካልሆነ ለምን? 1. መጥፎ ጣእም ስላለው 2. ይረሱታል 3. አስፈላጊነቱን አላመንኑበትም 4. ክሊኒኩ ውስጥ አይገኝም **5.** አንከብሉ ስላለቀብኝ **6. ሌሎች (ዝርዝር ይግለጹ) .....**	
3.5	የተለያዩ ብረት (ኣይረን) ያላቸውነን ምግቦች ይመገባሉ? (ብዙ መልሶች ሊሆኑ ይችላሉ)	

ክፍል 4: የቅድመ ወሊድ ክትትል እና በበሽታ መተኛት

ተ.ቁ	**መልስ እና የመልስ አማራጭ**	**መልስ**
4.1	የቅድመ ወሊድ ክሊኒክን ስንት ጊዜ ተገኝተሻል? 1. አንድ ጊዜ 2. ሁለት ጊዜ 3. ሦስት ጊዜ 4. አራት ጊዜ **5. ከ 4 ጊዜ በላይ**	
4.2	ባለፉት ሁለት ሳምንታት ታምመሻል? 1. አዎ 2. አይ **(ካልሆነ ወደ 5.0 ይዝለሉ)**	
4.3	ምን ዓይነት ሕመም 1. ወባ 2. ደም ማነስ 3. የትላትል 4. የመተንፈሻ አካላት በሽታ 5. በዳታዊ ግንኙነት የሚተላለፉ በሽታዎች **6. ሌሎች**	
4.4	የሕክምና ዕርዳታ ፈልገዋል? 1. አዎ 2. አይ	

	(ካልሆነ ወደ 5.0 ይዝለሉ)	
4.5	አዎ ከሆነ, የሕክምና ዕርዳታ ያገኙት የት ነው? 1. የግል ክሊኒክ 2. የመንግስት ሆስፒታል 3. ከፋርማሲ መድኃኒት ገዝቻለሁ 4. ባህላዊ ፈዋሽ **5. ሌሎች**	

ክፍል 5 - ማህበራዊ ኢኮኖሚያዊ ባሕርያት

ተ.ቁ	**መልስ እና የመልስ አማራጭ**	**መልስ**
5.1	የት ትኖራለህ? 1. የሚከራይ ቤት 2. የራሱ ቤት **(መልሱ 2 ከሆነ, ወደ 5.3 ይዝለሉ)**	
5.2	በወር ውስጥ ምን ያህል ነው የሚከፍሉት?	
5.3	በመኖሪያው ውስጥ ያሉት የመኝታ ክፍሎች	
5.4	የቤቱ ግድግዳ ምንድን ነው? 1. የቆርቆሮ 2. ጭቃ እና የእንጨት ምሰሶዎች 3. የሲሚንቶ / የድንጋይ 4. የጡብ 5. ጭቃ እና ሲሚንቶ 6. ሌሎች ደግሞ	
5.5	የቤት ጣሪያው ከምን የተሰራ ነው? 1. ቆርቆሮ 2. ታይልስ 3. ሣር 4. ሌላ ይግለጹ	
5.6	የቤቱ ወለል ከምን የተሰራ ነው? 1. ጭቃ 2. ሲሚንቶ 3. ሌላ ይግለጹ	

5.7	ዋናው ምግብ ማብሰያ ምንጭዎ ምንድነው? 1. የማገዶ እንጨት 2. ከሰል 3. ካሮሲን 4. ጋዝ 5. ኤሌክትሪክ 6. ሌሎች (ዝርዝር ይግለጹ)	
5.8	ዋናው የብርሃን ምንጭዎ ምንድነው? 1. ካራሴን 2. ኤሌክትሪክ 3. ፀሐይ 4. ሻማ 5. ሌሎች ደግሞ	

ክፍል6. የአካባቢያዊ ሁኔታዎች

ተ.ቁ	**መልስ እና የመልስ አማራጭ**	**መልስ**
6.1	ለመጠጥ ዋነኛ የውሀ ምንጭ ምንድነው? 1. የቧንቧ ውሃ 2. የህዝብ 3. ያልተጠበቀ ጉድጓድ ቆፍረው 4. የተጠበቀ ቆፍሯል 5. የዝናብ ውሃ 6. ሌላ (ዝርዝር ይግለጹ) _____	
6.2	ምን አይነት መፀዳጃ ቤት አለዎት? 1. ፍልፈል ፍሰት 2. የመፀዳጃ ጉድጓድ 3. ምንም መገልገያዎች ወይም ጫካ / መስክ የለም 4. ሌላ (ዝርዝር ይግለጹ) _____	
6.3	ቤተሰብዎ ወዴት ቆሻሻ የት ይጥላሉ? 1. መስክ 2. ጉድጓድ 3. ይቃጠላል	

6.4	ምግብ ካዘጋጁ በኋላ የማብሰያ አካባቢው፣ ድስቶች፣ መጥበሻዎች፣ ሰሃኖች እና ሌሎች መገልገያዎች መጽዳት ይኖርባቸዋል። አብዛኛውን ጊዜ እንዴት እንደሚያጸዷቸው ሊነግሩኝ ይችላሉ? 1. ጠራርጌ ጥራጊውን ወደ ቆሻሻ ማጠራቀሚያው እደፋዋለሁ። 2. በሞቀ ውሃ አጥበዋለሁ። 3. በሳሙና (አጃክስ) ወይም በፈሳሽ ሳሙና አጥበዋለሁ 4. መልስ የለም	
6.5	ቶሎ ሊበላሹ የሚችሉ ምግቦችን (እንደ ስጋ፣ ያልተሰራ ዶሮ ወይም አሳ) እስኪሰሩ ድረስ እንዴት ያቆዩዋቸዋል? 1. ፍሪጅ ውስጥ 2. ዝንብ፣ አቧራ ወይም አይጥ እንዳይደርስበት ተሸፍኖ 3. ለምግብነት ከተዘጋጁ ምግቦች ጋር እንዳይነካካ ተለይቶ 4. ሌላ 5. መልስ የለም	
6.6	እጆችዎን እንዴት እንደሚታጠቡ በቅደም ተከተል ሊነግሩኝ ይችላሉ? 1. እጆችን ሰሃን ውስጥ ባለ ውሃ ውስጥ እየነከሩ ከሌሎች ሰዎች ጋር አብሮ መታጠብ (መጥፎ ልምድ) 2. ሌላ ሰው ትንሽ ንጹህ ውሃ እያንቆረቆረ መታጠብ (ትክክለኛ ልምድ) 3. ከቧንቧ በሚወርድ ውሃ መታጠብ (ትክክለኛ ልምድ) 4. እጆችን በሳሙና እና ውሃ መታጠብ 5. ሌሎች 6. መልስ የለም	

ክፍል 7: አንትሮፖመትሪክ

MUAC (ወደ ቅርብ 0.1 ሴንቲሜትር)	
ሂሞግሎቢን ንባብ (mmols / l)	

ክፍል 8: ባህላዊ ልምዶች

8.1. በባህል ለዕርጉዝ ሴቶች የተከለከሉ ምግቦች አሉን?

1 - አዎ [ ] 2- የለም [ ]

8.2. አዎ ከሆነ, የትኞቹን ምግቦች **(የምግብ ቡድኖችን ዝርዝር ይጠቀሙ)**

የቃለመጠይቅ መመሪያ

1. በዚህ አካባቢ በጣም የተለመዱ ምግቦች የትኞቹ ናቸው?
2. የምግብ ምርጫን የሚወስኑት ዋናዎቹ ነገሮች ምንድን ናቸው?
3. ለዕርጉዝ ሴቶች የተለየ ምግብ አለ? አዎ ካሉ, የትኞቹ ናቸው?
4. ከላይ የተጠቀሱት ምግቦች መቼ ነው የሚወሰዱት? በእርግዝና ወቅት / ወዲያውኑ እንደወለዱ?
5. በእርግዝና ወቅት የተከለከሉ ምግቦች አሉ?
6. በተለያዩ ምግቦች ላይ የምግብ የመረጃ ምንጮች ምን ምን ናቸው?
7. እርጉዝ ሴቶች በዚህ ማህበረሰብ ውስጥ የተለያየ የአመጋገብ ስርዓት እንደሚመገቡ ታምናላችሁ? ያብራሩ
8. የምግብ ስብጥርን እንዴት ማሻሻል እንደሚቻል አስተያየት አለዎት?
9. በአካባቢዎ የሚኖሩ ነፍሰ ጡር ሴቶች የተመጣጠነ ምግብ እጥረት ደረጃ ለመቀነስ ሊሆኑ የሚችሉ መንገዶችን ይጠቁሙ?
10. በማህበረሰብዎ ውስጥ የትኞቹ የማህበረሰብ ድርጅቶች እየሰሩ ናቸው እርጉዝ ሴቶችን የተመጣጠነ ምግብ እጥረትን ደረጃ ለመቀነስስ?
11. ለእናቶች እና ለልጆች ጤና ጉዳይ አስፈላጊ ቅድመ ጣልቃ ገብነት የሚያስፈልጋቸው የትኞቹ ናቸው?

በጣም አመሰግናለሁ

THANK YOU VERY MUCH!!