DETERMINANTS OF FOOD SECURITY IN RURAL HOUSEHOLDS: EVIDENCE FROM EAST HARARGHE ZONE, OROMIA REGIONAL STATE, ETHIOPIA

BY: HANA ENDASHAW

ADVISOR: SISAY DEBEBE (PHD)

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ST. MARY'S UNIVERSITY
SCHOOL OF GRADUATE STUDIES
INSTITUTE OF AGRICULTURE AND DEVELOPMENT STUDIES

DETERMINANTS OF FOOD SECURITY IN RURAL HOUSEHOLDS: EVIDENCE FROM EAST HARARGHE ZONE, OROMIA REGIONAL STATE, ETHIOPIA

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DECLARATION

I, investigator signing below confirms that the work presented in this document is original and has not been published or submitted elsewhere. Any external sources referenced in this thesis have been properly acknowledged and cited.

Name	Signature	Date
Hana Endashaw	_____	_____

ENDORSEMENT

This thesis has been submitted to St. Mary's University, School of Graduate Studies for examination with my approval as a university advisor.

Sisay Debebe (PhD) 

Advisor Signature

St. Mary's University, Addis Ababa July 15, 2024

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APPROVED BY BOARD OF EXAMINERS

Dean, Graduates Studies	Signature	Date
Advisor	Signature	Date
Internal Examiner	Signature	Date
External Examiner	Signature	Date

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LIST OF ACRONYM AND ABBREVIATIONS

CRS: Catholic Relief Service

ERHS: Ethiopian Rural Households Survey.

FAO GIEWS: Global Information and Early Warning System on Food and Agriculture

FAO: Food and Agricultural Organization of United Nations.

FCS: Food Consumption Score.

FEWS NET: Famine Early Warning Systems Network

FIES: Food Insecurity Experience Scale

FSPs: Financial Service Providers

GFSI: Global Food Security Index

GHI: Global Hunger Index

GOE: Government of Ethiopia

Ha: Hectare.

HDDS: Household Dietary Diversity Score

HFIES: Household Food Insecurity Experience Scale

HHS: Household Hunger Scale

HIV/AIDS: Human Immunodeficiency Virus Infection and Acquired Immune Deficiency Syndrome.

HRCS: Hunger Reduction Commitment Scale

IMPEL: Implementer-Led Evaluation & Learning Associate Award

INDDEX: International Dietary Data Expansion

LASER-PULSE: Long-term Assistance and Services for Research- Partners for University-Led Solutions Engine

MTANRO: Midega Tola Agriculture and Natural Resources Office

MIRA: Monthly Interval Resilience Analysis

PCA: Principal Components Analysis.

PHI: Poverty and Hunger Scale

PPS: Probability Proportional to Size

PSNP: Productive Safety Net Program

RPASS: Rural Productive Safety Net Assessment and Support System

RCSI: Reduced Coping Strategy Index.

RFSA: Resilience Food Security Activity

SNNPR: Southern Nations, Nationalities, and Peoples' Region.

SSA: Sub-Saharan Africa.

TB: Tuberculosis.

TLU: Tropical Livestock Unit

USAID: United States Agency for International Development

USG: United States Government

ABSTRACT

Higher food security with life expectancy and total employment has a beneficial impact on economic growth, reducing poverty, achieving food security, and boosting economic growth. There are different socio-economic, demographic, infrastructural, and personal factors which can affect households' food security. With this in mind, this study examined the food security level of households using Food Consumption Score (FCS), Household Dietary Diversity Score (HDDS), Reduced Coping Strategy Index (rCSI), and Household Hunger Scale (HHS). And, to identify the determinants of rural households' food security using cross-sectional data from nine Woredas of East Hararghe, Regional State of Oromia. The data used for this study was secondary data collected by Catholic Relief Service (CRS) Ethiopia using a context monitoring tool called Monthly Interval Resilience Analysis (MIRA). The general two-stage sampling design was used, based on this 44 kebeles were selected from nine woredas with 20 households in each kebele. Following this, a sample of 880 respondents was selected. To analyze data, descriptive analysis, and econometric technique of ordered Logit regression were used. The finding revealed that most of the respondents are poorly food secure. Using FCS, 674(77%), 179(20%), and 24(3%) are on poor, borderline, and acceptable levels of food security, respectively. In addition, using HDDS, 476(54%), 330(38%), and 71(8%) have poor, borderline, and acceptable levels of food security, respectively. Moreover, 245(28%), 608(69%), and 24(3%) are insecure, moderate/stressed, and food secure using rCSI, respectively, and 613(70%), 203(23%), 60(7%) 0(0%), and 1(0.001%) of respondents are on food secure, stressed, insecure, crisis and catastrophe level of food security using HHS, respectively. Additionally, the ordered logit model marginal effect found that age of household head, living in Highland, dependency ratio, being Public Work PSNP beneficiary, livestock ownership and taking farm related training have positive and significant effects on food security. Conversely, credit access, off-farm activity engagement, and household size have negative significant effects. Based on the result, government is recommended to prioritize key initiatives to bring social behavior change and to enhance the PSNP interventions by collaborating with NGOs and financial service providers to better improve the food security in the study area and beyond.

***Keywords**: Food security; Determinants; Indicators; Ordered Logit; MIRA; RFSA; CRS; East Hararghe, Ethiopia.*

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the Study

Various scholars and organizations have provided multiple definitions and interpretations of food security. FAO's definition of food security is one of the most renowned and widely accepted definitions in the field. FAO (2002) described food security as a state where all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life. According to World Bank (2023), Food security has four components: availability, accessibility, utilization, and stability. Food security has a relationship with economic growth. As found by Nur-Marian et al (2019), Insufficient consumption of nutritious foods can lead to food security challenges, diminished work efficiency, heightened levels of hunger, decreased life expectancy, and hindered economic development. In addition, food security influences economic growth through its impact on life expectancy, job creation, and poverty reduction.

Food insecurity has been a concern in Ethiopia for over a century. It becomes a significant development challenge starting in the early 1970s, with its impact spreading across the country in subsequent decades. The situation worsened in the 1980s due to severe drought and widespread starvation, which heightened the need for food security measures and aid initiatives. (Sabates-Wheeler, 2012). The study conducted by FAO (2023), shows that the 2022 Humanitarian Response Plan indicates that there are 20.4 million individuals experiencing severe food insecurity, marking a rise of 2.4 million compared to the previous year.

FEWS NET (2023) estimates the national food assistance requirements in Ethiopia in 2023 have reached unprecedented levels for the second consecutive year. Prior to the beginning of the Meher harvest in September 2023 and the rainy season in October 2023, millions of households experience food insecurity, which reached an annual peak in August 2023. Relief Web (2023) explained Ethiopia's' current food security status as; the worst food insecurity in the world, with record-breaking food assistance needs brought on by the effects of a protracted drought and ongoing internal conflict and insecurity.

According to CSS (2022), 41.5% of households in Ethiopia experienced moderate food insecurity whereas 9.2% of households experienced severe food insecurity. There is variation in the severity of food insecurity between Rural and Urban areas and also between different regions. More rural households are food insecure than those in urban area. Regarding difference between regions, Oromia is the leading with 50.3% of households experienced food insecurity where Harari is the least with 18.9% of households.

According to FAO GIEWS (2017), the drought brought on by El Niño made Ethiopia's food security situation worse in 2016–2017. Ethiopia's Global Hunger Index (GHI) score in 2000 was 55.9, which was considered extremely alarming. However, by 2018, the GHI score had improved to 29.1, placing it at the upper end of the serious category. Despite improvements in each of the GHI indicators since 2000, Ethiopia still faces significant threats related to hunger and food security (Global Hunger Index, 2018). Out of the 125 nations where there is enough data to generate GHI scores for 2023, Ethiopia comes in at number 101 with a serious level of hunger, scoring 26.2 on the 2023 Global Hunger Index (Global Hunger Index, 2023).

As stated by FAO (2023), multiple shocks affecting food availability and access have led to a challenging and deteriorating food security situation. Along with restricting access to food for large portions of the population, extremely high food prices and severe pasture and water shortages that led to numerous livestock deaths were other factors contributing to the severe food insecurity.

There are different determinants of food security mentioned in different studies. Lack of off-farm income, and rain shock all had a substantial impact on the level of food security and recommended that the availability of off-farm income-generating activities should be improved, and farmers should be required to take into account each rainy season when planning their farming operations and also, a global policy is required for the implementation of mitigation measures to curb climate change, which is the primary contributor to shocks in rainfall and agriculture (Nur-Marian et al, 2019).

This research, therefore, was conducted to evaluate the food security status and determine the factors influencing food security in nine woredas of East Hararghe Zone, Oromia Regional State.

1.2. Statement of the Problem

Food security is essential for economic growth as it impacts different facets of a country's development. Unfortunately, the food security situation in the specific area is extremely inadequate. In the case area of nine woredas in East Hararghe, including Babile, Chinaksen, Deder, Fedis, Gursum, Jarso, Melkabelo, Meta, and Midega tola, the food security level was evaluated using two food security by IMPEL (2022). As per the findings from the FIES, almost all households exhibited signs of food insecurity, with 96.2% facing moderate to severe food insecurity, and 77.7% experiencing severe food insecurity, a rate higher than the average for East Africa. In addition, through the utilization of a FCS, it was determined that the average FCS stands at 20.5. Merely 7.8% of households exhibit an acceptable score, while the majority (69.85%) possess a poor score, indicating that households predominantly rely on staple foods daily and infrequently consume meat, fish, milk, and dairy products.

Numerous research investigations have identified various factors that influence food security situation. World Economic Forum (2020), identified several factors contributing to food insecurity, including rapid population growth, shifting dietary preferences, the impacts of climate change, and water scarcity. In addition, according to the World Bank (2023), food security levels could be influenced by adverse weather conditions, political instability, and economic factors like increasing food price and unemployment.

Moreover, Tobin (2009) and Ingram et al (2008), states that food insecurity in SSA is made worse by weak electric power, road, and market access infrastructure development and limited rural development. Another factor causing food insecurity in the area is poor government policy that hurts the agricultural industry. Food insecurity is also influenced by poor health, the prevalence of infectious, fatal, but preventable diseases like malaria, TB, and HIV/AIDS. As a result, fewer rural residents work in agriculture or engage in non-farming activities that increase food insecurity. In addition, rising global commodity prices and climate change are likely to make the region's food insecurity worse.

While drought and other catastrophes like floods are important triggers, even more, crucial are the factors that cause or worsen vulnerability to these shocks and have weakened livelihoods. Land

degradation, a lack of household resources, a lack of employment opportunities, and population pressure are some of these factors (MARD, 2009).

Many studies investigated different determinants of food security. For instance, Hussein (2017), studied determinants of food security evidence from an Ethiopian rural household survey (ERHS) using a pooled cross-sectional study by using binary multivariable logistic regression. He found that the households' location, lack of off-farm income, and rain shock all had a significant impact on their level of food security. This research failed to incorporate more than one indicator to measure food insecurity and also used binary multivariable logistic regression.

In addition, Asmelash (2014), investigated, rural household food security status and its determinants in the case of Laelaymychew Woreda, Central Zone of Tigray, Ethiopia by using descriptive and logistic distribution model analysis. According to the study, 31.2% and 68.8% of the sample households were food secure and food insecure, respectively. Moreover, the model's findings showed that the size of the total cultivated land holding, the total livestock holding, the total annual income, and the use of chemical fertilizer were all positively related to and statistically significant for the study area's food security situation. On the other hand, it was discovered that the number of family members in a household was negatively related and statistically significant to the level of food security in rural households. This study lacked incorporating a large number of samples from different locations to increase the representativeness of the study. In addition, it utilized a logit regression model which just classifies the status as food secure and food insecure.

Moreover, Abafita et al (2014), studied determinants of household food security in rural Ethiopia by using self-reported food security status and a multidimensional index generated based on principal components analysis-PCA). The findings showed that household food security was strongly and positively related to the age and education of the household head, adequate rainfall, livestock, possession, participation in off-farm activities, soil conservation practices, and per capita consumption expenditure, while access to credit and remittance had a negative impact. This study fails to incorporate experience-based and dietary diversity types of food security indicators, instead, it used self-reported food security status and PCA based on selected set of indicators.

Besides, Assefa et al (2022) assessed determinants of food insecurity in rural households in the case of Lemo district, Southern Ethiopia using a logistic regression model. In a study involving

383 respondents, it was found that 68.4% of them experienced food insecurity, while the remaining respondents were food secure. Among the 383 households surveyed, 362 were headed by males, with the remaining households being led by females. Individuals who participated in off-farm activities had a higher level of food security compared to those who did not engage in such activities in the rural areas under investigation. The study also revealed that households with literate heads had a greater proportion of food security than those with illiterate heads. Additionally, respondents with larger landholdings exhibited higher levels of food security than those with smaller landholdings. Moreover, the proportion of food security increased with the age of the respondents in the rural areas studied. This research also failed to utilize ordered logit model and more than one indicator to measure food security.

Additionally, Seble et al (2020), studied determinants of food insecurity in food aid-receiving communities in Ethiopia, a case of Meskan and Mareko districts using descriptive and logistic regression model. The findings of the descriptive statistics indicate that 74.17% of the households included in the survey experienced food insecurity. The results of the logit model analysis demonstrated that variables such as gender, age, educational attainment of the household head, family size, and access to remittances were significant determinants influencing the food security status of households. This study lacked incorporating more food security indicator and using order logit model.

Similarly, Yusuf et al (2021), investigated the determinants of food security and coping strategies in the case of Meta district, East Hararghe zone of Oromia by using descriptive statistics, inferential statistics, and the Logit model. According to the survey results, 53.02% of participants had access to enough food, compared to 46.980% who did not. The findings also show that there was a significant mean difference between food-secure and food-insecure households at various levels of significance in terms of age, sex, family size, dependency ratio, educational levels, size of cultivated land, livestock ownership (aside from oxen), off/non-farm income, cash crop produces, fertilizer user, contact with development agents, improve seed user, distance to the nearest market, and access to credit. The size of the cultivated land and the ownership of livestock had a positive impact on food security. Age, family size, the proportion of dependents, proximity to the nearest market, and credit availability, however, had a negative impact on food security. However, this

research studied Meta Woreda households' food security, which is one of the Woredas from East Hararghe, it just used one Woreda as a case area. And failed to utilize ordered logit model.

However, there are several studies related to the topic, there are gaps in utilizing more than one food security indicators in measuring the food security situation, but food security is multidimensional in nature, so it should be assessed from different aspects. In addition, most of the reviewed research used a logit regression model which has two outcomes instead of an ordered logit model with categorical outcomes. And they failed to incorporate the variables PSNP membership type, agroecological zone, and farm-related training to know their effect on households' food security. Moreover, there is lack of studies that incorporate all mentioned case areas in single study for the referenced year, 2024.

Therefore, this study is conducted to fill the aforementioned research gaps (1) by measuring the food security status of rural households through a combination of experience-based and dietary diversity type of food security indicators, (2) by utilizing the ordered logit model to identify determinants for each categorical outcomes, (3) by conducting the study for nine Woredas of East Hararghe Zone of Oromia Reginal State to obtain a comprehensive understanding across various locations for the year 2024.

1.3. Research Objective

1.3.1. General objective

The general objective of this study is to estimate the level of food security and identify its determinants in East Hararghe, Oromia Reginal State.

1.3.2. Specific objective

- To measure the level of food security situation at household level.
- To describe the food security situation in the study area.
- To identify different factors affecting food security situation at household level in the study area.

1.4. Research Questions

This study focuses on finding solutions to the fundamental research questions listed below.

- How to measure food security at household level?
- What is the food security situation in study area?
- What are the key factors affecting food security situation at household level in study area?

1.5. Significance of the Study

Because access to safe, nutritious, and sufficient food is a basic need and, is related to long-term health, economic stability, and environment, it is crucial to know what factors can better improve the food security status of households. Thereupon, this study will mainly benefit households by assessing determinants of food security and it will be an alert for government, humanitarian agencies, financial service providers, households, and other concerned bodies to take necessary measures to better improve the food security situation and to mitigate factors that contribute to food security negatively. In addition, it will serve as a literature review for other researchers who want to study related topics.

1.6. Scope and Limitations of the Study

Investigation of determinants of food security is a contemporary issue that needs to be investigated at the regional or national level in Ethiopia. However, due to time and budget limitations, geographically, this study was conducted in nine woreda of East Haraghe, Ethiopia only. Regarding the study population, the data utilized was only from Productive Safety Net Program (PSNP) beneficiaries. Conceptually, the study focused on the food security situation and factors in concerned households only. The model used to discern the relationship of rural households' food security with different factors was ordered logit regression as the dependent variable FCS has ordinal values known as "Acceptable, Borderline, and Poor".

In addition to the mentioned scopes, there are limitations that may impact the interpretation and generalizability of the results. One of these is reliance on self-reported measures of food security. The food security indicators used are based on respondents' perceptions and recollections of their food consumption patterns and coping strategies. This subjective nature of data collection may introduce biases such as social desirability bias or recall bias, potentially affecting the accuracy

and reliability of the results. Also, the use of four food security indicators may not capture the full spectrum of food security experience and nuances within households. Additionally, reliance on cross-sectional data is other potential limitation. Cross-sectional data provides a snapshot of a population at a single point in time, which may not capture the dynamic nature of food security and its determinants over time. Another limitation of this research is its exclusive reliance on quantitative data, which may overlook nuanced qualitative insights into the socio-cultural, contextual, and behavioral factors influencing food security in rural households. Quantitative data alone may not fully capture the complex interplay of cultural norms, community dynamics, and individual perceptions that shape food security outcomes.

1.7. Organization of the Study

This paper is organized into four chapters. The first chapter deals with introduction issues which consist of the background of the study, statement of the problem, research questions, research objectives, significance of the study, and scope of the study. The second chapter deals with a literature review which consists of a theoretical literature review, an empirical review, and a conceptual framework. The third chapter deals with the methodology of the study which consists description of the study area, data source and method of data collection, sampling technique and sampling size, method of data analysis, model specification and variable definition, measurement and hypothesis. The fourth chapter deals with data presentation and discussion. The fifth chapter deals with conclusion and recommendation. Lastly, references and appendixes are included.

CHAPTER TWO

2. LITERATURE REVIEW

A variety of theories encompass a broad spectrum of perspectives on food security. This research delves into theories and empirical studies on food security. The chapter focuses on discussing basic concepts, theoretical and empirical reviews, conceptual frameworks, and food security indicators.

2.1. Concepts and Definition

Food security: various scholars and organizations have provided different definitions for the concept of food security. According to United nations (1975), food security is ensuring constant availability of sufficient global food resources, particularly essential food items, to support a consistent growth in food consumption and to counteract variations in production levels and prices. This definition is solely concentrated on the quantity and consistency of food supply. FAO (1983), expanded on the idea, the concept was broadened by incorporating both the aspects of demand and supply concerning food. It was defined as, to guarantee that every individual consistently possesses the necessary food for sustenance, both in terms of physical availability and economic affordability. World Bank (1986), further elaborates the concept by providing additional terms, as ensuring that every individual has consistent access to an adequate amount of food to maintain an active and healthy lifestyle. As explained by Edward (2002), food security became a notable issue by the mid-1990s. Access currently encompasses an adequate supply of food, highlighting ongoing concern regarding protein-energy malnutrition, as well as integrating food safety and nutritional balance. Considering the various definitions of food security by different organizations mentioned above, the definition widely accepted was given by FAO. According to FAO (2002), food security is a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

While other definitions by scholars and organizations also contribute to the understanding of food security, the FAO definition is widely accepted and provides a comprehensive framework that aligns well with the challenges faced by rural households in Ethiopia, particularly those in East Hararghe Zone. It addresses the multidimensional nature of food security and underscores the need

for sustainable solutions that ensure food access, availability, and nutrition. There are four major reasons why these definitions most relevant and related to the context of the study. The first one is access focus; the definition emphasizes not only the availability of food but also the access to food as in rural areas, access to food can be limited by factors such as income levels, infrastructure (roads, markets), and social factors. The second reason is nutritional dimension; the definition highlights the importance of food quality in addition to quantity, which is crucial for ensuring that households have access to nutritious food that meets their dietary requirements. The third reason is sustainability and livelihoods; the definition acknowledges the economic aspect of food security, linking it with livelihoods and the ability of households to sustainably produce or procure food over time. The last reason is contextual relevance; the definition is broad enough to encompass various dimensions of food security that are pertinent to in East Hararghe.

2.2. Theoretical Literature

Dimension of food security

Food access is ensured when households and all individuals within them have adequate resources to obtain appropriate foods for a nutritious diet. Additionally, food availability is said to be achieved when enough food is consistently available to all individuals within a country (FAO, 2006; Schmidhuber et al, 2007 and Ingram et al, 2008). In addition, Food utilization refers to the consumption of food through adequate diet, clean water, sanitation, and health care to reach a state of nutritional well-being where all physiological needs are met. Food sustainability, on the other hand, refers to a situation where the above components of food security are fulfilled at any time (FAO, 2006). Furthermore, World Bank (2023), there are four food security dimensions. The first one is the physical availability of food which addresses the supply side of food security and is determined by the level of food production, stock level, and net trade, the second one is, economic and physical access to food, which deals with an adequate supply of food at the national or international level. The third one is food utilization, which is commonly understood as the way people make the most of various nutrients in food. Sufficient energy and nutrient intake by individuals are the result of good care and feeding practices, food preparation, diversity of the diet, and intra-household distribution of food. Combined with good biological utilization of food

consumed, this determines the nutritional status of individuals. The last one is the stability of the other three dimensions, which deals with the consistency of food intake adequacy.

Measurement of food security

Food security is measured by several proxy indicators rather than by a single, universal indicator. There are different types of measurement of food security stated by different literatures.

A. Food Consumption Score (FCS)

According to INDDEX Project (2022), the FCS collects information at the household level on the variety and consumption patterns of food groups over the previous seven days. This information is weighted based on the relative nutritional value of the food groups consumed. For instance, food groups containing foods with high nutritional value are given more weight than those containing foods with lower nutritional value, such as tubers. A household's food consumption can be further categorized into one of three groups based on this score: poor, borderline, or acceptable. The food consumption score is a proxied measure of caloric availability in the household. Based on the dietary variety, food frequency, and relative nutritional significance of various food groups in households, this indicator generates a composite score. The FCS is determined by looking at how frequently households eat foods from various food groups over a seven-day reference period. Additionally, the FCS module gathers information on the sources of the purchased foods that households consume. The food groups to be used to calculate FCS are main staples, pulses, vegetables, fruit, meat/fish, milk, sugar, and oil. In addition, according to the Food Security Cluster (2020), based on a seven-day recall of the food consumed at the household level, the FCS is a composite indicator that assesses dietary diversity, food frequency, and the relative nutritional importance of food groups. **(See Appendix 1).**

B. Household Dietary Diversity Score (HDDS)

A key indicator of food security, household dietary diversity is defined as the number of food groups a household consumes over a specified reference period. A more varied diet at home is linked to adequate calorie and protein intake, the proportion of protein from animal sources, and household income. The food groups to be used to calculate HDDS are cereals, root and tubers, vegetables, fruit, Meat, eggs, fish and seafood, pulse/legume/nut, milk and milk products, oil/fats, sugar/honey, and miscellaneous (Swindale et al, 2006). As Food Security Cluster (2020), stated,

one of the stand-ins for measuring household food access is HDDS. To calculate HDDS, questions about household consumption of foods from 12 different food groups over the previous 24 hours are used. Maxwell et al (2013), The HDDS and FCS are highly correlated and can be used interchangeably in most contexts as a validated proxy for energy sufficiency and a measure of household-level diet diversity **(See Appendix 2).**

C. Reduced Coping Strategy Index (rCSI)

A tool that gauges what people do when they have insufficient access to food is called the Coping Strategies Index (CSI). A simple numeric score is generated after answering a series of questions about how households handle a shortage of food for consumption. The many possible responses to a single question form the foundation of the CSI. The indicator assesses how frequently, and severely coping behaviors are used. When other approaches are impractical, the CSI is an appropriate tool. It can be used for a number of things, such as: giving a brief, up-to-date status report on the level of food insecurity, counting or keeping track of the results of food assistance programs, serving as a warning sign for an approaching food crisis, determining which regions and population segments have the most needs and distinguishing the root causes of malnutrition (SPRING, 2008). According to Maxwell et al, (2008), The CSI tracks behavior that people do when they don't have access to enough food. People manage household food shortages using a variety of fairly common behavioral responses to food insecurity or coping mechanisms. These coping mechanisms are simple to see. Information on coping mechanisms can be gathered more quickly, easily, and affordably than actual household food consumption data. In addition, Food Security Cluster (2020) stated the rCSI is an experience-based indicator that tracks how households behaved over the course of the previous seven days when they were short on food or cash **(See Appendix 3).**

D. Household Hunger Scale (HHS)

According to Ballard et al (2011), The HHS strategy is predicated on the notion that experiencing a lack of food in the home results in predictable reactions that can be recorded through a survey and summed up in a scale. This strategy is also known as an "experiential" or "perception-based" method of data collection. Food Security Cluster (2020), HHS serves as a gauge for assessing hunger in households. HHS is gathered by asking three questions about any possible food

insecurity that may have occurred at the household level over the previous 4 weeks/30 days. Furthermore, HHS is appropriate for assessing severe food insecurity situations where households experience food deprivation, HHS is less relevant for areas and situations where food deprivation is not widespread, HHS does not include any aspects of the quality of food consumption but instead focuses exclusively on food quantity. **(See Appendix 4).**

E. Global Hunger Index (GHI)

GHI is a mechanism created to thoroughly assess and monitor hunger on a worldwide, regional, and national scale, capturing various aspects of hunger trends over time. The GHI score of each area is determined through a calculation that incorporates four indicators, which collectively represent the various aspects of hunger, such as undernourishment, child stunting, child wasting, and child mortality. The GHI aims to increase awareness and comprehension of the fight against hunger, offers a method to compare hunger levels across countries and regions, and highlights regions with the highest hunger levels where additional efforts are needed to eradicate hunger (Global Hunger Index, 2023).

F. Household Food Insecurity Experience Scale (HFIES)

HFIES is one of the four experience-based food insecurity scales. HFIAS was created by the Food and Nutrition Technical Assistance II (FANTA) project, which was funded by USAID and developed the scale between 2001 and 2006. HFIAS is developed from a concise survey that records the actions and emotional signs of food insecurity within households, like reducing meal frequency or compromising food quality because of limited resources. The questionnaire responses help determine where the household falls on a scale that shows the level of severity of food insecurity (INDDEX Project, 2022).

G. Global Food Security Index (GFSI)

The Global Food Security Index is created using 68 indicators and serves as a dynamic benchmarking model that assesses the factors influencing food security. It offers an aggregate score for every country, as well as individual scores for the four dimensions of food security it evaluates (Harvard University, 2022). GFSI utilizes a consistent framework to evaluate food security through three main aspects: affordability, availability, and utilization. In contrast to the Global Hunger

Index (GHI), the GFSI not only evaluates food security in developing nations but also in developed countries (Jiaqi et al, 2015).

H. Poverty and Hunger Index (PHI)

The PHI establishes a connection between poverty and hunger or nutrition, with indicators for assessing the nutritional aspect being the prevalence of underweight children and the proportion of the undernourished population (Gentilini et al, 2008).

I. Hunger Reduction Commitment Scale (HRCS)

HRCI represents a significant effort to evaluate the quality of governance and political dedication towards diminishing undernutrition (Lintelo, 2012).

To assess the level of food security in this study, indicators such as the Food Consumption Score, Household Dietary Diversity Score, Reduced Coping Strategy Index, and Household Hunger Scale were utilized. These indicators are chosen for their ability to measure food security at the household level.

For the econometrics analysis, Food Consumption Score was used. However, each of four indicator provides valuable insights into different aspects of food security, FCS provides a comprehensive picture of a household's food security situation. It combines three elements into one: the type of food, its frequency, and its nutritional value in the diet, and is a widely used method for assessing food security levels in households. For instance, Ryan (2015); Madhav et al (2016); Ndakaza et al (2017); Nurudeen et al (2019); William et al (2019), Mohamed (2019), Antwi et al (2021); Sedighe et al (2023); Habtamu et al (2023); Bekele et al (2023) and many other utilized FCS for measurement of food security level.

2.3. Empirical Literature

There are studies that identified different determinants of food security. For instance, Hussein (2017); Hailu et al (2022); Aboaba et al (2020); Asimelash (2014); Sedighe et al (2023); William et al (2019); Antwi et al (2021); Mohammed (2019) and Ndakaza et al (2017) assessed status and factors affecting households' food security.

Hussein (2017) studied determinants of food security: evidence from the Ethiopian Rural Household Survey (ERHS) using a pooled cross-sectional study by using binary multivariable logistic regression based on 2722 sample respondents from Amhara, Oromia, SNNP, and Tigray regions. Only 1040 (38.21%) are food secure. From the total of 2722 samples, 1517 (90.19%) of the 1682 households with food insecurity have experienced rain shock, and 1440 (85.61%) have also experienced crop shock. Only 32.05% of food-insecure households were visited by extension agents. The study also found that households that have experienced rain shock are 73% less likely to be food secured when compared to the households those were not experiencing the rain shock, households that have got off-farm income are 62% more likely to be food secure than those without off-farm income. On the other side, there are only 3.08%, 40.29%, 37.21% and 19.42% of households in Tigray, Amhara, Oromia, and SNNP, were food secured, respectively. When compared to the other three regions, households in the Tigray region were the least secure in terms of food.

In addition, Hailu et al (2022) assessed determinants of rural household food security status in North Shewa Zone, Amhara Region, Ethiopia based on 800 selected households from four districts called Minjar-Shenkora, Angolela-Tera, Moretna-Jiru and Menz-Gera. The researchers used both descriptive and econometric methods to analyze the data. According to the finding, the variable education level, age, and income of the household have a positive and significant effect with a probability of being food secured by 2.1%, 0.2%, and 55.7%, respectively. On the other hand, family size and distance to the market have a negative and significant effect with a probability of being food insecure by 13.3% and 4.6%, respectively.

Furthermore, Aboaba et al (2020) analyzed determinants of food security among rural households in Southwestern Nigeria based on a purposive selection of 180 rural households using descriptive and multinomial logistic regression. The result revealed that 66.67%, 27.78%, 3.89%, and 1.67% fell into very low, low, marginal, and high food security categories, respectively. For high food-secure households, being male-headed significantly reduces their food security status by 12.4%, and being married significantly increases their food security status by 32.9%. In addition, the food security status of high food-secure households that have access to credit is likely to increase by 32% and an increase in the dependency ratio by one member would likely result in a 46.8% decrease in the food security status. On the other hand, age, marital status (being married), and

farming experience increase the food security status of marginal food secure category households by 0.48%, 44.24%, and 0.36%, respectively. The study also found that gender (being a male-headed household), household size, and farmland ownership decrease the food security status of marginal food secure category households by 7.44%, 2.48%, and 1.21%, respectively. And lastly, farm experience increases the food security status of low food secure category households by 0.77% whereas, an increase in dependency ratio decreases the food security status of low food secure category households by 41.41%.

Moreover, Asimelash (2014) examined rural household food security status and its determinants: the case of Laelaymychew woreda, the central zone of Tigray, Ethiopia based on 125 sample respondents using logit model. First, the farmers' wealth was computed (computing the value of the wealth of the household in monetary terms) and compared with the minimum subsistence requirement of wealth. GoE's minimum acceptable probable value of the total wealth of household per family was employed as a cutoff between food secure and food insecure. The result revealed that, the probability of being food secure increases by a factor of 1.001, 1.327, 1.997, and 1.001 as the total size of cultivated land (ha), total livestock holding, use of chemical fertilizer, and total annual income increases by one unit, respectively.

Similarly, Sedighe et al (2023) investigated food security determinants of Qashqai Nomadic households in Fars province based on 250 randomly sampled households. The FCS index was calculated, and determinants of food security were determined using the ordered logit model. The findings of the FCS index revealed that 33.6% of households exhibit high food security, 29.2% experience low food security, and 37.2% face food insecurity. The results obtained from the ordered logit model analyzing food security determinants demonstrated that various factors such as income, livestock ownership, income diversity, access to infrastructure, level of education of the household head, possession of a personal vehicle, and the percentage of educated individuals in the household are directly linked to food security. Conversely, variables like household size, dependency ratio, and distance from nomadic areas to food markets are inversely associated with household food security. The marginal effects of these variables indicate that income diversity (-0.149) and access to infrastructure (-0.132) have the most positive impact on food security, while the dependency ratio (0.181) and household size (0.094) have the most negative impact on the food security status of these households.

Besides, William et al (2019) studied factors associated with household food security in Zambia based on 400 smallholder farmers using FCS and HHS and ordered probit model. The FCS indicator revealed that more educated heads were 12.6% less likely to have the poor FCS, 6.1% and 12.5% were more likely to have borderline, and acceptable FCS, respectively. Regarding the HHS indicator, with an increase in education level, there was 4.4% and 12% lower probability of households being in the severe and moderate hunger respectively, while 11.6% had more chance of being in the little to no hunger. Households with off-farm income were 10% more likely to have poor FCS, while 5% and 10% were less likely to have borderline and acceptable FCS. The HHS indicated that an increase in off-farm activities to be in a severe hunger category being 1.9%, while 4.7% of households were more likely to be in moderate hunger, and 5.3% were less likely to be in the little to no hunger. A one-hectare increase in land size is associated with being 2.4% less likely to have poor FCS, 1.1% and 2.4% more likely to have the borderline and acceptable FCS, respectively. HHS revealed that the probability of a household with one-hectare larger land size was reduced by 2% and 5% with regard to being in the severe hunger and moderate hunger, respectively while the probability of being in the little to no hunger increased by 5.3%. The households that are members of a farming group or cooperative were indicated as being 8% less likely to have poor FCS, while they had respectively 3.9% and 7.9% more chance of being in the borderline and acceptable FCS. The HHS revealed that membership in a farmer's group reduced the probability of a household being in severe hunger by 6.9%, while such a household was 15.9% less likely to be in moderate hunger and 17.5% more likely to be in little to no hunger.

Additionally, Antwi et al (2021) assessed socioeconomic determinants of rural households' food security status in Northern Ghana, based on 2260 rural households using FCS and ordered logit model. The findings indicate that 70% and 17% of households experience severe, and moderate food insecurity, respectively, while 13% were food secure. About 71% and 67 % of female-headed and male-headed households, respectively, fall within the high food insecurity category status. As a result of one unit increase in education level and income of household head, the probability of being food secured household increased by 0.07%, 5.4%, and 5.3%, respectively. Conversely, a unit increase in household size and retail price of food commodities reduces the probability of households being food secure by 3.4% and 9.4%, respectively. In addition, the likelihood of a household headed by a female to be food secured decreased by 5.8%.

Furthermore, Mohammed (2019) analyzed demographic and socio-economic determinants of household food security in Tanzania based on national panel survey data using FCS and probit model. As per the analysis, about 92.6% of the households were food secure and 7.4% of the households were food insecure. The probit model result indicated that, if the household doesn't obtain non-agriculture income, the household is 4.14% more likely to be not food secured as compared with those who obtain non-agriculture income. Moreover, the probability of households who lived in urban areas being food secure is 4.07 % higher than those who lived in rural areas. The chances of households with 5-8 members being food secure are 3.08% compared with 1-4 members. However, households with more than 8 members in the household have a probability of being food secured increased by 5.54% as compared to households with 1-4 and 5-8 members. If the household head is not married, then the probability of being food secured decreased by 3.51% compared with married household head.

Moreover, Ndakaza et al (2017) examined key determinants of household food security in Rwanda based on WFP Comprehensive Food Security and Vulnerability Analysis and Nutrition Survey using FCS and probit model. The result indicated that, if the education level of head of household increased by one unit, the household is 6.5% more likely to be food secured. Moreover, each additional household member increases the probability of a household being food insecure by 1.6%. additionally, if household' land size increases by one hectare, household is 4.7% more likely to be food secured. The chances of households which practice climate adaptation being food secure are 2.8 % higher than non-practicing households. If ownership of a beast for (cow) increases, household is 11.5% more likely to be food secured. Furthermore, if the time to reach the nearest market increases by one hour, household is 4.7% less likely to be food secured.

Those studies which are mentioned above are, more likely to use one or two measurement of food security to assess the food security status of households. But food security doesn't have a single measurement due to its nature of multidimensionality. Also rare of them used an ordered logit model. In addition, there is no study conducted for all case areas in a single study, mentioned in this research.

Therefore, the effort to fill the existing gap was conducting the level and determinants of food security using both experience-based and dietary diversity indicator types in mentioned case areas.

2.4. Conceptual Framework of the Study

Based on the theoretical and empirical literature reviewed above the following diagram is developed to show the factors that affect households' " food security". The following schematic representation of the conceptual framework/model is developed which shows the relationship between the economic factors, social factors, personal factors, family-related factors, and demographic factors with food security. The dependent variable is measured in four widely accepted food security indicators. In addition, the relationship between the dependent and independent variables were measured using ordered logit model as the dependent variable FCS is ordinal and categorical variable.

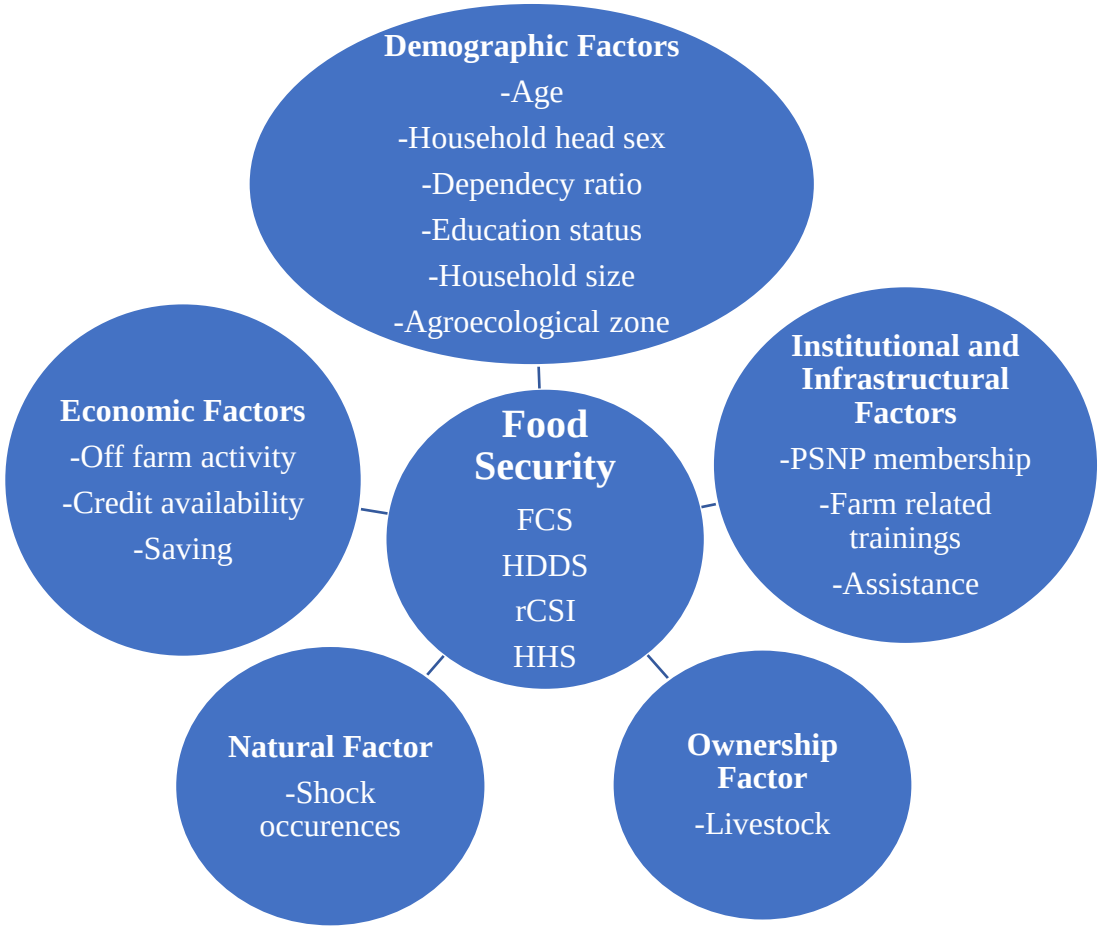

Figure 1: Conceptual Framework

CHAPTER THREE

3. RESEARCH METHODOLOGY

This chapter primarily focuses on discussing the methods, approaches, and models used in the study to gain a clear understanding of the status and determinants of food security. It delves into various aspects such as sampling design, data sources, methods of data collection, econometric models, and data analysis techniques.

3.1. Description of the Study Area

Oromia Region is one of the populus region in Ethiopia with 10,884,000 total population from which 20,402,000 females (CSS, 2023), covering 320,000 km^2 area. The population change is 2.6% per annum. The region is located between $3^0$40'to 10'46 north and $34^0$08' to 42'55' east. (City Population, 2022). Oromia region has a total of twenty zones from which three are special zone and the administrative town is Adama.

East Hararghe is one of zones from Oromia Regional State. There are twenty woredas in the zone, five of which are woredas for agropastoralists. The zone is found between $8^0$48' 28.9008''North and 41^0 36' 4.2516'' East. It is bounded to the north and east by the Somali Region, to the west and east by the Bale Zone, and to the west by the West Hararghe Zone and the Dire Dawa administration (Roberts, 2022). The projected population of East Hararghe is 4,035,797 from which 1,994,580 are females (CSA, 2023). The primary rainy season and the belg season are its two distinct rainy seasons. A small portion of the geographical area is covered by highland agroecology, while two thirds of the zone's agroecology fall under low land agroecology and one-fourth under midland agroecology (Zeleke et al, 2021). The population of this study are RFSA and PSNP beneficiaries located in nine woredas of East Hararghe Zone called Babile, Chinaksen, Deder, Fedis, Gursum, Jarso, Melka Belo, Meta and Midega Tola.

3.1.1. Resilience Food Security Activity (RFSA)-*Ifaa*

Catholic Relief Service (CRS) led RFSA, also known as *Ifaa*, is a five-year program supported by USAID with goal to brighten the future for poor communities in the Oromia region by reducing interactable poverty, vulnerability, and food insecurity. *Ifaa* targets nine woredas based on poverty, PSNP caseload/potential for scale, partner presence, and opportunity for impact in Ethiopia's East

Hararghe Zone. *Ifaa* prioritize pregnant and lactating women, with a particular focus on first-time mothers, caregivers, and influential community members to ensure children under five receive adequate nutrition, vulnerable community members are reached, and behavior change takes root to create lasting change (CRS Ethiopia, 2022).

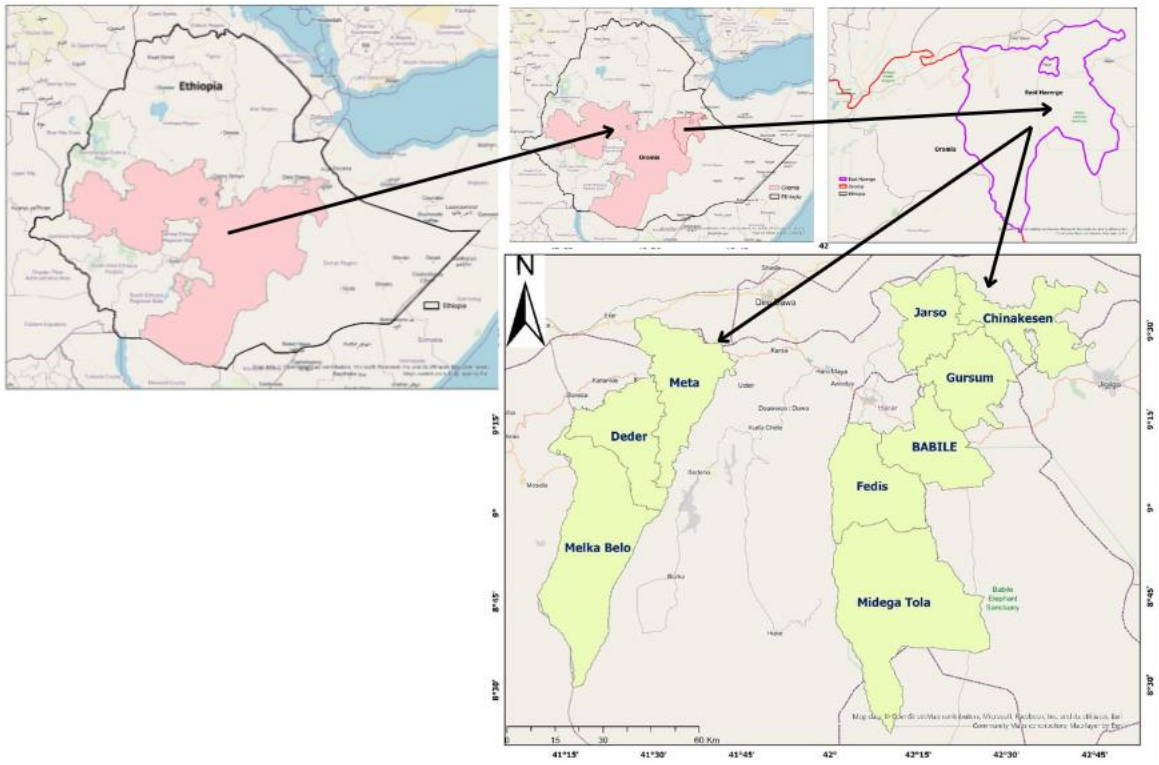

Figure 2. Map of the study area

3.2. Data Type, Source and Method of Data Collection

Quantitative secondary data sources were used for this study. This study was conducted based on cross-sectional data, collected by Monthly Interval Resilience Analysis (MIRA). Data on the demographic, economic, social, and institutional factors of rural households were gathered using a well-structured MIRA questionnaire. More significantly, the survey enabled the measurement of food security status using various food security indicators.

3.2.1. Monthly Interval Resilience Analysis (MIRA)

MIRA is a context monitoring tool being implemented by *Ifaa.* It is an approach to assess shocks and measure households' resilience to shocks and food security. MIRA has developed into a multi-faceted protocol for measuring and understanding resilience, and for improving and refining resilience programming. Unlike commonly practiced methods of collecting only baseline and end-line surveys, MIRA involves frequent collection of a broad set of information combined with monthly monitoring of food security and shock experience (MIRA, 2022).

3.3. Sampling Technique and Sample Size Determination

The sampling procedure encompasses tree main sections; the sample frame, sample size calculation and sampling design.

Sample frame: The sample frame includes all households in the i*faa* operational woredas, which includes 304,334 households (1,521,672 people) in 241 Kebeles, nine woredas.

Sample size calculation: The first step in determining the sample size consists of selecting a variable or indicator on which to base sample size calculations. The MIRA study tracks four key food security indicators: the Food Consumption Score (FCS), Household Dietary Diversity Score (HDDS), Household Hunger Score (HHS), the Reduced Coping Strategy Index (rCSI). Based on in these food security indicators over the life of the project, the calculation for the estimated change in the HHS over the life of the project produces the largest sample size. Therefore, HHS was selected to base the sample size calculation.

The second step in determining sample size is to determine the magnitude of the expected effect. The *ifaa* program estimates a decrease in the mean HHS that are classified as severe (HHS > 3) to moderate ((HHS ≤ 3) over the life of the project. Additional parameters used to determine the sample size calculation include the probability of detecting a true change (alpha, set at 0.95), the power to detect if a change has occurred (beta, set at 0.80), a design effect (to compensate for the use of cluster sampling, set at 1.5) and an attrition rate of 10%.

Using the formula developed by Food and Nutrition Technical Assistance (FANTA III), 1999:

$$n = D [(Z_\alpha + Z_\beta)^2 * (sd_1)^2 + (sd_2)^2 / (X_2 - X_1)^2$$

It was calculated that a total of 745 households are required to effectively measure the targeted degree of change over the life of activity. To produce data that allows for the analysis to compare the change in levels of food security across the different livelihood zones in the *ifaa* operational areas and given that the majority households are in the lowland kebeles, additional 120 households in the midland and highlands were oversampled to create a more balanced design. As the next step was determining number of kebeles to select, a total of 44 kebeles were calculated using FANTA's sampling guidance, bringing the total number of households to be surveyed to 880 households. The final sampling frame is comprised of 44 kebeles of 20 households each. Yet three respondent households dropped due to migration and illness from Deder woreda, a total of 877 respondent households were participated in this study.

Sampling technique: the general two stage sampling technique was used. Primary sampling units (kebeles) were selected using systematic probability proportional to size (Systematic PPS) sampling. The list of all kebeles in the sampling frame and the population of each kebele has been developed based on RPASS. The secondary sampling units (households) were randomly selected from the selected kebeles. Household listing exercise was conducted in the kebeles to create the household frame.

3.4. Food Security Measurement

Food security is a multidimensional concept that can't be measured by a single indicator. For this study two experience based and two dietary diversity type of indicators were used. The indicators are Food Consumption Score, Household Dietary Diversity Score, Reduced Coping Strategy Index and Household Hunger Scale.

Food Consumption Score (FCS): According to INDDEX (2022), the FCS collects information at the household level on the variety and consumption patterns of food groups over the previous seven days. This information is weighted based on the relative nutritional value of the food groups consumed. The indicator categorizes food items onto eight groups and weight each food groups. The weight is 2,3,1,1,4,4,0.5 and 0.5 for staples, pulses, vegetables, fruits, meat and fish, milk, sugar and honey, and oil and fat food categories. Ryan (2015); Madhav et al (2016); Ndakaza et al (2017); Nurudeen et al (2019); William et al (2019), Mohamed (2019), Antwi et al (2021); Sedighe

et al (2023); Habtamu et al (2023) and Bekele et al (2023) used FCS for measurement of food security as dependent variable. The calculation is as per below:

FCS = (FCS1_days * 2) + (FCS2_days * 3) + (FCS3_days) + (FCS4_days) + (FCS5_days * 4) + (FCS6_days * 4) + (FCS7_days * 0.5) + (FCS8_days * 0.5)

Thresholds

Poor, if FCS≤21

Borderline, if FCS 21 - 35

Good/acceptable, if FCS >35

Household Dietary Diversity Score (HDDS): is defined as the number of food groups a household consumes over the past 24 hours. A more varied diet at home is linked to adequate calorie and protein intake, the proportion of protein from animal sources, and household income. The food groups to be used to calculate HDDS are cereals, root and tubers, vegetables, fruit, Meat, eggs, fish and seafood, pulse/legume/nut, milk and milk products, oil/fats, sugar/honey, and miscellaneous (Swindale et al, 2006). It is unweighted sum of twelve food groups. The calculation is as per below:

HDDS= Sum (A+B+C+D+E+F+G+H+I+J+K+L)

Thresholds

Poor, if HDDS≤2

Borderline, if HDDS 3-4

Acceptable, if HDD≥5

Reduced Coping Strategy Index (rCSI): The CSI tracks behavior that what people do when they don't have access to enough food. People manage household food shortages using a variety of fairly common behavioral responses to food insecurity or coping mechanisms (Maxwell et al, 2008). The calculation is as per below:

rCSI = (rCSI a*1)+(rCSI b*1)+(rCSI c*1)+(rCSI d*3)+(rCSI e*2)

Thresholds

Food secure, if rCSI <4

Moderate/stressed, if rCSI≥4, rCSI≤21

Insecure, if rCSI >21

Household Hunger Scale: According to Ballard et al (2011), The HHS strategy is predicated on the notion that experiencing a lack of food in the home results in predictable reactions that can be recorded through a survey and summed up in a scale. Food Security Cluster (2020), HHS serves as a gauge for assessing hunger in households. HHS is gathered by asking three questions about any possible food insecurity that may have occurred at the household level over the previous 4 weeks/30 days. Furthermore, HHS is appropriate for assessing severe food insecurity situations, where households experience food deprivation. The calculation is as per below:

HHS=(HHS1a*FS) + (HHS2a*FS) + (HHS3a*FS)

Thresholds

Food Secure, if=0, Moderate/Stressed, if=1, 2, Insecure, if=3, 4, Crisis level, if=5, and Catastrophe level, if=6

3.5. Method of Data Analysis

Both descriptive and econometric analysis were used in this study to analyze the data. The descriptive approach was used to pinpoint the demographic, socioeconomic, and institutional factors of respondents and data relevant to food security. Frequency counts, percentages, and means were used in the descriptive analysis. On the other hand, to ascertain the causality between different factors and households' food security, an ordered logit regression model was employed. Additionally, the food security status of the sample households was determined using the Food Consumption Score, Household Dietary Diversity Score, Reduced Coping Strategy Index, and Household Hunger Scale.

3.6. Model Specification

3.6.1. Theoretical model specification

Econometric models serve as a tool that precisely identifies the empirical connection between independent and dependent variables. Ordered logit model is appropriate if the dependent variable is categorical and being ordered. Hence, this study used ordered logit model since the dependent variable is categorical and ordered and other related studies also utilized the model as mentioned on the above section. Analysis of food security using FCS is subject to ordered choice, namely: poor, borderline, and acceptable with predetermined cutoff point.

3.6.2. Econometric model specification

Ordered logistic regression is a method developed to fulfill the goal of modeling the relative frequency distribution of cases across three or more ranked categories of the dependent variable (Y). In contrast with other probabilistic models, ordered logit regression incorporates the assumption that there is a definite ordering of the categories of the dependent variable. Rare researchers such as Ibrahim et al (2016); Abiodun, (2013); Samia et al (2021); Pipi et al (2023); Aschalew et al (2023) also utilized ordered logit model for such kind of study.

According to Williams (2021), in the ordered logit model, there is an observed ordinal variable, Y. In the ordered logit model, there is a continuous, unmeasured latent variable Y*, whose values determine what the observed ordinal variable Y equals. The continuous latent variable Y* has various threshold points. (κ is the Greek small letter Kappa). The value of the observed variable Y depends on whether or not it crossed a particular threshold. For example, when the outcome is three,

$$Yi = 1 \text{ if } Y^*i \text{ is } \leq \kappa_1$$

$$Yi = 2 \text{ if } \kappa 1 \leq Y^*i \leq \kappa_2$$

$$Yi = 3 \text{ id } Y^*i \geq \kappa_2$$

Therefore, the equations are;

$$P(Y=1) = \frac{1}{1+\exp(Zi-\kappa 1)}$$

$$P(Y=2) = \frac{1}{1+\exp(Zi-\kappa 2)} - \frac{1}{1+\exp(Zi-\kappa 1)}$$

$$P(Y=3) = 1 - \frac{1}{1+\exp(Zi-\kappa 2)}$$

In the context of this study, the dependent variable, FCS has three distinct outcomes that can be represented with values of 0, 1, and 2. The FCS has three possible outcomes, Poor if the FCS ≤ 21, Borderline if the FCS is 21-35, and Acceptable if the FCS is > 35. Therefore,

Yi = 0 if Y^*_i is ≤ 21, Poor food security level

Yi = 1 if 35 ≤ Y^*_i >21, Borderline food security level

Yi = 2 if Y^*_i >35, Acceptable food security level

The model for this study is specified as follows:

$$FCS = \beta 0 + \beta_1 Sex\_HH + \beta_2 Age\_HH + \beta_3 HH\_Size + \beta_4 Educ\_Lev + \beta_5 Agro\_EZ + \beta_6 Dep\_Rat + \beta_7 PSNP\_Memb + \beta_8 Assis + \beta_9 Credit\_Acc + \beta_{10} Saving + \beta_{11} TLU + \beta_{12} Offfarm\_Act + \beta_{13} Shock + \beta_{14} Train\_Farm + U_{it} \ldots\ldots\ldots\ldots\ldots (1)$$

3.7. Definition of Variable, Measurement and Hypothesis

3.7.1. Dependent variable

Food Security: It is a status of being food secure or food insecure. It is measured by different indicators such as Food Consumption Score, Household Dietary Diversity Score, Reduced Coping Strategy Index and Household Hunger Scale. But for the econometric model, Food Consumption Score was used as a dependent variable because this indicator accommodates both the household diet and nutritional value. Ryan (2015); Madhav et al (2016); Ndakaza et al (2017); Nurudeen et al (2019); William et al (2019), Mohamed (2019), Antwi et al (2021); Sedighe et al (2023); Habtamu et al (2023) and Bekele et al (2023) used this indicator to measure food security. Based on this indicator, there are three results, Poor if the FCS ≤ 21, Borderline if the FCS is 21-35 and Acceptable if the FCS is > 35. **(See Appendix 1).**

3.7.2. Independent variables

Sex of Household Head (Sex_HH): This variable refers to the sex of the household head whether male or female. This variable has a dummy value where value 1 is given for female headed household and value 0 is given for male headed household. Female headed households can have improved food security because women are responsible for food preparation and have more direct impact on household food security. When women have control over resource, they are more likely to allocate them towards food and nutrition. According to Aboaba et al; (2020); Janvier et al (2023) and Sharaunga et al (2016), female headed households are more likely to be food secured that male headed households. Therefor female headed households are expected to be food secured than male headed households.

Age of Household Head (Age_HH): This variable represents the age of household head; it is continuous variable. younger household may also struggle with food security due to lack of experience, resources or stable employment. But older household heads have more experience and stability in managing resources and planning for the future needs of the family. Abafita et al (2014); Assefa et al (2022); Hailu et al (2022); Aboaba et al (2020) and Chernet (2023) found positive relationship between age of head and household food security status. Therefore, the impacts of age of head are expected to be positive in this study.

Household Size (HH_Size): This is a number of peoples in a household. It has numerical value. Larger household size increase food consumption and economic burden, if the family's income is not sufficient it may lead to food insecurity. In addition, it increased demand for resources which may lead to deforestation, soil degradation and other environmental issues, this will exacerbate food insecurity by reducing agricultural productivity. Seble et al (2020); Yusuf et al (2021), Hailu et al (2022); Aboaba et al (2020); Sedighe et al (2023); Belayneh (2022) and Antwi et al (2021) states that as a number of household member increases, household tends to be food insecure. So, it is expected to be negative.

Education Level (Educ_Lev): This variable is measured by total years of schooling of the household head, and it is numerical. It is associated with better understanding of nutrition, hygiene and agricultural practice which can lead to improved food insecurity. Educated household heads are more likely to have stable employment and higher incomes, which can enable them to afford diverse and nutritious diets. Abafita et al (2014); Yusuf et al (2021); Hailu et al (2022); Seble et al

(2020); Sedighe et al (2023); William et al (2019); Antiwi et al 92021) and Ndakaza et al (2017) found positive relationship between education level of household head and food security status. Therefore, it is expected to be positively related.

Agroecological Zone (Agro_EZ): These variable measures whether the household lives in highland or midland or low land agroecological zone. It has a dummy value, 0 if low land, 1 if midland and 2 if highland. Highland agroecological zones are characterized by cooler temperature, longer growing seasons and higher rainfall which can support a diverse range of crops and more stable and reliable food supply. Therefore, household living in highland zone are expected to be food secure than those who lives in midland and lowland zones.

Dependency Ratio (Dep_Rat): A measure of the number of dependents aged zero to 14 and over the age of 65, compared with the total population aged 15 to 64. This demographic indicator gives insight into the number of people of non-working age, compared with the number of those of working age. It has continuous value. Large number of dependents require more resources, including food, and put pressure on available food supply and distribution system. According to Habtamu et al (2023); Temesgen et al (2023); Sintayehu et al (2022); Yusuf et al (2021); Aboaba et al (2020) and Sedighe et al (2023), high dependency ratio is related with food security negatively. For this reason, dependency ration is expected to have negative relation.

PSNP Membership (PSNP_Memb): This variable identifies whether the household is Public work or Direct support beneficiary. It has dummy value of 0 if the beneficiary is direct support beneficiary and 1 if the beneficiary is public work beneficiary. Public work beneficiary are required to participate in community asset-building activities for a certain number of days per month in exchange for food or cash transfers, while direct support beneficiary receive unconditional transfer. Public work project can provide participants with new skills, knowledge and experience that can be applied in other areas. In addition, as they are at working age, they can do other side businesses to help their livelihood. Therefore, public work beneficiaries tend to have better food security compared than direct support beneficies..

Assistance (Assis): These variable measures whether the household get assistance including cash and in kind from government, relative, neighbor, NGO, religious institution, etc. It has a dummy value 0 if the household didn't receive any assistance and 1 if the household received assistance. Assistance can increase the household purchasing power, allowing them to buy more and better-quality food. As it increases resource, households can afford a more balanced and nutritious diet.

In addition, it can help households cope with unexpected events such as natural disaster, economic downturns, or health emergencies. Smiriti et al (2016) and Sarah (2013) confirmed assistance help to improve food security. Therefore, this variable is expected to have positive relationship with food security.

Credit Access (Cred_Acc): This variable refers whether households have access to formal or informal credit. The variable has a dummy value where 1 is given for household with credit access and 0 for household with no credit access. Access to credit can improve households' food security in several ways. It allows households to invest on agricultural input which can increase crop yield and improve production, it helps households to cope with unexpected expenses, it enables households to diversify their income which reduce their vulnerability to food insecurity, and it empower households to start small business which will allow them to access nutritious food. Teshager (2020); Amanuel et al (2023); Aboaba (2020) and Nadia et al (2018) revealed there is positive relationship between food security and access to credit. On the other hand, credit access has negative impact on food security when it leads to over-indebtedness or unsustainable borrowing practice, when borrowers are unable to repay their loans, they may be forced to sell their land and livestock which will reduce agricultural production and food security. Abafita et al (2014) and Yusuf et al (2021) found that there is negative relationship between food security and credit access. Therefore, this variable is expected to be either positive or negative as there are controversial existing evidence.

Saving (Saving): This variable measures the amount of monetary saving the household has, both formal and informal. This variable has a continuous variable. Saving can be used to purchase food when needed, ensuring that the household has access to nutritious and safe food. It also helps households to cope unexpected expense such as medical or job loss which could otherwise lead to reduced food consumption or hunger. In addition, saving can enable households to invest in asset that can improve food security, such as purchasing land, livestock, or agricultural equipment. Hawi et al (2022); Ayele (2014) and Terrence et al (2021) found households with saving has better food security. So, it is expected to have positive impact.

Livestock Ownership (TLU): This indicator measures the number of different livestock the household own. This variable is continuous and measured by tropical livestock unit (TLU). By owing livestock, households can diversify source of food and income. Livestock products like milk, meat and egg contribute essential nutrients to the diets of households. It also enhances

household resilience to climate change and other environmental changes, in times of drought or crop failure livestock can provide a buffer against food insecurity by offering alternative source of food and income. As revealed by Abafita et al (2014); Asmelash (2014) Yusuf et al (2021) and Sedighe et al (2023), livestock ownership has positive relation with food security. Therefore, it is expected to have positive sign.

Off-farm activity (Offfarm_Act): This variable is the status of engaging in off-farm activities. And it is a dummy variable where the value 1 is given for the household that is engaged in off-farm activity and the value 0 is given for the household who is not engaged in off-farm activity. It can provide household with additional income, which can be used to purchase food. It can contribute to the diversification of livelihoods, reducing households' reliance on agriculture alone for their food and income needs. It can also lead to improved access to markets and service which can further enhance food security by increasing the availability of food. According to Nur-Marian et al (2019); Abafita et al (2014); Tobin (2009); Ingram et al (2008); Assefa et al (2022); Yusuf et al (2021); William et al (2019) and Hussein (2017), if the household is engaged in off farm activities, the probability of being food secured increased. In contrary with the above, there is a way that off-farm activity engagement may negatively affect food security. It often diverts labor away from agricultural pursuits, reducing farm productivity and income generation. Additionally, off-farm work may incur additional expenses such as transportation or childcare costs, further constraining the household budget and exacerbating food insecurity. Binswanger-Mkhize et al (2018); Thorpe et al (2013), and Haddad et al (2016) confirm that off-farm engagement may reduce the food security states of rural households. Therefore, this variable is expected to be either positive or negative as there are contradicting literatures.

Shock Occurrence (Shock): These variable measures the occurrence of any shock that can impact household's day to day life such as drought, pest, livestock disease and death, illness, displacement, unexpected price rise, etc. It has dummy value with 1 no shock occurrence and 0 with shock occurrence. It can disrupt food production, distribution and access leading to food shortage. Shock can also have long-term effects on household food security by eroding assets, reducing income opportunities, and undermining the ability of households to recover and rebuild their food security level. According to Isaac et al (2020); Teshager (2020); FAO (2023); Nur-Marian et al (2019) and Hussein (2017) shock is one of causes for food insecurity. Accordingly, peoples who experienced shock are less likely to food secure.

Training Related to Farming Activity (Train_Farm): These variable measures whether the household receive training related to farming practice. It has a dummy value of 1 if the household receive training and 0 if the household didn't receive training. It enhances agricultural productivity, improving farming techniques. Farmers who receive training are better equipped to deal with challenges such as climate change, pests, and diseases, leading to increased yield and improved food availability. Therefore, it is expected to have positive impact. Ketemae et al (2022) found that there is a positive relationship between farming related training and food security. Therefore, this study is expected to be positively related with food security.

Table 1: Summary of Variables and Working Hypothesis

S/N	Variable description	Variable representation	Variable measurement	Expected sign	Literatures
Demographic Factors					
1.	Sex of household head	Sex_HH	1=Female, 0, otherwise	+	Aboaba et al; (2020); Jnvier et al (2023) and Sharaunga et al (2016)
2.	Age of household head	Age_HH	In years	+	Abafita et al (2014); Assefa et al (2022); Hailu et al (2022); Aboaba et al (2020) and Chernet (2023)
3.	Household Size	HH_Size	In number	-	Seble et al (2020); Yusuf et al (2021), Hailu et al (2022); Aboaba et al (2020); Sedighe et al (2023); Belayneh (2022) and Antwi et al (2021)
4.	Education Level	Educ_Lev	In years of schooling	+	Abafita et al (2014); Yusuf et al (2021); Hailu et al (2022); Seble et al (2020); Sedighe et al (2023); William et al (2019); Antiwi et al 92021) and Ndakaza et al (2017)
5.	Agroecological Zone	Agro_EZ	1=Highland, 0, otherwise	+	
6.	Dependency Ratio	Dep_Rat	In number	-	Habtamu et al (2023); Temesgen et al (2023); Sintayehu et al (2022); Yusuf et al (2021); Aboaba et al (2020) and Sedighe et al (2023)
Institutional and Infrastructural Factors					

7.	PSNP Membership	PSNP_Memb	1=Public work, 0, otherwise	+	
8.	Training Related to Farming Activity	Train_Farm	1=Received training, 0, otherwise	+	Ketemaw et al (2022)
Economic Factors					
9.	Credit Access	Cred_Acc	1=Accessed, 0, otherwise	+/-	Teshager (2020); Amanuel et al (2023); Aboaba (2020) and Nadia et al (2018) Abafita et al (2014) and Yusuf et al (2021)
10.	Saving	Saving	1=Have saving, 0, otherwise	+	Hawi et al (2022); Ayele (2014) and Terrence et al (2021)
11.	Off-farm Activity	Offfarm_Act	1=Engaged in off-farm activity, 0, otherwise	+/-	Nur-Marian et al (2019); Abafita et al (2014); Tobin (2009); Ingram et al (2008); Assefa et al (2022); Yusuf et al (2021); William et al (2019), Hussein (2017), Binswanger-Mkhize et al (2018); Thorpe et al (2013), and Haddad et al (2016)
Ownership Factors					
12.	Livestock Ownership	TLU	TLU	+	Abafita et al (2014); Asmelash (2014) Yusuf et al (2021) and Sedighe et al (2023)
Other Factors					

13.	Assistance	Assis	1=Received Assistance, 0, otherwise	+	Smiriti et al (2016) and Sarah (2013)
14.	Shock Occurrence	Shock	1=Experienced shock, 0, otherwise	-	Isaac et al (2020); Teshager (2020); FAO (2023); Nur-Marian et al (2019) and Hussein (2017)

CHAPTER FOUR

4. DATA PRESENTATION AND ANALYSIS

Secondary data was obtained from 877 sample households and was analyzed using both descriptive and econometric methods of analysis. Therefore, this chapter deals with the presentation and interpretation of the results by using descriptive statistics such as mean, frequency counts, and percentages to reveal some background information about the characteristics of sample households followed by the presentation and interpretation of estimated empirical models designed to address the objective of the research. In addition, food security is measured using four food security indicators.

4.1. Descriptive Data Analysis

4.1.1. Demographic and socioeconomic characteristics of respondents

Table 2: Woreda distribution of respondents

Woreda	Number of respondents	Percentage
Babile	80	9.1%
Chinakesen	100	11.4
Deder	137	15.7
Fedis	120	13.7%
Gursum	100	11.4
Jarso	80	9.1%
Melka belo	100	11.4
Meta	80	9.1%
Midega tola	80	9.1%
Total	877	100%

Source: Own computation, based on household survey data (2024)

As shown from Table 2, total of respondents are from nine woredas of East Hararghe zone. From the total of respondents, Babile, Jarso, Meta and Midega tola have 80 (9.1%) each, Chinaksen, Gursum and Melka belo have 100 (Chinaksen, Gursum and Melka belo have 100(11.4%) each and Deder and Fedis have 120(13.7%) and 137 (15.7%), respectively.

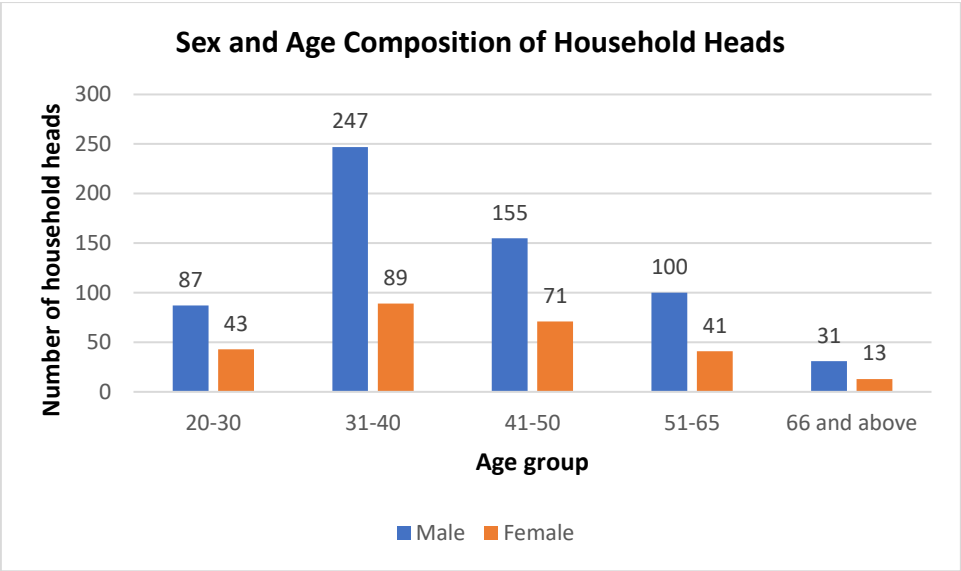

Figure 3: Sex and age Composition of respondent household heads
Source: Own computation, based on household survey data (2024)

Figure 3 revealed that majority of the respondent household heads are working-age groups whereas, the smallest are above 65 years old. On the other side, majority (620) of respondents are male headed households. From the total of 877 respondents, 87, 247, 155, 100, and 31 are in 20 to 30, 31 to 40, 41 to 50, 51 to 65, and 65 and above age groups, respectively. Similarly, 43, 89, 71, 41, and 13 are in 20 to 30, 31 to 40, 41 to 50, 51 to 65, and 65 and above age groups, respectively.

Table 3: Agroecological zone of respondent households

Agroecological Zone	Frequency	Percentage
Highland	160	18%
Midland	297	34%
Lowland	420	48%
Total	877	100%

Source: Own computation, based on household survey data (2024)

As shown from Table 3, majority of respondents are living in lowland agroecological zone. From the total of 877 households, 160 (18%), 297 (34%) and 420 (48%) of respondents are from Highland, Midland, and Lowland, respectively.

Table 4: Summary statistics of continuous variables

Variable	Mean	Std. dev	Min	Max
Age_HH	43.228	11.982	20	90
HH_Size	6.019	2.165	1	14
Educ_Lev	0.83	2.188	0	15
Dep_Rat	1.153	0.922	0	6
TLU	1.708	2.509	0	20.8

Source: Own computation, based on household survey data (2024)

Table 4 shows that the mean value for the age of household head, household size, education level of household head, dependency ratio, and tropical livestock unit is 43.228, 6.019, 0.83, 1.153, and 1.708, with the standard deviation of 11.982, 2.165, 2.188, 0.922 and 2.509, respectively. In addition, the maximum of age of household head, household size, education level of household head, dependency ratio, and tropical livestock unit is 90,14, 156 and 20.8, with the minimum 20, 1, 0,0, and 0, respectively.

4.1.2. Food security situation

A. Food Consumption Score (FCS)

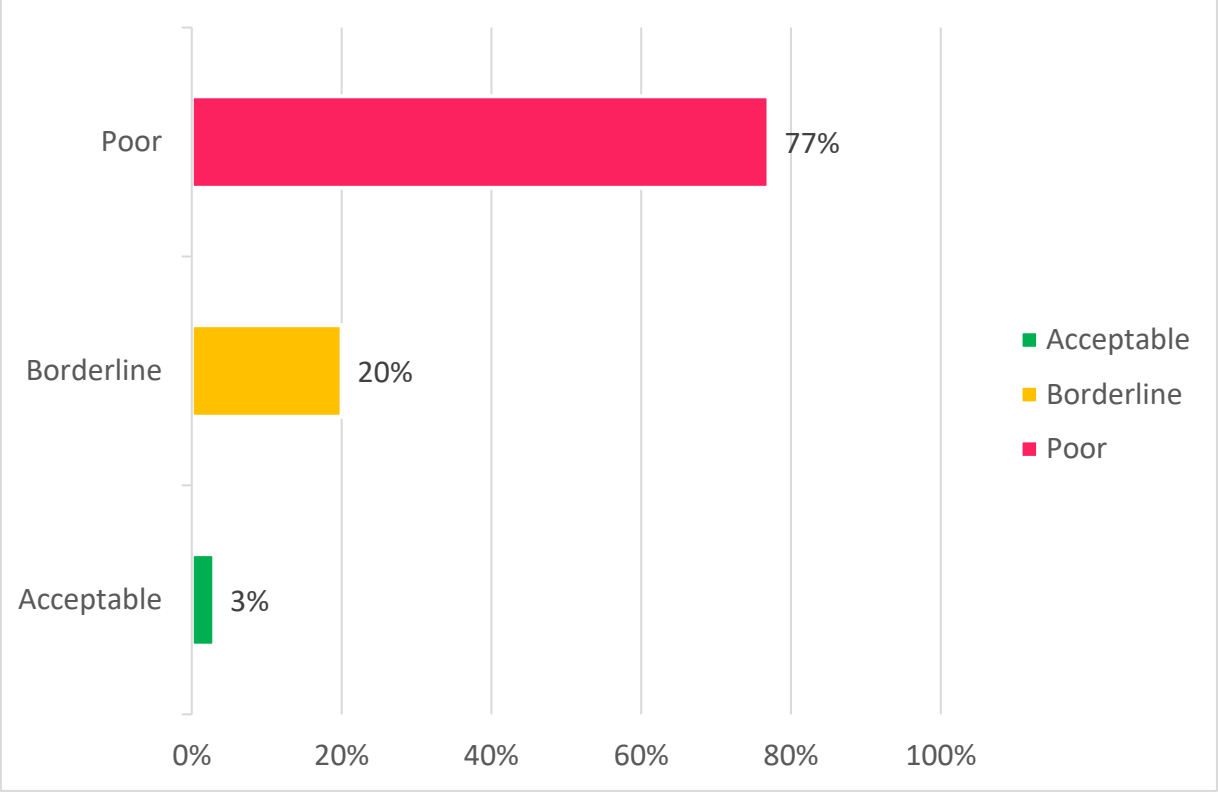

Figure 4: Food Consumption Score
Source: Own computation, based on household survey data (2024)

Figure 4 revealed that majority of the households have poor food security level. From the total of 877 respondents, 674(77%), 179(20%), and 24(3%) are on poor, borderline and acceptable level of food security, respectively. As this indicator considers three things, (1) categorization of the food items that the household ate for the past 7 day into 8 food groups, (2) frequency of eating those items and lastly (3) measuring the nutritional weight of the food groups, we can conclude that households in the study area mainly consume food items with low nutritional weight such as injera, bread, porridge and other staples and rarely consume milk, meat, fish, etc that have highest nutritional weight.

B. Household Dietary Diversity Score (HDDS)

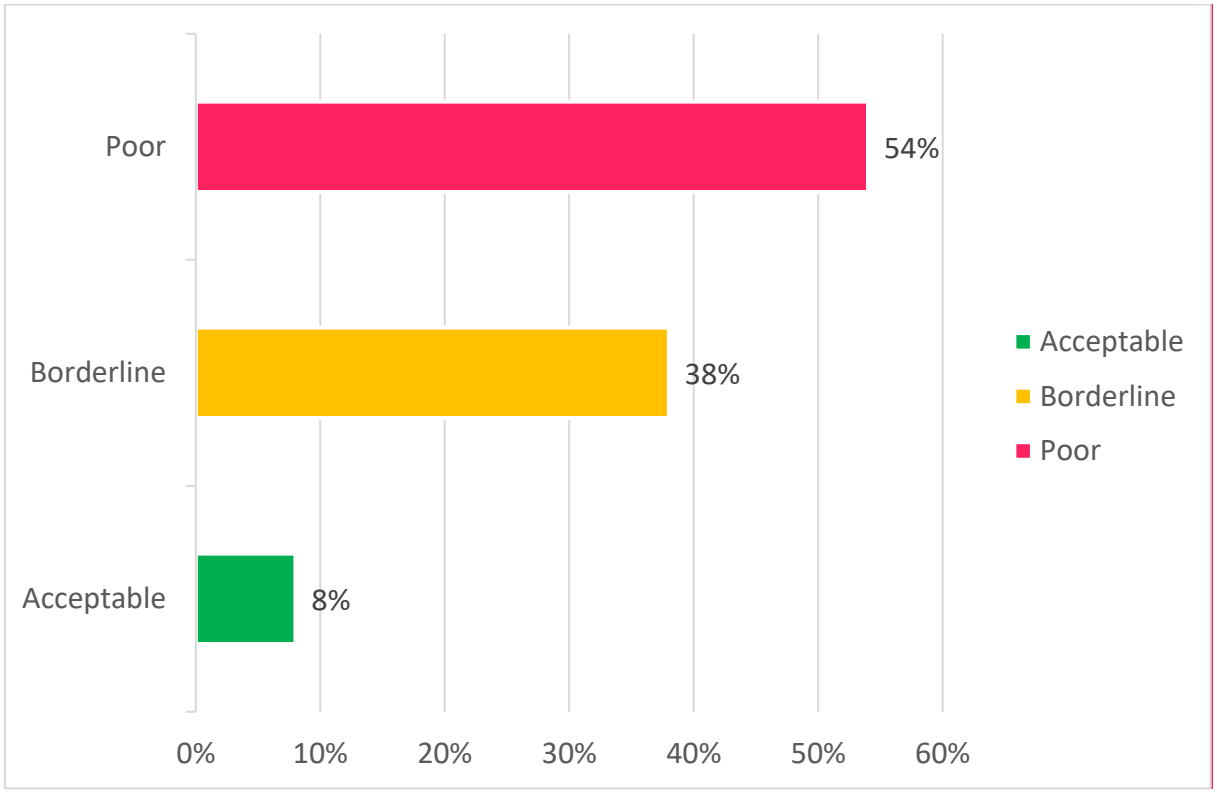

Figure 5: Household Dietary Diversity Score
Source: Own computation, based on household survey data (2024)

As shown from Figure 5 majority of the households are on poor food security level. From the total of 877 respondents, 476(54%), 330(38%) and, 71(8%) have on poor, borderline and acceptable level of food security, respectively. However, FCS and HDDS are both measure of dietary diversity food security level, HDDS only a measure of variety of food groups consumed in a day regardless of the nutritional value of the food item. Because of this difference, food

security level found by using HDDS are better that food security level found by using FCS. From the result above, it can be concluded that most of the respondent households consume small number of food items in a day.

C. Reduced Coping Strategy Index

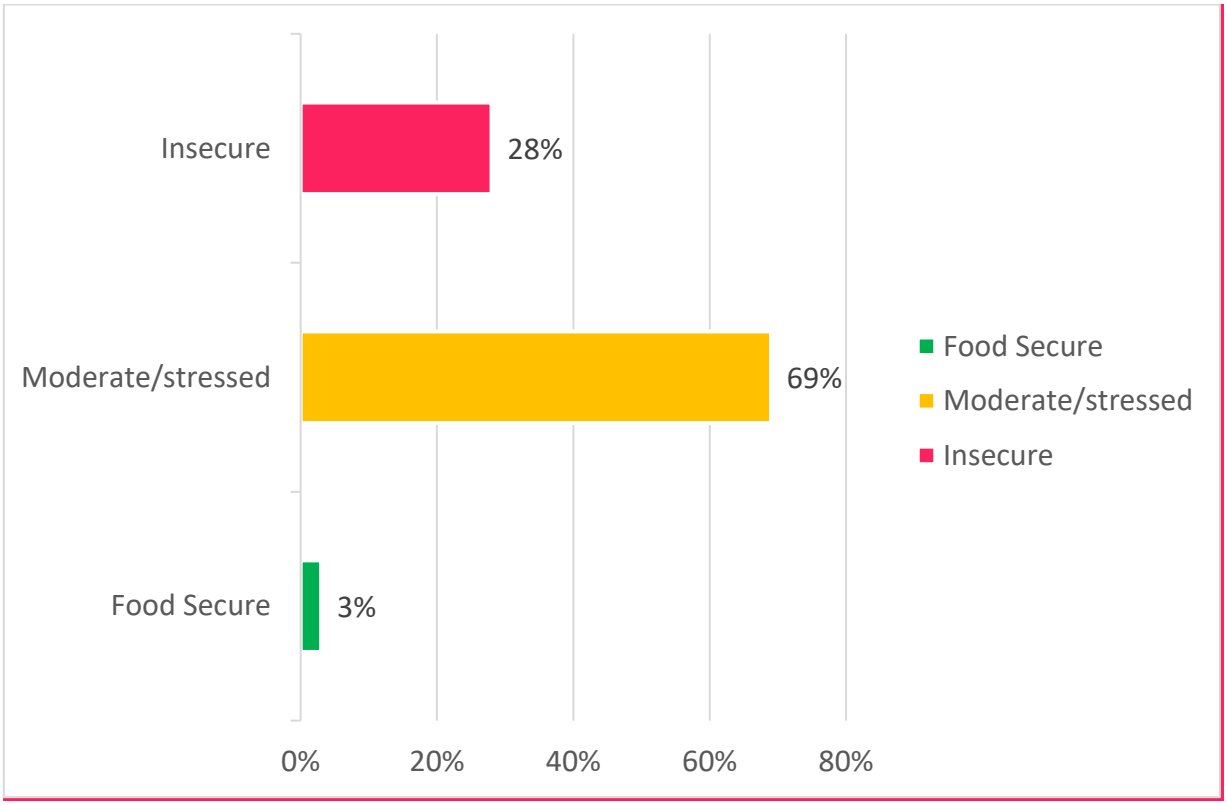

Figure 6: Reduced Coping Strategy Index
Source: Own computation, based on household survey data (2024)

As indicated from Figure 6, above, majority of respondents have moderate/stressed level of food security. From the total of 877 respondents, 245(28%), 608(69%), and 24(3%) are insecure, moderate/stressed and food secure, respectively. The reduced coping strategy index measures the strategies that households took when they don't have enough food or enough money to buy food. Therefore, the result revealed most of respondents use harmful strategies such as reducing number of meals eaten in a day (frequency), restriction adults' food consumption, etc when the don't have enough food.

D. Household Hunger Scale

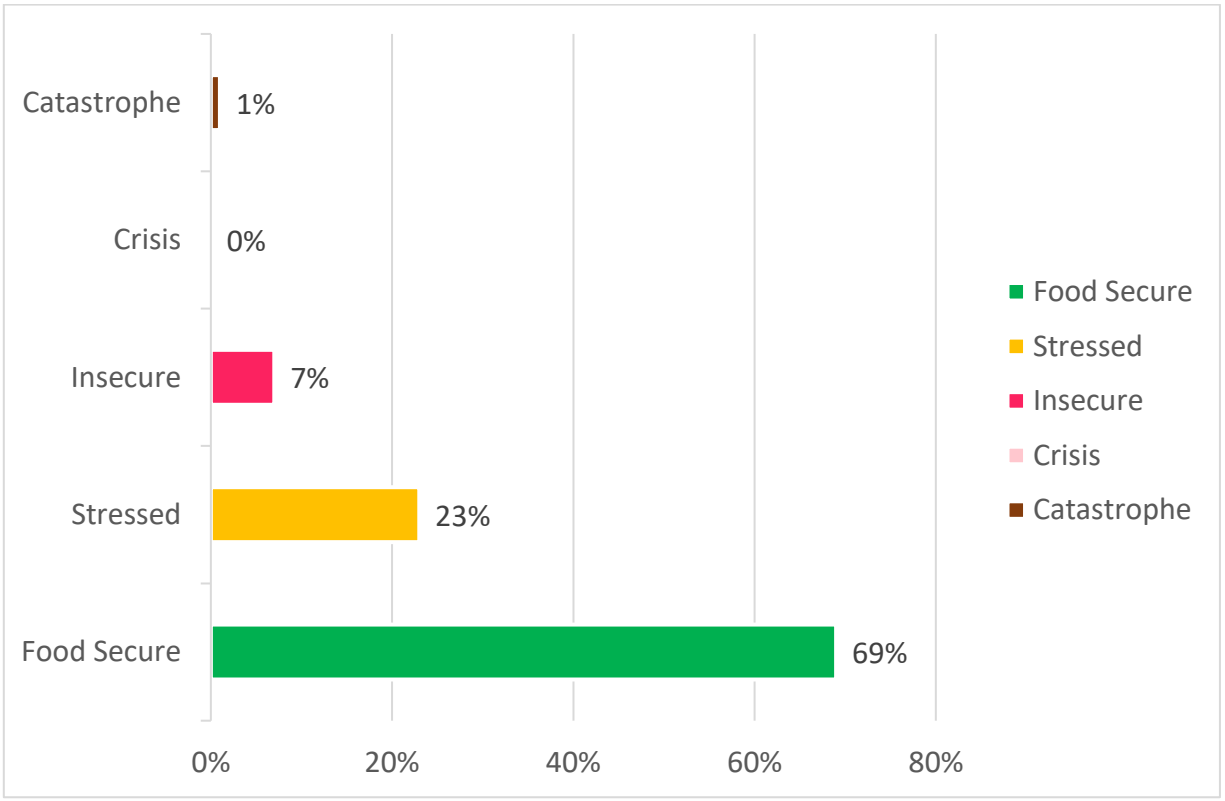

Figure 7: Household Hunger Scale
Source: Own computation, based on household survey data (2024)

As shows from the Figure 7, majority of the households are food secure. 613(70%), 203(23%), 60(7%) 0(0%), and 1(0.001%) of respondents are on food secure, stressed, insecure, crisis and catastrophe level of food security, respectively. As HHS measures how hungry the households were in the past month, we can conclude that most of the households eat at least once in a day. Even though, the number of respondents with insecure, crisis and catastrophe level of food insecurity level are very small compared to the total respondents, it is still very dangerous to be found food insecure by household hunger scale. This is mainly because it means food insecure households didn't eat any food in any kind for a days in this context.

4.2. Econometric Analysis

4.2.1. Diagnostic tests

The Order logit model was utilized to investigate the factors influencing food security in nine woredas of the study area. Before proceeding with estimating the parameters of the ordered logit model, diagnostic tests were carried out. Test for multicollinearity were conducted utilizing

variance inflation factors, and a link test was performed to confirm the specification of the estimated model.

A. Proportional odds assumption test

The parallel test was utilized to test the proportional odds of assumption, according to the result, the p-value (Prob > chi2) is 0.132, 0.149, 0.116, 0.087, and 0.151for Wolfe Gould, Brant, Score, Likelihood Ration and Wald tests, which is less than the significance level of 0.05. Therefore, the null hypothesis is accepted, indicating that the proportional odds assumption is kept **(See Appendix 6).**

B. Multicollinearity test

Since the computed values of mean VIF were 1.17 and all of the values were less than 10 test results individually. Based on this result, it is possible to conclude that the data is free from high multicollinearity problem **(See Appendix 6).**

C. Model specification test

Model specification was computed using a link test, the result indicated that the hat square is insignificant with a p-value of 0.71, implying that the model is adequate **(See Appendix 6).**

4.2.2. Regression result

I. Ordered logit regression result

To determine the best predictors of the dependent variable, food consumption score, a comprehensive analysis was conducted using ordered logistic regression. Fourteen independent variables were incorporated into the model to estimate the parameters of all the variables. The decision to include these variables was based on theoretical expectations and empirical studies conducted previously.

In STATA/SE 18, all the variables were inputted, and an ordered logistic regression model was utilized to determine the key factors influencing food security in the specific area under study. The regression model used food consumption score, which was treated as a categorical ordered dependent variable with values of 0, 1, and 2 representing poor, borderline, and acceptable levels of food security for households.

The likelihood ratio statistic as a measure of goodness of fit of the model shows that the number of observations is 877. The LR chi -squared is 64.85 with p-value of 0.000, indicating that the model fits the data well as compared to the null. From the total of fourteen independent variables, the marginal coefficients of nine variables found to be significant. The effect of those significant variables would be discussed below. Most of the variables have the expected sign and comply with previous studies.

Table 5: Marginal effect results after ordered logit

Variables	**Poor Food Security**		**Borderline Food Security**		**Acceptable Food Security**	
	Coef. (st.E)	Marginal effect	Coef. (st.E)	Marginal effect	Coef. (st.E)	Marginal effect
Sex_HH	0.0332	-0.0206	0.0288	0.0179	0.0044	0.0027
Age_HH	0.0012	-0.0022*	0.0011	0.0019*	0.0002	0.0003*
HH_Size	0.0073	0.015**	0.0064	-0.0131**	0.001	-0.0019*
Educ_Lev	0.0064	-0.007	0.0056	0.0061	0.0009	0.0009
Agro_EZ	0.0493	-0.2168***	0.0406	0.1824***	0.0113	0.0344***
Dep_Rat	0.0153	-0.0262*	0.0133	0.0228*	0.0021	0.0034
PSNP_Memb	0.032	-0.0655**	0.028	0.057**	0.0044	0.0084*
Assis	0.0322	0.0326	0.0281	-0.0284	0.0042	-0.0042
Credit_Acc	0.0288	0.1019***	0.0255	-0.0891***	0.0042	-0.0128***
Saving	0.0449	0.0041	0.0392	-0.0036	0.0058	-0.0005
TLU	0.0053	-0.0164***	0.0046	0.0143***	0.0008	0.0021***
Offfarm_Act	0.0466	0.0822*	0.0397	-0.0708*	0.0073	-0.0115
Shock	0.0402	-0.0573	0.0355	0.0502	0.0049	0.007
Train_Farm	0.0529	-0.1067**	0.0447	0.0914**	0.0088	0.0153*
***, **, * significant at 1%, 5% and 10% probability level respectively						
Number of observations			877			
LR $chi^2(14)$			64.85			
Pseudo R^2			0.0591***			
Log likelihood			-515.84			

Source: Own computation, based on household survey data (2024)

II. Discussion on regression results

A. Demographic factors

Age Of Household Head (Age_HH)

The variable age of household head has negative effect on being on poor food security level at 10% level of significance, whereas, has positive effect on being on borderline and acceptable

food security status with 10% level of significance. The regression result revealed that, other things remain constant, an increase in age of household head by one year is associated with 0.22% less likely to be on poor security level. on the other hand, it is associated with 0.19% and 0.03% more likely to be on borderline and acceptable food security level, respectively. The age of the household head can have a significant positive effect on the food security level of rural households. Older household heads often bring with them a wealth of experience, knowledge, and skills that can contribute to better decision-making regarding food production, management, and utilization within the household. With age comes wisdom and a deeper understanding of agricultural practices, resource management, and coping strategies during times of scarcity or crisis. Older household heads may also have established social networks and community connections that can provide additional support in times of need. Furthermore, their experience in dealing with various challenges over the years can lead to more resilience and adaptability in ensuring food security for the household. This result is consistent with the developed hypothesis and previous studies of Abafita et al (2014); Assefa et al (2022); Hailu et al (2022); Aboaba et al (2020) and Chernet (2023).

Household Size (HH_Size)

The variable household size has positive effect on being on poor food security level at 5% level of significance, whereas, has negative effect on being on borderline and acceptable food security status with 5% and 10% level of significance. The estimation result found that, an increase in household size by one member increases the probability of being on poor food security level by 1.5%. Whereas it reduces the probability of being on borderline and acceptable level of food security level by 1.31% and 0.19%, respectively. This is mainly because increased strain on available resources, particularly food supplies. With more mouths to feed within a household, there is a higher demand for food, which can lead to food scarcity and inadequate nutrition for all family members. This situation is exacerbated in rural areas where access to diverse and affordable food options may already be limited. Additionally, larger households may struggle to afford an adequate quantity of food for everyone, leading to malnutrition and food insecurity among family members. This result is consistent with the developed hypothesis and previous studies of Seble et al (2020); Yusuf et al (2021), Hailu et al (2022); Aboaba et al (2020); Sedighe et al (2023); Belayneh (2022) and Antwi et al (2021).

Agroecology Zone (Agro_EZ)

According to the result, living in Highland agroecology zone has negative relation with being on poor food security level at 1% level of significance, whereas, has positive effect on being on borderline and acceptable food security status with 1% level of significance. The result confirmed that, other things remain constant, households living in Highland are 21.68% less likely to be on poor security level compared to households living in midland and low land. On the other hand, they are 18.24% and 3.44% more likely to be on borderline and acceptable food security level compared to households living in midland and low land, respectively. Highland areas often have cooler temperatures and more consistent rainfall patterns, which can be beneficial for certain crops that thrive in these conditions. This can lead to increased agricultural productivity and a more diverse range of crops being grown, ultimately improving food availability and dietary diversity for rural households. Additionally, the topography of highland areas can provide opportunities for terracing and other sustainable farming practices that help conserve soil and water resources, leading to more resilient agricultural systems. Furthermore, the isolation of highland regions can sometimes act as a natural barrier against pests and diseases that commonly affect crops, reducing the risk of crop losses and contributing to higher yields. This result is consistent with the developed hypothesis.

Dependency Ratio (Dep_Rat)

The variable dependency ratio has negative and positive effect on being on poor and borderline food security level at 10% level of significance, respectively. The result revealed that, an increase in ratio of dependent age groups to working age groups increases by one unit decreases the probability of being on poor food security level by 2.62%. Whereas it increases the probability of being on borderline level of food security level by 2.28%. How ever, this result contradicts with the developed hypothesis and previous studies of Habtamu et al (2023); Temesgen et al (2023); Sintayehu et al (2022); Yusuf et al (2021); Aboaba et al (2020) and Sedighe et al (2023), the following reasons can be mentioned as a factor. One of the reasons for this is, as the respondents of this study are rural households, having more family members present can also mean more hands available for farming activities regardless of their age because dependent age groups also engaged in the farming activity, which can contribute to higher yields and better food security overall. When there are more dependents, such as children and elderly

family members, in a household, it often motivates the working-age population to increase their efforts to provide for the family. This can lead to increased agricultural productivity as individuals work harder to ensure there is enough food to feed everyone in the household. Additionally, a high dependency ratio can foster collective efforts to improve food security through initiatives like community gardens or shared resources.

B. Institutional and infrastructural factors

PSNP Membership (PSNP_Memb)

According to the result, Public Work PSNP beneficiaries are less likely to be on poor food security level at 5% level of significance, whereas they are more likely to be on borderline and acceptable food security status with 5% and 10% level of significance, respectively. The result confirmed that, other things remain constant, Public work PSNP beneficiaries are 6.55% less likely to be on poor security level compared to Direct Support beneficiaries. On the other hand, they are 5.7% and 0.84% more likely to be on borderline and acceptable food security level, respectively, compared to Direct Support beneficiaries, respectively. Participation in public work projects can equip individuals with new skills, knowledge, and experience that can be applied to other areas. Additionally, since public work are of working age, they can engage in additional entrepreneurial activities to support their livelihoods. Engaging in public works not only enhances household income through cash or food transfers but also fosters community development, builds social capital, and equips participants with valuable skills that can improve their long-term food security resilience. This result is in line with the developed hypothesis.

Training Related to Farming Activity (Train_Farm)

According to the result, households those who took farming related trainings are less likely to be on poor food security level at 5% level of significance, whereas they are more likely to be on borderline and acceptable food security status with 5% and 10% level of significance, respectively. The result confirmed that, other things remain constant, households who took farming related training are 10.67% less likely to be on poor security level compared to who didn't take training. Conversely, they are 9.14% and 1.53% more likely to be on borderline and

acceptable food security level. By providing farmers with the necessary knowledge and skills to improve agricultural practices, such training programs can enhance crop yields, reduce post-harvest losses, and increase overall productivity. This leads to a more diverse and nutritious diet for the household members, as well as surplus produce that can be sold for additional income. Additionally, training in sustainable farming techniques can help farmers adapt to changing environmental conditions, mitigate risks associated with climate change, and ensure long-term food security for their families. The training not only improves the livelihoods of rural households but also contributes to the broader goal of achieving food security in rural communities. This finding confirmed the developed hypothesis a study done by Ketemaw et al (2022).

C. Economic factors

Credit Access (Credit_Acc)

The variable access to credit has positive effect on being on poor food security level at 1% level of significance, whereas, has negative effect on being on borderline and acceptable food security level with 1% level of significance. The regression result revealed that, other things remain constant, households with access to credit are 10.19% more likely to be on poor food security level. Besides, they are 8.91% and 1.28% less likely to be on borderline and acceptable food security level, respectively. While access to credit can be beneficial for investment in agricultural activities and improving livelihoods, it can also lead to increased debt burdens for rural households. In some cases, rural families may prioritize repaying loans over purchasing an adequate amount of food, leading to food insecurity. Additionally, high-interest rates on loans can further exacerbate the financial strain on these households, impacting their ability to afford nutritious food and maintain food security. This variable was expected to be either positive or negative as there are controversial existing evidence, for instance Teshager (2020); Amanuel et al (2023); Aboaba (2020) and Nadia et al (2018) found that credit access improves the rural household's food security, whereas Abafita et al (2014) and Yusuf et al (2021) revealed credit access worsen food security level. Therefore, the finding of this study is in conformity with studies that found negative relationship between food security and credit access.

Off-farm Activity (Offfarm_Act)

According to the result, off-farm activity engagement has positive effect on being on poor food security level at 10% level of significance, whereas it has negative effect on being on borderline food security level at 10% level of significance. The result implied that, other things remain constant, households engaged in off-farm activities are 8.22% more likely to be on poor food security level compared to those who didn't engage on off-farm activity. On the other hand, they are 7.78% less likely to be on borderline food security level compared to those who didn't engage on off-farm activity. This variable was also expected to be either positive or negative as there are contradicting literatures, for example, Nur-Marian et al (2019); Abafita et al (2014); Tobin (2009); Ingram et al (2008); Assefa et al (2022); Yusuf et al (2021); William et al (2019) and Hussein (2017) found positive relation whereas Binswanger-Mkhize et al (2018); Thorpe et al (2013), and Haddad et al (2016) found negative relationship between off-farm activity engagement and food security level. However, It can provide household with additional income, which can be used to purchase food, it can also worsen the rural household food security. Engaging in off-farm activities can divert labor and resources away from agriculture, leading to reduced farm productivity and lower agricultural output. This shift can result in rural households facing insufficient food supplies, being compelled to buy food from the market, increasing their food expenses, and compromising their overall food security. Additionally, off-farm income sources are often more unstable than agricultural income due to factors like seasonality, market variations, and technological advancements. Lastly, participating in off-farm activities involving non-food crops or livestock can cause dietary deficiencies if households prioritize cash crops over food production or sell their livestock for cash instead of consuming them. Therefore, regression result is consistent with studies that found negative relationship between food security and off-farm activity engagement.

D. Ownership Factors

Livestock Ownership (TLU)

The variable livestock ownership has negative effect on being on poor food security level at 1% level of significance, whereas, has positive effect on being on borderline and acceptable food security status with 1% level of significance. The finding revealed that, other things remain constant, an increase in livestock measured using TLU reduces the probability of being on poor security level by 1.64%. on the other hand, it increases the probability of being on borderline

and acceptable food security level by 1.43% and 0.21%, respectively. Livestock play a crucial role in providing food and income diversification for rural households. They offer essential protein sources such as meat, milk, and eggs, with small ruminants like goats and sheep being particularly important. Additionally, surplus livestock products can be sold or traded for economic stability. Livestock contribute to agricultural productivity by serving as draught animals for plowing fields and transporting produce, while their manure enhances soil fertility for organic farming systems. The result of this variable in relation with food security is in line with the developed hypothesis and previous studies such as Abafita et al (2014); Asmelash (2014) Yusuf et al (2021) and Sedighe et al (2023).

On the other side, sex of household head, education level of household head, assistance, saving and shock occurrence was found to be statistically insignificant for the estimated ordered logit model, however, previous studies found statistically significant relationship with food security. for instance, Aboaba et al; (2020); Jnvier et al (2023) and Sharaunga et al (2016) found that female headed households are more likely to be food secure than male headed households. Additionally, Abafita et al (2014); Yusuf et al (2021); Hailu et al (2022); Seble et al (2020); Sedighe et al (2023); William et al (2019); Antiwi et al 92021) and Ndakaza et al (2017) revealed educated household heads have better food security than uneducated household heads. Moreover, Hawi et al (2022); Ayele (2014) and Terrence et al (2021) states that saving have the ability to improve the rural household's food security. according to Smiriti et al (2016) and Sarah (2013) households who received assistance have improved food security than those who didn't receive any assistance. Lastly, Isaac et al (2020); Teshager (2020); FAO (2023); Nur-Marian et al (2019) and Hussein (2017) found that households who experienced shock tend to have poor food security that those who didn't experienced.

CHAPTER FIVE

5. SUMMARY, CONCLUSION AND RECOMMENDATION

The aim of the study was to identify determinants of food security on rural households nine woredas of East Hararghe zone of Oromia Regional state, Ethiopia. Based on the discussion in chapter four, the study drawn important conclusion and recommendation in the following two sections of this chapter.

5.1. Summary

Based on the findings of the research, the subsequent key summary points are extracted from the outcomes and discussions of the study.

- The majority of household heads surveyed (833) are in the working-age group, while the smallest number (44) are above 65 years old. Additionally, most of the households surveyed (620) are headed by males.
- In Highland, midland, and lowland agroecological zones, 18%, 34%, and 48% of respondents reside, respectively.
- The mean values for the age of the household head, household size, education level of the household head, dependency ratio, and tropical livestock unit are 43.228, 6.019, 0.83, 1.153, and 1.708, respectively.
- The food security level in the specified area is determined to be inadequate based on four food security indicators.
- From the total of 877 respondents surveyed, 674 (77%) were classified as having poor food security, 179 (20%) were on the borderline, and 24 (3%) were deemed to have an acceptable level of food security, based on FCS.
- Out of the total 877 respondents, 476 (54%) reported poor food security, 330 (38%) reported borderline food security, and 71 (8%) reported acceptable food security levels using HDDS.
- Among the 877 respondents, 245 (28%) were identified as insecure, while 608 (69%) were classified as moderately insecure, and 24 (3%) were considered food secure using rCSI.

- 613(70%), 203(23%), 60(7%) 0(0%), and 1(0.001%) of respondents are on food secure, stressed, insecure, crisis and catastrophe level of food security, respectively, using HHS.
- Age of household head, agroecological zone (living in Highland), dependency ratio, PSNP membership (being Public Work PSNP benificiary) and livestock ownership have positive and significant effect on food security.
- Credit access, off-farm activity engagement and household size have negative significant effect.
- Sex of household head, education level of household head, assistance, saving and shock occurrence was found to be statistically insignificant for the estimated ordered logit model.

5.2. Conclusion

Food security is a fundamental prerequisite for economic growth as it influences various aspects of a nation's development. Regrettably, the food security condition in the specified region is alarmingly insufficient due to different demographic, institutional and infrastructural, economic, ownership and other factors.

This research was conducted with the objective to find out determinants of food security on rural households of nine woredas of East Hararghe zone using four widely accepted food security indicators called Food Consumption Score (FCS), Household Dietary Diversity Score (HDDS), Reduced Coping Strategy Index (rCSI), and Household Hunger Scale (HHS). To meet this objective a cross-sectional secondary data was collected by Catholic Relief Service (CRS) Ethiopia was utilized from 877 rural households of nine woredas. Both descriptive and econometric methods were employed for the analysis of the data. Econometric software STATA/SE 18 was used to estimate the ordered logit model.

As stated above, food security of the study area was measured using four indicators. It is found that out of 877 participants, 77% were classified as having poor food security, 20% as borderline, and 3% as acceptable based on the Food Consumption Score (FCS). This suggests that households in the research area predominantly consume low-nutrient foods like injera, bread, porridge, and other staples while infrequently including high-nutrient options such as milk, meat, fish, etc.

Additionally, most of the respondent households, respondents were found to have varying levels of food security with 54% on a poor level, 38% on a borderline level, and 8% on an acceptable level using Household Dietary Diversity Score (HDDS). This data suggests that the majority of these households consume a limited number of food items daily.

Moreover, it was found that 28% were insecure, 69% were moderate/stressed, and 3% were food secure using Reduced Coping Strategy Index (rCSI). Consequently, the majority of respondents resort to harmful coping mechanisms like reducing meal frequency and restricting adult food intake when faced with food insecurity. According to the Household Hunger Scale (HHS), 70% of respondents are classified as food secure, 23% as stressed, 7% as insecure, with 0% at crisis level, and only 0.001% at catastrophe level of food security. This distribution reflects the severity of food insecurity experienced by households, where those classified as food insecure did not consume any food for a period of time within the context of the survey.

From the ordered logit repression included fourteen variables based on based on theoretical expectations and empirical studies conducted previously. From those, nine variables were found to be statistically significant. Age of household head, agroecological zone (living in Highland), dependency ratio, PSNP membership (being Public Work PSNP benificiary) and livestock ownership have positive and significant effect on food security. Conversely, credit access, off-farm activity engagement and household size have negative significant effect.

5.3. Recommendation

Based on the findings of the study, government is recommended to prioritize the below key initiatives in collaboration with humanitarian agencies, financial service providers and other stakeholders to improve the food insecurity of households for rural of the study area and beyond.

- **The overall food security status:** it was found that the overall food security status of the area is very poor. Therefore, to solve this problem government is recommended to initiate a comprehensive social behavior change education and awareness campaign. his effort should focus on promoting sustainable farming practices, nutrition education, and proper food handling techniques. By raising awareness and fostering behavioral change, communities can adopt practices that enhance food security and resilience.

- **Agroecology zone:** as per the finding households who are living low land areas have high probability of having poor security status. Therefore, it is imperative for the government to endorse and encourage Climate Smart Agriculture (CSA) in midland and lowland areas. By supporting CSA initiatives such as drought-resistant crops and efficient water management techniques, rural households can better withstand environmental challenges. This approach integrates climate adaptation strategies into agricultural practices, promoting resilience to climate variability and reducing vulnerability to food shortages.
- **Farm related trainings:** it was found that households who are provided with farm related trainings have better food security. Therefore, government would Equip farmers with technical skills and knowledge on modern agricultural practices, soil conservation, and pest management enhances productivity and food availability. Additionally, initiating a food education program will empower communities to make informed dietary choices, improving nutrition and overall health outcomes.
- **PSNP membership:** the study revealed that Direct Support PSNP beneficiaries are more vulnerable for food insecurity than Public Work PSNP beneficiaries. Therefore, it is recommended that government enhance the PSNP intervention in a way that it compensates for these vulnerable communities who are elderly and peoples with disability (PWD) and who are unable to engage in field work to generate other income. Strengthening mechanisms such as food assistance programs and social protection initiatives ensures that vulnerable households have access to essential food supplies during times of scarcity or economic hardship. In addition, as the PSNP and RFSA intervention contributes to HHS indicator result, additional effort should be made to make the intervention more impactful and to bring change in other food security indicators result also.
- **Household Size:** according to the result, having large family size exacerbates food insecurity. To reduce this impact government should strength family planning programs to empower individuals to make informed choices about family size, which could help alleviate the economic burden associated with larger household sizes.

- **Livestock ownership:** as per the result, livestock ownership has positive impact on food security. To support this government is recommended to initiate animal breed distribution to help households to own more livestock.
- **Credit access:** the study revealed that having access to credit will negatively affect households' food security if used inappropriately or if repayment takes priority over nutritious food consumption. To mitigate this, government should promote financial literacy, provide agricultural financing, monitor loan use, and collaborate with NGOs and financial service providers to reach more rural households effectively and provide them with comprehensive support beyond just financial services.

REFERENCES

Abafita, j., & Kim, K. R. (2014). *Determinants of household food security in rural Ethiopia: An empirica analysis.*

Abbasi, N., Ghoochani, O., Ghanian, M., & Kitterlin, M. (2016). *Assessment of households food insecurity through use of a USDA questionnaire.*

Abiodun , E. O. (2013). *Households food security status and it's determinants in the north central Nigeria.*

Amanuel, B., Alula, T., Abraham, B., John, W. R., & Philip, M. O. (2023). *Impact of credit on household food security: The case of Omo microfinance institution in Southern Ethiopia.*

Antwi , K. D., & Lyford, C. P. (2021). *Socioeconomic determinants of rural households' food security status in Northern Ghana.* Science and Technology Policy Research Institute.

Aschalew , A., Tewodros , T., & Muluken, G. (2013). *Determinants of food security status in selected drought prone areas of SNNPR, Ethiopia.*

Asmelsh , M. (2014). *Rural household food security status and Its determinants: The case of Laelaymychew Woreda, Central Zone of Tigray, Ethiopia.*

Assefa, T., & Abide, E. B. (2022). *Determinants of food insecurity in rural households: A case of Lemo district, Southern Ethiopia.* Wachemo University, College of Computational and Natural Sciences and College of Agricultural Sciences. Retrieved from https://doi.org/10.1016/j.heliyon.2022.e12764

Ayele , Z. A. (2014). *Impact of saving and credit cooperatives on food security in West Amhara region of Ethiopia.*

Ballard, T., Coates, J., Swindale, A., & Deitchler, M. (2011). Crop and Food Supply in The Emergency of Food Security Assessment. Rome. *Food and Agricultural Organization*.

Bekele , W. F., Jemal , H., & Alisher , M. (2023). *Determinants of food and nutrition security: Evidence from crop-livestock mixed farming households of central and eastern Ethiopia.*

Binswanger-Mkhize, C., Chimukangara, T., & Thirtle, D. (2018). Labour allocation between farming and non-farming: Evidence from Malawi. *Journal of Agriculture and Applied Economics, 51(3)*, 479–493.

Chernet , w. (2023). *Determinants of food security status of household in west gojjam zone, Ethiopia.*

City Population. (2022). *Population statistics, charts, map and location. Oromia.*

CRS Ethiopia. (2022). Overview of Ifaa. *Resilience food security activity (RFSA).*

CSS. (2022). *Ethiopian Statistical Service.* Retrieved from http://www.statsethiopia.gov.et/population-projection

CSS. (2022). *The socio-economic survey wave 5, 2021-2022.*

Edward, C. (2002). Concept and measurement. *Food security*.

FAO. (1983). Reappraisal of the concepts and approaches. *World food security*.

FAO. (2002). *The State of Food Insecurity in The World.* Rome: FAO.

FAO. (2006). *Food security.* Paris.

FAO. (2009). Crop and Food Security Assessment Mission in Ethiopia. *Integrating*.

FAO. (2023). Global information and early warning system on food and agriculture. *Food and Agriculture Organization of the United Nations* .

FAO GIEWS. (2017). Prolonged and Severe Drought Exacerbates Food Insecurity. *Special Alert*.

FEWS NET. (2023, August). Food Security Emergency Persists across Ethiopia Aftermath of Severe Shock . *Food Security Outlook Update*.

FEWS NET. (2023, May 30). The emergency in Ethiopia is far from over, as food aid remains vital to saving lives, 2023. *Ethioipia Food Security Alert*.

Food Security Cluster. (2020). *Food security indicators handbook.*

Gentilini, U., & Webb, P. (2008). How are We Doing on Poverty and Hunger Reduction? *Food Policy, 33:*, 521-532.

Global Hunger Index. (2018, October). A Closer Look at Hunger and Undernutrition. *Ethiopia*.

Global Hunger Index. (2023). GLOBAL HUNGER INDEX 2023. *Ethiopia*.

Global Hunger Index. (2023). *Methodology.*

Habtamu, T. W., Temesgen, Z., Aweke, A. M., & Zelalem, G. D. (2023). *Household food insecurity levels in Ethiopia: quantile regression approach.*

Haddad, L., Hoddinott, J., & Kassie, B. (2016). Food security implications of agricultural commercialization: Evidence from Ethiopia. *Journal of Development Economics, 127(C)*, 58–74.

Hailu, A., & Belay, M. (2022). *Determinants of rural household food security status in North Shewa Zone, Amhara Region, Ethiopia.*

Harvard University. (2022). Global health education and learning incubator. *Global food security index*.

Hawi , G., Adugna , E., & Akalu , D. (2022). *Impact of cash saving on the food security status of smallholder coffee farmers, evidence from Southwest Ethiopia.*

Hussein, A. (2017). *Determinants of Food Security: Evidence from Ethiopian Rural Household Survey (ERHS) Using Pooled Cross-Sectional Study.*

Ibrahim, H. Y., Adeola, S. S., & I, I. H. (2016). *Determinants of food insecurity among farming households in Katsina state, Northwestern Nigeria.*

IMPEL. (2022). *Baseline Study of the Ifaa Resilience Food Security Activity in Ethiopia (Vol 1).* Washington, DC.

Ingram , J. S., Gregory, P. J., & Izac, A. M. (2008). *The role of agronomic research in climate change and food security policy.*

International Dietary Expansion Project (INDDEX). (2022). *Food Consumption Score.*

Isaac, G. K., Cornelis, G., & Richo, I. (2020). *Shock interactions, coping strategy choices and household food security.*

Janvier, E., Sissou , Z., Latifou , I., Nehemle , K. I., Mohammed , N. B., & Marie-Paule , K. (2023). *Eliciting the gender income influences on households food security in west Africa.*

Jiaqi , H., Fengying, N., & Jieying , B. (2015). *Comparison of Food Consumption Score (FCS) and Calorie Intake Indicators to Measure Food Security.* Chinese Academy of Agricultural Sciece, Agricultural Information Institute, Beijin, China.

Ketemaw, M. W., Abraham, S. T., & Samson, E. L. (2022). *Training at farmers training centers and its impact on crop productivity and households' income in Ethiopia.*

Lintelo, D. J. (2012). *Measuring Political Commitment to Reducing Hunger and Under-nutrition: can it be done and will it help?*

Maddala. (1992). *Introduction to Econometrics, 2nd edition.* University of Florida and OHIO State University.

Madhav, R., & Krishna, P. P. (2016). Impact of Remittance on Food Security in Bangladesh. *Food Security in a Food Abundant World*.

MARD. (2009). *Tigray region livelihood profile. Livelihood integration unit. Tigray, Ethiopia.*

Marxwell, D. (2008). *The coping strategy index.*

Marxwell, D., Coates, J., & Vaitla, B. (2013). *How do different indicators of household food security compare? Empirical evidence from Tigray. Tufts University.*

Mekbib, G. H., & Muhammed, A. U. (2021). *Market access, household dietary diversity and food security: Evidence from Eastern Africa.*

MIRA. (2022). *MIRA Scope of Work.*

Mohamed , K. M. (2019). *Demographic And Socio-Economic determinants of household food security In Tanzania.*

Muhammed, A. U., & Daniel, C. (2022). *Does market access improve dietary diversity and food security? Evidence from Southwestern Ethiopian smallholder coffee producers.*

Nadia , A., & Aneel , S. (2018). *Impact of agriculture credit on food production and food security in Pakistan.*

NDAKAZA, J. N., & Joseph , K. M. (2017). *Modeling key determinants of the household food security in Rwanda: .*

Nur-Maria, A. M., & Normaz, W. I. (2019). *Food Security and Economic Growth.*

Nurudeen , A. M., & Shaufique , F. B. (2019). *Determinants of Food Security Among Households in Nigeria.* Universiti Putra Malaysia, Institute of Agriculture and Food Policy, Seri Kembangan, Malaysia.

Pipi , D., Teruaki , N., & Yosuke , C. (2023). *Impacts of dietary diversity on perceived food security in Indonesia.*

Relief Web. (2023). Ethiopia food security outlook June 2022 to January 2023. *Ethiopia*.

Robert, K. (2022). A desk review of development interventions, youth aspirations, and opportunities in the context of agropastoral areas of East Hararghe (Chinaksen and Midega tola woredas), Oromia regional state, Ethiopia. *LASER PRULSE*.

Ryan , M., Patrick , N., John , R. P., & Marty , K. L. (2015). *Determinants of food security in Tanzania: gendered dimensions of household headship and control of resources.*

Sabates-Wheeler, R., Tefera, M., & Bekele, G. (2012). *Assessing enablers and constrainers of graduation: Evidence from the food security programme, Ethiopia.*

Samia, S. O., Mohamed, N., & Eltayeb, M. A. (2021). *Determinants of food security in Sudan case of Kassala State.*

Schmidhuber, J., & Tubiello, F. N. (2007). *Global food security under climate change.*

Sedighe , Y., & Fatemah , F. (2023). *Food Security Determinants of Qashqai Nomadic Households in Fars Province.* Shiraz University, College of Agriculture, Shiraz, Iran.

Sharaunga , S., Mudhara , M., & Bogale, A. (2015). *Effects of women empowerment' on household food security in rural Kwaulu-Natal province.*

Sintayehu, W. M., & Abere, W. K. (2022). *Household Level determinants of food insecurity in rural Ethiopia.*

Smriti , T., Silviano , D., Maria , A., Elvin , P., Sudhanshu , H., Benjamin , D., . . . David, S. (2016). *Impact of cash transfer program on food security and nutrition in Sub-Saharan Africa.*

SPRING. (2008). Field methods manual (2nd Edition). Feinstein international center, Tufts University & TANGO. *The Coping Strategies Index: .*

Storck , H., Emana , B., Adnew, B., Borowiccki , A., & Woldehawariat , S. (n.d.). *Farming systems and resource economics in the tropics: farming system and farm management practices of smallholders in the Hararghe Highland.*

Swindale, A., & Bilinsky, P. (2006). *Household Dietary Diversity Score (HDDS) for measurement of household food access. Washington DC.*

Temesgen, M. T., Kassahun, T. A., Rahel, A. A., Bahiru, M. K., & Mintesinot, M. G. (2023). *Household food insecurity and associated factors in South Ari district, Southern Ethiopia: A community-based cross-sectional study.*

Terrence , K., George, K., Vengesal , M., & Asankha , P. (n.d.). *Gender attributes of the impact of internal savings and loans associations on food security in rural Zimbabwe.*

Teshager, A. S. (2020). *Household level food insecurity assessment: Evidence from panel data, Ethiopia.*

Thorpe, A., Sperling, G., & Wiegersdeeusen, R. (2013). *Non-Farm Income Diversification: A Review of Concepts and Empirical Evidence from Developing Countries.*

Tigistu, S., & Hagena, B. (2022). *Determinants of food insecurity in food aid receiving communities in Ethiopia.* Wolkite University, Department of Agribusiness and Value Chain Management and College of Agriculture and Natural Resource, Wolkite, Ethiopia.

UNDP. (1994). *Human Development Report.* Oxford and New York.

United Nations. (1975). *Report of the World Food Conference.* Rome.

William , N., Miroslava , A., & Jan, b. (2019). *Factors associated with household food security in Zambia.* Czech University of Life Sciences Prague, Faculty of Tropical AgriSciences, Czech Republic.

Williams, R. (2021). Ordered Logit Models – Basic & Intermediate Topics.

World Bank. (1986). Issues and options for food security in developing countries. *Poverty and Hunger*.

World Bank. (2023). *What is food security?*

Yusuf, A., Ndemo, E., & Seyoum, C. (2021). *The determinants of rural households food security and coping strategies: The case of Meta district, East Hararghe Zone of Oromia National Regional State of Ethiopia.*

Zeleke, T., Beyene, F., Deressa, T., Yousuf, J., & Kebede, T. (2021). *Vulnerability of smallholder farmers to climate change-induced shocks in East Hararghe Zone, Ethiopia.*

APPENDIXES

Appendix 1: FCS Calculation

It is a sum of eight categories of foods, weighted for quality and frequency (seven-day recall)

Food Groups	Weight
Staples (e.g. Injera, bread)	2
Pulses (e.g. Lentils, peas)	3
Vegetables (e.g. Cabbage, carrot)	1
Fruits (e.g. Mangoes, tomatoes)	1
Meat and fish (e.g. Goat, kok)	4
Milk (e.g. Cheese, milk)	4
Sugar and Honey (e.g. soft drinks, sugar cane)	0.5
Oils and fats (e.g. Butter, cooking oil)	0.5

FCS = (FCS1_days * 2) + (FCS2_days * 3) + (FCS3_days) + (FCS4_days) + (FCS5_days * 4) + (FCS6_days * 4) + (FCS7_days * 0.5) + (FCS8_days * 0.5)

FCS	Threshold
Poor	FCS ≤ 21
Borderline	FCS 21 - 35
Acceptable	FCS >35

Appendix 2: HDDS Calculation

HDDS is the unweighted sum of the eleven food groups

Food Groups
1. Cereals (e.g. Injera, bread, porridge)
2. Roots and tubers (e.g. Soursop Potato, Bula)
3. Vegetables (e.g. Cabbage, carrot, cucumber)
4. Fruits (e.g. Mangoes, tomatoes, sugar apple)
5. Meat and poultry (e.g. Jigra, Guinea fowl, Kok)
6. Eggs (e.g. Boiled eggs)
7. Fish and sea food (e.g. Fish)
8. Legumes and nuts (e.g. Peas, cowpeas, ghee chips)
9. Dairy (e.g. Cheese, milk)
10. Oils and fats (e.g. butter, cooking oil)
11. Sugar and honey (e.g. Areki, sugar cane, soft drinks)
12. Other/Miscellaneous

HDDS= Sum (A+B+C+D+E+F+G+H+I+J+K+L)

HDDS Label	Threshold
Poor	HDDS ≤ 2
Borderline	HDDS 3-4
Acceptable	HDDS ≥5

Appendix 3: rCSI Calculation

It is a weighted sum of deployed coping strategies (rCSI a, rCSI b, rCSI c, rCSI d, and rCSI e)

	In the past 7 days, if there have been times when you did not have enough food or money to buy food, how many days has your household had to:	**Weight**
rCSI Ia	Rely on less preferred and less expensive foods?	1
rCSI b	Reduce size of meals eaten in a day?	1
rCSI c	Reduce number of meals eaten in a day?	2
rCSI d	Restrict consumption of adults for children to eat?	3
rCSI e	Borrow food, or rely on help from a friend or relative?	2

(RCSIa*1)+(RCSIb*1)+(RCSIc*1)+(RCSId*3)+(RCSIe*2)

Label	**Treshold**
Food Secure	rCSI <4
Moderate/Stressed	rCSI >=4, rCSI <=21
Insecure	rCSI >21

Appendix 4: HHS Calculation

Shows the food quantity dimension of food access and only the frequency is weighted.

Label	**Question**	**Frequency Score** (FS)
HHS1a	In the past 4 weeks / 30 days, was there ever no food of any kind in your house because of a lack of resources to get food?	1= Rarely (1 or 2 times) 1= Sometimes (3 to 10 times) 2= Often (more than 10 times)
HHS2a	In the past 4 weeks / 30 days, did you or any household member go to sleep at night hungry because there was not enough food?	1= Rarely (1 or 2 times) 1= Sometimes (3 to 10 times) 2= Often (more than 10 times)
HHS3a	In the past 4 weeks / 30 days did you or any household member go a whole day and night without eating anything because there was not enough food?	1= Rarely (1 or 2 times) 1= Sometimes (3 to 10 times) 2= Often (more than 10 times)

(HHS1a*FS)+(HHS2a*FS)+(HHS3a*FS)

Label	**HHS Score**
Food Secure	0
Stressed	1, 2
Insecure	3, 4
Crisis level	5
Catastrophe level	6

Appendix 5: Conversion Factors for TLU

Animal category	**Tropical Livestock Unit (TLU)**
Calf	0.25
Weaned calf	0.34
Heifer	0.75
Cow and ox	1.00
Horse	1.10
Donkey (adult)	0.70
Donkey (young)	0.35

Sheep and goat (adult)	0.13
Sheep and goat (young)	0.06
Chicken	0.013

Source: Storck et al (1991)

Appendix 6: Diagnostic Test Results

Proportional odds assumption test result

```
. oparallel

Tests of the parallel regression assumption

                     |      Chi2      df   P>Chi2
---------------------+------------------------------
      Wolfe Gould    |     19.93      14    0.132
             Brant   |     19.43      14    0.149
             score   |     20.46      14    0.116
likelihood ratio     |     21.59      14    0.087
              Wald   |     19.36      14    0.151
```

Multicollinearity test result

```
. vif

    Variable |       VIF       1/VIF
-------------+----------------------
    psnp_memb |      1.31    0.765252
      agro_ez |      1.26    0.794069
      hh_size |      1.23    0.812350
        assis |      1.20    0.834302
       age_hh |      1.20    0.835140
       saving |      1.19    0.842397
     educ_lev |      1.18    0.847149
  offfarm_act |      1.15    0.869098
      dep_rat |      1.14    0.876868
   train_farm |      1.12    0.891276
       sex_hh |      1.11    0.901826
          tlu |      1.11    0.902486
     cred_acc |      1.10    0.908432
        shock |      1.07    0.935349
-------------+----------------------
     Mean VIF |      1.17
```

Model specification test result

```
. linktest

Iteration 0:   Log likelihood = -548.26419
Iteration 1:   Log likelihood = -517.01074
Iteration 2:   Log likelihood = -514.15288
Iteration 3:   Log likelihood = -514.13072
Iteration 4:   Log likelihood = -514.13072

Ordered logistic regression                     Number of obs =    877
                                                LR chi2(2)    =  68.27
                                                Prob > chi2   = 0.0000
Log likelihood = -514.13072                     Pseudo R2     = 0.0623
```

fcs	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
_hat	1.501812	.3127767	4.80	0.000	.8887807	2.114843
_hatsq	-.2457837	.1359966	-1.81	0.071	-.512332	.0207647
/cut1	2.063557	.1641732			1.741783	2.385331
/cut2	4.530791	.2584243			4.024289	5.037294

Appendix 7: Regression Results

Ordered logit regression result

```
. ologit fcs sex_hh age_hh hh_size educ_lev agro_ez dep_rat psnp_memb assis cred_acc saving tlu offfarm_act shock tr
> ain_farm

Iteration 0:  Log likelihood = -548.26419
Iteration 1:  Log likelihood = -516.95234
Iteration 2:  Log likelihood = -515.84291
Iteration 3:  Log likelihood = -515.84156
Iteration 4:  Log likelihood = -515.84156

Ordered logistic regression                     Number of obs =    877
                                                LR chi2(14)   =  64.85
                                                Prob > chi2   = 0.0000
Log likelihood = -515.84156                     Pseudo R2     = 0.0591
```

fcs	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
sex_hh	.1206072	.1915009	0.63	0.529	-.2547277	.4959421
age_hh	.0127685	.0073265	1.74	0.081	-.0015912	.0271283
hh_size	-.0891695	.0434028	-2.05	0.040	-.1742373	-.0041017
educ_lev	.0418315	.0381363	1.10	0.273	-.0329143	.1165773
agro_ez	1.090073	.2239122	4.87	0.000	.6512131	1.528933
dep_rat	.1557639	.0907416	1.72	0.086	-.0220863	.3336141
psnp_memb	.3972194	.199065	2.00	0.046	.0070592	.7873797
assis	-.1970609	.1991281	-0.99	0.322	-.5873449	.193223
cred_acc	-.6508372	.2002051	-3.25	0.001	-1.043232	-.2584424
saving	-.0244865	.2697972	-0.09	0.928	-.5532794	.5043064
tlu	.097282	.0314012	3.10	0.002	.0357369	.1588272
offfarm_act	-.4485686	.2366806	-1.90	0.058	-.912454	.0153169
shock	.3706138	.2851955	1.30	0.194	-.1883591	.9295866
train_farm	.5661609	.2550612	2.22	0.026	.0662502	1.066072
/cut1	1.915803	.5747075			.7893967	3.042209
/cut2	4.39556	.6103559			3.199284	5.591835

Marginal effect result

```
. mfx, predict(p outcome(0))

Marginal effects after ologit
      y  = Pr(fcs==0) (predict, p outcome(0))
         =  .78550144
```

variable	dy/dx	Std. err.	z	P>|z|	[95% C.I.]		X
sex_hh*	-.0206102	.03316	-0.62	0.534	-.085604	.044384	.293044
age_hh	-.0021514	.00123	-1.74	0.081	-.004571	.000268	43.2281
hh_size	.0150241	.00729	2.06	0.039	.000734	.029314	6.01938
educ_lev	-.0070481	.00642	-1.10	0.273	-.01964	.005543	.830103
agro_ez*	-.2167855	.04928	-4.40	0.000	-.313382	-.120189	.18244
dep_rat	-.0262445	.01526	-1.72	0.085	-.056151	.003662	1.15283
psnp_m~b*	-.0654513	.03196	-2.05	0.041	-.12809	-.002813	.597491
assis*	.0325576	.03222	1.01	0.312	-.030594	.095709	.327252
cred_acc*	.1019425	.02878	3.54	0.000	.045529	.158356	.307868
saving*	.0041032	.04496	0.09	0.927	-.084016	.092223	.109464
tlu	-.0163909	.00528	-3.11	0.002	-.02673	-.006052	1.70751
offfar~t*	.0822127	.04662	1.76	0.078	-.009164	.173589	.848347
shock*	-.0573323	.04018	-1.43	0.154	-.136082	.021417	.889396
train_~m*	-.1067362	.05287	-2.02	0.044	-.21036	-.003112	.122007

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx, predict(p outcome(1))

Marginal effects after ologit
      y  = Pr(fcs==1) (predict, p outcome(1))
         =  .19213655
```

variable	dy/dx	Std. err.	z	P>|z|	[95% C.I.]		X
sex_hh*	.0179085	.02878	0.62	0.534	-.038491	.074308	.293044
age_hh	.0018722	.00108	1.74	0.082	-.000238	.003983	43.2281
hh_size	-.0130747	.00637	-2.05	0.040	-.02556	-.000589	6.01938
educ_lev	.0061336	.0056	1.10	0.273	-.004833	.017101	.830103
agro_ez*	.1823677	.04058	4.49	0.000	.102827	.261909	.18244
dep_rat	.0228392	.01331	1.72	0.086	-.003247	.048925	1.15283
psnp_m~b*	.0570349	.02797	2.04	0.041	.00222	.11185	.597491
assis*	-.0283815	.02814	-1.01	0.313	-.083541	.026778	.327252
cred_acc*	-.0891228	.02549	-3.50	0.000	-.139088	-.039157	.307868
saving*	-.0035727	.03917	-0.09	0.927	-.080342	.073196	.109464
tlu	.0142642	.00462	3.09	0.002	.005204	.023324	1.70751
offfar~t*	-.0707529	.03974	-1.78	0.075	-.148638	.007132	.848347
shock*	.0502406	.03548	1.42	0.157	-.019297	.119778	.889396
train_~m*	.0913972	.04466	2.05	0.041	.00386	.178935	.122007

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx, predict(p outcome(2))

Marginal effects after ologit
      y  = Pr(fcs==2) (predict, p outcome(2))
         =    .022362
```

variable	dy/dx	Std. err.	z	P>|z|	[95% C.I.]		X
sex_hh*	.0027017	.00442	0.61	0.541	-.005962	.011366	.293044
age_hh	.0002791	.00017	1.67	0.096	-.000049	.000608	43.2281
hh_size	-.0019494	.00101	-1.94	0.053	-.003921	.000023	6.01938
educ_lev	.0009145	.00085	1.08	0.282	-.000752	.002581	.830103
agro_ez*	.0344178	.01126	3.06	0.002	.012346	.05649	.18244
dep_rat	.0034053	.00207	1.64	0.100	-.000657	.007468	1.15283
psnp_m~b*	.0084164	.00436	1.93	0.053	-.00012	.016953	.597491
assis*	-.0041761	.00417	-1.00	0.316	-.012347	.003994	.327252
cred_acc*	-.0128197	.00422	-3.04	0.002	-.02109	-.004549	.307868
saving*	-.0005305	.00579	-0.09	0.927	-.011883	.010822	.109464
tlu	.0021268	.00079	2.70	0.007	.000584	.003669	1.70751
offfar~t*	-.0114599	.00728	-1.57	0.116	-.025737	.002817	.848347
shock*	.0070916	.00492	1.44	0.150	-.002559	.016742	.889396
train_~m*	.0153389	.00881	1.74	0.082	-.00192	.032598	.122007

(*) dy/dx is for discrete change of dummy variable from 0 to 1