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Assessment of THE ROLE OF WOMENS EMPOWERMENT IN AGRICULTURE FOR HOUSEHOLD DIETARY DIVERSITY IN LIBO KEMKEM AND ENEBSIE SAR MIDIR WOREDAS

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BAHIR DAR UNIVERSITY

COLLEGE OF AGRICULTURE AND ENVIRONMENTAL SCIENCE

Department of Rural Development and Agricultural Extension

**Assessment of THE ROLE OF WOMENS' EMPOWERMENT IN AGRICULTURE FOR
HOUSEHOLD DIETARY DIVERSITY IN LIBO KEMKEM AND ENEBSIE SAR MIDIR**

WOREDAS

Msc. Thesis

By

Birhanu Aschalew Girma

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BAHIR DAR UNIVERSITY

COLLEGE OF AGRICULTURE AND ENVIRONMENTAL SCIENCE

DEPARTMENT OF RURAL DEVELOPMENT AND AGRICULTURAL EXTENSION

**ASSESSMENT OF THE ROLE OF WOMENS' EMPOWERMENT IN AGRICULTURE FOR
HOUSEHOLD DIETARY DIVERSITY IN LIBO KEMKEM AND ENEBSIE SAR MIDIR WOREDAS**

**A THESIS SUBMITTED TO THE COLLEGE OF AGRICULTURE AND ENVIRONMENTAL SCIENCE OF
BAHIR DAR UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIRMENTS OF THE DEGREE
OF MASTER SCIENCE IN RURAL DEVELOPMENT MANAGEMENT.**

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June, 2021

Bahir Dar, Ethiopia

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THESIS APPROVAL SHEET

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Approval of Thesis for defense

I hereby certify that I have supervised, read, and evaluated this thesis titled “ASSESSING THE ROLE OF WOMENS’ EMPOWERMENT IN AGRICULTURE FOR HOUSEHOLD DIETARY DIVERSITY IN LIBO KEMKEM AND ENEBSIE SAR MIDIR WOREDAS,” by **Mr. Birhanu Aschalew Girma** prepared under my guidance. I recommend the thesis be submitted for oral defense.

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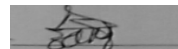
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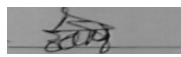
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I declare that this thesis is my original work and that all sources of material used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for M.Sc. degree at Bahir Dar University, College of Agriculture and Environmental sciences and is deposited at the University or College library to be made available to borrowers under the rules of the Library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate.

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ABSTRACT

Gender, agriculture and nutrition are highly linked issues, Agriculture is the main source of food and gender roles are vital for increasing agricultural productivity. Many agricultural interventions are working on empowering women in agriculture to address high dietary quality, because of womens' are mainly the caregiver of food in the household.. Due to womens' are highly dominated by men's the dietary diversity in Ethiopia is still very low that is why resources are mainly in hand of men. Hence, this study aims to assess the role of women empowerment for household dietary diversity in Libokemkem and Enebsie sar midir woredas, and subsequently assess the level of womens' empowerment. In this study, 200-sample households were selected using multi stage random sampling techniques. A cross-sectional study was conducted from November, 2019 to October, 2020 to assess the role of Womens' Empowerment in Agriculture for Household Dietary Diversity in Libo Kemkem and Enebsie Sar Midir woreda, Ethiopia. Abbreviated womens' empowerment in agricultural index (A_WEAI) was used to capture empowerment level of womens'. Two stage least squares and ordinal least square estimation was also conducted to analyze the relationship between women empowerment in agricultural index and dietary diversity. ordinary least square regression was used to analyze the effect of empowerment indicators on household dietary diversity. The result in both regression models shows as there is positive and statistically significant effect between women empowerment and household dietary diversity. The finding in the ordinary least squares shows that input in productive decision, input in income decision, ownership of assets and input in credit decisions have positive and statisticaly significance.. Thus, it is recommended that there is a need to work more on empowering women in agriculture to increase the household dietary quality.

Keywords: A_WEAI , Agriculture, Dietary, Empowerment, Gender, Women,

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LIST OF ABBRIVATIONS/ACRONYMS

2SLS	Two Stage Least Square
5DE	Five Domains of Empowerment
CSA	Central Statistics Agency
EDHS	Ethiopian Demographic Health Survey
ETB	Ethiopian Birr
FAO	Food and Agricultural Organization
FGD	Focus Group Discussion
FH	Food for Hunger
GFDRE	Government of Federal Democratic Republic of Ethiopia
GO	Governmental Organization
GPI	Gender Parity Index
HDD	Household Dietary Diversity
HDDS	Household Dietary Diversity Score
NGO	Non-Governmental Organization
ORDA	Organization for Rehabilitation and Development in Amhara
PSNNP	Productive Safety Net Program
UN	United Nation
USAID	United State of America International Development
WEAI	Women Empowerment in Agricultural Index
WHO	World Health Organization

Chapter 1. INTRODUCTION

1.1. Background and Justification

Gender, agriculture and nutrition are highly linked issues. Agriculture is the main source of food and gender roles are vital for increasing agricultural productivity (FAO, 2011). Change in agricultural productivity is generally believed to have both direct and indirect implications on nutritional outcomes. Agriculture is closely linked to food security in rural parts of developing countries including Ethiopia. This is mainly because household agricultural production is the primary source of nutrients and income for households (Feiruz, 2015). This implies that an increase in agricultural productivity of the household have a positive change in dietary diversity score of the household (Arimond *et al.*, 2010).

According to FAO (2011), report women produce over 50 percent of the world's food. They also comprise about 43 percent of the agricultural labor force globally (Doss, 2014). Women in some African countries contribute up to 50 percent of labor on farms and more than 60 percent of employed women are working in agriculture (FAO, 2011).

Empowering women is widely recognized around the world as a tool to achieve agricultural growth and food security. Many international development programmes such as the United States Agency for International Development, feed the future initiative, which also operates in Ethiopia perceived women's empowerment as a key in agricultural productivity. Gender systems are complex and diverse because they are determined by community norms and values. Thus, the nature and extent of gender inequality and the conditions necessary to empower women vary across countries, communities, regions, cultures as well as crops (Jejeebhoy and Sathar, 2001; Alkire *et al.*, 2013).

Due to the multidimensional nature of empowerment and the complexity and diversity of gender systems around the world, the study of different gender systems is perceived to capture the cross-cultural variations in gender specific needs and constraints. Promoting gender equality is a major focus of rural development policy and it is one of the sustainable development goal in our country which aims for achieving sustained food security and poverty alleviation. Therefore, understanding the role of womens' empowerment in agriculture is important for policymakers and development partners interested in devising more effective interventions to increase agricultural productivity, enhance household and national economic growth, achieve food security, improve nutrition, and reduce poverty (Malapit *et al.*, 2017).

In Ethiopia women have been placed to the disadvantaged position facing political, social and cultural challenges that undermine their benefit in agricultural production, access to and decision-making power about productive resources, control of use of income, leadership in the community (Halina, 2015 and UN, 2014). Even if they faced these challenges, women are highly participated in agricultural production and they have a significant role on nutritional and food security. Despite, their role and contribution is highly dominated by men (Alkire *et al.*, 2013). Studies showed that women spend their income for household expenditure especially for buying diverse' foods to feed their family. Given this background women empowerment in agriculture plays a very important role in the dietary diversity of households (Bose, 2011).

The A-WEAI is the abbreviated version of the Women Empowerment in Agriculture Index (WEAI) including six indicators and an adjusted set of less time consuming and more effective questions developed to measure women empowerment in the Future zones. Beyond the use for project evaluations, the WEAI is used for further analysis regarding female empowerment, agency, and inclusion in the agriculture sector and this study adapted the A-WEAI, its sub-indices, and its indicators for a regression analysis.

1.2. Statement of the Problem

Serious food shortages and high levels of malnutrition continue to affect a large number of people in several parts of Ethiopia. Low quality of dietary diversity is the one which is the most factor for malnutrition. Majority of the food-insecure household with low dietary diversity live in rural areas are almost entirely dependent on agriculture (FAO 2011). This indicates that an obvious starting point for action to address long term food insecurity and to achieve higher dietary quality is doing more on agricultural sector.

International development programmes, USAID, feed the future initiative perceived womens' empowerment as a key issue in closing gender gaps in agricultural productivity and household dietary quality (Feed the Future, 2015). Moreover, understanding the role of womens' empowerment in agriculture is important for policymakers and development partners to devise effective interventions to address sustainable development goals (Malapit *et al.*, 2017). This implies that there should be focus on gender issues at household level in order to attain agricultural growth and to achieve higher household dietary diversity. But, due to the multidimensional nature of empowerment and coupled with its complexity and diversity of gender systems, study of different gender systems is perceived to capture the cross-cultural variations in gender specific needs and constraints (Malapit *et al.*, 2017).

National nutrition program of Ethiopia recognizes household dietary diversity is usually determined by women because of food preparation is highly restricted by mothers. They are also more responsible to source special foods for the household and to use this food at appropriate time. But, the general lack of control of women over household's resources, time, knowledge, and, social support networks constitute a major barrier to improve nutritional outcomes because the type of food and the time of feeding are usually determined by mothers (GFDRE, 2013).

In Ethiopia GOs and NGO like Ethiopian nutrition institute, Food for Hunger Ethiopia, and Productive Safety Net Program are working towards improving dietary diversity of households. But, the problem of under nutrition haven't been addressed as expected due to lack of addressing women's empowerment as a key issue to improve poor nutritional outcomes (Doss, 2006).

In the study areas women are highly engaged in activities such as sowing, weeding, harvesting, take care of livestock, and other agricultural and household feeding related activities. But they have little power on decision making, controlling, and managing of income obtained from agricultural products. This means resources are highly managed by men counter parts. Without the permission of husband women are highly restricted to sell agricultural products and to use it for household consumption. Thus they face financial shortage to buy diversified foods in order to feed the household (Enebsie Sar Midir agricultural office, 2019).

Besides this truth in some cases women empowerment through engagement in agriculture reduce the amount of time to take care of their household dietary diversity. On the other hand, the additional time spent on agriculture have a positive contribution to gain income which in turn contribute towards improving nutritional out comes. This implies that linkages among women empowerment and household dietary quality are complex, and the relationship between women empowerment status and household dietary diversity are not straight forward thus the implication of women empowerment in agriculture for intra household dietary diversity is under identified.

In our country gender related researches in agriculture at household level are very low (Quisumbing *et al.*, 2014). Some studies have been conducted regard to women empowerment on agriculture. There is a study by Lemlem Abebe, Dereje Kifle and Hugo De Groote (2016) on Analysis of women empowerment in agricultural index: the case of Toke Kutaye District of Oromia Region which mainly emphasized on assessing women empowerment in agricultural index and measure the contribution of the empowerment indicators to the disempowerment of

women and men. Another study by Tefera Assefa (2018) on Nature of Women Empowerment in Ethiopia: Constitutional and Policy Provisions was studied and this study mainly focused on assessment of government effort in relation to women empowerment in Ethiopia. But, both of the above studies, haven't addressed the relationship of women empowerment in agriculture and intra household dietary diversity.

There was also another study conducted by Feiruz and Fanaye (2015) country level study on women empowerment in agriculture and dietary diversity in Ethiopia and investigated that there was positive and statistically significance relation between womens' empowerment in agricultural index indicators and household dietary diversity, but as the characteristics of women's empowerment in agriculture is complex and vary from place to place this study lacks to address empowerment in woreda level. This study was also used the oldies womens empowerment in agricultural index than the updated abbrevaited women empowerment in agricultural index to analyze the level of women empowerment.

Therefore, this study analyzed women empowerment in agriculture and the relationship between women empowerment in agriculture and household dietary diversity and to fill the gaps of previous studies in Libo Kemkem and Enebsie Sar Midir, Amhara Region, Ethiopia.

1.3. Objectives

1.3.1. General objective

- The general objective of the study is to assess the role of womens' empowerment in agriculture for household dietary diversity.

1.3.2. Specific objectives

- ✓ Assess womens' empowerment in agricultural index in the study area.
- ✓ Measure the contribution of the empowerment indicators to the disempowerment of women.
- ✓ Analyze the relationship between women empowerment in agricultural index and intra-household dietary diversity

- ✓ Analyze the relationship between women empowerment indicators and intra-household dietary diversity

1.4. Research Questions

- ✓ What is the level of womens' empowerment in agricultural index of the study area?
- ✓ How much is the contribution of the empowerment indicators to the disempowerment of women?
- ✓ What is the level of intra household dietary diversity?
- ✓ What is the relationship between womens' empowerment in agriculture and household dietary diversity?
- ✓ What is the relationship between women empowerment in agricultural index indicators and household dietary diversity?

1.5. Scope and Limitation of the Study

This study conducted in Libo kemkem and Enebsie Sar Midir districts and the study focus on women empowerment and household dietary diversity. Hence, the study was restricted to the assessment of the role of womens' empowerment in agriculture for intra-household dietary diversity. The study mainly focusses on five domains of women empowerment. Due to COVID-19 pandemic disease this research did not address gender parity gap and the men in the household were not interviewed.

1.6. Significance of the Study

The comprehensive understanding of the relationship between women empowerment in agriculture and those indicators with household dietary diversity have paramount importance for designing future research, development policies and other remedy mechanisms for improving dietary quality. The information generated from this study could use as a reference for anyone wishing to conduct research in the area of womens' empowerment and household dietary diversity.

Chapter 2. Review of Related LITRATURE

This chapter reviews findings of past studies undertaken on issues related to womens' empowerment in agriculture and household dietary diversity, including basic concepts and other issues related to womens' empowerment and dietary diversity.

2.1. Basic Concepts

2.1.1. Agriculture

The English term 'agriculture' is derived from Latin words 'ager' or 'agri' meaning soil' and 'cultura' meaning cultivation i.e. agriculture is cultivation of soil in it narrow sense. Agriculture, however, is a very broad term and it includes crop cultivation, soil management, farm tools and agricultural engineering, animal husbandry, veterinary and dairy science, poultry, and piggery, horticulture, fisheries, home science and forestry (Messay, 2012).

2.1.2. Gender

Gender refers to the socially determined differences between women and men, such as roles, attitudes, behaviors, and relationships which are learned and vary across cultures and over time. The differences in access and control over resources make gender norms, roles and relations which resulted in differences between men and women in exposure to risk factors or vulnerability, household-level investment in nutrition, care and education, access to and use of health services (WHO, 2015).

2.1.3. Empowerment

Empowerment has been defined quite diversely but common conceptualizations focus on power, options, control, and choice (van den Bold *et al.*, 2013), and it is a change in ability to make important life decisions considering three dimensions: resources, agency, and achievements where agency is defined as the ability to define one's goals and act upon them. (Fleur, 2016).

2.1.4. Dietary diversity

Dietary diversity refers to variety of foods across and within the food groups. A lack of dietary diversity is a severe problem among poor populations in the developing world. There is substantial evidence that dietary diversity is extremely low among Ethiopian rural households, especially for children (Feed the Future, 2015).

2.2. Womens' Agricultural Activities

Women play active role in most aspects of agricultural activities across the world. In developing countries, like Ethiopia where traditional agriculture predominates, women contribute a lot to the family in particular and to the society in general through house hold care and maintenance, crop production, animal husbandry, marketing and several domestic works. However, their contribution is underestimated due to the deep rooted gender based division of labour (Moa, 2019)

Women play important roles to help their family in particular and their community in general in preparing their food demand, in the world. But the most surprising thing is that the community has not significantly understood the effort that women exert in the last several years. Woman are involved in agricultural and rural development representing more than half of the labor required to produce food consumed in developing countries (Etenesh, 2005).

The international labor organization labor force of Food and Agricultural Organization's agricultural census data for the 82 developing countries shows, women's proportion in the agricultural labor force to be 42% for sub-Saharan Africa, the regional average was 46% for north Africa and 31% for middle east (Messay, 2012).

2.3. The Importance of Womens' property ownership

There is significant evidence that women's rights to property and other assets are associated with improved well-being and agency. Studies predict that bargaining power within the marriage depends on the husband's and wife's 'outside options', e.g. their expected utility if the union were to end. These outside options depend, among other factors, on who in the family owns the household's property, and the rules and norms that shape the division of assets and other family resources upon divorce (Lundberg and Pollak 1996; Lundberg et al 1997; Fafchamps and Quisumbing 2005).

Studies from India show that legislative changes under the Hindu Succession Act, which strengthened women's inheritance rights, positively impacted measures of female empowerment (i.e. education and health outcomes). These effects were even larger for the 'second generation', i.e. daughters born to women themselves affected by the reforms (Deininger et al 2013, 2018; Roy 2015)

2.4. Womens' Access to Financial Services

When spouses have similar goals and priorities, it seems reasonable to expect that women would have the support of their husbands to gain access to financial resources: spouses that agree with each other are likely to pool their resources. That is, they are likely to combine their assets, their labour, their financial resources and the information they have in order to produce an agreed upon basket of goods and services, and then consume or invest the profits they obtain according to their shared priorities. However, and contrary to what is assumed in most

development interventions, spouses can disagree and they often do. Family dynamics can be complex. Spouses can differ in how they want to allocate their resources, what they would like to produce and how they prefer to spend the income they earn (Liza, 2019)

Men have more power to control on the income made by women and often decide to finance their own personal interest instead of the households. This is because women have less power /right/ to make decision on the household income independently. Provisions of credit support and micro-finance facilities for rural women were one of the most important strategies for empowering rural women in the economic aspect (Linda, 2005).

2.5. History of Women Empowerment

The approach of women empowerment emerged from several important critiques and debates generated by the women movement throughout the world during the 1980s, when feminists, particularly the Third World Feminists were increasingly discounting the largely political and economic models in prevailing development interventions (Batiliwala, 2007). But in the 1990s many agencies used the term women empowerment in association with a wide variety of strategies including those which focused on enlarging choices and productivity of individual women and broad-based economic and social support (Bisnath, 2001 cited in Mosedale, 2005). The empowerment of women responds to a growing recognition that women lack access to and control of resources, self-confidence and an opportunity to participate in decision making. According to Dalal (2005), although both women and men play substantial roles in economies of every country there is a great disparity in the matter of economic resourcefulness between a man and a woman. Moreover, gender inequality in access to and control of resources is a key dimension of poverty that needs attention.

2.6. Women Empowerment, Production and Nutrition

2.6.1. Linkages between empowerment, production and nutrition

Production diversity may directly influence nutrition in agricultural households, not only through incomes generated from agricultural production, but also through home consumption. This means if households consume large share of food products, they produce more diverse production portfolios may increase the availability of different types of food for household consumption, in turn improving dietary quality among household members. (Arimond *et al.*, 2010).

Decisions on how and what to produce are mediated by gender roles. Accumulating evidence shows that men and women within households do not always pool their resources nor have the same preferences. Thus, the nonpooling of agricultural resources within the household creates a gender gap in control of agricultural inputs which several empirical studies have identified as a constraint to higher productivity (Kilic *et al.*, 2013).

According to Arimond *et al.*,(2010) increase in agricultural productivity can change nutritional outcomes through five path ways, increased food for own consumption ,increase in income, reduction in market prices, change in preference, and shift in the control of resources with in households. In all of those pathways gender roles have a significance influence

2.6.2. Gender equity and power in the context of agriculture

Womens' access to key resources, including land, is mostly determined via their relationship to a husband or father. The fact that women play a major role in production in smallholdings but may not control the proceeds of their labor is detrimental to the well-being

and food security of children and other dependents. Examples such as the proactive inclusion of women and disadvantaged groups in community-based maize seed production in Nepal or during participatory variety selection in Ethiopia and Mexico show that research can influence established community patterns for greater research-for-development outcomes (Blackladen *et al.* 2006)

2.6.3. Womens' empowerment and food production

Womens' empowerment can improve agricultural productivity and thus increase food production. Globally women face many inequities and constraints, these inequities and constraints are often embedded in to norms and practices and encoded in legal provisions. Sometimes laws, such as those governing access to land, but at other times customary rules and practices have restrictive consequences for women. They limit women access to resources such as land and credit and thereby affect household food and nutrition security in food production, preparation, processing, distribution and marketing activities (De Schutter, 2013).

Increasing agricultural productivity related womens' empowerment can lead to an increase agricultural income. This means more money to spend on both food and non-food items, like health care. Furthermore, empowering women also leads to increased control of women over agricultural income. This enables more expenditures on food and health care, which impacts the diet and health status of the child positively. Research shows that income controlled by women is more frequently used on food and health care for the family and especially for children (UNICEF, 2011; Smith *et al.*, 2003).

2.7. Measuring Womens' Empowerment and Dietary Diversity

2.7.1. The womens' empowerment in agricultural index

The Womens' Empowerment in Agriculture Index (WEAI) is a new survey-based index designed to measure the empowerment, agency, and inclusion of women in the agricultural sector. The WEAI was initially developed as a tool to reflect womens' empowerment. The index have two sub-indexes, The first reflects the percentage of women who are empowered in five domains of empowerment (5DE) in agriculture which are decisions about agricultural production, access to and decision-making power about productive resources, control of use of income, leadership in the community, and time allocation. The second sub index: The Gender Parity Index (GPI) measures gender parity. It reflects the percentage of women who are empowered or whose empowerment score meets or exceeds that of the men in their households (Alkire *et al.*, 2013).

In the A-WEAI index a woman is considered to be empowered if she has adequate achievements in at least four out of five domains or when in some combination of the weighted indicators that reflects 80 percent of total adequacy (Alkire *et al.*, 2013)

Table 1 The domains, indicators and weights in the A-WEAI

Domain	Indicators	Weight
Production	Input in production decisions	1/5
	Ownership of assets	2/15
Resources	Access to and decisions on credit	1/15
Income	Control over use of income	1/5
Leadership	Group membership	1/5
Time	Workload	1/5

Source Adapted from (Malapit *et al.*, 2015).

2.7.2. Measuring dietary diversity

Dietary diversity scores are created by summing either the number of individual foods or the food groups consumed over a reference period (FAO, 2008). The dietary diversity scores described in the FAO guidelines consist of a simple count of food groups that a household or an individual has consumed over the past 24 hours. Since individual food items can be classified into more than one food group, the sixteen food groups were categorized into twelve food groups in order to measure household dietary diversity based on FAO's aggregation of food groups. For example, vitamin A-rich vegetables and tubers, dark-green leafy vegetables, and other vegetables were merged into a vegetables group; vitamin A-rich fruits and other fruits were merged into a fruit group; and the meat group is a combination of organ meat and fresh meat (FAO, 2011)

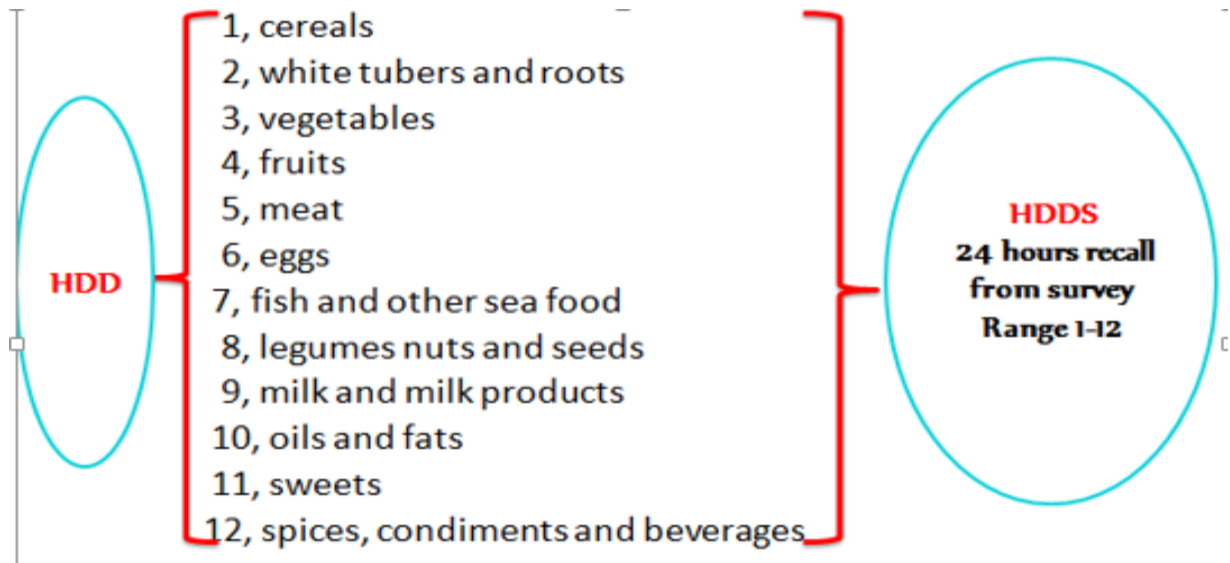


Figure 1 : Measuring dietary diversity (Source: WHO, 2006)

2.8. Womens' Policy in Ethiopia

Ethiopian women are actively involved in all aspects of life in their country. They played various and important roles in economic, social, cultural and political aspects. However, their roles have been devalued and they lag behind men in all fields of self-advancement. Therefore, gender related problems have remained a serious concern in Ethiopia. Haile-Giorgis (2008), indicates that women in Ethiopia are disadvantageous in all aspects of life and gender inequality persists as the feature of the country despite the efforts made by government and nongovernmental organizations in the last regimes. In the country women are disempowered economically, socially and politically. The study undertaken by many scholars show that women are economically very poor that inhibits their involvement in the social and political aspects of their country.

Application of the WEAI in Empirical Studies

Using the score of the WEAI and its indicators, several studies estimate the effect of these on the nutritional status of children, women, or the overall household (Cunningham et al., 2015; Malapit et al., 2015; Malapit & Quisumbing, 2015; Sraboni et al., 2014; Yimer & Tadesse, 2015). They analyze mostly cross-sectional data in developing countries with multivariate regression and instrumental variables techniques to account for possible endogeneity of female empowerment. Most of them focus on associational relationships as causality seems to be particularly hard to establish (Cunningham et al., 2015; Malapit et al., 2015; Malapit & Quisumbing, 2015; Sraboni et al., 2014). Malapit et al. (2015) show that overall empowerment as well as indicators of group membership, control over income, and reduced workload are positively associated with maternal dietary diversity in rural Nepal. Female empowerment also outweighs negative consequences of low production diversity on dietary diversity.

Two studies conduct their analysis in Bangladesh: Malapit & Quisumbing (2015) find that the indicator of womens' empowerment in credit decisions is positively and significantly associated

with female dietary diversity but not with BMI. Sraboni et al. (2014) identify that overall womens' empowerment score, a smaller gender parity gap, and higher levels for WEAI related indicators of active group participation and individual control of assets are positively associated with calorie availability and dietary diversity at the household level. However, the relationships are purely associational and seem less important than other factors like household wealth, education, and occupation. Interestingly, womens' access and decision-making regarding credit as well as active group participation has a significantly negative association with adult male BMI. Van de Bold (2013) also raises the concern that "*female empowerment may have opposite effects*" changing womens' preference from favoring spending on household and children to dedicating a larger share to her own consumption goods. All peer-reviewed studies to date linking female empowerment and dietary diversity have used the generally version of the WEAI, not the A-WEAI.

2.9. Empirical Evidences

2.9.1. Womens' empowerment in agriculture in Ethiopia

According to the UN, Ethiopia has some of the lowest gender equality performance indicators in sub-Saharan Africa. Ethiopian women's rights are being violated in almost every sphere of their lives. This was recently confirmed in a survey conducted in 2016, at the time of which only 1 in 3 of the women who responded were employed (compared to 88% of men); almost half of the women was not join formal education (marriage meant leaving school for 75% of them); and it was found that husbands still largely hold control in terms of how a woman spends her earnings (UN, 2013).

Lemlem, *et al.*, (2016) in Analysis of women empowerment in agricultural index: the case of Toke Kutaye District of Oromia region indicated that women farmers were empowered in 73% of the 5DE indicator and the average empowerment gap was 31.5% while the gender parity index was 68.4%. This indicates that gap in empowerment needs to be addressed.

2.9.2. Contribution of women empowerment indicators to the disempowerment of womens' in agriculture

Indicators of women empowerment in agriculture have different contribution to overall disempowerment of the woman. According to the finding by Malapit (2015), production and resource domains were the most contributor domains to the disempowerment of empowerment in Ghana. Inside those domains the study was also identified that access to and decisions about credit is the key indicator that contributes the most to disempowerment in the resource domain while input into productive decisions is the most important indicator in the production domain.

The study by Lemlem (2016) investigated that the domains that contributed most to women disempowerment were inadequate work load (64%) and lack of adequate access to credit and control over income obtained from credit (53%) in Ethiopia. This study was used the five domains with ten indicators for the analysis and conclude that 64% of women in the study area were disempowered in workload dimension and 53% of women were disempowered in credit dimension.

2.9.3. level of household dietary diversity in Ethiopia

The study conducted by Urmale et al. (2020) in Konso, South Ethiopia reported that 41.9%, 48.5% and 9.6% of the households had high, medium and low DDS respectively. This implies that around half of the households in the study area had medium quality of dietary diversity whereas about one tenth of the total household in Konso had low DDS.

According to the study by Mekuria et al. (2017) in Finoteselam town, north-west Ethiopia reported that the prevalence of 11.8%, 62.2% and 21% of households were low, medium and high in dietary diversity score respectively. Both of the above studies investigated that majority of rural household consumed more than or equal to four food groups.

2.9.4. Relation between womens' empowerment in agriculture and household dietary diversity

In the world Literature has provided broad associational evidence regarding women empowerment and dietary diversity. Bhagowalia *et al.* (2012) showed that women empowerment is positively related to dietary diversity of the household in Bangladesh. Most studies conducted in Ethiopia investigated that though level of malnutrition seems in reduction trend, but the problem needs much concentration from the country's prior agenda to fulfill the sustainable development goals.

Kibret (2013) using Demographic Health Survey 2011 data and logistic regressions on Ethiopian children nutrition condition indicated that place of residence, mother's education, age of child, birth interval, sex of child, number of children and household economic status are found to be important determinants of household dietary diversity.

2.9.5. Effect of women empowerment indicators on household dietary diversity

According to Marco (2019) by using ordinary least squares for analysis investigated that those womens' empowerment indicators in Tunisia were statistically significance with household dietary diversity. The study reported that input in production decision of women were negatively affect household dietary diversity whereas input in credit decisions, input in to credit decisions, speaking in public, and leisure time had positively and significantly affected household dietary diversity.

Another study by Feiruz (2015) in Ethiopia by using two stage least squares analysis reported that women empowerment indicators were affect dietary diversity significantly. This study showed that group membership, input in credit decision, autonomy in production decision, and workload were positively and significantly affected household dietary diversity.

2.10. Conceptual Frame Work of the Study

The study focused on assessing womens' empowerment in agriculture and household dietary diversity, and ultimately to come up with recommendation for what to do with these relations. There is a need to examine the interrelationship and interactions of various factors revolving around household dietary diversity and womens' empowerment in agriculture thus the following conceptual frame work is designed for the study

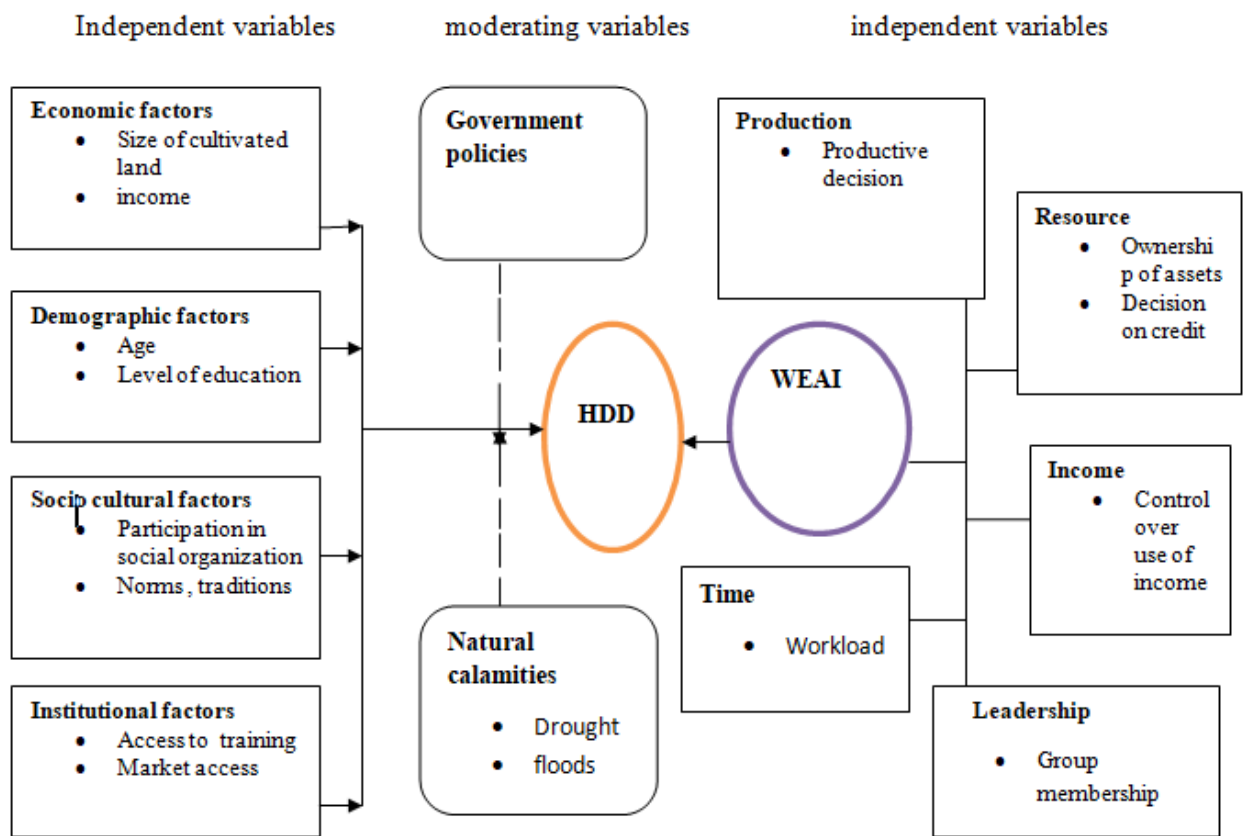


Figure 2 : Conceptual framework of the study source: (Owen, 2019)

Chapter 3. METHODOLOGY

This chapter discusses how the research was conducted which consists of description of the study area, sampling procedures, method of data collection and analysis, research design and definitions of variables and their hypothesis.

3.1. Description of the Study Areas

3.1.1. Location

The research was conducted in two *woredas* of amhara region namely, Libokemkem and Enebsie Sar Midir. The reason why this study was conducted in two *woredas* was for better representing of the region. Libokemkem is located in South Gondar administrative Zone of Amhara Regional State, whereas Enebsie Sar Midir is located in East Gojjam Zone of Amhara Regional State.

Libokemkem *woreda* bordered by West Bellessa *woreda* in the North, Ebenat *woreda* in the East, Fogera *woreda* in the South, and Lake Tana and Gonder Zurie *woreda* in the West. Enebsie Sar Midir *woreda* is bordered on the south by Enarji Enawuga, on the west by Concha Siso Enesie, on the east and north by Abay river which separates it from the Debub Gonder Zone and Debub Wollo Zone. Adisszemen and Mertolemariam are the capital of Libo kemkem and Enebsie Sar Midir respectively. Where Adisszemen located at a distance of 85kms from Bahir Dar (capital of Amhara Region) and Mertolemariam located at 180kms away from Bahir Dar (capital of Amhara Region).

3.1.2. Population Size

According to the data in 2017/2018 the total number of households of those *woredas* is given by the following table

Table 2 population size of the study areas

Descriptions	Libokekem	Enebsie Sar Midir
Total population of the district	296,850	164,752
Number of males in the district	150,045	81,387
Number of females in the district	146,805	83,365

Source: Libokemkem and Enebsie Sar Midir Agricultural offices (2019/2020)

3.1.3 Agroecological Zone

Libokemkem and Enebsie Sar Midir have different agroecology. According to the data 2017/2018 table 3 discuss the agroecology of those *woredas*.

Table 3 agroecological zone of the study areas

Descriptions	Libo Kemkem	Enebsie Sar Midir
Dega in %	18%	14%
Dega In ha	17,994.28ha	14,964.551 ha
Weyna Dega in %	81.1%	33%
Weyna Dega in ha	81,076.64ha	35,735.58 ha
Kolla in %	0.9%	53%
Kolla in ha	899.74ha	56,651.5145 ha
Rainfall minimum	900 mm	900 mm
Rainfall maximum	1300 mm	1,200 mm
Altitude minimum	1,800 m	1,300 m
Altitude maximum	2,953 m	3,664 m
Temperature minimum	11.1°C	10 °c
Temperature maximum	27.9°C	22.5 °c

Source : Libokemkem and Enebsie Sar Midir Agricultural offices (2019/2020)

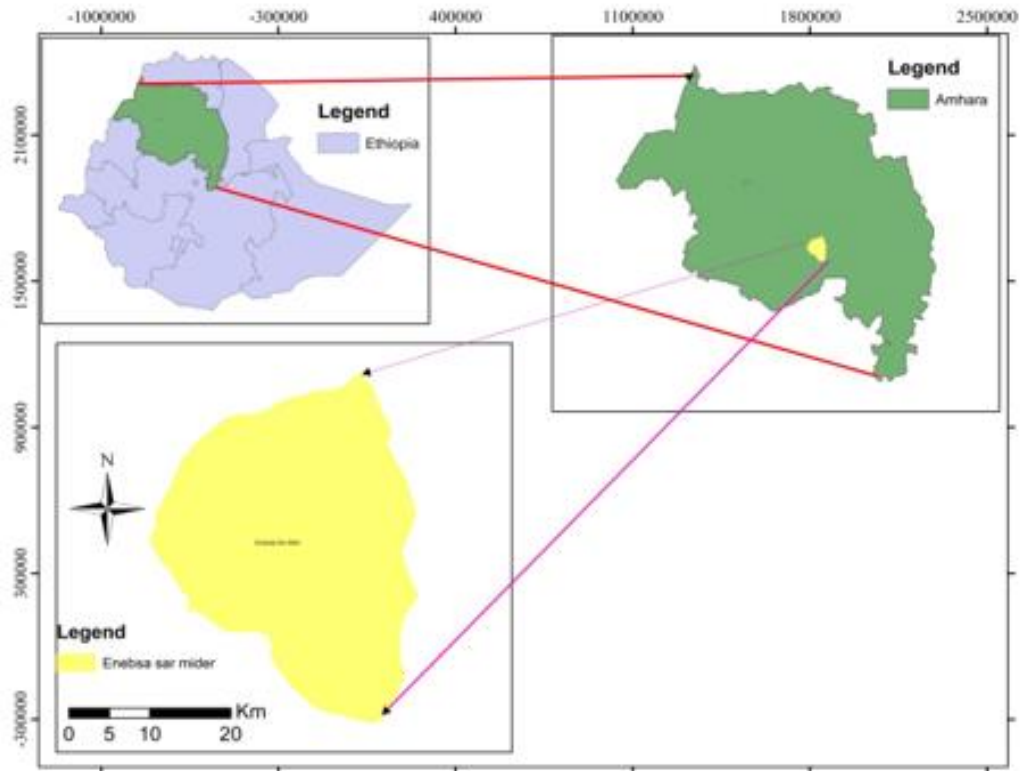
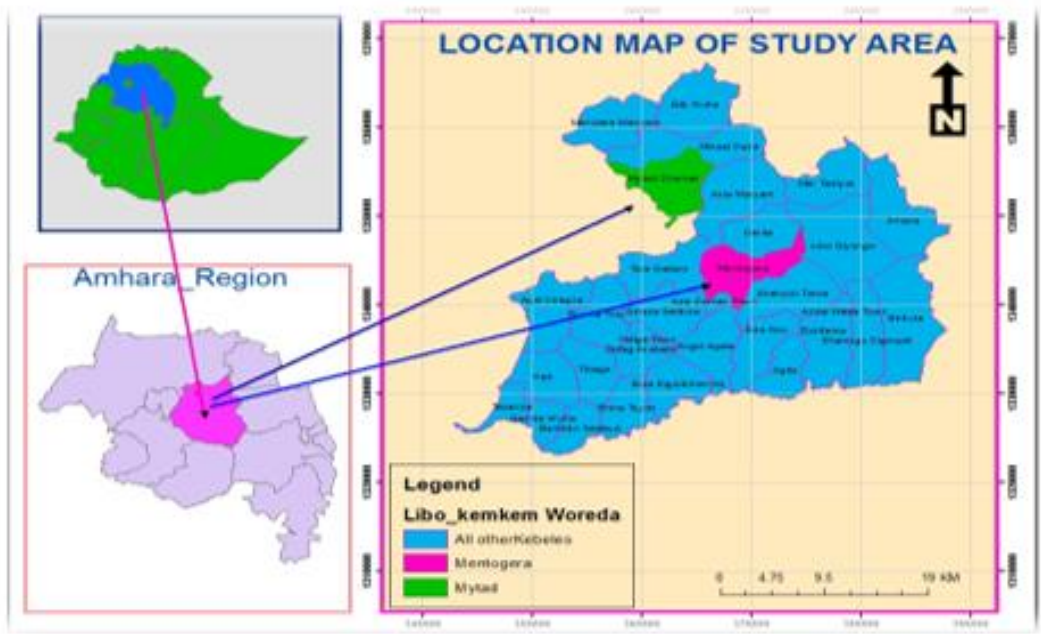


Figure 3 : Map of Libokemkem and Enebsie Sar Midir

3.2. Research Approach and Design

3.2.1 Sample Size and Sampling Procedure

The target population of the study is all rural households engaged in agriculture and fulfills WEAI characteristics in Libo Kemkem and Enebsie Sar Midir *woredas*. Households without sufficient data for both partners are excluded; the study followed a multi-stage random sampling. Stage 1 involved purposive selection of the targeted *woreda*. The main activity of the *woreda* was agricultural activity thus Enebsie Sar Midir and Libo Kemkem *woreda* are selected. Stage 2 involved in random selection of sample kebeles in each targeted *woreda*, those kebeles are assumed as the representative of the whole kebeles. Stage 3 involved in stratified method of sampling which was classification of those kebeles to village level this is to gain homogenous groups to measure village norms by leave out means of women empowerment in agricultural index. Stage 4 involve in purposively selection of households which fulfill WEAI and GPI characteristics in those villages in this Stage women in male headed households were selected. This was done according to the data which is gained from those kebeles office. Stage 5 involved in simple random selection of sample households from those households selected in stage 4. In this stage sample respondents were randomly selected by lottery method regard to the population proportion.

The total sample size was determined according to the sampling formula provided by Yamane (Yamane, 1967). The sampled households then randomly selected from selected Kebeles in Enebsie Sar Midir and Libo Kemkem *woreda*'s on proportionality basis. The formula used for sample determination was:

$$n = \frac{N}{1 + N(e^2)}$$

Where: n= Sample size, N= Population size and e= level of precision

According to the above formula the total sample size gained was 200 households. The population and the selected sample households from those kebeles are discussed in the following table.

Table 4 sampling size of the study area

Woreda	Kebeles	Households with primary male and female	Selected households	Precision level
Enebsie Sar	Debremedhanit	855	50	
Midir	Tenta	830	50	
L	Shamo	1006	57	
	Wushatirs	783	43	
LLibo kemkem				
Over all		3494	200	0.07

3.3. Methods of Data Collection

Primary data were collected from sample respondents by using interview schedule because the respondents are farmers and assumed as most of them can not read and write. Focus group discussion among 55 women's in which 6 of them was the participant of the interview was also performed to gain detail information regard to the study. Secondary data were also collected from internet, published and unpublished documents by reviewing.

3.4. Method of Data Analysis

Both descriptive analysis and econometric model were employed for achieving the objectives of this study

3.4.1. Descriptive analysis

Descriptive statistics such as mean, percentages, frequencies and standard deviations were used in the process of assessing the empowerment of women. A-WEAI was used to analyze women

empowerment in agriculture; the five dimensions of empowerment with six indicators were used and weighted according to their weight (Alkire *et al.*, 2012:33). The 5DE contribute to the 100% of the measurement.

3.4.1.1. Assessing Women Empowerment in Agricultural Index

Following the (Alkire and Foster, 2011) multidimensional poverty index, this sub-index assesses whether women are empowered across the five domains examined in the A-WEAI. For the women who are disempowered, it also shows the percentage of domains in which they meet the required threshold and thus experience sufficiency or adequacy. The 5DE sub-index captures women’s empowerment within their households.

An inadequacy score is computed for each person, according to his or her inadequacies across all indicators. The inadequacy score of each person is calculated by summing the weighted inadequacies experienced so that the inadequacy score for each person lies between 0 and 1. The score increases as the number of inadequacies of the person increases and reaches its maximum of 1 when the person experiences inadequacy on all of the 6 indicators. A person who has no adequacy on any indicator receives a *ci* score equal to 0.

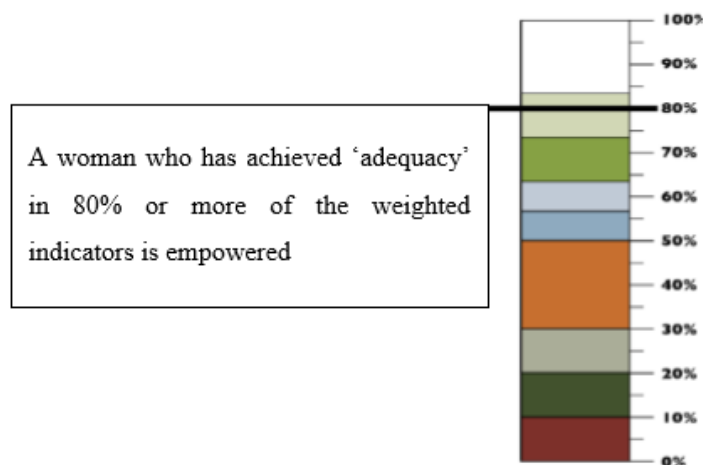


Figure 4 : Adequacy cutoff in agricultural index: source Alkire *et al.*, (2011)

3.4.1.2. Measure the Contribution of Empowerment Indicators to the Disempowerment of Women

Although the objective is to measure of empowerment, the construction of 5DE in such a way helps to analyze disempowerment. The advantage of this construction is that it allows us to identify the critical indicators that must be addressed to increase empowerment. This enables decision makers to focus on the situation of the disempowered. It starts by computing a disempowerment index across the five domains (M_0); then compute 5DE as $(1 - M_0)$.

3.4.1.3. Assess Level of Intra-Household Dietary Diversity

To reflect a diversity of diet, the number of different *food groups* consumed is calculated. The HDDS is used as a proxy measure of the socio-economic level of the household. The following set of 12 food groups is used to calculate the HDDS:

- | | |
|-------------------------|---------------------------|
| A. Cereals | G. Fish and Sea food |
| B. Root tubers | H. Pulses/ legumes/nuts |
| C. Vegetables | I. Milk and milk products |
| D. Fruits | J. Oil /fats |
| E. Meat, poultry, offal | K. Sugar/honey |
| F. Eggs | L. Miscellaneous |

According to Anne (2006) the HDDS is calculated by adding the number of food groups simply and the value is ranged from 1-12.

$$HDDS = \text{sum}(A + B + C + D + E + F + G + H + I + J + K + L)$$

In order to assess the level of intra-household dietary diversity of the study area the HDDS is classified with low, medium and high which is according to Motuma *et al.* (2019). The level of household dietary diversity which is said to be low is thus consuming three or below three food groups in 24 recall period. The level of household dietary diversity said to be medium for households consumed four to six food groups whereas households said to be high level of dietary diversity if consumed seven and above food groups during the 24-hour recall period.

3.4.2. Econometric analysis

When analyze the relationship between women empowerment in agriculture and intra-household dietary diversity, our outcome is household dietary diversity. Both the dependent and independent variables are continuous variables and their relationship is a linear relationship, there was also a normal distribution of dependent variable to the independent variable.

3.4.2.1. Analyze the effect of Women Empowerment in Agriculture for Dietary Diversity

There was endogeneity; factors that affect household dietary diversity was also affect women's empowerment in agriculture. In order to solve this endogeneity bias instrumental variables that are directly correlate with women's empowerment in agriculture and not correlate with the error term is used. Thus, a two Stage Least Squares (2SLS) analytical approach is used which fits the above characteristics of the study therefore, the following stages have been performed.

1st stage estimate womens' empowerment in agriculture

2nd stage analyzing the relationship in A-WEIA & HDD

Hence, in order to analyze the relationship between womens' empowerment in agriculture and household dietary diversity outcomes, the following equation is estimated:

$$Y_i = b_0 + b_1 \times Empowerment + b_2 I + b_3 H + E_i$$

Where b_0 =slope

b_1, b_2 and b_3 = Coefficients

Y_i = household dietary diversity which is measured by dietary diversity score.

I = vector of individual characteristics

H = vector of household characteristics

E_i = the error term.

Possible endogeneity

In order to interpret the effects of women empowerment on household dietary quality in a causal sense, women empowerment in the regression models would have to be exogenous, which may not be the case. One possible source of endogeneity could be reverse causality. Another possible source of endogeneity is unobserved heterogeneity, which is more likely in our context, as it cannot be ruled out that unobserved factors influence women empowerment and dietary diversity simultaneously thus it is tried to address this issue by using an instrumental variable (IV) approach (instrumental variable regression).

The component of the aggregate empowerment score(5DE) may be affected by different determinants that also affect household dietary diversity thus instruments that have no direct effect on household dietary diversity is needed. Finding this instrument for aggregate empowerment score was very challenging. However different studies showed that womens' empowerment is highly dictated by gender norms Feiruz Yimer and Fanaye Tadesse (2015). Thus, it was tried to measure social norms by leave out means of women empowerment score (5DE). The social norm in the village is thus measured by the average village level womens' empowerment score excluding the woman in consideration. This directly affects the empowerment level of the particular women but doesn't affect the household dietary diversity directly.

3.4.2.2. Analyze the effect of women empowerment indicators on household dietary diversity

To analyze the effect of women empowerment indicators on household dietary diversity this study used ordinary least squares because of both those indicators and the dependent variable are continuous, their relation is linear, and the distribution is normal. Therefore, the following equation was developed for those of the six models to test the effect of six empowerment indicators on HDDS.

$$Y_i = b_0 + b_1X_1 + b_2Z_1 + b_3Z_2 + b_4Z_3 \dots \dots \dots + u$$

Where, b_0 =slope

b_1, b_2 and b_3 = Coefficients

Y_i = household dietary diversity which is measured by dietary diversity score.

X_1 = women empowerment indicator

Z_1, Z_2 and Z_3 = dietary diversity variables

u = the error term

Research design of the study

Table 5 research design of the study

Objectives	Type of data	Methods of data collection	Method of data analysis
Assess women's empowerment in agricultural index in the study area.	Primary and secondary data	Interview schedule and deep review from published and unpublished documents	Descriptive statistics by using Abbreviated women Empowerment in Agricultural Index (A-WEAI)
Measure the contribution of the empowerment indicators to the disempowerment of women.	Primary and secondary data	Interview schedule and deep review from published and unpublished documents	Descriptive statistics (A-WEAI)
Assess level of household dietary diversity.	Primary and secondary data	Interview schedule and deep review from published and unpublished documents	Descriptive statistics by using HDDS
Analyze the relationship between women's empowerment in agricultural index and household dietary diversity	Primary and secondary data	Interview schedule and deep review from published and unpublished documents	Econometric analysis by using two stage least square estimation.
Analyze the relationship between women's empowerment indicators and household dietary diversity.	Primary and secondary data	Interview schedule and deep review from published and unpublished documents	Econometric analysis by using ordinary least square estimation

3.5. Variable Definition and Practical Hypothesis

3.5.1. Dependent variables

The dependent variable in this study is household dietary diversity which was derived from 24 hours recall in which the female participants had to list the ingredients, quantity, type of meal as well as the consumed amount for each household member in normal day. And it is a continuous variable. The ingredients were listed and mothers were asked what types of foods they had fed in 24 hours preceding the interview to calculate the household dietary diversity score (HDDS).

3.5.2. Key independent variables

Women's empowerment based on A-WEAI; The main predictor of this study is the women's empowerment in agriculture, it is a continuous variable which was gain by calculating 5DE and GPI to analyze the relationship of women's empowerment and household dietary diversity, studies show that the women's empowerment in agriculture have a direct impact on household dietary diversity and it is also expected that there may have a positive relation between them.

Indicators in abbreviated women's Empowerment; those indicators of women's empowerment also assumed to be the main predictors of the study according to Marco kruse (2019) it is expected that those indicators will have positive coefficient to the household dietary diversity. Thus the study used six different models related to the A-WEAI to test the relationship between women's empowerment and household dietary diversity.

Model I: Aggregate Empowerment Score in the 5DE; is the equally weighted average adequacy achieved within each of the five domains of the A-WEAI. It ranges from zero to one with increasing value indicating increased empowerment.

Model II: Productive Decisions; is the continuous indicator for productive decisions counts the number of agricultural activities in which the participant has some input or feels that they could contribute to the decisions made regarding that domain. An increasing number of input areas stand for greater empowerment

Model III: Income Decisions; is the continuous indicator for income related decisions counts the number of income generation activities in which the participant has some input or feels that they could contribute to the decisions made regarding that domain. An increasing number of input areas stand for greater empowerment.

Model IV: Ownership of Assets; is the continuous variable which is the number of assets which womens' in the household have solely or jointly.

Model V: Access to and Credit Decisions; number of credit decisions in which women participated or feels that she can make credit decisions.

Model VI: Group Membership; is the number of groups in which the respondent has reported to be involved in. The WEAI assumes that greater participation is a sign of greater empowerment because it accounts for the available number of groups for participation - empowerment options - and woman's choice to become active, i.e., take up agency (Alkire *et al.*, 2013).

Model VII: workload; represents the number of hours a woman works daily. The data come from a 24-hour recall starting at 4:00 am the previous day in the A-WEAI a higher burden of workload is regarded as being disempowering (Alkire *et al.*, 2013).

a. Individual variables

Principally the entire objective of this study is to show the relationship of womens' empowerment and household dietary diversity by using household dietary diversity score as dependent variable So that, the following individual characteristics variables will be included as independent variables.

Age of household head; It is a continuous variable measured in the number of years of the household head. According to Motuma *et al.* (2019) increase in age of the household head have a negative effect on dietary diversity of the household. This study hypothesizes the relationship between age and dietary diversity may be indeterminate.

Educational level of household head; according to Marco (2019) education of the household head (years of schooling) has a positive and significant effect on household dietary diversity, Better education typically means higher awareness of nutrition and health issues, which is important for healthy diets. Thus, it is expected that the higher the educational level of the household head may have the higher the household dietary diversity score.

Mothers educational level; according to Murakami *et al.* (2009) mothers who have greater education tends to have higher dietary diversity in the household in this study it is expected that education level of mothers will have a positive effect on household dietary diversity. Education level of mothers will be recorded as the exact school what they have finished.

Age of mothers; according to Marco (2019) age of mothers has a positive effect on household dietary diversity and in this it is expected as whether it will have positive or negative effect on household dietary diversity and it is continuous variable which will recorded by the number of years of mothers from birth up to the year of the survey.

b. Household level variables

Among different sets of household variables, the following key variables used to analyze women's empowerment in agriculture and intra household dietary diversity.

Household size; according to Marco (2019) household size is positively associated with household dietary diversity, more household members with different needs and preferences mean more food diversity at the household level. Thus, it is expected that household size may affect household dietary diversity positively.

Access to training; According to (Jones *et al.*, 2014; Sibhatu, Krishna and Qaim, 2015) high training access can positively affect dietary diversity as smallholder households' trainers gain information about the use of diverse foods. Thus, it is expected that access to training will have a positive effect on dietary diversity of the household and it is a dummy variable have no training access = 0 or who have training access =1.

Income level of the household; income level of the household may also be another variable which affect household dietary diversity, according to Alkire *et al.* (2013) when the households reached in a certain income level, they consumed more divers' foods and the higher the income level of the respondent grants women's more options they could choose and use their independent decision making. Thus, it is expected that different income group will have different dietary diversity score and different level of social capital.

Area of cultivated land; according to Liza (2017) area of cultivated land positively correlated to the nutritional out come as greater area of cultivation increases the opportunities to either to generate money to buy divers foods from the market or to cultivate for own consumption in abundance. Thus, it is expected that the household with the large the area of cultivated land will have the higher dietary diversity score.

Distance to market; this variable reflects the market access and the availability of food consumption that hasn't been produced within the household as Enebsie Sar Midir *woreda* is sparsely populated and has relatively low infrastructure distance to market may have negative effect on dietary diversity of the household.

Number of Dependents ; the number of dependant may have negative association with household dietary diversity according to Liza (2017) dependents which are aged below 15 and above 64 assumed to no longer be actively contributing to the household income it implies that more family members rely on fewer income producers thus less income per capita should be available for purchasing food items. It is continuous variable which is the number of dependents in the household counted and recorded in number.

Table 6 summary table of Dependent and Independent variables

Variables	Category	Measurement	Expected sign
Household dietary diversity	Continuous	1-12	Dependent
Aggregate Empowerment Score in the 5DE	Continuous	0-1	+
Number of productive decisions	Continuous	Number of decisions	+
Number of income decisions	Continuous	Number of decisions	+
Ownership of assets	Continuous		+
Access to and credit decisions	Continuous	Number of decisions	+
Group Membership	Continuous	Number of group membership	+
Workload	Continuous	Hour	-
Age of household head	Continuous	Completed year	-
Educational level of household head	Continuous	Completed grade level	+
Mothers educational level	Continuous	Completed grade level	+
Age of mothers	Continuous	Completed year	+
Household size	Continuous	Number of household member	-
Access to training	Dummy	0= no training access 1= training access	+
Annual income	Continuous	In ETB	+
Area of cultivated land	Continuous	Hectare	+
Distance to market	Continuous	Km	-
Number of Dependent	Continuous	Number of Dependent	-

Chapter 4. RESULT AND DISCUSSION

The presentation of the results started by looking at descriptive statistics for individual-level and household-level variables, including general socioeconomic characteristics as well as the main variables of interest, namely dietary diversity and women empowerment.

4.1. characteristics of the Respondents

Table 4.1 below presents descriptive statistics for those key variables included in the analysis. The average sample household has around six members in the study area. In terms of market access, the average distance to the closest food or agricultural market is about 4.21 kilometers. The average gross annual income of sample households is about ETB 20,401 and cultivates 1.843 ha. The average number of dependents is almost 2 member of those households which is below 14 aged or above 65 aged for the study area. This implies that there are two household members who haven't extra implication for production rather than being depend on the remaining household members. About 39% of those households have been participated in nutritional training in the district. The average number of food groups consumed during the 24-hour recall period was about 5.591 in the study area this implies that the study area has medium level of dietary diversity in those sample households.

The mean age of the sample women respondent found to be around 37 years and the mean age of sample household heads (men) found to be 45 years in the study area. This implies that the majority of women respondent as well as household heads (men) were within the productive age. The average education level of sample household heads (men) was 1.33 and the average education level of sample women respondents was 0.66. This implies sample household heads (men) as well as sample women respondents in the study area are not well educated.

Table 7: Descriptive statistics of dietary diversity and Socioeconomic characteristics

Variables	Obs	Mean	Std.dvn	Min	Max
Household characteristics					
Household size (members)	200	5.505	1.638	2	10
Distance to nearest market(km)	200	4.212	2.010	0.052	8.973
Annual income of household (sqrt)	200	142.833	53.366	22.361	290
Total land holding (ha)	200	1.843	0.865	0.25	4
Number of dependant	200	2.095	1.373	0	5
Training in nutrition	200	0.39	0.489	0	1
Individual characteristics					
Age of household head (years)	200	45.57	10.118	23	67
Age of woman (years)	200	37.82	9.228	18	63
Year of schooling of household head	200	1.335	2.592	0	13
Year of schooling of woman	200	0.665	1.335	0	8
Dietary diversity					
Household dietary diversity (HDDS)	198	5.591	2.040	2	10

Source: Own survey result, 2021

4.2. Women empowerment

Descriptive statistics of the women empowerment in agriculture variable that used in the regression models is shown in table 7 the empowerment score which uses all six indicators of the five domain of empowerment (5DE) which was calculated by Alkire, Foster methodology (2013) which has a mean value of 0.657 in the study area. This implies that women in the study area have adequate achievement in 65% of indicators in A-WEAI. While we use the individual household observations of womens' empowerment as explanatory variables in the regression

models, it is interesting to use the data for calculating womens' empowerment in agricultural index (A-WEAI). However, WEAI is the sum of weighted five domain of empowerment (5DE) and gender parity index (GPI) from 0.9 and 0.1 respectively, because of the shortage of data for those household heads (men's) to calculate the gender parity, this study analyzes WEAI in five domains of empowerment (5DE).

The mean number of decisions in which womens was able to decide lonely or jointly in production activities was 1.51. This implies that womens in the study area have no more input in production decisions. The mean number of decisions in which women were able to decide lonely or jointly in credit decisions was 0.652. This implies that womens in the study area have no more input in credit decisions whether to decide the amount of credit taken or to decide what to do on that credit. The average number of assets in which womens have lonely or jointly was 2.16. This also implies that womens in the study area are dis empowered in ownership of assets aspect of women empowerment indicator. The average number of groups in which women were a member of each was 0.92 it indicates that women in the study area were not active member of groups. The average time in which sampled women respondents spend in working agricultural and non-agricultural during 24-hour recall was about 0.93 hours.

Table 8 Descriptive statistics of dietary diversity and women empowerment variables

Variables	Obs	Mean	Std.dvn	Min	Max
Women empowerment					
Empowerment score (5DE)	198	0.657	0.189	0	1
No of production decision	200	1.51	1.121	0	4
No of income decision	200	1.13	0.988	0	3
No of assets of woman	200	2.16	1.492	0	5
No of credit decisions	198	0.652	0.875	0	3
No of group membership	200	0.92	1.029	0	3
Workload in hour	200	9.325	1.942	5	14
Instrument					
Leave out means of women empowerment score	198	0.657	0.103	0.444	0.893

Key: Obs: observation, Std.dvn: standard deviation, Min: minimum, Max: maximum

4.2.1. The 5DE Index

This sub index indicates whether women are empowered across the five domains of empowerment examined in A-WEAI and for the women who are disempowered it also show the percentage of domains in which they meet the required threshold and those experience sufficiency or adequacy. Thus, according to Alkire *et al.* (2012) there is to be begin by computing the disempowerment index across the five domains (M_0); then we compute 5DE as $(1 - M_0)$.

Computing 5DE

As mentioned above computing the five domain of disempowerment index (M_0) Followed the structure of the Adjusted Headcount measure of Alkire and Foster (2011), M_0 combines two key pieces of information: (1) the proportion or incidence of individuals (within a given population) whose share of weighted inadequacies is more than *the disempowerment cutoff* and (2) the intensity of their inadequacies—the average proportion of (weighted) inadequacies they experience.

The headcount ratio of disempowered (H_p) of Libo Kemkem is 71.4% and 65% in Enebsie Sar Midir calculated by using the formula of Alkire *et al.* (2012) which is;

$H_p = q/n$ where q is the number of womens' disempowered and n is the total observation.

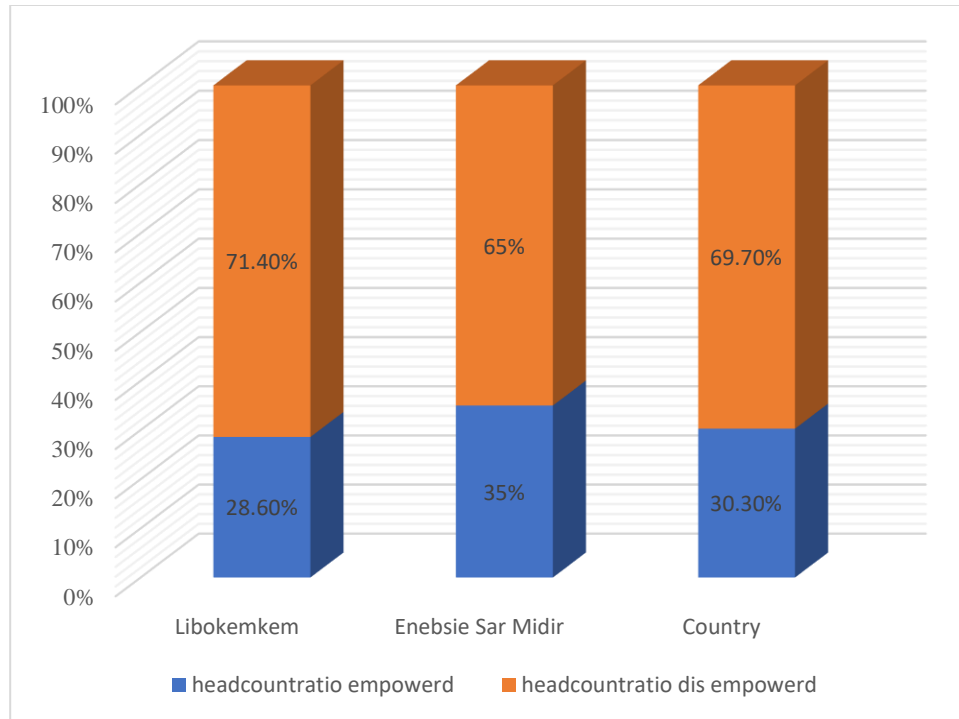


Figure 5 : headcount ratio of empowered and disempowered womens’

As shown on above figure 6, 69.7% of womens in the study area are inadequate where their achievement in those indicators is less than 80% and those of the remaining 30.3% of respondents are said to be empowered in five domain of empowerment and this study is inline with the study by Lemlem (2016) Toke Kutaye District of Oromia region.

Head count ratio of womens’ disempowerment in those indicators

This section discusses about those percentage of womens’ which are disempowered in those five domains of empowerment indicators. As shown in the following Figure 7 womens’ in in the study area are more disempowered in access to and control over credit decisions which is 56.2% this implies that more than half of the women respondents in the district were unable to decide whether to borrow or to do something by that credit. In other word only 43.8% of women respondents were empowered in access to and control over credit decisions who have power to decide whether to borrow or what to do with that credit.

The second most indicator in which womens' were disempowered was also group membership which is 52% of womens' were not member of at least one group it implies that only 48% of women respondents were a member of one or more than one groups.

About 27% of women respondents were disempowered in participation and input in agricultural production indicator of abbreviated womens' empowerment in agricultural index whereas those of 73 % of respondents were empowered in input in agricultural production indicator.

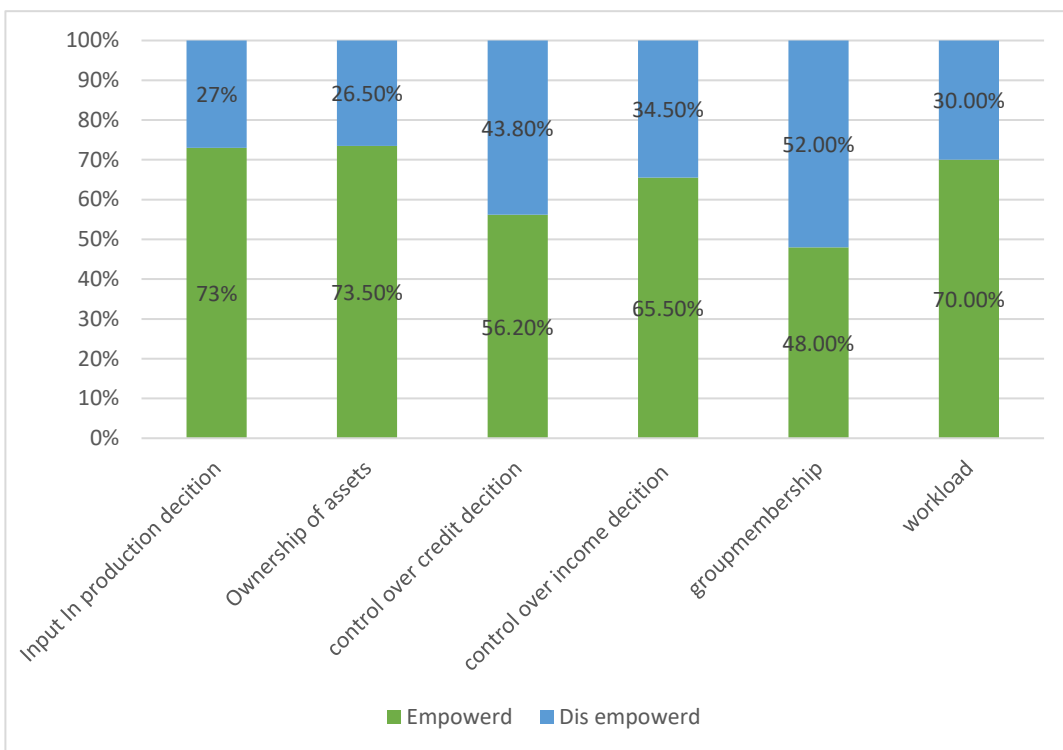


Figure 6 : Head count ratio of disempowerment of womens' in those empowerment indicators

4.3. Womens' Empowerment in the study area

Womens' empowerment in this study is said to be the weighted score in five domain of empowerment which is expressed as 5DE index calculated by;

$$5DE = 1 - M_0 \quad \text{where } M_0 \text{ is the disempowerment index}$$

Thus, it is need to calculate the disempowerment index first by using the following formula;

$$M_0 = \text{headcount inadequacy ratio } (H_p) * \text{intensity (breadth) of disempowerment } (A_p)$$

Where intensity of empowerment (A_p) is the average inadequacy score of disempowered womens’.

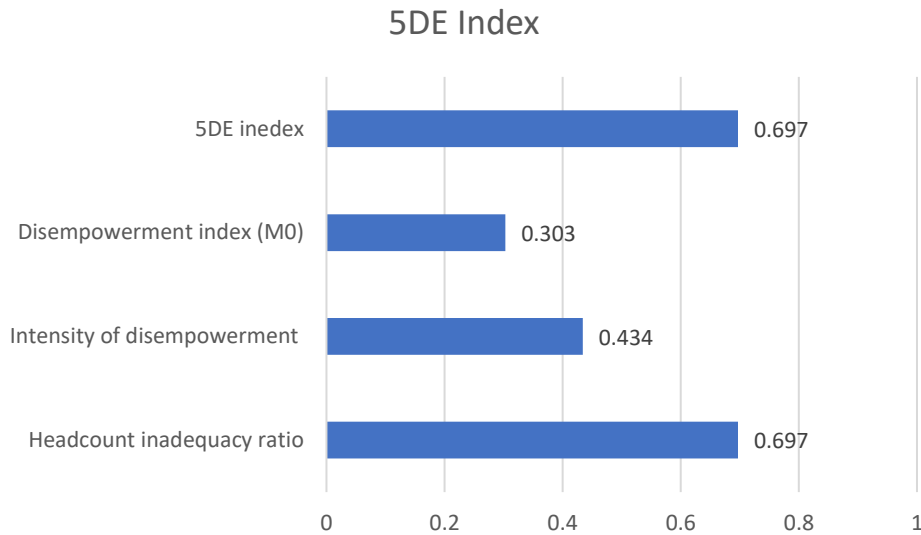


Figure 7 : Aggregate empowerment of womens’ (5DE index) source: (own data)

As shown in Figure 8, the 5DE score for the study shows that 69.7 percent of women who are not yet empowered have, on average inadequate achievements in 43.4 percent of those empowerment domains. Thus, womens’ disempowerment index(M_0) is 69.7 percent \times 43.4 percent = 0.303 and 5DE is $1 - 0.303 = 0.697$. This implies that the aggregate womens’ empowerment in those five domains and six indicators is 0.697 this means womens’ in the district achieved adequacy in 69.7% of those indicators and this study was also inclined with the study by Feiruz (2015) in Ethiopia.

4.4. Weighted Contribution of Indicators and Domains to the Overall Disempowerment of Womens' of those *Woreda*

Having measured empowerment, we now need to increase it. To do so, it is useful to understand how women are disempowered in different contexts. A key feature of M_0 is that once the disempowered have been identified (in other words, once M_0 has been computed), one can decompose M_0 into its component-censored indicators to reveal how people are disempowered—the composition of inadequacies they experience.

To decompose by indicators, compute the censored headcount ratio in each indicator. The censored headcount ratio for a particular indicator is obtained by adding up the number of disempowered people who are deprived on that indicator and dividing by the total population. Once all the censored headcount ratios have been computed, it can be verified that the weighted sum of the censored headcount ratios also generates the country's M_0 . That is, if the M_0 is constructed from all 6 indicators, then

$$M_o = w_1CH_1 + w_2CH_2 + \dots + w_6CH_6$$

Here w_1 is the weight of indicator 1, CH_1 is the censored headcount ratio of indicator 1, and so on for the other five indicators, with $\sum w_i d_i = 1$. It is called censored because the inadequacies of women who are not identified as disempowered are not included so as to focus attention on disempowered women.

The percentage contribution of each indicator to overall disempowerment is computed as follows:

$$\text{contribution of indicator } i \text{ to } M_o = \frac{w_i CH_i}{M_o} \times 100$$

4.4.1 Weighted Contribution of Indicators to the overall Disempowerment of womens' of those *woreda*

According to Figure 9 below womens' in the study area were highly disempowered in group membership indicator of women empowerment in agricultural index. It holds about 27.60% of the overall disempowerment. This implies that group membership indicator holds about more than one fourth of the overall disempowerment. Control over use of income was also the second most indicator which covers about 19.8% of the overall dis empowerment. This implies that Control over use of income was also covered one fifth of the overall disempowerment.

Workload was also the third most indicator which holds the overall weighted disempowerment which is 17.20% of it. This implies that women were not able to take their time for leisure rather than using their time for work at field as well as at home. Input in production decision was also another indicator which covered about 15.55% of the overall disempowerment.

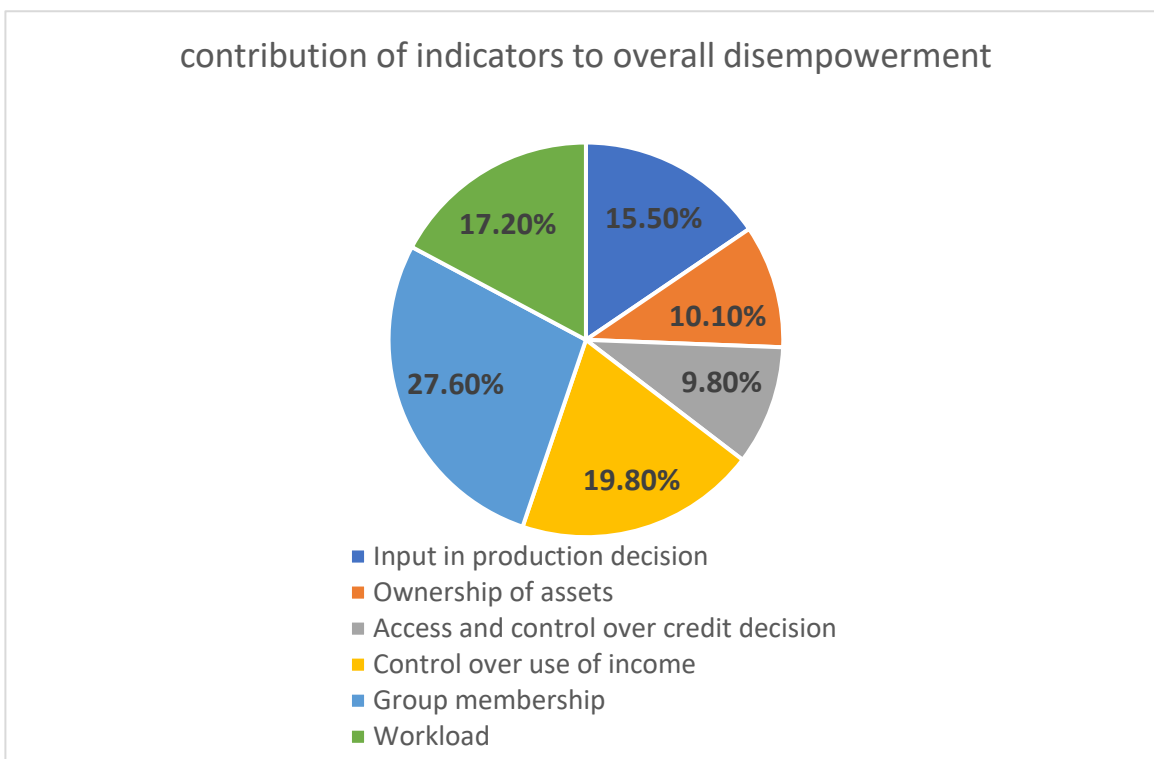


Figure 8 : Weighted contribution of indicators to the overall disempowerment

The indicators, ownership of assets and access to and control over credit decision indicators were covered about one fifth of overall disempowerment, 10.10% and 9.8% respectively. This study is inclined with the study by Malapit (2015) in Ghana.

4.4.2. Weighted Contribution of domains to the overall Disempowerment of womens’

Figure 9 above 1shows the contribution of each indicator inside those women empowerment dimension to the overall disempowerment whereas Figure 10 below shows the contribution of those five domains (dimension) of empowerment to the overall disempowerment in the study area.

The decomposed result of 5DE revealed that the domains that contributed most to women disempowerment was group membership (27.80%) and resource (19.90%) in the study area. This implies that those two dimensions contribute around half of (47.7%) of the overall disempowerment of the district.

The third most dimension was also income (19.8%) this implies that this domain covers around one fifth of the overall disempowerment. The remaining two dimension of empowerment, time and production were covered almost one third of the overall disempowerment.

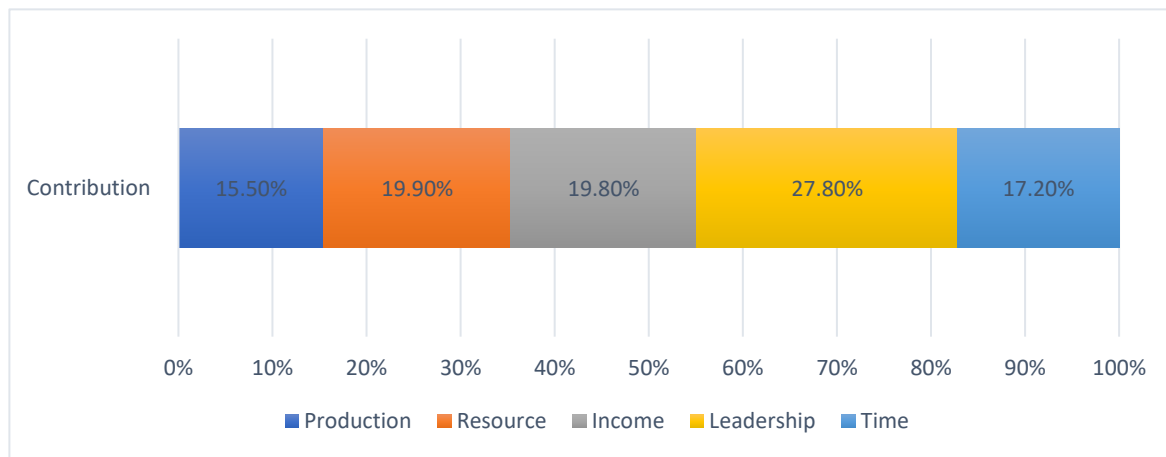


Figure 9 : Weighted contributions of domains to the overall disempowerment

4.5. Dietary Diversity

As shown by table 8 above the descriptive statistics for the dietary quality variable HDDS have mean value of 5.59 in the study area, this is almost similar to other recent studies that had used 24-hour recall period to assess household dietary diversity among smallholders in southwest Ethiopia Motuma *et al.* (2019).

The study showed that almost all household which is about 96.9% of those households in the study area consumed cereals this implies that the major household's diet is mainly based on cereals. As many of previous studies (Motuma *et al.*, 2019; Marco Kruse, 2019) this study also reported the dominance of cereals on intra household dietary diversity. The consumption of roots and tubers was also 34.8% in the area. About 63.1% of the household consumes vegetables which is almost the same as the finding in south west Ethiopia Motuma *et al.* (2019). Whereas 71% of households in Enebsie Sar Midir consumes vegetables

About 28.3% of those households in the study area consume fruits. The finding also indicates that intake of meat was 38.9%. The consumption of eggs from those households was also 32.8% in the study area. As many of studies, this study finding indicates that almost no household consumes fish and sea foods except 2 households consumed it. This implies that eating fish in different part of Ethiopia hasn't been adopted.

As shown in table 9 below about 71.7% of household also consumed legumes, nuts and seeds like beans and peas, in the form of *wot*, *kolo* or *nifro* which is almost the same as many of those previous studies (Mkemwa, 2015).

About 35.4% of households consumed milk and milk products like butter, yogurt cheese *arera* and *aguat*. This study also indicates that 60.1% of households consumed oil, butter and fat group in the study area.

Table 9 Descriptive statistics of household dietary diversity in those food groups

HDD type	Obs	Mean	Std.dvn	Min	Max
Cereals	198	0.969	0.172	0	1
White tuber and roots	198	0.348	0.478	0	1
Vegetables	198	0.631	0.484	0	1
Fruits	198	0.283	0.452	0	1
Meat	198	0.389	0.489	0	1
Egg	198	0.328	0.471	0	1
Fish and sea foods	198	0.010	0.100	0	1
Legumes, nuts and seeds	198	0.717	0.452	0	1
Milk and milk products	198	0.354	0.479	0	1
Oils and fats	198	0.601	0.491	0	1
Sweets	198	0.444	0.498	0	1
Spices, condiments and beverages	198	0.515	0.501	0	1

4.5.1. Dietary diversity status of households in those woreda's

The household dietary diversity score which is used for the regression has been explained in table 4.1 which is continuous and it ranges from 1 up to 12 food groups but this portion is in order to know the level of dietary diversity of households of the study area is classified with low, medium and high which is according to Motuma *et al.* (2019). The level of household dietary diversity which is said to be low is thus consuming three or below three food groups in 24 recall period. The level of household dietary diversity said to be medium for households consumed four to six food groups whereas households said to be high level of dietary diversity if consumed seven and above seven food groups during the 24-hour recall period.

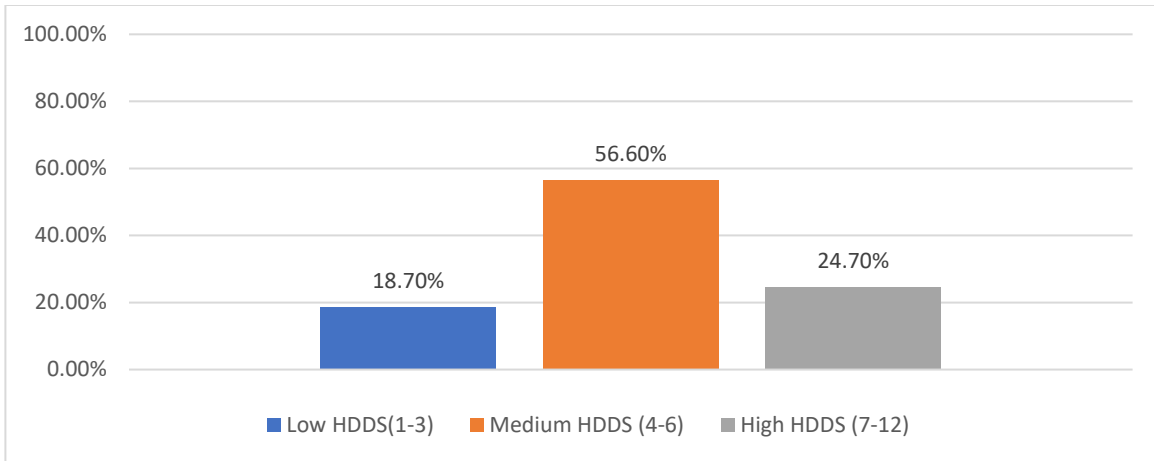


Figure 10 : level of dietary diversity in the study area

As shown by Figure 4.6 the status of dietary diversity in the study area indicates that from 198 of households 37 (18.70%) of households consumed up to three food groups (low dietary diversity), 112 (56.60%) consumed four to six food groups (medium dietary diversity) and 29 (24.70%) consumed seven or more food groups (high dietary diversity) during the preceding 24 hours. This result was also almost the same as the study by Motuma *et., al.* (2019) in southwest Ethiopia.

4.6. Econometric Analysis Result

4.6.1. The effect of womens' empowerment in agriculture on household dietary diversity.

Table 10: shows the association between women's empowerment in agricultural index which is the average value of five domains of empowerment score with household dietary diversity. We used two stage least square approaches to minimize endogeneity problem. Thus, five domains of empowerment score is instrumented by the leave out means of empowerment score which is the average score of empowerment score excluding the woman herself into consideration. The regression shows as the five domains of empowerment in agricultural index have appositive relation with household dietary diversity in both the OLS and the instrumental regression estimation. This was also true on the study by Feiruz Yimer and Fanaye Tadesse (2015) in Ethiopia and Marco Kruse (2019) employed in Tunisia and India. However, those

two studies used the women empowerment in agricultural index (WEAI) rather than the Abbreviated women's empowerment in agricultural index (A-WEAI).

As indicated in table 10: below there was also individual and household variables which have positive association with household dietary diversity in *model I*. Training in nutrition thus have a positive relation with the household dietary diversity, this implies that household who have participated in nutritional training have greater dietary diversity than those who haven't participated. Educational level of both man and women has positive relation with the dietary diversity. Number of dependant also have a negative influence on household dietary diversity which means household who have more number of dependent have lower dietary diversity score than the others this result was also the same as the study by Liza, (2017) in Bangladesh.

Five domains of empowerment score have positively associated with household dietary diversity and statistically significance at 5% level of significance on both of the OLS and IV estimation. The result revealed that, when other variables held Constance, increase 5DE score in 0.01 there is increasing household head dietary diversity by 0.0187 and 0.086 score in the OLS and the 2SLS, this implies that womens' empowerment in agriculture has a positive impact on household dietary diversity. This result is in line with the study by Feiruz Yimer and Fanaye Tadesse (2015) in Ethiopia and Marco Kruse (2019) employed in Tunisia and India.

Year of schooling of the house hold head has positively associated with household dietary diversity on both of the OLS and IV estimation. It is also significantly influenced at 5% level of significance on the OLS estimation. The result revealed that, when other variables held constance, increase household head in one year of schooling increasing household head dietary diversity by 0.134 score. This implies that year of schooling has a positive impact on household dietary diversity. This result is in line with the study by Feiruz Yimer and Fanaye Tadesse (2015) in Ethiopia.

Table 10 Coefficient estimate of Women Empowerment (5DE) and Household Dietary diversity.

Variables	Model I: 5DE score	
	OLS estimate	IV estimate
5DE score	1.869*** (0.703)	8.653*** (2.539)
Household size	0.197*** (0.074)	0.130 (0.091)
Distance to nearest market	-0.089 (0.055)	-0.048 (0.061)
Annual income of household	-0.001 (0.002)	0.001 (0.003)
Total land holding	0.042 (0.132)	-0.024 (0.175)
Number of dependant	-0.28*** (0.088)	-0.187* (0.114)
Training in nutrition	1.252*** (0.236)	1.025*** (0.283)
Age of household head	-0.029 (0.028)	0.044 (0.048)
Age of woman	0.032 (0.031)	-0.044 (0.053)
Year of schooling of household head	0.134** (0.052)	0.016 (0.088)
Year of schooling of woman	0.170* (0.102)	-0.004 (0.151)
Observations	196	196
R squared	0.496	
Ovtest	0.107	
Hetest	0.346	
Kleibergen-Paap Wald F		19.47
Kleibergen-Paap lm(p-value)		0.000
Durbin-Wu-Hausman test (p-value)		0.001

Note: OLS is the ordinary least squares estimation and IV is instrumental variable estimation. The figures in the parenthesis are standard errors clustered at village level; *** p<0.01, **p<0.05 and * p<0.1.

The Durbin-Wu-Hausman test of endogeneity rejects the null of exogenous repressors. The Hansen J statistics indicates that the instrument is valid. The Kleibergen-Paap LM test is also significant indicating that the excluded instrument is correlated with the endogenous regressors, the Kleibergen-Paap Wald F statistics exceed the Stock and Yogo (2005) critical values at 5 percent. The instrument is not weak. The first stage estimation also indicates the significance and positive relationship between five domain of empowerment and leave out means of empowerment (see appendix 1).

4.6.1. Association between Womens' Empowerment Indicators and Household Dietary Diversity

Table 11 shows the regression result for associations between women empowerment and household dietary diversity. The household dietary diversity score (HDDS) is the dependent variable in all models, the six models shown are all identical with the only difference is that different measures of women empowerment indicators are used as explanatory variable.

Empowerment indicators in *model II, model III, model IV and model V* have positive and statistically significant coefficients. However, work load in model VII has negative and statistically significance coefficient. The remaining empowerment indicator group membership in model VI has positive coefficient but not statistically significance.

Production Decisions

As expected, the indicator, production decision has positive and statistically significance at 1% level of significance. Table 11 in model II showed that when there is an increase in number of production decision of woman by 1, there is an increase in household dietary diversity by 0.277 by keeping other variables constance. Moreover, this study revealed that increasing number of decisions of womens in production activities increases the chance to have high level of dietary diversity. This result is contradicted with the study by Liza (2017) in Bangladesh.

Income Decisions

As shown by table 11 in model III number of income decision has positive and significance at 5% significance level to household dietary diversity. This revealed that when held other variables constance an increase in number of income decision by 1, there is also an increase in household dietary diversity by 0.271. moreover, this study revealed that edition making power of woman regard to income usage in the family affected household diversity positively. This study is in lined with the study by Liza (2017) in Bangladesh and in lined with the study by Malapit et, al. (2013) in Nepal.

Ownership of Assets

As expected, number of assets of women has positive and statistically significance at 1% level of significance with household dietary diversity. This result magnifies that this women empowerment indicator affected dietary diversity positively in the study area. According to table 11 below in model IV an increase in number of assets by 1, there is also an increase in household dietary diversity by 0.249. This result is in line with the study by Feiruz Yimer and Fanaye Tadesse (2015) in Ethiopia and Marco Kruse (2019) employed in Tunisia and India.

Access to and Credit Decisions

Table 11 in model V showed that, access to and credit decision has positive and statistically significance at 10% level of significance. This revealed that access to and number of credit decisions of woman affected dietary quality positively. Increase in number of credit decisions by 1, there is an increase of household dietary diversity by 0.222 by holding other variables constance. This study is in lined with the study by Marco Kruse (2019) in Tunisia and India.

Group Membership

This study revealed that group membership affects household dietary diversity positively. But it wasn't statistically significance as expected. As shown by table 11 in model VI the sign of association is positive and this result magnify that when the probability of womens participating in different groups they may share different knowledges which have great impact on increasing the chance of having high dietary quality.

Workload

This study investigated that workload has negatively and statistically significance with household dietary diversity by 5% level of significance. As shown by table 11 in model VII the result implied that by holding other variable constance, an increase in workload of woman by 1 hour, there is a decrease in household dietary diversity by 0.138. As seen by their association thus, the empowerment indicator workload affected household dietary diversity negatively. The plausible reason is that workload of woman could reduce the time to produce more diverse foods. This study contradicts the study by Liza (2017) in Bangladesh and in lined with the study by Malapit et, al. (2013) in Nepal.

Table 11 Association between women empowerment indicators and household dietary diversity

Variables	Model II: Productive Decisions	Model III: Income Decisions	Model IV: Ownership of Assets	Model V: Access to and Credit Decisions	Model VI: Group Membership	Model VII: workload
No of production decisions	0.277*** (0.105)					
No of income decisions		0.271** (0.127)				
No of assets of woman			0.249*** (0.072)			
No credit decisions				0.222* (0.130)		
No of group membership					0.138 (0.110)	
Work load in hour						-0.138** (0.058)
Household size	0.187** (0.073)	0.201*** (0.073)	0.199*** (0.072)	0.211*** (0.074)	0.202*** (0.074)	0.201*** (0.073)
Distance to nearest market	-0.082 (0.056)	-0.093 (0.056)	-0.119** (0.054)	-0.112** (0.056)	-0.102* (0.056)	-0.092* (0.055)
Annual income of household	-0.002 (0.002)	-0.001 (0.002)	-0.002 (0.002)	-0.002 (0.002)	-0.002 (0.002)	-0.002 (0.002)
Total land holding	0.049 (0.132)	0.047 (0.133)	0.058 (0.131)	0.076 (0.134)	0.073 (0.135)	0.062 (0.133)
Number of dependant	-0.268*** (0.086)	-0.286*** (0.087)	-0.278*** (0.084)	-0.300*** (0.088)	-0.290*** (0.087)	-0.286*** (0.086)
Training in nutrition	1.252*** (0.235)	1.217*** (0.239)	1.35*** (0.232)	1.28*** (0.239)	1.296*** (0.238)	1.254*** (0.236)
Age of household head	-0.041 (0.027)	-0.043 (0.027)	-0.058** (0.027)	-0.049* (0.027)	-0.052* (0.027)	-0.042 (0.027)
Age of woman	0.045 (0.030)	0.044 (0.031)	0.061** (0.029)	0.052* (0.031)	0.055* (0.031)	0.040 (0.031)
Year of schooling of household head	0.148*** (0.051)	0.148*** (0.052)	0.165*** (0.050)	0.159*** (0.052)	0.161*** (0.052)	0.154*** (0.051)
Year of schooling of woman	0.192* (0.101)	0.172* (0.103)	0.183* (0.099)	0.197* (0.102)	0.202* (0.103)	0.221** (0.100)
Observations	198	198	198	196	198	198
R squared	0.489	0.482	0.502	0.484	0.474	0.485
Ovtest	0.119	0.506	0.250	0.187	0.232	0.109
Hetest	0.914	0.469	0.899	0.449	0.764	0.786

Coefficient estimates of OLS regressions are shown with standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.

To the reverse of the expectation household size in all model's has positively and statistically significance at 1% level of significance. The result indicated that, when other variables held Constance, increase in household size in 1 there is increasing household dietary diversity by 0.187, 0.201, 0.199, 0.211, 0.202, and 0.201 respectively from model II to model VII. This study is in lined with the study by Marco Kruse (2019).

Number of dependant was also has negatively and statistically significance at 1% level of significance. The result revealed that, when other variables held constance increase in dependent by 1 person there is decreasing household dietary diversity by 0.268, 0.286, 0.278, 0.300, 0.290, and 0.286 respectively from model II to model VII. Moreover, the result suggests that minimizing number of dependents through family planning and by other means of contraception there would have chance to increase high dietary quality this study is in lined with the study by Liza (2017) in Bangladesh.

As shown in table 11 above distance to market also has negatively associated with household dietary diversity in all models. It is also statistically significance at 10% level of significance in models III, VI and VII. This implied that when other variables held constance increasing distance of market from the homestead by 1 kilometer, there is decreasing dietary diversity by 0.093, 0.102, and 0.092 in models III, VI and VII respectively. Moreover, the result directs that minimizing distance of markets by building local markets it is possible to increase household dietary diversity.

Training in nutrition in both models has positive significance at 1% level of significancy according to the ordinary least square result in table 11 thus households who trained in nutrition had better dietary quality that who didn't take any training. The plausible reason is that woman could get different understandings from nutritional trainings regard to household dietary diversity. this result is in lined with jones et al (2014) studied in Malawi. As shown in table 11 when the woman gets training there is an increase in household dietary diversity by, 0.148, 0.148, 0.165, 0.159, 0.161, and 0.154 in models II to VI respectively.

Educational level of womens' in the study area was also has positive and statistically significance with household dietary diversity in all models. Furthermore, it is significance at 10% level of significance in models from II to VI. This revealed that when held other variables constance, an increase in years of formal education of woman increased by one year, there is also an increase of household dietary diversity by 0.192, 0.172, 0.183, 0.197, and 0.202 in models II to VI respectively. In model VII educational level of woman has positive and statistically significance at 5% level of significance. This study in both models magnified that by increasing the opportunities of mothers for education there is a chance to increase household dietary quality. This finding is in lined with Motuma et al (2019) studied in Yayu district of southern Ethiopia.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

This study demonstrated that the recently developed A-WEIA can be used not only to assess the level of womens' empowerment in agriculture but also it is used to identify areas where the gaps in empowerment are greatest. Domain of leadership and control over resources are identified as the most contributor to womens disempowerment. The findings also verify that households in the study area found at medium level of dietary diversity.

Based on the results of two stage least square model, the findings confirm that training in nutritional aspect, women empowerment, education level of both woman and the household heads have increased the probability of having high dietary diversity. The findings also confirm that number of dependant and distance to the nearest market are major bottlenecks to have high household dietary diversity.

Based on the results of ordinary least square model, the findings confirm that number of production decision of women, number of income decision of women, number of asset of women, and number of credit decision of womens have increased the probability of having high dietary diversity. On the reverse the study identifies that workload of womens' is the barrier to have higher household dietary diversity.

Generally as expected, this study investigated that average empowerment and women empowerment indicators are an important determinant of dietary diversity. Women play a significant role in household food consumption and production; they also have the capacity to make better choices on the quality and mix of diet that the household will be consuming. This is unlike males, whose main responsibilities in the household are not directly tied to diet or decision over the choice and mix of diets.

5.2 Recommendations

The findings revealed that educational level of womens' significantly influenced household dietary diversity. Therefore, Amhara Education Bureau should expand women based educational system in rural areas in such way it meets extensive applications of improved dietary diversity.

Farmers training on nutritional aspect were positively and significantly influenced the dietary quality of the household. Hence, kebele agricultural extension agents and kebele health extension agents jointly should organize regular training for farmers in relation to improved dietary diversity.

Womens' empowerment was positively and significantly influenced the dietary quality of the household. Therefore, NGOs like Food for Hunger, FH Ethiopia, PSNNP, and Feed the Future should jointly do with Bureau of Women, Children & youth affairs on empowering womens' to make important life decisions considering three dimensions: resource, agency, and achievements.

Ownership of assets of woman also influenced dietary diversity positively and significantly this implies that Bureau of Amhara Regional Land Administration and Use should give special concern regard women's land ownership rights. Number of credit decision of womens was affect household dietary diversity positively. Therefore, Amhara Saving and Credit cooperatives should work on participating womens in credit decisions with their counterparts.

According to the finding of this inquiry, distance to the nearest market affect household dietary diversity negatively and significantly. Therefore, NGOs like ORDA, Food for Hunger, FH Ethiopia, PSNP, Feed the Future should jointly do with woreda trade and industry sector to build local markets.

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APPENDICES

Appendix Table 1 Omitted variable test using Ramsey RESET

Model (I) Ols	Ho: model has no omitted variables	$F(3, 180) = 2.06$
	Hl: model has omitted variables	$\text{Prob} > F = 0.1077$
Model (II)	Ho: model has no omitted variables	$F(3, 183) = 1.97$
	Hl: model has omitted variables	$\text{Prob} > F = 0.1194$
Model (III)	Ho: model has no omitted variables	$F(3, 183) = 0.78$
	Hl: model has omitted variables	$\text{Prob} > F = 0.5060$
Model (IV)	Ho: model has no omitted variables	$F(3, 183) = 1.38$
	Hl: model has omitted variables	$\text{Prob} > F = 0.2502$
Model (V)	Ho: model has no omitted variables	$F(3, 181) = 1.62$
	Hl: model has omitted variables	$\text{Prob} > F = 0.1866$
Model (VI)	Ho: model has no omitted variables	$F(3, 183) = 1.44$
	Hl: model has omitted variables	$\text{Prob} > F = 0.2321$
Model (VII)	Ho: model has no omitted variables	$F(3, 183) = 2.04$
	Hl: model has omitted variables	$\text{Prob} > F = 0.1094$

Appendix Table 2 Results of the first stage regression on empowerment measures for household dietary diversity

Variables	5DE score
Leave out means of womens' empowerment (5DE) score	0.47982*** (0.10872)
Household size	0.0104258 (0.0073558)
Distance to nearest market	-0.002705 (0.0055966)
Annual income of household	-0.0003529* (0.0001985)
Total land holding	0.0164869 (0.0133407)
Number of dependant	-0.011311 (0.0087091)
Training in nutrition	0.0296694 (0.0236403)
Age of household head	-0.0103401*** (0.0027218)
Age of woman	0.0102532*** (0.0030265)
Year of schooling of household head	0.0187283*** (0.0050983)
Year of schooling of woman	0.0211641** (0.0100565)
Observations	196
R squared	0.4126

APPENDIX 3

SURVEY INTERVIEW SCHEDULE

Objectives: This survey is a part of MSc research project to assess the role of womens; empowerment in agriculture for dietary diversity. The data is collected at household level. Thus, household head is the respondent of individual and household level questionnaire and the woman is the respondent of women empowerment related questionnaire.

Name of data collector: _____

Date of data collection ____/____/____

GPS location

Altitude: _____

N: _____

E: _____

Woreda: _____

Kebele: _____

Part 1 individual characteristics

	A101	A102	A103	A104	A105	A106	A107	A107
	Name	Relationship to head of household 1 Head 2 Spouse 3 Child 4 Grandchild 5 Parent/Parent-in-law 6 Sibling 7 Brother-/sister-in-law 8 Other relative 9 Other nonrelatives	Sex 0 Male 1 Female	Age completed in years Years If less than 1, write 0	Marital Status 1.Single 2.Married 3.Divorced 4.Widowed	Educational attainment (person 6 years old or older) 0-None 1. Grade 1 2-Grade 2 3-Grade 3 4-Grade 4 5-Grade 5 6 Grade 6 7 Grade 7 8 Grade 8 9 Grade 9 10 Grade 10 11-Grade 10 12 Grade 12 12 Diploma 14 Bachelors 15Adult education 16 religious education 98 Other, specify	What was (name)'s primary occupation in the last 12 months? (person 6 years old or older) CODES at a side	1. Agricultural farmer 2. Agricultural laborer 3. Non-agricultural laborer (permanent) 4 Non-agricultural laborer (casual) 5. Craftsman 6 .Trader 7. Non-farm salaried employment 8.Self-employed nonfarm enterprise 9. Self-employed natural resource extraction 10. Student 11. Unemployed, seeking work 12. Retired 13. Unpaid worker/volunteer 14. Herder 98 .Other, specify
1								
2								
3								
4								
5								
6								
7								
8								

Part 2 : Household characteristics

2.1.Land size related questions

Total landholding of the household: _____ ha

B201	B202	B203	B204		B205	B206	B207	B208		B209
Does your HH own or rent residential plots?	Apart from your residence, how many plots of land do your HH own?	How many of those plots that your HH owns, are agricultural plots?	What is the total area of the agricultural land that your HH owns?		Record the plot size in hectares	Did your HH shared out land to others, in the last agricultural year?	How many plots did you household share out , in the last agricultural year?	What is the total area of land that your HH shared out , in the last agricultural year?		Record the area in hectares
1 own 2 rent 3 both 98 Other, specify			Quantity	Unit (ha)	quantity	1 – yes 0 – no		Quantity	Unit (ha)	Quantity

B210	B211	B212		B213	B214	B215	B216		B217
Did your HH shared in land from others, in the last agricultural year?	How many plots did you household share in , in the last agricultural year?	What is the total area of land that your HH shared in , in the last agricultural year?		Record the area in hectares	Did your HH rent out land to others, in the last agricultural year?	How many plots did you household rent out , in the last agricultural year?	What is the total area of land that your HH rented out , in the last agricultural year?		Record the area in hectares
1 – yes 0 – no	quantity	Quantity	Unit (ha)	Quantity	1 – yes 0 – no	Quantity	quantity	Unit ha	Quantity

B218	B219	B220		B221	B222	B223		B224
Did your HH rent in land from others, in the last agricultural year?	How many plots did you household rent in , in the last agricultural year?	What is the total area of land that your HH rented in , in the last agricultural year?		Record the area in hectares	How many plots did your HH operate , including plots rented in and shared in , in the last agricultural year?	What is the total area of land that your HH operated , in the past agricultural year?		Record the area in hectares
1 – yes 0 – no if no skip to C101	quantity	quantity	Unit (ha)	quantity	Quantity	quantity	Unit (ha)	Quantity

Part 2.2: Source of income

2.2.1. Temporary crop selling and buying in the last 12 months

Crops	produced (Kg)	selling (kg)		Buying	
		Quantity (Kg)	Total price (Birr)	Quantity (Kg)	Total Price (Birr)
<i>Tef</i>		.			
Maize					
Wheat					
Barley					
Sorghum					
Bean					
Pea					
Red onion					
Garlic					
Potato					
Chickpea					
Haricot bean					
Grass pea					
Finger millet					
Total					

2.2.2. Permanent crops and vegetable selling in the last 12 months

	How much produce (Kg)	How much selling (kg)	how many birr did you get (Birr)
Mango			
Papaya			

Banana			
Barley			
Apple			
Orange			
Lemon			
Buckthorn			
Vegetable			
Others			
Total			

1. Do you have tree (i.e., Equilaptus)? Yes No
2. If yes Q1, Did you sell tree? Yes No
3. If yes Q2, How many birr did you get?(Birr)

2.3. Extension and training related questions

C101	C102	C103
In the past one year, did you participate in any training?	If so, on what?	How often are you visited by the extension agent?

0-no 1-yes (if no skip to D101)	0-Agronomy, 1-animal husbandry, 2-nr conservation, 3-finance, 4-nutrition, 5-health, 6-other: please specify.	0- Never, 1-once a year 2-every month 3-every two weeks 4-weekly

G1. Market related questions

G101. What is the distance to markets to sell and buy agricultural products.....km?

G102. What is the distance to markets to buy fertilizer.....km?

G103. What is the distance to markets to buy food and non food items.....km?

Part3: Women Empowerment Related

3.1. production and income decisions

“Now I’d like to ask you some questions about your participation in certain types of work activities and on making decisions on various aspects of household life”	Did you yourself participate in [ACTIVITY] in the past 12 months (that is, during the last [one/two] cropping seasons), from [PRESENT MONTH] last year to [PRESENT MONTH] this year	When decisions are made regarding [ACTIVITY], who is it that normally takes the decision?	How much input did you have in making decisions about [ACTIVITY]?	To what extent do you feel you can make your own personal decisions regarding [ACTIVITY] if you want(ed) to? CIRCLE ONE	How much input did you have in decisions on the use of income generated from [ACTIVITY]
ACTIVITY CODE ACTIVITY DESCRIPTION	G1.01	G1.02	G1.03	G1.04	G1.05
Food crop farming: These are crops that are grown primarily for household food consumption	YES 1 NO..... 2 ◊ <i>ACTIVITY B</i>	self..1 spouse...2 other hh member..3 other non-hh member ...4 not applicable..98 <i>next activity</i>		not at all .1 small extent.. 2 medium extent... 3 to a high extent ..4	
Cash crop farming: These are crops that are grown primarily for sale in the market	YES 1 NO..... 2 ◊ <i>ACTIVITY C</i>	self..1 spouse...2 other hh member..3 other non-hh member ...4 not applicable..98 <i>next activity</i>		not at all .1 small extent.. 2 medium extent... 3 to a high extent ..4	
Livestock raising	YES 1 NO..... 2 ◊ <i>ACTIVITY D</i>	self..1 spouse...2		not at all .1 small extent.. 2	

		other hh member..3 other non-hh member ...4 not applicable..98 <i>next activity</i>		medium extent... 3 to a high extent ..4	
Non-farm economic activities: This would include things like running a small business, self-employment, buy-and-sell	YES 1 NO..... 2 \diamond <i>ACTIVITY E</i>	SELF..1 SPOUSE...2 OTHER HH MEMBER..3 OTHER NON-HH MEMBER...4 NOT APPLICABLE..98 \diamond <i>NEXT ACTIVITY</i>		not at all .1 small extent.. 2 medium extent... 3 to a high extent ..4	
<p>G1.03/G1.05 DECISION CODES:</p> <p>NO INPUT OR INPUT IN FEW DECISIONS.....01</p> <p>INPUT INTO SOME DECISIONS.....02</p> <p>INPUT INTO MOST OR ALL DECISIONS.....03</p> <p>NO DECISION MADE98</p>					

ACTIVITY DESCRIPTION	Did you yourself participate in [ACTIVITY] in the past 12 months (that is, during the last [one/two] cropping seasons), from [PRESENT MONTH] last year to [PRESENT MONTH] this year?	When decisions are made regarding [ACTIVITY], who is it that normally takes the decision?	How much input did you have in making decisions about [ACTIVITY]?	To what extent do you feel you can make your own personal decisions regarding [ACTIVITY] if you want(ed) to? CIRCLE ONE	How much input did you have in decisions on the use of income generated from [ACTIVITY]
	G1.01	G1.02	G1.03	G1.04	G1.05
Wage and salary employment: This could be work that is paid for in cash or in-kind, including both agriculture and other wage work	YES 1 NO 2	self..1 spouse...2 other hh member..3 other non-hh member... .4 not applicable..98 <i>next activity</i>		not at all .1 small extent.. 2 medium extent... 3 to a high extent ..4	
Fishing or fishpond culture	YES 1 NO 2	self..1 spouse...2 other hh member..3 other non-hh member... .4 not applicable..98 <i>next activity</i>		not at all .1 small extent.. 2 medium extent... 3 to a high extent ..4	
Major household expenditures (such as a bicycles, land)	YES 1 NO 2	self..1 spouse...2 other hh member..3		not at all .1 small extent.. 2	

		other non-hh member... .4 not applicable..98 <i>next activity</i>		medium extent... 3 to a high extent ..4	
Minor household expenditures (such as food for daily consumption or other household needs)	YES 1 NO 2	self..1 spouse...2 other hh member..3 other non-hh member... .4 not applicable..98 <i>next activity</i>		not at all .1 small extent.. 2 medium extent... 3 to a high extent ..4	
G2.03/G2.05 DECISION CODES: NO INPUT OR INPUT IN FEW DECISIONS.....01 INPUT INTO SOME DECISIONS.....02 INPUT INTO MOST OR ALL DECISIONS.....03 NO DECISION MADE98					

3.2. asset to productive capital

“Now I’d like to ask you about your household’s access to and ownership of a number of items that could be used to generate income.” PRODUCTIVE CAPITAL	Does anyone in your household currently have any [ITEM]? G2.01	Do you own any of the item? G2.02
Agricultural land (pieces/plots)		
Large livestock (oxen, cattle)		
Small livestock (goats, pigs, sheep)		
Chickens,		
Fish pond or fishing Equipment		
Farm equipment (non mechanized: hand tools, animal-drawn plough)		
Farm equipment(mechanized: tractor-plough, power tiller, treadle pump)		
Nonfarm business equipment(solar panels used for recharging, sewing machine, brewing equipment, fryers)		
House or other structures		
Large consumer durables (refrigerator, TV, sofa)		
Small consumer durables (radio, cookware)		
Cell phone		
Other land not used for agricultural purposes (pieces/plots, residential or commercial land)		
Means of transportation(bicycle, motorcycle, car)		
G2.01/ DECISION CODES: YES.....1 NO.....2	G2.01/ DECISION CODES: YES, SOLELY..... 1 YES, JOINTLY..... 2 NO..... 3	

3.3. Access to credit

<p>Next I'd like to ask about your household's experience with borrowing money or other items in the past 12 months."</p> <p>LENDING SOURCE NAMES2</p>	<p>Would you or anyone in your household be able to take a loan or borrow cash/in-kind from [SOURCE] if you wanted to?</p> <p>G3.01</p>	<p>Has anyone in your household taken any loans or borrowed cash/in-kind from [SOURCE] in the past 12 months?</p> <p>G3.02</p>	<p>Who made the decision to borrow from [SOURCE] most of the time?</p> <p>G3.03</p>	<p>Who makes the decision about what to do with the money/ item borrowed from [SOURCE] most of the time?</p> <p>CIRCLE ALL APPLICABLE</p> <p>G3.04</p>
<p>Non-governmental organization(NGO)</p>				
<p>Formal lender (bank/financial institution)</p>				
<p>Informal lender</p>				
<p>Friends or relatives</p>				
<p>Group based microfinance or lending including VSLAs / SACCOs</p>				
<p>Informal credit/savings groups such as merrygo-rounds, tontines, funeral societies, etc.</p>				
<p>G3.01/ DECISION CODES YES.....1 NO.....2 MAYBE.....3</p>	<p>G3.02/ DECISION CODES yes,cash1 yes, in kind.....2 yes, cash and in-kind3 no.....4 don' t know97</p>		<p>G3.03/ G3/04 DECISION CODES self1 spouse2 other hh member3 other non-hh member.....4 not applicable98</p>	

3.4. Time allocation

ACTIVITY	Morning		Day																					
	1	2	3	4	5	6	7	8	9	10	11	12												
Sleeping																								
Eating drinking																								
Personal care																								
School /homework/																								
Work as employed																								
Own business work																								
Farming/livestock/fishing																								
Shopping																								
Weaving/sewing																								
Cooking																								
Domestic work/fetching wood and water																								
Care for children/adult/elder																								
Traveling and communiting																								
Watching TV/ listing radio/reading																								
Exercising																								
Social activities and hobbies																								
Religious activities																								
Other specify																								

	Evening		night									
ACTIVITY	1	2	3	4	5	6	7	8	9	10	11	12
Sleeping												
Eating drinking												
Personal care												
School /homework/												
Work as employed												
Own business work												
Farming/livestock/fishing												
Shopping												
Weaving/sewing												
Cooking												
Domestic work/fetching wood and water												
Care for children/adult/elder												
Traveling and comminuting												
Watching TV/ listing radio/reading												
Exercising												
Social activities and hobbies												
Religious activities												
Other specify												
QNO.	QUESTION											RESPONSE
G4.02	In the last 24 hours did you work (at home or outside of the home) more than usual, about the same as usual, or less than usual?											MORE THAN USUAL.....1 ABOUT THE SAME AS USUAL...2 LESS THAN USUAL.....3

3.5.Group membership

Now I'm going to ask you about groups in the community. These can be either formal or informal and customary groups.	Is there a [GROUP] in your community? (G5.G1)	Are you an active member of this [GROUP]?(G5.G2)
GROUP CATEGORIES		
Agricultural / livestock/ fisheries producer's group (including marketing groups)		
Water users' group		
Forest users' group		
Credit or microfinance group (including SACCOs/merry-go-rounds/ VSLAs)		
Mutual help or insurance group (including burial societies)		
Trade and business association group		
Civic groups (improving community) or charitable group (helping others)		
Religious group		
Other [women's/men's] group (only if it does not fit into one of the other categories)		
Other (SPECIFY)		
ANSWER FOR (G5.G1) YES.....1 NO.....2 DON'T KNOW.....97	ANSWER FOR (G5.G2) YES.....1 NO 2	