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Food Security, Determinants and Coping Strategies: The Case of Meket Woreda, Amhara Regional State, Ethiopia

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MSc Thesis

By

Mussie Birhanie Menkir

A Thesis submitted to the Department of Disaster Risk Management and Sustainable Development in Partial fulfillment of the Requirements for the degree of Master of Science in Disaster Risk Management and Food Systems Resilience

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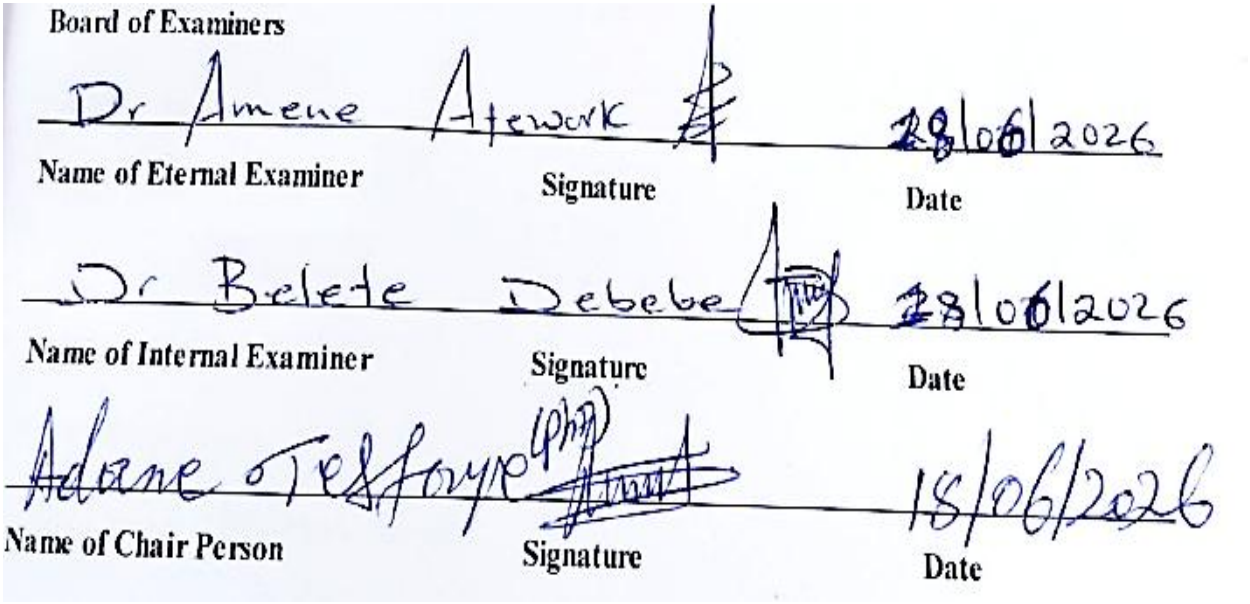
THESIS APPROVAL SHEET

As members of the board of examiners of the Masters of Sciences (MSc) open defense examination, we have read and evaluated this thesis prepared by **Mr. Mussie Birhanie** Entitled "FOOD SECURITY, DETERMINANTS AND COPING STRATEGIES: THE CASE OF MEKET WOREDA, AMHARA REGIONAL STATE, ETHIOPIA". We hereby certify that the thesis is accepted for fulfilling the requirements for the awards of the degree of Masters of Science (MSc) in **Disaster Risk Management and Food Systems Resilience.**



DECLARATION

This is to certify that this thesis entitled "FOOD SECURITY, DETERMINANTS AND COPING STRATEGIES: THE CASE OF MEKET WOREDA, AMHARA REGIONAL STATE, ETHIOPIA**"** submitted in partial fulfillment of the requirements for the award of the degree of master of science in **"Disaster Risk Management and Food Systems Resilience"** to the graduate program of Institute of Disaster Risk Management and Food Security Studies, Bahir Dar University by **Mussie Birhanie** is an authentic work carried out by him under our guidance. The matter embodied in this project work has not been submitted earlier for an award of any degree or diploma to the best of our knowledge and belief.

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ABSTRACT

Food insecurity remains a persistent developmental challenge across rural communities in Ethiopia, with the Amhara Region continuously ranking as one of the country's most vulnerable areas. The objective of this study was to analyze the food security status, determinants and coping strategies in the context of Meket Woreda, Amhara Regional State, Ethiopia. The study employed an explanatory sequential mixed research design, pairing quantitative household surveys with qualitative focus group discussions (FGDs) and key informant interviews (KIIs). Primary data were gathered from a randomly sampled cross-section of 286 rural household heads distributed across three distinct agro-ecological zones: Dega (highland), Woigna dega (midland) and Kolla (lowland). Household food security status was computed quantitatively via the World Food Programme's (WFP) standardized Food Consumption Score (FCS). Determinants of household food security were modeled using an multiple linear regression analysis, while the coping strategies were analyzed using the reduced Coping Strategies Index (rCSI). The results revealed a high food insecurity with a striking 87% of surveyed households falling into either the "poor" or "borderline" food consumption categories. The overall sample mean FCS was 24.2, denoting widespread insecure dietary access. Notably, both a one-way ANOVA ($F = 1.8518$, $p = 0.1588$) and the final multiple linear regression model proved that agro-ecological placement was statistically non-significant, reflecting a "homogenization of vulnerability" where erratic macro-shocks overwhelm traditional elevation-based privileges. Econometric model results demonstrated that household size ($\beta = 1.2469$, $p = 0.005$) and distance to market centers ($\beta = 0.0804$, $p = 0.023$) exerted a highly significant positive relationship on household food consumption scores, validating the labor endowment hypothesis and localized market dependency dynamics. Conversely, being married ($\beta = -4.5471$, $p = 0.042$) negative impacted food security, highlighting vulnerabilities tied to high child-dependency burdens. To manage these problems, local smallholders deployed severe quantitative rationing mechanisms, with 52.4% forced into maternal/adult fasting and 50.3% utilizing portion restrictions to shield younger children. Furthermore, 39.5% of respondents identified plant pests and animal diseases as their most critical information deficit within local early warning systems. The study concludes that rural household food insecurity in Meket Woreda is structurally high across all ecological zones. Interventions must heavily on building institutional support. It is recommended that local government and development practitioners design tailored, shock-responsive social safety nets, expand off-farm livelihood diversification options to relieve nuclear household burdens, and strengthen early warning communication channels specifically covering transboundary crop pests and climate-driven livestock diseases.

Keywords: *Food Security, Food Consumption Score, Multiple Linear Regression, Coping Strategies, Meket Woreda.*

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ACRONYMS AND ABBREVIATIONS

ACF	Action Contre la Faim
ACSI	Amhara Credit and Saving Institution
AEZ	Agro-Ecological Zone
ANOVA	One-Way Analysis of Variance
CARE	Cooperative for Assistance and Relief Everywhere
CSA	Central Statistical Agency
CSI	Coping Strategies Index
DPPC	Disaster Prevention and Preparedness Commission
DRM	Disaster Risk Management
DRMC	Disaster Risk Management Commission
ETB	Ethiopian Birr
EWS	Early Warning System
FAO	Food and Agriculture Organization of the United Nations
FCS	Food Consumption Score
FDRE	Federal Democratic Republic of Ethiopia
FEDO	Finance and Economic Development Office
FGD	Focus Group Discussion
GIS	Geographic Information System
HDDS	Household Dietary Diversity Score
HH	Household / Household Head
IFPRI	International Food Policy Research Institute
IIED	International Institute for Environment and Development
KII	Key Informant Interview
KOBO	KoboToolbox
M	Mean
MFS	Multi-hazard and Food Systems Resilience
NDRRMC	National Disaster Risk Reduction and Management Commission
NGO	Non-Governmental Organization
OLS	Ordinary Least Squares
PSNP	Productive Safety Net Programme
rCSI	Reduced Coping Strategies Index
RUSACCO	Rural Saving and Credit Cooperative
SCRP	Soil Conservation Research Programme

SD	Standard Deviation
SDG	Sustainable Development Goal
SSA	Sub-Saharan Africa
TLU	Tropical Livestock Unit
USAID	United States Agency for International Development
WFP	World Food Programme

CHAPTER 1: INTRODUCTION

1.1. Background and Justification of the Study

According to FAO (2021), the issues of food insecurity and hunger are a problem for the world. Under the shadow of the COVID-19 pandemic, global hunger raised in 2020 (FAO, 2021b). After being almost stable for the previous five years, the prevalence of undernourishment (PoU) increased from 8.4 percent to approximately 9.9 percent in only one year, exacerbating the difficulty of reaching the Zero Hunger goal by 2030. It is estimated that between 720 and 811 million people would go hungry in the world by 2030. Using the midpoint of the expected range (768 million), around 118 million more people were suffering from hunger in 2020 than in 2019, or up to 161 million more if the upper end of the projected range was used (FAO, 2021).

At the continental level, food insecurity remains a major impediment to human development and economic growth across Africa, severely challenging the realization of the United Nations Sustainable Development Goal 2 (Zero Hunger) and the African Union's Agenda 2063. According to recent data from the Food and Agriculture Organization and the United Nations Economic Commission for Africa, more than 300 million Africans suffer from chronic undernourishment; meaning over 20% of the continent's population faces a severe food deficit (FAO et al., 2025; UNECA, 2026). This widespread vulnerability is deeply rooted in structural systemic challenges, such as inadequate agricultural financing, low technological adoption in farming, rapid urbanization, and macro-economic shocks like currency devaluations and high global food prices. These factors collectively weaken continental food systems and reduce the capacity of both urban and rural households to absorb economic shocks.

When narrowing the scope to the sub-regional level, East Africa and the Horn of Africa stand out as areas experiencing some of the most severe and complex food crises globally. As documented in the joint FAO–WFP Hunger Hotspots report and the Global Report on Food Crises, acute food insecurity in East Africa has escalated rapidly due to a devastating combination of climate shocks and localized conflicts (FAO & WFP, 2025; WFP, 2026). The region is highly vulnerable to extreme weather patterns, where prolonged, historic droughts are frequently followed by erratic, destructive flooding that decimates crops and livestock. When these environmental shocks merge with hyperinflation, market disruptions, and regional instability, millions of households are pushed

into emergency levels of food insecurity highlighting an urgent need for targeted research into sustainable safety net interventions and community resilience strategies (WFP, 2026).

Ethiopia remains one of the most populous countries in Africa, with an estimated population exceeding 138.9 million in recent years (United Nations UN, 2026, World populaton review 2026). Ethiopia is the tenth largest and the second most populous country in Africa (Samuel, 2006). The country is endowed with diverse agro-ecological zones and climatic conditions that are suitable for the production of a wide range of crops and livestock. Nevertheless, agricultural production has remained insufficient to meet the food requirements of the rapidly growing population due to the combined effects of climate variability, land degradation, population pressure, low adoption of improved technologies, and institutional inefficiencies. Consequently, food insecurity persists as a widespread challenge affecting both rural and urban households (Gebrehiwot and van der Veen, 2014; Bekele et al., 2020; Alemayehu and Bewket, 2022). Ethiopia is an agrarian country (>78% engaged in smallholder agriculture) with a moderately small urban population (19.7% of the total) (United Nations, 2018). Despite this context, its annual produce from smallholder farmers fails to satisfy the food requirement of the rural and the urban people. Scholars indicate that higher prices of food crops are more likely striking the urban poor who are net buyers of the food crops(Kinabo et al., 2017). Hence, rising food prices associated with deteriorating food availability and accessibility are indicators of chronic urban food insecurity (Tsegaye and Hoddinott, 2022).

The food insecurity problems of Ethiopia are well documented in the literature. The country has experienced recurrent famines throughout its history, and despite economic and policy reforms, severe food crises have continued to occur over the past two decades, driven by climate shocks, conflict, and structural vulnerabilities in the food system (Devereux et al., 2020; Bachewe et al., 2023). More recently, DPPC-led multi-agency pre harvest assessment teams concluded that a total of 14.5 million people (about 21% of the total population) are estimated to be in need of emergency food aid. Presently, relief requirements are estimated at 1,461,679 MT (NDRRMC, 2023).

At the sub-national level, the Amhara Region of Ethiopia experiences widespread and acute food insecurity, driven by a volatile mix of localized instability, climate-induced production shocks, and severe macroeconomic pressures. Recent empirical evidence from Google Scholar indices and global tracking platforms highlights that the region faces substantial food consumption gaps and escalating multidimensional hunger (Abebe, 2024; Global Hunger Index [GHI], 2025). According

to the World Food Programme (WFP), over 2.3 million people in the Amhara region require immediate emergency food assistance, which constitutes more than 30% of the entire country's acute food aid needs (FEWS NET, 2026; Research Gate, 2024). This vulnerability is structurally exacerbated by persistent land degradation, soil erosion, and severe rainfall variability that compromise rain-fed agrifood systems, alongside hyperinflation and steep rises in agricultural input prices driven by national currency depreciation (Frontiers in Sustainable Food Systems, 2025; Welthungerhilfe et al., 2025). Consequently, a massive proportion of both rural and urban households across the region remain highly dependent on external humanitarian assistance and structured social safety net interventions to mitigate systemic caloric deficits. When narrowing the geographical focus to the North Wollo Zone of the Amhara Region, the localized food security situation is heavily constrained by historically entrenched structural vulnerabilities and persistent agricultural shocks.

Academic studies focusing on the northeastern Amhara ridge confirm that all districts within the North Wollo Zone suffer from recurrent agricultural droughts and severe agro ecological degradation, leaving resource-poor smallholders unable to produce sufficient food to meet their household requirements for more than six months of the year (Science & Education Publishing, 2024; Taylor & Francis, 2024). Econometric analyses of the zone reveal that approximately 42% to 54% of rural households are chronically food insecure, with the incidence and severity being exceptionally high in the rugged lowland (Kolla) agro ecological zones (Research Gate, 2024). Key household-level determinants driving this crisis include high dependency ratios, limited access to non-farm income, small farmland sizes, and an early exhaustion of Meher harvest stocks, which forces households into market dependence much earlier in the lean season amid skyrocketing staple food prices (FEWS NET, 2026; Frontiers, 2025). These compounding factors place an extraordinary strain on local coping mechanisms, underscores the fragility of household resilience, and necessitates rigorous academic evaluation of targeting efficiency.

Adverse changes in climate, combined with long term factors (technology, environmental, institutional) led to a decline of land holding, soil degradation and a decline in yield per hectare. Moreover, policy induced stagnation of agriculture and internal conflict during the 1970s and the 1980s, resulted in continuous food gap for two decades or so that has to be covered with food aid. Having peaked at about 26.2 % in 1984/85, food aid imports amounted to a significant proportion of domestic production of food crops, often, about 10% or more (NDRRMC, 2023). Moreover, the

same source further explained that harvest failure often leads to losses of assets and a fall into poverty. When weather conditions affect food production, the country's food situation deteriorates quite rapidly entailing emergency external food aid imports. In the last two decades, this has happened several times.

Over the past two decades, Ethiopia has continued to rely heavily on large-scale food assistance to address persistent food insecurity in vulnerable regions of the country. Recent studies indicate that annual food aid imports have remained substantial, reflecting increasing exposure to climate shocks, conflict, and structural weaknesses in domestic food production systems. This sustained dependence on food aid signals a growing level of vulnerability and food insecurity, as well as an expanding number of people unable to meet their food needs from domestic sources alone (Devereux et al., 2020; Bachewe et al., 2023). Related to problems of food insecurity is the level of nutritional deprivation, stunting and wasting of children less than 5 years of age, which is quite widespread in Ethiopia. According to the 2000 Demographic and Health Survey, 52% of children under age 5 are underweight (FDRE, 2001).

Although food self-sufficiency has long remained a stated policy objective of the Government of Ethiopia, food insecurity continues to persist across the country. A substantial proportion of rural households have experienced progressive food insecurity as a result of recurrent droughts, climate variability, and repeated crop failures. These challenges have been further compounded by population pressure and limited adaptive capacity, leaving many households increasingly vulnerable to chronic food insecurity (Devereux et al., 2020; Alemayehu and Bewket, 2022). Hence, a study of this sort in addressing the problem has an important role at least in clearly identifying specific factors and the severity of the problem that pertain to the study area.

1.2. Statement of the Problem

Both transitory and chronic food insecurity are severe in Ethiopia. Moreover, food insecurity is one of the defining features of rural poverty affecting millions of people particularly in moisture-deficit and pastoral areas. Even in years of adequate rainfall and good harvests, these people remain in need of food assistance (FRRE, 2018). Drought, the longer-term decline in the economic condition of households, and the resulting chronic and acute food insecurity have become a constant challenge and a way of life for millions of households in rural Ethiopia. In Wollo and Hararghe, for example, there have been very few years without famine relief distribution since the

1970s, even in moderately dry or non-draught years. In the central Ethiopian highlands, where government development resources are believed to have been concentrated, food insecurity is now permanent. Despite massive reforestation programs, few trees have survived, and deforestation and soil erosion continue to affect wider areas each year with great loss to agricultural and pastoral production (Getachew, 2015).

Ethiopia continues to face significant development challenges due to food insecurity, with the Amhara Region continuously ranked as one of the nation's most vulnerable regions. A significant percentage of households still face both temporary and chronic food insecurity in spite of continuous governmental and non-governmental measures. The region's on going livelihood vulnerability has been exacerbated by recurrent droughts, decreasing soil fertility, land fragmentation, restricted access to agricultural inputs, population pressure, and socioeconomic limitations (Devereux and Sussex, 2000; Belay and Bewket, 2015).

According to Berlie (2023), unpredictable market prices, lack of employment, opportunities and distress-coping strategies are indicators of household food insecurity in Ethiopia. Besides, as in many developing countries, food security studies in Ethiopia have traditionally focused on certain rural areas, where the poorest and most food insecure population resides. Numerous interconnected elements, such as household demographics, asset ownership, agricultural production, market access, and institutional support systems, have an impact on food security, according to empirical studies (FAO, 2008).Climate unpredictability and environmental degradation are particularly important factors that determine households' food security status in the Amhara Region, where rain-fed subsistence agriculture is predominant (Deressa et al., 2009). However, the data is still inadequate, inconsistent, or localised, and the strength and interaction of these factors differ from district to district.

Furthermore, a large number of current studies concentrate on socioeconomic or climatic issues. This leads to significant gaps in our knowledge of the intricate, multifaceted factors that influence household food security outcomes in Amhara's rural settings. It becomes challenging to develop and carry out focused policies and interventions in the absence of precise, context-specific evidence.

A thorough study that looks at the main factors influencing food security in the Amhara Region identifies the households most at risk, and analyses the ways in which socioeconomic, demographic, agricultural, and environmental factors interact to affect food security outcomes is therefore needed. In order to support resilient livelihoods, inform evidence-based planning, and advance sustainable food security in the area, such a study is crucial.

In addition to the general identification of food insecurity of the World, regional and country level, disaggregated information on the incidence of food insecurity is required both for proper policy design and adequately targeted interventions. This entails identification of different categories of the food insecure at the local and household level. Furthermore, more than at any time, it will be lack of information and analysis rather than ideology and conflict that will constrain the ability of policy makers to make choices that bring about food security both now and, in the future, (Kostas et al., 2017). Hence, the researcher has taken the initiative to study this problem and to analyze with the socio-economic factors that are associated with household food insecurity and the severity of the problem in the rural areas of Meket woreda, of north Wollo zone of Amhara region.

1.3. Objectives of the Study

1.3.1. General Objective

The general objective of this study is to analyze the food security status, determinates and coping strategies with an evidence of rural households in Meket district, Amhara regional state, Ethiopia.

1.3.2 Specific Objectives

The specific objectives of this study are

- To analyze the hazards situation that may affect the food security of the households
- To measure the food security status of the households in the study area
- To identify the determinants of household food security in the study area and
- To analyze the coping strategies employed by the rural households.

1.4. Research Questions

Based on the research objectives the following research questions are developed

- What are the hazards situation that may affect the food security situation of the households?
- What is the current food security status of households in the study area?

- What are the key determinants that influence household food security in the study area?
- What are the coping strategies employed by the households?

1.5 Significance of the Study

The findings of this study will be expect to use local governments and development practitioners as well as, policy makers in terms of improving the knowledge and experience base for rural households. The results of this study might enhance our knowledge of rural household food security and its determinants. The study will help to partially fill the gap in the literature on food security status, determinates and coping strategy of rural households in the study area. With regard to practical attempt of food security attainment, the knowledge of the food challenges that rural households face obtained from the study will be of importance in the formulation of policies and strategies aimed at ensuring food security in rural areas. Thus, the policy makers and planners might be benefited from outcome of such study to address the problem of food insecurity. Furthermore, this study may spark other questions or resulted in breeding of new problems that are researchable and needs extra examination. Therefore, this research can be a baseline for further investigation.

1.6. Scope of the Study

The thematic scope of this study is conceptually focused on analyzing the household food security status, identifying its primary socioeconomic and demographic determinants, and evaluating the short-term consumption coping strategies deployed by rural smallholders. Geographically, the research is delimited to three selected rural kebeles specifically Arabal, Weketa, and Debre Zebit situated within a single district, Meket Woreda, in the North Wollo Zone of the Amhara Regional State, Ethiopia. Demographically, the investigation is bounded by a cross-sectional sample of 286 rural household heads distributed across three primary agro-ecological zones: Kolla (lowland), Woigna dega (midland), and Dega (highland). Temporally, the boundaries of the study are restricted to tracking and evaluating these food security dynamics within the specific timeframe of the 2025/2026 agricultural and calendar year.

1.7. Limitations of the Study

The foremost constraint of this research is its narrow geographic scale, as it strictly investigates a case study of a single Woreda. This localized boundary was a necessary compromise driven by

scarce financial backing and limited material resources, which directly prevented the researcher from expanding data collection across a wider regional or national spectrum. Consequently, while the resulting econometric model and descriptive data provide deep, context-specific insights for Meket Woreda, the broader generalizability of these findings to other districts or region-wide agrarian populations in Ethiopia may be constrained by local biophysical and institutional differences.

1.8. Organization of the Study

This thesis is structured into five interconnected chapters to provide a systematic and comprehensive analysis of household food security in the study area. Chapter One provides the foundational framework of the research, encompassing the background of the study, statement of the problem, research questions, core objectives, significance, and the scope and limitations of the investigation. Chapter Two reviews relevant theoretical and empirical literature, establishing the conceptual framework regarding household food security, its socio-economic determinants, and the dynamics of consumption coping strategies among rural smallholders. Chapter Three details the research methodology, outlining the biophysical and socio-economic characteristics of Meket Woreda, the multi-stage sampling techniques, methods of data collection, and the descriptive and econometric models (such as logistic regression) used for data analysis. Chapter Four presents the empirical results and discussion, merging descriptive statistics of household demographics with econometric outputs to explain the determinants of food security and the utilization of coping mechanisms. Chapter Five concludes the thesis by providing a concise summary of the major empirical findings, drawing overarching conclusions, and offering targeted policy recommendations for local and regional stakeholders.

CHAPTER 2: REVIEW OF RELATED LITERATURES

This chapter is aimed to present a review of related literature that had been done by various researchers on the issue of food security and its determinants.

2.1 Concepts of Food Security

The concept of food security is essential to effectively analyze the underlying causes and dimensions of food insecurity. Food security is a multidimensional concept that can be examined at global, regional, national, sub-national, community, household, and individual levels (Pinstrup-Andersen, 2020; FAO, 2022). Since the World Food Conference of 1974, the concept has evolved substantially, with definitions expanding to encompass not only food availability but also access, utilization, and stability. Recent reviews indicate that numerous definitions of food security exist, reflecting its complexity and the need to consider diverse socio-economic, environmental, and institutional factors when analyzing food security outcomes (Devereux and Maxwell, 2018; FAO, 2022).

The conceptual framework of food security has progressively evolved, particularly in response to the persistent incidence of hunger, famine, and malnutrition in developing countries. The concept gained broader attention in the 1980s with increasing focus on "access" to food, which shifted the unit of analysis from national and global levels to households and individuals (Devereux and Maxwell, 2018; Pinstrup-Andersen, 2020). The evolution of food security thinking since the World Food Conference can be described through three interrelated paradigm shifts: a shift from global and national perspectives to household and individual levels, a shift from a "food-first" approach to a broader livelihood perspective, and a shift from reliance on objective indicators to consideration of subjective perceptions and experiences of food insecurity (Devereux and Maxwell, 2018; FAO, 2022).

As argued in recent literature, the mere presence of food at the national or market level does not guarantee that individuals have access to it, meaning that starvation and malnutrition can occur even when aggregate food availability is sufficient (**Sen,** 2021; Devereux & Maxwell, 2018). Empirical evidence indicates that over the past two decades, global per capita food production has generally increased. Nevertheless, a substantial proportion of populations, particularly in developing countries, continue to experience hunger and malnutrition. For instance, despite sufficient calorie availability at the global level, millions of people remain food insecure due to

unequal access, poverty, and other structural barriers (FAO and WFP., 2022). These observations demonstrate that national-level food availability does not automatically translate into household- or individual-level food security. Consequently, recent research emphasizes the importance of examining food security at household and individual levels, recognizing that improvements in national food production alone are insufficient to ensure that all households and members achieve adequate nutrition (Alemayehu and Bewket, 2022; Bachewe et al., 2023).

Food security is commonly defined as a condition in which all people, at all times, have reliable access to sufficient, safe, and nutritious food necessary for an active and healthy life. While access to adequate food is a fundamental requirement, it alone is not sufficient to ensure a healthy life. Other interrelated factors, including the health and sanitation environment, as well as household and public capacity to care for vulnerable members of society, play a critical role in determining food security outcomes (Devereux and Maxwell, 2018; Pinstrup-Andersen, 2020).

2.2. Dimensions of Food Security

Food security has four major dimensions: food availability, accessibility, utilization and stability.

Food availability: Food availability refers to the sufficient physical presence of food to meet the minimum dietary energy requirements for an active and healthy life. It can originate from household own production, purchases from domestic markets, or imports from external sources (Pinstrup-Andersen, 2020; FAO, 2022). Food availability reflects the "supply side" of food security and is influenced by the level of domestic production, stock levels, net trade, and inclusion of food aid. It is important to note that food production alone does not equal food availability, as availability accounts for production minus exports, plus imports, and changes in stocks for each food item in the national food balance sheet. Adequacy is evaluated by comparing the total available food with the estimated consumption requirements for the population (Devereux and Maxwell, 2018; FAO, 2022).

Food access: Food access refers to the resources that households have to obtain foods, either through own production or through purchase. So, individuals need to have assets or incomes to produce, purchase in order to obtain foods needed to maintain their consumption. Hence, food

access is largely related to household income and own production. Food access depends on; income available to the household, the distribution of income within the household, the price of food in the market and other factors worth mentioning are individual's access to the market, social and institutional rights. According to Kuwornu et al. (2011) food access is determined by physical and financial resources, as well as by social and political factors. Availability and access include several components: quantity (i.e., enough food and energy), quality (i.e., foods that provide all essential nutrients), safety (i.e., food that is free of contaminants and does not pose health risks) and cultural acceptability and preferences. (i.e., foods that people like and that fit into traditional or preferred diets).

Food stability: Stability refers to the availability of secure access to enough food currently as well as in the future or at different points in time. This recognizes that people's food security situation may change. Generally, stability in food security may be determined by livelihood characteristics, production patterns, political stability, livelihood resilience and type of shocks and hazards. Stability is a cross-cutting dimension that refers to food being available, accessible and utilization being adequate at all times, so that people do not have to worry about the risk of being food insecure during certain seasons or due to external events (Devereux et al., 2015). Stability of access has to do with the ability of the household to have continuous access to the food source, with minimal risks.

Food utilization: refers to the capacity of households to use food effectively to meet their nutritional needs and maintain good health. The concept highlights that adequate quantities of food alone do not guarantee well-nourished households. Food utilization involves the proper intake and absorption of nutrients, requiring diets that provide sufficient energy and essential nutrients, as well as appropriate food storage, processing, preparation practices, and health care, including child care and illness management (Pinstrup-Andersen, 2020; FAO, 2022). At the household level, food utilization depends on access to adequate services for safe food storage and processing, knowledge and practices related to food preparation, equitable food allocation among household members, and the health status of individuals, which can be influenced by disease, hygiene, sanitation, and access to health services (Devereux and Maxwell, 2018; Headey and Alderman, 2019).

2.3. Measuring Food Security

Food security is a multidimensional concept that reflects the availability, access, utilization, and stability of food necessary for an active and healthy life. Measuring food security is essential for understanding the extent and nature of hunger and malnutrition, designing effective interventions, and monitoring progress toward national and global development goals such as the Sustainable Development Goals (SDG 2 – Zero Hunger). Food security measurement involves both **quantitative** and **qualitative** approaches that capture different aspects of household and individual food situations.

Food Consumption Score: There is no single way to measure food security, the concept itself being rather elusive. Analysis of food security by WFP generally uses food consumption as the entry point. Food consumption measured in kilocalories is the gold standard for measuring consumption, and often considered to be one of the gold standards for food security- but the collection of detailed food intake data is difficult and time consuming.

Food consumption score is an indicator of food security which takes into consideration the diversity, quantity and adequacy of food consumption. It is a frequency-weighted dietary diversity score, calculated using the frequency with which a household consumed eight food groups (i.e., staples (2), pulses (3), vegetables (1), fruits (1), meat/fish/egg (4), milk (4), sugar (0.5) and oil (0.5)) with a 7-day recall from the date of the survey. The frequencies of food consumption shall not be more than seven which is equal to number of the recall period. Each food consumption frequency is multiplied by its weights (given in parentheses above) and then summed to create the FCS. The score ranges from 0 to 112, where 0 indicate a household didn't consume any food in the last 7 days and 112 when household consumed each food groups all days for the last 7 days. In FCS, there are two kinds of cut-off that determine the status of food security depending on the frequency of consumption of oil and sugar in the society. If the consumption of oil and sugar is proportional or positively correlated with other category of food, we used 21 and 35 thresholds to determine the food security status based on FCS. Therefore, below 21 is considered as poor, above 35 acceptable and between 21 and 35 as borderline. However, this can be raised from 21 and 35 to 28 and 42 if populations where consumption of sugar and/or oil is frequent among nearly all households surveyed, even when the consumption of other food groups is rare (Coates et al., 2017; Maxwell et al., 2020; Jones et al., 2021; WFP, 2022).

Diet diversity score: Diet diversity score measures the number of different food groups or food items consumed over a specific period and evaluates whether an individual is consuming a

sufficiently varied diet to meet nutritional requirements (Arimond et al., 2021; Ruel, 2021). It is widely recognized as an indicator that captures both food availability and access (Ruel, 2021). Diet diversity also correlates with nutrition-related outcomes, including child growth, birth weight, and micronutrient adequacy (Arimond et al., 2021; Jones et al., 2021). This measure typically relies on dietary recall methods to assess food diversity, which can introduce recall bias, particularly when the recall period is long or when respondents have difficulty remembering all foods consumed (Muthuri, 2020; FAO, 2022).

Food gap: is an indicator used to assess food security at both household and national levels. At the household level, it is commonly measured by the number of months a household experiences food shortages, providing insight into seasonal or chronic food insecurity (Alemayehu and Bewket, 2022; Bachewe et al., 2023b). This measure often relies on recall methods, which can introduce bias if respondents are unable to accurately remember periods of food insufficiency. At the national level, food gap quantifies the additional amount of food required to raise per capita consumption in each income group to meet recommended nutritional requirements, typically around 2,100 calories per person per day (Headey and Alderman, 2019; FAO, 2022).

Subjective (perception based) measures: Subjective measures are used to assess food security at the household or individual level by directly asking respondents about their own perceptions of their food security status (Frongillo, 2019; Jones et al., 2021). While these measures provide valuable insights into lived experiences of food insecurity, their reliance on personal perception may introduce bias, and they can be challenging to compare across different populations or contexts (Frongillo, 2019; Jones et al., 2021).

2.4. Food Security and Dimensions in Ethiopia

Per capita food production in Ethiopia has faced significant challenges over the past few decades, with growth rates frequently lagging behind population growth (Devereux et al., 2020; Bachewe et al., 2023b). While food production has increased in absolute terms, it has often been insufficient to meet the rapidly growing demand, driven by an annual population growth rate of around 2.5–3 percent (Bank, 2023). This imbalance has resulted in recurring reliance on food imports and international assistance. Despite Ethiopia's substantial agricultural resources and government-led interventions, food insecurity remains a persistent challenge in the country and across Sub-Saharan Africa (Headey and Alderman, 2019; FAO, 2022). Historical analyses also highlight periods when consumption exceeded domestic production, underlining structural gaps in the food system

(Bachewe et al., 2023b). Ethiopia endowed with considerable agricultural potential, was largely self-sufficient in staple foods and, until the mid-20th century, even exported food grains. Historical analyses indicate that Ethiopia regularly contributed to regional food markets during the 1940s and 1950s (Devereux et al., 2020; Bachewe et al., 2023). However, from the 1960s onward, domestic food production has frequently been unable to meet the country's growing food requirements. Even in years with favorable harvests, average food production over the past decades has remained relatively stagnant, failing to keep pace with population growth and increasing demand (Headey and Alderman, 2019; FAO, 2022). Nevertheless, since the mid-1980s, food production in Ethiopia has experienced very low growth. Analyses show that over several decades, total domestic food production has increased only modestly, while rapid population growth has led to a decline in per capita food production (Devereux et al., 2020; Bachewe et al., 2023). Consequently, the country's food self-sufficiency ratio the share of national food demand met by domestic production has declined, reflecting persistent gaps between production and the nutritional requirements of the population (Headey and Alderman, 2019; FAO, 2022). Food availability in Ethiopia is largely determined by domestic staple food production by subsistence agriculture. Even though there is a marked variation among various regions, cereals including teff, sorghum, maize and wheat are predominantly produced and consumed in the country. There is growing evidence indicating that even in years with favorable conditions, Ethiopia has been unable to produce sufficient food domestically to meet the subsistence needs of its population (Devereux et al., 2020; Bachewe et al., 2023). The same source further stipulated that as cumulative effect of both natural and manmade factors, domestic grain production has rarely been above 140 kg/capita/annum since the early 1980s. Based on an estimated daily per capita energy requirement of approximately 2,300 kcal, and considering that cereals contribute roughly 65–70 percent of total household energy intake in Ethiopia, cereals remain the primary source of dietary energy for most households (Headey and Alderman, 2019; Bachewe et al., 2023). And cereal can produce an average of 3700 kcal per kilogram, at least 0.42 kg of cereal is required per capita and day to meet the recommended daily subsistence requirements. This implies that an estimated 157 kg of cereal is needed per person per year. Comparing these values to domestic cereal production give us a crude picture of food self-sufficiency of the country.

2.5. Determinants of Food Security

Food security encompasses the availability of food, access to food, and the risks associated with either availability or access. At the national, regional, or local levels, food availability is primarily determined by production, stockholding, and trade. Variations in any of these factors can increase vulnerability to food insecurity. Additionally, fluctuations in a country's capacity to import food can exacerbate insecurity by limiting local availability, even when global supplies are sufficient (Devereux and Maxwell, 2018; Headey and Alderman, 2019; Bachewe et al., 2023).

Household access to food depends on the ability to purchase food at prevailing prices, the availability of land and other productive resources for own production, or support received through formal programs or informal social networks to offset any shortfall. Beyond income and prices, household access to adequate calories is influenced by demographic characteristics, education levels, and geographic location (Headey and Ecker, 2013; Jones et al., 2021; Bachewe et al., 2023).

In urban areas, household-level food availability is primarily determined by income, food prices, access to home production such as urban agriculture, and transfers from formal programs or informal social networks. Household behavior, shaped by cultural norms, knowledge, and preferences, also influences food demand patterns and intra-household allocation (Abera and Hailu, 2021; Gebreyesus et al., 2022).

Involvement in the cash economy is an unavoidable aspect of urban life. Unlike rural households that can rely on own production, urban residents must purchase most of their food, making food prices a critical determinant of urban food security. Even when food is physically available, high prices can prevent the urban poor from accessing adequate nutrition. Several factors contribute to elevated urban food prices, including inefficiencies in urban marketing systems, small and dispersed retail markets, and the inability of low-income households to purchase in bulk due to limited cash resources. Structural changes, such as reductions in government food subsidies, can further increase prices for urban residents (Abera and Hailu, 2021; Bachewe et al., 2023).

The state of household food security is largely shaped by factors related to food acquisition, household procurement strategies, and the socio-economic conditions of the community. Household food security is generally determined by two key dimensions: the availability of food and access to it. Food availability is influenced not only by the level of production, trade, and stocks but also by the diversity of food sources and the handling and storage practices within

households, which determine the temporal distribution of food supply (Headey and Ecker, 2013; Gebreyesus et al., 2022). Access to food is further conditioned by income, purchasing power, household demographics, education, and social support networks, highlighting the multidimensional nature of food security (Devereux et al., 2020; Jones et al., 2021).

A household's ability to achieve food security depends on its human, material, and institutional resource base, commonly referred to as "food security factors." These factors include education and employment status, household demographics, participation in urban agriculture, ownership of assets, savings, access to formal social assistance or direct transfers, informal social networks, access to clean water and sanitation, and the cost of living. Together, these determinants influence a household's capacity to acquire sufficient, safe, and nutritious food over time (Kassa et al., 2021; Fekadu et al., 2022).

The same source indicates that lower educational level and illiteracy are directly related to food insecurity. This is usually measured just for the head of household, but the educational status of other household members, especially income earners, is also important. The possession of assets especially liquid assets is positively correlated with food security. More urban households save, maintain bank account, and belong to saving and microfinance clubs than rural households. Households with either form of saving tend to be more food secure than those without convertible assets.

2.6. Conceptual Framework of the Study

Food security of the households in Meket woreda of Amhara region can be affected divers factors including demographic, resource and assets and institutional and economic factors. Household demographic characteristics such as sex, age, education, marital status of the household head and family size are expected to influence food security by affecting labor availability, decision-making capacity and consumption needs. Larger family size is hypothesized to positively influence food security due to increased labor availability.

On the other hand, resource and asset-related factors such as total land size, livestock ownership, irrigation access and participation in productive safety net program (PSNP) are crucial determinants of food production and income generation are expected to positively influence food security through improved agricultural productivity and resilience to climate variability.

Furthermore, institutional and economic factors including income, saving and access to credit services are hypothesized to enhance food security by improving access to knowledge, financial resources, and income diversification. Similarly, access to basic services like market centers and all weather roads contributed towards creating favorable room towards food and income. Overall, the framework assumes that these demographic, economic, institutional, and asset related factors directly and jointly determine the household food security status in the study area.

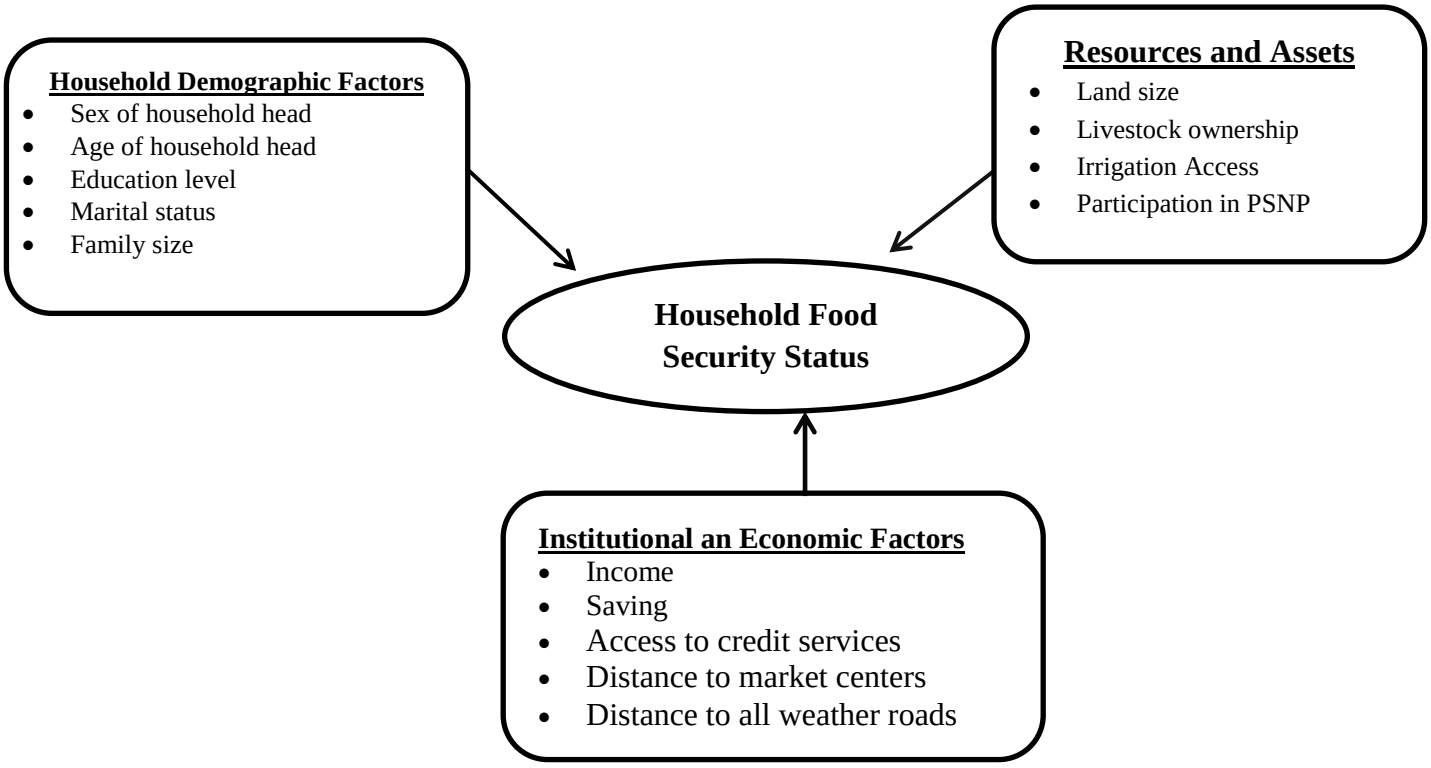

Figure 1: Conceptual framework of the study

Source: Self demonstrated from the review of related literature (2026)

2.8. Operational Definitions

Food Security: Food security 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 preferences for an active and healthy life. The concept encompasses four interrelated dimensions: food availability, food access, food utilization, and food stability, which collectively determine the capacity of households and individuals to maintain adequate nutrition over time (Barrett, 2010; Smith et al., 2020; Tadesse and Alemu, 2020).

Food Availability: Food availability refers to the physical presence of sufficient quantities of food at the national, regional, or household level, supplied through domestic production, food stocks, or imports. It reflects the "supply side" of food security and is a prerequisite for ensuring that households can meet their dietary needs (Barrett, 2010; FAO, 2021a; Taffesse, 2021).

Food Access: Food access refers to a household's ability to obtain sufficient, safe, and nutritious food through purchase, own production, barter, or transfers. Access is largely influenced by household income, food prices, market functioning, and the availability of social support mechanisms. It reflects the economic and social capacity of households to acquire food and is a critical determinant of food security (Headey and Ecker, 2013; Taffesse, 2021).

Food Utilization: Food utilization refers to the proper biological use of food, requiring adequate diet, clean water, sanitation, and health care to ensure nutritional well-being (FAO, 2008b).

Food Stability: Food stability refers to the ability of individuals or households to access adequate food at all times without the risk of losing access due to economic shocks, climate variability, or seasonal food shortages (FAO, 2008b).

Household Food Security: Household food security is defined as a household's capacity to consistently obtain sufficient, safe, and nutritious food to meet the dietary needs of all its members through own production, purchase, or transfers (Abera and Hailu, 2021). In empirical studies, household food security is typically assessed at the household level, as this provides the most accurate reflection of intra-household access and consumption patterns. The determinants of household food security include demographic factors, economic status, institutional support, and resource endowments, which collectively influence a household's ability to produce, acquire, and utilize food. These factors operate through mechanisms such as income generation, agricultural production, market participation, and consumption decisions, and their effects vary across households, income groups, and agro-ecological zones (Tadesse and Alemu, 2020; Workie, 2020; Fekadu et al., 2022).

Household Demographic Determinants: Household demographic factors encompass characteristics such as the sex, age, education, and marital status of the household head, as well as family size and dependency ratio. These factors influence labor availability, decision-making

capacity, and overall household consumption needs, thereby affecting food security outcomes (Workie, 2020; Fekadu et al., 2022; Gebreyesus et al., 2022).

Resource and Asset Determinants: Resource and asset determinants refer to a household's ownership and access to productive resources, including land, livestock, agricultural inputs, and technology. These resources influence agricultural productivity, income generation, and the household's resilience to shocks, thereby directly affecting food security outcomes (Tadesse and Alemu, 2020; Beshir, 2021; Fekadu et al., 2022).

Institutional Determinants: Institutional determinants include access to agricultural extension services, credit institutions, and market infrastructure. These factors improve farmers' access to information, financial services, and markets, enhancing food production and income diversification (Feder et al., 2004; FAO, 2015).

Economic Determinants: Economic determinants of household food security include sources of income, such as farm and off-farm earnings, as well as access to markets and price information. These factors affect households' purchasing power, their ability to smooth consumption during periods of food shortage, and their overall resilience to shocks (Tadesse and Alemu, 2020; Fekadu et al., 2022).

CHAPTER 3: RESEARCH METHODOLOGY

3.1. Description of the Study Area

3.1.1. Location and Description of the Study Area

Meket district is located in North Wollo Zone, Amhara National Regional State. According to (Assefa and Ewunetu, 2020) the administrative center of Meket is Filakit and situated at about 660 km North of Addis Ababa, the capital of Ethiopia. The same source has showed that the study area is also located at about 139 km from Woldiya, the capital of North Wollo Zone and 221 km from Bahir Dar, the capital of Amhara National Regional State. Besides, Meket is bordered on the south by Wadla and Dawunt district, on the west by South Gondar Zone (Gaint both Lay and Tach Gaint), on the northwest by Bugna district, on the north by Lasta district, on the northeast by Gidan district, and on the east by Guba Lafto district (Wollie et al., 2018). Moreover, the absolute location of Meket is located within an latitude and longitude of $11^0$35’50’’N to $12^0$2’30’’N and $38^0$32’35’’E to $39^0$16’40’’E, respectively (Asnake and Mammo, 2016). The total area of Meket district is 1,909 km².

The rationales of taking Meket district as a study area are the presence of different agro-ecological setting namely: humid highlands, sub-humid areas at mid-altitude and semi-arid lowlands (Elias and Fantaye, 2000). In addition, Demeke et al. (2020) reported the proportion of agro-climatic or ecologic region as highland (20%), midland (55%) and lowland (25%). The study area is characterized by small-scale rain fed subsistence agriculture. However, this rain fed subsistence agricultural production is highly vulnerable to climate change(Elias and Fantaye, 2000; Adem and Ayenew, 2011). According to (Elias and Fantaye, 2000) more than 60% of the households were poor households’ in all agro-climatic zones. Furthermore, Meket is identified as drought affected and food insecure district in North Wollo Zone, Amhara Region (Demilew and Nigussie, 2020). To add more, Meket is the largest district in North Wollo Zone and small-scale rain fed agriculture is the main livelihoods (Asnake and Mammo, 2016).

The topography of the study area is consisting of gorges and valleys (65%), mountains (7%) and plain land (28%) (Assefa and Ewunetu, 2020). The highland topography of Meket district is well-suited for barley production (Asnake and Mammo, 2016).

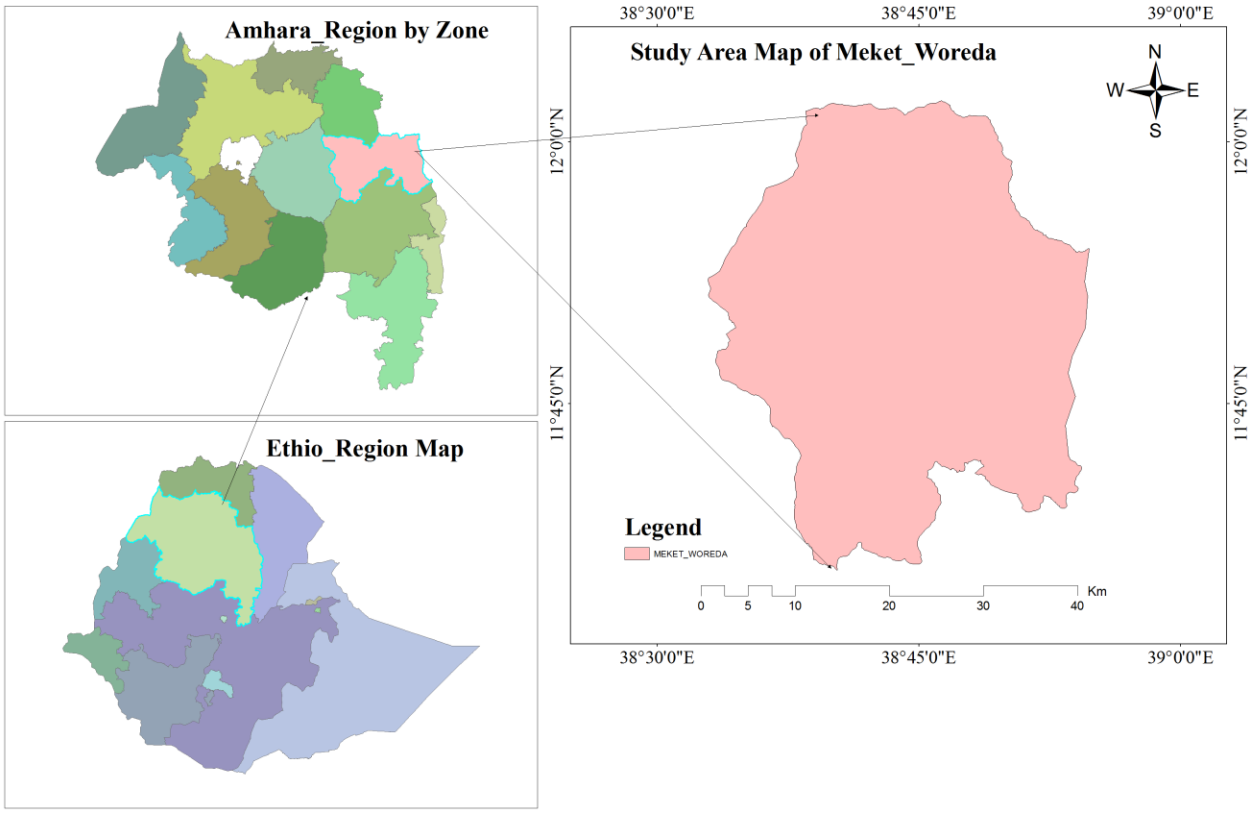

Figure 2: Study Area Map

Source: Own production, 2026

3.1.2. Agro-ecology and Climatic Conditions

Meket *Woreda* comprises of four agro-climatic zones namely: semi-arid lowlands below 2,300 meters above sea level (masl), sub-humid midlands ranging from 2,300 to 2,800 masl, humid highlands between 2,800 and 3,200 masl, and very-humid high altitude plateau above 3,200 masl, which frequently experiences frost and hail (Elias and Fantaye, 2000; Wollie et al., 2018). In other ways, the altitude of Meket *Woreda* is found between 1500 and 3500 masl and classified in to three ecological or climatic regions namely: lowland (25%), midland (55%) and highland (20%) (Assefa and Ewunetu, 2020).

According to (Gissila et al., 2004) has reported bi-modal monsoon rainfall in Meket where 40% of the 300-900mm annual rainfall occurs during September to October (Belg) and 60% between June to August (Kiremt). In relation to the status of rainfall in the study area, (Anteneh, 2021)

has reported the presence of an erratic distribution of rainfall and it affects crop yields. Lowlands of Meket received an average annual rainfall of 600 mm while highlands are received 1120 mm of average annual rainfall, it ranges from 600 mm to 1120 mm average annual rainfall. The mean maximum and minimum temperature of the area is about 24.60^{o}c and 12.10^{o}c, respectively(Asnake and Mammo, 2016). Moreover, the variation of temperature in the study area ranges from 22^{o}c to 7^{o}c(Assefa and Ewunetu, 2020).

There was a wide variation of soils in Meket *Woreda* due to the presence of variation in climate, topography and vegetation. *Walka*(Vertisols) and *keyate* (Nitisols) is the dominant soil types throughout all agro-climatic zones(Elias and Fantaye, 2000). *Walka* (Vertisols) is a relatively fertile black cotton soil, which has similar property to Vertisols with limitation of waterlogged. *Walka* (Vertisols) soil dominated the mid-altitude zones and the lower parts of mountains. On the other hand, red-brown *keyate* (Nitisols*)* soil have similar property to Nitisols which is abundant in the high plateau. *Keyate* (Nitisols) soils covers 60% of the study area. *Keyate* (Nitisols) soils is highly vulnerable to erosion and becomes shallow, infertile and unproductive. In addition to *Walka* (Vertisols) and *keyate* (Nitisols), *nechate* is a highly degraded, whitish soil commonly found alongside *Walka* (Vertisols) and *keyate* (Nitisols) soils in the study area. *Nechate* soils; often associated with Arenosols or Acrisols are unsuitable for cultivation of crop. Less important soils in the study area is *taskima;* associated with Phaeozems and Vertisols, suitable for the cultivation of wheat and lentil while tazmima; associated with Cambisols or Luvisols, is suitable for the production of sorghum and chickpea. However, there is no direct scientific name of taskima, tazmima and nechate soils. To sum the soils in Meket, there are varied soils with fertile highland soils in some areas that are suitable for agriculture. However, soil erosion is a significant challenge due to steep slopes and deforestation.

3.1.3. Demography of the Study Area

The total population was 287,098 of which 144,315 (50.27%) were males while the remaining 142,783 (49.13%) were females using population projection. Therefore, this projection has been used to design the study sample population for this study. Meket has population density of 150.39/km^{2}. The total households were estimated to be 57,420 based on the projection and considering 5 persons in a household in the study area. On the other hand, according to (CSA,

2021), Meket had 27,670 urban population of which 13,869 were males while 13, 801 were females.

The largest ethnic group reported in Meket was the Amhara (99.95%). Amharic was spoken as a first language by 99.77%. The majority of the population practiced Ethiopian Orthodox Christianity with 94.69% professing this belief, while 5.31% of the population was Muslim.

3.1.4. Socio-economic Activities of the Study Area

The primary livelihood in the study area is subsistence mixed farming, involving both crop and animal production, with an average farm size of about one hectare per household (Anteneh, 2021; Kidane et al., 2022). Asnake and Mammo (2016) has characterized the study area in relation to the livelihoods; small-scale rain fed agriculture is the main livelihood sources to the local community. Moreover, agriculture is responsible for 92% of the peoples livelihood in the study area (Assefa and Ewunetu, 2020). The primary resource for the livelihoods of the study area is land. Meket covers a total area of 21,600 ha, of which agricultural land accounted for 39%, settlement (18%), grazing land (7%), and 8% of bush and scrub (Azene, 1995). The remained of 28% is eroded wasteland which was unsuitable for cultivation.

According to (Anteneh, 2021) maize, teff, rice and beans were the common growing crops in Mekete. Other less important crops were also reported such as chickpea, onion, cabbage and Chilies pepper. In addition, cash crops such as garlic, Ethiopian mustard, oats and carrot were cultivated. The same source has reported that cattle, goat, donkey, chicken and bees are domestic animals kept on traditional basis.

Humans and livestock's were the highest abundance in humid and sub-humid highland of Meket *Woreda*. However, the semi-arid lowlands were unattractive to farmers due to the combination of erratic rainfall, poor soil quality, and the prevalence of diseases affecting both humans and livestock (Anteneh, 2021)

Poultry production is a common income-generating activity among farmers in Meket Woreda. It is widely practiced alongside other farming activities, providing farmers with an additional source of income(Assefa and Ewunetu, 2020). The most importance of Chicken production were income generation, egg production, egg hatching, home consumption, and for religious ceremonies in descending order in the study area.

Bee keeping is also widely practiced in the study area as a means of livelihoods(Kidane et al., 2022). Beekeepers primarily use traditional hives, followed by movable frame hives, and top bar hives, in that order. Most beekeepers follow to traditional production methods in the study area (Tefera and Melaku, 2024). In relation to the sources of bee colonies, beekeepers specified that the primary sources of bee colonies, in descending order, were purchasing, catching swarms, and receiving them as gifts.

3.2 Research Design

Research design is a framework that provides a plan for studying the research problem. The role of a research design is to manage the collection of relevant data with minimal consumption of effort, time and money considering the research objectives (Kothari, 2004)). This study applied explanatory sequential mixed research design. Explanatory sequential mixed methods is one in which the researcher first conducts quantitative research, analyzes the results and then builds on the results to explain them in more detail with qualitative research. It considered explanatory research design because the initial quantitative data results were explained further with the qualitative data. The researcher consider sequential because the initial quantitative phase is followed by the qualitative phase.

Qualitative Approach: Used to gain a deep understanding about the sources of household income, food security status, coping strategies and determinants of food security in the study areas. Semi-structured interviews, key informant interviews and focus group discussions were carried out to gather qualitative type of data.

Quantitative Approach: Involves the measurement of quantity or amount and used to quantify and see the relationship among variables. Household survey was carried out to conduct a cross-sectional study to collect data on the socio-economic and demographic information of households, food security status, coping strategies and determinants of food security. Various available statistical and econometric methods employed for analysis in such research.

Mixed research approach that combines both qualitative and quantitative methods employed in this study. Qualitative research approach considers and use non-numeric data whereas, quantitative research approaches consider on numeric data. Qualitative approach used to capture data on the major sources of income, food security, coping strategies and determinants of

household food security using focus group discussion and key informant interview. Quantitative data on household's resource ownership, income status, demographic characteristics, food security status, coping strategies, determinants and other basic information were collected from sample households using semi-structured questionnaire. Employing qualitative and quantitative approaches in research enable the researcher to benefit from the insights that the two approaches provide when use in combination. Moreover, the most effective research is one that combines qualitative and quantitative components (Babbie, 2003).

3.3 Sources of Data

Primary Source: Primary data for the study was collected from selected sample households' questionnaire survey, focus group discussion, and interview with key informants.

Secondary Source: Secondary data was collected from formal sources such as, books, journals, Finance and Economic Development office (FEDO) reports, District Administrative office, District Agriculture and Rural Development office (WoARDO) reports.

3.4 Population, Sampling Technique and Sample Size Determination

3.4.1. Population (Sample Frame)

A population can be defined as all people or items (unit of analysis) with the characteristics that one wishes to study (Bhattacherjee, 2012). The main purpose of the study is to examine the food security status and it's determinants with the case of Meket district. Therefore, the sampling frame of this research was rural households in the study area.

3.4.2. Sample Size Determination

There are several approaches to determine sample size. These include using a survey or small populations, imitating a sample size of similar studies, using published tables and applying formulas to calculate a sample size. This study applied simplified formula provided by Yamane (1967) in order to determine the required sample size at 93% confidence level is

$$n = N/1+N(e)^2 \qquad \ldots\ldots (1)$$

Where;

n is sample size,

N is the household size, and

e is the level of precision or error 7% (0.07).

No. of household in the total sample size (N) =3784 (Finance and Economic Development office (FEDO), 2021)

$n=3784/1+3784*(0.07)^2=194$

However, 286 household was data collected from 3 kebeles in the woreda.

3.4.3. Sampling Techniques

In this study, a multi-stage sampling technique was used for the selection of sample site and sample respondents. First, from the whole woredas in Amhara regional state, Meket woreda was selected by using purposive sampling technique because there were no comprehensive findings that deal about food security and determinants. Secondly, out of 27 rural kebeles in the district, 3 kebeles namely **Debre Zebit**, **Arabal** (Kebele 012) and **Weketa** were selected by stratification technique in consideration of their agro-ecology. Finally, the sample households were selected by simple random sampling technique through proportionally. From the 3784 households in the 3 selected kebeles, 194 samples were selected thus 97 household heads from Debre zebit kebele, 117 households from Weketa kebele households and 72 households from Arabal kebele households.

Table 1: Distribution of sample in selected sample kebeles

No	Agro-ecology zone	Total Kebeles	Sample Kebeles	Selected kebele Name	No of total Households	Sample households
1	Kolla	5	1	Arabal	1030	72
2	Woina Dega	13	1	Weketa	1737	117
3	Dega	9	1	Debre Zebit	1017	97
Total		27	3		3784	286

Sources: Vulnerability assessment, DRMC (2024)

3.5 Data Collection Methods

3.5.1 Primary Data Collection Method

Primary source of data was collected from rural households in the study area, and food security related experts in the woreda. Primary data was collected using household questionnaire survey, focused group discussion (FGD) with the community members, interviews with key informants and also video and photo will be used in this study with field observation.

Household Survey/Questionnaire: The researcher collected primary data with the help of semi-structure questionnaire designed to obtain information from selected sample households. The questionnaire includes both closed ended and open-ended questions. The closed-ended questions were collected to understand about the background information about the respondent. Open ended questions were used to collect information, including feelings, attitudes and practice of the food security.

The questionnaire was first prepared in English then translated into the local language Amharic so that the data collectors and respondents easily understand the questions. In order to collect data through semi-structure questionnaire three enumerators who have completed first degree and able to speak the local language Amharic were represented from each study sites. The researcher helps the data collection as a supervisor and had a visibility on the actual field works. The data collection was conducted by digital data collection tool named KOBO toolbox.

Key Informant Interview (KII): Rigorous interviews were conducted with key informants including members of kebele administrators, district disaster risk management experts, district and kebele agriculture experts and Woreda administrators. According to this, a total of 12 key informants were interviewed about their food security and determinants related experience in the study area. The data collection continued until data saturation attains. The researcher developed guiding questions that may guide the interview.

Focus Group Discussion (FGD): Regarding the focus group discussion, village elders, youth, women, religious leaders and others who are believed to have knowledge about the food security were included in the focus group discussions. Separate sessions of discussion were arranged for both male and female to let them be able to speak out their feelings freely and more comfortably. Two focus group discussions at each study kebele were conducted and each focus group discussion consists of eight to twelve individuals. Similar to the key informant's interview, guiding questions were developed by the researcher to guide the focus group discussions.

3.5.2 Secondary Data Collection Method

For this study secondary data was collected from different relevant written documents, websites, magazines, articles, journals, annual reports, quarterly bulletins, various reports regarding to the

food security and its determinants in study area. The secondary data was used to substantiate the primary data.

3.6. Data quality assurance and validity

To ensure the quality and validity of data it is essential for producing reliable and credible research findings in this study, several measures will be taken at different stages of the research process to ensure the accuracy, consistency, reliability, and validity of the data collected and analyzed. To maintain high data quality, the following procedures were employed:

Questionnaire Design and Pre-testing: A structured questionnaire was developed based on relevant literature and previous empirical studies on food security and determinants. The questionnaire was pre-tested on a 10 sample of households outside the selected study kebeles to identify ambiguities, unclear questions, and logical inconsistencies. Based on the pre-test results, necessary modifications were made to improve clarity and relevance.

Enumerator Training: Enumerators were carefully selected and trained before to data collection. The training was focused on the objectives of the study, the meaning of each question, interviewing techniques, ethical considerations, and accurate recording of responses. This helps to minimize interviewer bias and measurement errors.

Translation and Consistency Checks: The questionnaire was initially prepared in English and then translated into the local language (Amharic) to ensure respondents' understanding. The translated version was reviewed to ensure consistency with the original questionnaire and to avoid misinterpretation of questions.

Close Supervision during Data Collection: The researcher will closely supervise the data collection process. Completed questionnaires will be immediately collected through follow-up.

Data Coding and Entry: Data was carefully coded and entered into statistical software. Double-entry and cross-checking techniques were applied to minimize data entry errors.

3.8. Data Analysis

In this study both descriptive analysis and inferential analysis were used to analyze the data. The quantitative data was coded and entered into Python 3.13 then analyzed by using descriptive statistics such as frequency, mean, standard deviation, chart, table and percentage. This study used Python software to analysis the determinant factors of food security using statsmodels library. The statistical significance of the variables in the descriptive part was tasted for both categorical and continuous variables using chi-square, t-test and one way ANOVA respectively. Independent sample t-test was used to identify the mean difference between food secured and secured households for continuous variables while chi-square was used for dummy variables. In addition, one way ANOVA was applied to show the mean difference of continuous variables across the three agro-ecology zones (kola, dega and woina dega).

3.8.1. Measuring Food Security Status

In this study food consumption score (FCS) was used to measure the food security status of households. The study focused on the food utilization component of food security and it considers both food quality and quantity of the households. The food security status of the households was estimated by food consumption score based on the households seven days food consumption. The food groups consumption of the households was used to construct the food consumption score and evaluated across benchmark developed by WFP (2008).

Food consumption score (FCS) is a composite index for the measurement of household dietary adequacy focusing principally on macronutrients and energy. The score is composed of dietary diversity, food frequency and relative nutrient quality of the different food groups (ACF, 2010). FCS is relatively strong indicator of diet quality and quantity while the recent literatures confirm FCS more tends to diet quality rather than quantity (Wiesmann et al., 2009). FCS is calculated based on the different food group consumption of households for 7 days ahead of the field survey. The number of distinct food groups consumed, rather than the number of individual items ingested, is estimated to better reflect a healthy diet (Swindale and Bilinsky, 2006). In this study, estimation of FCS was computed based on the food items, their group and respective weights developed by WFP (2008) (Table 2). The consumption frequency of the food items with in a group were added to find the score of each food group while scores above 7 were taken as 7 (Vhurumuku, 2014). Finally, the FCS of the households were converted from continuous to

categorical groups using typical thresholds: 0-21 poor, 21.5-35 borderline and above 35 as acceptable (WFP, 2008; ACF, 2010).

Table 2: Food items, their group and respective weights

Food items	**Food group**	**Weight**	**Justification**
Maize , maize porridge, rice, sorghum, millet pasta, bread and other cereals	Cereals	2	Energy dense/usually eaten in larger quantities, protein content lower and poorer quality (PER less) than legumes, micro-nutrients (bound by phytates).
Cassava, potatoes and sweet potatoes, other tubers, plantains			
Beans. Peas, groundnuts and cashew nuts	Pulses	3	Energy dense, high amounts of protein but of lower quality (PER less) than meats, micro-nutrients (inhibited by phytates), low fat.
Vegetables, leaves	Vegetables	1	Low energy, low protein, no fat, micro-nutrients
Fruits	Fruit	1	Low energy, low protein, no fat, micro-nutrients
Beef, goat, poultry, pork, eggs and fish	Meat and fish	4	Highest quality protein, easily absorbable micronutrients (no phytates), energy dense, fat. Even when consumed in small quantities, improvements to the quality of diet are large.
Milk yogurt and other diary	Milk	4	Highest quality protein, micro-nutrients, vitamin A, energy. However, milk could be consumed only in very small amounts and should then be treated as condiment and therefore re-classification in such cases is needed.
Sugar and sugar products, honey	Sugar	0.5	Empty calories. Usually consumed in small quantities.
Oils, fats and butter	Oil	0.5	Energy dense but usually no other micro-nutrients. Usually consumed in small quantities
Spices, tea, coffee, salt, fish power, small amounts of milk for tea.	Condiments	0	These foods are by definition eaten in very small quantities and not considered to have an important impact on overall diet.

Source: WFP (2008)

3.8.2. Coping Strategies Index

Reduced Consumption Coping strategy Index : Households, are not passive agents, respond to the hazards or shocks they meet, making food safety a managed process (Maxwell, 1996). These actions are referred to as coping strategies, and the research in the area of food security makes a distinction between coping mechanisms based on food consumption and those based on means of subsistence (livelihood), short-term and long term coping strategies respectively (Maxwell et al., 2003). The reduced Consumption Coping Strategies Index (rCCSI) is an

appropriate tool for a rural-based community study(Maxwell, 1996; Maxwell et al., 2003) to measures households' immediate reactions to actions involving food or adjustments to their consumption patterns in response to food shortages(Sassi, 2021). It is based on a clear understanding of livelihoods(Maxwell and Caldwell, 2008). Additionally, Maxwell et al. (2003) echoed, rCCSI is also relatively easy to use, quick to comprehend, and correlates favorably with other more complex measures of food security. It is essentially a set of questions regarding how households deal with a lack of food for consumption that yields a straightforward numeric score (Maxwell et al., 2003). According to Renzaho and Mellor,(2009) cited inMayanja et al. (2015, p. 2) the access component of food security is addressed by rCCSI, just like the household asset index and diet diversification. Because of the components that make up it, it essentially analyzes the many behaviors that households use to preserve access to sufficient and adequate food during times of food or financial resource constraint (Maxwell et al., 2008).

Furthermore, compared to the more traditional consumption, poverty and nutritional proxy measures, coping strategy indicators are best at minimizing the risk of classifying a food insecure household as food secure; they also identify sources of vulnerability (Maxwell et al., 1999). The rCCSI was developed as a context-specific indicator of food insecurity that counts up and weighs coping strategies at the household level (Maxwell et al., 2008). The rCCSI needs to follow four distinct steps (Maxwell, 1996; Maxwell et al., 2003). The first step is identifying the behavior of different coping strategies (Tefera et al., 2022) based on the right list of context specific coping strategies. According to Maxwell and Caldwell (2008), these strategies can be classified into three categories(dietary change, increased short-term food availability, and rationing food) and five universally accepted coping behaviors (Table 3).

The frequency of coping mechanisms used by households over the previous seven days was measured in the second stage. It was evident that all of these behaviors point to an issue of food poverty in the household, but not necessarily problems of the same intensity(Maxwell et al., 2003). The main concept is to assess the severity of these coping behaviors what level of food insecurity do they suggest? as well as their frequency (how frequently are they used?). Following that, each relevant coping strategy is with a universal set of severity weighted and the intensity is set in the third phase. The weights ranged from 1 to 3, with 1 denoting the household's less severe coping method and 3 denoting the most severe one (Maxwell and Caldwell, 2008). Scoring/combining frequencies and severity is the last stage of CSI. To calculate the total score

for the individual household food insecurity index, the weight/severity of each copping strategy was multiplied by the frequency of the corresponding copping strategies for all strategies, and the result was then added (Mayanja et al., 2015; Subedi and Kent, 2018; Tefera et al., 2022). Mathematically expressed as follows

$$\mathbf{CSI}=\sum(\boldsymbol{fCS1}\times\boldsymbol{wCS1})+(\boldsymbol{fCS2}\times\boldsymbol{wCS2})+\cdots\ldots\ldots+(\boldsymbol{fCSn}\times\boldsymbol{wCSn})\ldots\ldots\ldots(\mathbf{4})$$

Where *fCS= frequency of coping strategy used*

wCS = weight of coping strategy

1….n= number of coping strategy

The CSI score shows whether the level of food security in a household is deteriorating or improving (Maxwell, 1996; Maxwell et al., 2008). As a result, a higher CSI score indicates a higher amount of food insecurity. In this case, the intensity of food insecurity raises the CSI score. The choice of cutoff points has a significant impact on categorization (Maxwell et al., 2014). The rCSI scores can be classified into standardized food insecurity severity groups which are 0-3: No or Low Coping (Food Secure), 4- 9: Medium Coping (Moderately Food Insecure) and >9: High Coping (Severely Food Insecure).

Table 3: Food consumption coping strategies and Severity Weights

Category	Consumption coping strategy	Weight
Dietary change	Rely on less preferred and less expensive food	1
Increase short term food availability	Borrow food from a friend or relative	2
Rationing strategies	Limit portion size at mealtimes	1
	Restrict consumption by adults for small children to eat	3
	Reduce number of meals eaten a day	1

Source : Adapted from (Maxwell and Caldwell, 2008)

3.8.3. Multiple Linear Regression Model

3.8.3.1. Analysis Model Specification

Amongst the different econometric model estimation techniques used to identify the determinants that food security, multiple linear regression analysis was employed. It is selected because of the models relevance to deal with dependent variables that are continuous in nature. Multiple regressions are the instrument of choice when the researcher believes several independent variables interact to predict the value of a dependent variable. This model was chosen because it encompasses a variety of statistical methods used to analyze measurements on two or more variables and also because the dependent variable (food security status) was a

continuous variable. Thus, multiple regression estimation was run to find the major determinants of household food security.

The general formula for multiple regression models is given as follows

$$\text{Yi} = \beta o + \beta 1\text{X1} + \beta 2\text{X2} \ldots\ldots\ldots \beta n\text{Xn} + \varepsilon$$

Where, Yi denote the dependent variable, βo is the constant term, X1 to Xn denote the explanatory variables, βo to βn are the coefficients associated with explanatory variables and ε_i is the observable random error term or disturbance.

The multiple linear regression model was estimated using the ENTER method. Different parameters were used to observe the fitness of the model. F-test was computed to observe to the significance of the model. Diagnostic tests were also carried out to check for multicollinearity of the variables included in the model.

3.8.3.1. Variables and working hypothesis

Dependent variable of the study was food security. Food security: The household food security is continues variable representing the household's ability to maintain or maintain food need of the household. The study used food consumption score (FCS) to measure food security. The FCS of the households extends from 0 outwards.

Independent Variables: The independent variables of this study will determined and influence the status of food security. The 14 independent variables of the study, which are expected to determine the household food security, are discussed below with their hypothesis. Table 4 presents name, type and measurement of independent variables.

Sex of household head: labor plays a great role in agricultural production. Since female headed households lack work force they enforced to give their agricultural land for rent and sharecrop. In addition, males have better access to productive resources and diversify their livelihood, practice better farming experience and adapt new technology among others. Thus, sex of the household head has great impact on the food security of the household. Therefore, it was hypothesized that male headed households are more likely to be food insecure. Zero was attached with female headed and one with male headed households.

Age of the household head: the sample households mostly base their livelihood on the agriculture and related activities. As the age of the household head increased the family gains risk averting and safety skills in addition to intensifying and diversifying their productive activity. As a result the chance to become food security becomes high. By taking this in to account, it was hypothesized that the age of the household head is positively coordinated with the household to food security. The age of the household head is expressed in terms of completed years.

Marital Status refers to the social and legal standing of the household head, categorized as married or not (single, divorced, or widowed). The expectation with this variable is that married household heads generally have a higher capacity to pool financial resources, share agricultural or domestic labor, and diversify income streams compared to their single, divorced, or widowed counterparts. Accordingly, it is hypothesized that married households are more likely to be more food secured compared to households headed by single, divorced, or widowed individuals.

Educational level: this is categorical variable that shows the highest level of education that the household attained. It is categorized as not educated, informal education, primary education, secondary education and diploma and above. Literate individuals are very ambitious to get information and use it. As agriculture is a dynamic occupation, agricultural production technologies and the conservation practices are always coming up with better knowledge. If the household head is literate he will be very prone to accept extension services and any other income generating activities. So, it was hypothesized that level of education is positively correlated with resiliency of the household to food insecurity.

Household family size refers to the total number of individuals living together in a single economic unit and sharing food from the same kitchen. The expectation with this variable is that a larger household size increases the overall consumption pressure and the demand for basic resources within the home. This means that as the number of family member's increases, the volume of food and financial resources required to meet the basic nutritional needs of the entire household rises significantly. By taking this into account, it is hypothesized that households with a larger family size are more likely to be less food insecure.

Land ownership: the probability that more production gained is high for those with large agricultural land, while other production constraints remain the same. This variable represents the size of the agricultural land cultivated during the study season. The value of this variable was represented by Hectare and the hypothesis with this variable was that households with large agricultural land are more likely to be food secure while the reverse is true.

Income: this variable represents the total amount that any of the household members gained during the production season. The source of income could be from on-farm or off-farm activities. Having large amount of income creates favorable room to build the capacity of the household and food security in turn. Households that could not produce enough could afford their food through purchase if they have substantial income. Therefore, it was hypothesized that those households with more income are more likely to be food secured. The unit of measurement for this continues variable is Ethiopian Birr (ETB).

Saving: It is measured by the amount of money saved in financial institutions or at home. Households with more saving will vest their finance for procurement of food which affects food security. Thus, it was hypothesized that saving and food security have positive relation. This continues variable was measured in terms of Ethiopian Birr (ETB).

Irrigation Access: This variable refers to whether a household has the necessary infrastructure, technology, or access to a water source (such as motor pumps, canals, river diversions, or drip systems) to artificially apply water to their crops, rather than depending entirely on rain-fed agriculture. The expectation with this variable is that access to irrigation mitigates the risks associated with erratic rainfall patterns, prolonged dry seasons, and climate-induced droughts. This means that households can engage in multi-cycle cropping throughout the year, diversify into high-value crops (like vegetables and fruits), and secure a more stable, increased level of agricultural production and farm income. It is hypothesized that households with access to irrigation will be food secured.

Access to basic services (Distance to market center and Distance to all weather roads): this variable represents the proximity of the household to various services. Households nearest to these services could compliment and build their capacity easily. It was hypothesized that nearness to basic services has great possibility to be food secure. For this study school, human

and animal health center, all weather road, grain milling, drinking water source and market center were selected as basic services. Nearness to the services was measured by minutes taken to reach from their residence to each service centers by foot.

Participation in Productive Safety Net Program (PSNP): It refers to whether a household receives support (in the form of cash or food transfers) through PSNP, either through public works or direct support. The expectation with this variable is that the program acts as a critical social safety net that helps vulnerable households smooth their consumption, protect their existing assets from being sold off during crises, and bridge food gap months. This means that the transfers provide an additional layer of economic security and resource availability that would otherwise be missing. By taking this into account, it is hypothesized that households participating in the PSNP are more likely to be more to food secure compared to non-participating households.

Access to credit: This variable refers to whether a household has the opportunity to borrow financial resources from either formal institutions (such as microfinance institutions and banks) or informal sources (such as relatives, neighbors, or local moneylenders). The expectation with this variable is that access to credit relaxes financial constraints, enabling households to purchase essential agricultural inputs, invest in off-farm income-generating activities, or smooth their consumption during lean seasons. This means that credit serves as a critical financial mechanism to absorb economic shocks without forcing the household to liquidate productive assets. By taking this into account, it is hypothesized that households with access to credit are more likely tobefoodsecured.

Table 4: Summary of dependent and independent variables, codes, and expected sign

No	Variable	Measurement	Variable type	Expected sign/ hypothesis
1	Food security	Food consumption score of the household	**Dependent**	
			Independent	
2	Sex of household head	0-Female, 1-Male	Dummy	+
3	Age of a household head	Year	Continuous	+
4	Family size of a household	The number of HH members	Continuous	+
5	Education of HH head	0-Not educated, 1-Informal education, 2-Primary education, 3-Secondary education, 4-Diploma and above	Categorical	+
6	Marital status of HH head	0-No (Single, Divorced, Widowed), 1-Yes(Married)	Categorical	+-
7	Distance to market center	Time taken to reach to nearest markets in Minutes	Continues	-
8	Distance to all weather roads	Time taken to reach to nearest all weather roads in Minutes	Continues	-
9	Land size	The size of agricultural land	Continues	+
10	Livestock ownership	Livestock ownership in terms of Tropical livestock unity (TLU)	Continues	+
11	Income	Amount of income gained per annum in Ethiopian Birr (ETB)	Continues	+
12	Saving	Amount of money saved in financial institutions or at home measured in Ethiopian Birr (ETB)	Continues	+
13	Participation in Productive Safety Net Program (PSNP)	Being engaged in any of PSNP activities (0-No, 1-Yes)	Dummy	+
14	Access to credit	0-No, 1-Yes	Dummy	+
15	Irrigation Access	0-No, 1-Yes	Dummy	+

Source: Own source (2026)

3.9. Ethical Considerations

In addition to validity, ethical research practices were observed. The study has used the primary data collection including household survey. Therefore, it was mandatory to have an ethical approval about the collection and use of the data from the concerned governmental body. The institutional review board (IRB) of Bahir Dar University, Institute of Disaster Risk Management and Food Security Studies assesses and approves the research methodology of the study. In addition, oral consents were found for household survey, key informants interview and focus group discussion participants. Data of the study were used in compliance to the ethical standards of a scientific study. These measures helped to improve the reliability of responses by encouraging honest and accurate information sharing.

CHAPTER 4: RESULTS AND DISCUSSION

4.1. Demographic and Socio-economic Characteristics of the Respondents

4.1.1. Sex of Household Head by Agro-Ecological Zone

Table 5 outlines the cross-tabulation between the sex of the household head and the three distinct agro-ecological zones (*Dega*, *Kolla*, and *Woigna Dega*) sampled within Meket Woreda. Out of the total 286 sampled households, the vast majority (73%, n = 209) were male-headed households, while 27% (n = 77) were female-headed households. This dominant proportion of male leadership is consistent across all three agro-ecological settings. A chi-square test result indicates that there is no statistically significant association between the sex of the household head and the agro-ecological zone they reside in within Meket Woreda. In other words, the spatial distribution of female- and male-headed households across the highlands, midlands, and lowlands is statistically homogenous.

Table 5: Sex and agro-ecology of the households (n=286)

Sex	Dega		Kolla		Woigna dega		Total		Chi square test
	Number	Pct	Number	Pct	Number	Pct	Number	Pct	
Female	27	28%	20	28%	30	26%	77	27%	0.165
Male	70	72%	52	72%	87	74%	209	73%	
Total	97	100%	72	100%	117	100%	286	100%	

Source: Own production (2026)

4.1.1. Educational Status

The descriptive results reveal that formal human capital is low among household heads across the study area. Out of the 286 sampled households, the largest single group is comprised of not educated individuals, accounting for 36.0% (n = 103) of the total sample. This is followed by those with basic informal education (literacy acquired outside the formal school system, such as religious or adult education) at 32.2% (n = 92), and primary education at 28.0% (n = 80). Tiers of higher education are exceptionally rare among smallholder leaders in the woreda: only 2.8% (n = 8) achieved a secondary education and a mere 1.0% (n = 3) held a diploma and above.

When evaluated within their respective agro-ecology, the internal educational profiles show relatively consistency. To determine whether the educational status of a household head is structurally associated with a specific agro-ecological location, a Pearson Chi-Square test of

independence was performed. The test yielded a Chi-square value of 11.144 with a corresponding p-value of 0.193. Because the p-value is greater than the standard 5% significance level ($p > 0.05$), we fail to reject the null hypothesis. This statistically proves that there is no significant association between a household head's educational attainment and the agro-ecological zone they live in. Educational deprivation is a uniform, structural challenge spanning the entirety of Meket Woreda.

Table 6: Sex and agro-ecology of the households (n=286)

Sex	Dega		Kolla		Woigna dega		Total		Chi square test
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	
Diploma and above	1	1%	0	0%	2	2%	3	1%	Chi-Square Statistic: 11.1449 P-value: 0.1936
Informal education	25	26%	26	36%	41	35%	92	32%	
Not educated	33	34%	27	38%	43	37%	103	36%	
Primary education	32	33%	19	26%	29	25%	80	28%	
Secondary education	6	6%	0	0%	2	2%	8	3%	
All	97	100%	72	100%	117	100%	286	100%	

4.1.3. Marital Status

Out of the 282 responding households, the overwhelming majority of household heads are married, accounting for 75.2% (n = 212) of the sample. This is followed by widowed household heads at 13.5% (n = 38), divorced heads at 9.2% (n = 26), and single individuals at a low 2.1% (n = 6). To check if marital status is structurally associated with a specific agro-ecological zone, a Pearson Chi-Square test was applied. The test produced a Chi-square value of 1.938 with an associated p-value of 0.925. Because the p-value is far above the standard significance threshold ($p > 0.05$), the null hypothesis cannot be rejected. This indicates that there is no statistically significant association between the marital status of the household head and their agro-ecological zone. The marital structure of smallholders is uniform across the entire woreda landscape.

Table 7: Marital status and agro-ecology of the households (n=286)

Marital Status	Dega		Kolla		Woigna dega		Total		Chi square test
	Number	Pct	Number	Pct	Number	Pct	Number	Pct	
Divorced	7	7%	8	11%	11	10%	26	9%	Chi-Square Statistic: 1.938 P-value: 0.925
Married	73	76%	54	75%	85	75%	212	75%	
Single	4	4%	1	1%	1	1%	6	2%	
Widowed	12	13%	9	13%	17	15%	38	13%	
All	97	100%	72	100%	117	100%	286	100%	

4.1.4. Age of the Household Heads

The descriptive baseline shows that household heads in the midland Woigna dega zone exhibit the highest mean age (M=51.16 years, SD=12.44), followed closely by the lowland Kolla zone (M=50.39 years, SD=11.48), while the highland Dega zone presents the youngest cohort on average (M=48.67 years, SD=11.25). Despite these marginal descriptive differences and a broad demographic span encompassing household heads from as young as 19 years old to as advanced as 85 years old, the underlying age distributions across the three zones remain structurally uniform. To formally test for group differences, a One-Way Analysis of Variance (ANOVA) was executed, yielding an F-statistic of 1.1582 and a corresponding P-value of 0.3155. However, there is no statistically significant difference in the mean age of household heads across the highland, midland, and lowland agro-ecological environments within the study area.

Table 8: Age of the household head and agro-ecology of the households (n=286)

AEZ	count	Mean	std	min	25%	50%	75%	max	One Way Anova
Dega	97	48.67	11.25	20	43	48	55	75	F-statistic: 1.1582 P-value: 0.3155
Kolla	72	50.39	11.48	20	45	50	58	78	
Woigna dega	117	51.16	12.44	19	45	50	60	85	

4.1.5. Household size

As presented in Table 8, an assessment of household size across the three agro-ecological zones (n=286) indicates minor variations in descriptive metrics that ultimately prove to be statistically non-significant. Descriptively, the lowland (*Kolla*) zone exhibits the largest average household

size (M=4.28, SD=1.78), followed by the midland (*Woigna dega*) zone (M=4.04, SD=1.62), while the highland (*Dega*) zone records the lowest average size (M=3.78, SD=1.66). Despite these slight fluctuations in mean values, all three geographic zones share a uniform median (50%) household size of 4 members, as well as identical absolute ranges spanning from a minimum of 1 member to a maximum of 8 members. To evaluate whether these environmental variations correspond to meaningful differences in family structures, a One-Way Analysis of Variance (ANOVA) was conducted. The inferential test yielded an F-statistic of 1.8337 and a corresponding P-value of 0.1617. Because the P-value is well above the conventional significance threshold (α=0.05), the null hypothesis is retained. This leads to the conclusion that there is no statistically significant difference in household size across the highland, midland, and lowland agro-ecological zones within the study area.

Table 9: Household size and agro-ecology of the households (n=286)

AEZ	count	mean	std	min	25%	50%	75%	max	One Way Anova
Dega	97	3.78	1.66	1	3	4	5	8	F-statistic: 1.8337 P-value:0.1617
Kolla	72	4.28	1.78	1	3	4	6	8	
Woigna dega	117	4.04	1.62	1	3	4	5	8	

4.1.7. Land Ownership

As presented in Table 9, an analysis of land ownership across the three agro-ecological zones (n=286) reveals distinct geographical variations that are statistically significant. Descriptively, households in the lowland (*Kolla*) zone possess the highest average landholding size (M=2.19, SD=0.97), followed closely by those in the midland (*Woigna dega*) zone (M=2.08, SD=1.12). Conversely, households in the highland (*Dega*) zone exhibit the smallest average landholding size (M=1.77, SD=1.02). This pattern aligns with documented agricultural realities in rural Ethiopia, where higher population density and rugged topography in highland zones frequently accelerate land fragmentation, whereas lowland areas often permit slightly larger individual holdings due to expansive terrain. While landless households (minimum of 0) are observed across all environments, the upper quartiles highlight a tighter land constraint in the highlands, where the 75th percentile rests at 2 units compared to 3 units in both the midland and lowland zones. To determine the statistical validity of these variances, a One-Way Analysis of Variance (ANOVA) was executed. The test yielded an F-statistic of 3.8210 and a corresponding P-value of 0.0230. Because this P-value is below the standard significance threshold (α=0.05), the null

hypothesis is rejected. This provides strong empirical evidence that land ownership levels significantly differ across the agro-ecological zones within the study area, confirming that a household's ecological location is a meaningful determinant of its physical asset base.

Table 10: Land ownership and agro-ecology of the households (n=286)

AEZ	count	mean	std	min	25%	50%	75%	max	One Way Anova
Dega	97	1.77	1.02	0	1	2	2	5	F-statistic: 3.8210
Kolla	72	2.19	0.97	0	2	2	3	4	P-value: 0.0230
Woigna dega	117	2.08	1.12	0	2	2	3	4	

4.1.7. Livestock Ownership

As presented in Table 11, an empirical evaluation of livestock ownership across the three distinct agro-ecological zones (n=286) demonstrates substantial and highly significant variations. Descriptively, households residing in the lowland (*Kolla*) zone hold the largest average livestock assets (M=2.19, SD=0.97), followed closely by those in the midland (*Woigna dega*) zone (M=2.08, SD=1.12), while the lowest mean livestock ownership is recorded in the highland (*Dega*) zone (M=1.77, SD=1.02). This trend closely aligns with traditional mixed agricultural dynamics in rural Ethiopia, where lowland communities frequently emphasize livestock accumulation as a critical strategy to diversify livelihoods and mitigate risks associated with moisture stress and recurrent crop failures. The distribution percentiles reflect this divergence, revealing that the 75th percentile of highland households caps at 2 livestock units, whereas the upper quartiles in both the midland and lowland environments reach 3 units. To test the statistical significance of these environmental variations, a One-Way Analysis of Variance (ANOVA) was executed. The inferential test yielded an F-statistic of 9.2893 and a highly significant P-value of 0.0001. Because this P-value falls well below the standard significance threshold (α=0.01), the null hypothesis is rejected. This provides robust empirical evidence that livestock asset distribution is significantly differentiated by agro-ecological environment, confirming that a household's ecological location exerts a powerful influence on its livestock wealth and capacity for asset accumulation.

Table 11: Livestock ownership and agro-ecology of the households (n=286)

AEZ	count	mean	std	min	25%	50%	75%	max	One Way Anova
Dega	97	1.73	1.71	0.00	0.07	2.00	3.00	7.36	F-statistic: 11.2545
Kolla	37	3.46	1.87	0.00	2.30	3.48	4.35	8.74	P-value: 0.0000
Woigna dega	152	2.66	2.28	0.00	0.10	2.72	4.06	10.16	

4.2. Income Source of the Households

Household income is an essential indicator of livelihood sustainability and a primary determinant of food security. In rural economies like Meket Woreda, the size, diversity, and composition of income streams dictate a household's capacity to purchase food, invest in agricultural inputs, and withstand environmental shocks. Table 12 summarizes the annual income portfolio of the sampled households, including the mean, maximum value, standard deviation, and percentage contribution of each stream.

Table 12: Source, amount and percent share of household's income

Type of Income	**Mean**	**max**	**std**	**% of Income Contribution**
Income Crop trade (Cereals, pulses, fruits, etc.)	1713	40000	4317	11%
Income sale of own livestock and bi products/butter (Got, sheep, chicken, egg etc.)	1906	45000	4779	12%
Income obtained from Food aid sales, PSNP	2131	12000	2520	14%
income obtained from Sales of firewood and/or charcoal, Forest products	1110	30000	3214	7%
Income obtained from Handcrafting (e.g. weaving/spinning, pottery, metal works, etc.)	258	38000	2360	2%
Income obtained from agricultural /nonagricultural wage labor (e.g. construction, Carpentry)	773	40000	3456	5%
Income obtained from sale of shop local food and drinks	761	50000	5067	5%
Income obtained from Service delivery (haircut, animal loading etc.,)	598	25000	2581	4%
Income obtained from remittance	5923	70000	10431	38%
Income obtained from civil servant household members	382	40000	3100	2%
Other income	643	14000	1702	4%
Total Income	15555	95000	15438	100%

Source: Own production (2026)

The total average annual income for the sampled households stands at 15,555 ETB. However, the table reveals a remarkably high standard deviation of 15,438 ETB, coupled with an income

range extending up to a maximum of 95,000 ETB. This high standard deviation relative to the mean confirms severe income dispersion and economic inequality within the surveyed community; while a few households have successfully capitalized on high-return income streams, a significant portion of the population survives on minimal financial returns.

When looking at individual income categories, remittances are the single largest contributor to the household economic portfolio, accounting for 38% of the total income with a mean of 5,923 ETB. Surprisingly, the second largest income source is food aid sales and the Productive Safety Net Programme (PSNP), contributing 14% (mean of 2,131 ETB). Traditional agricultural activities occupy a secondary position in terms of direct cash generation. Livestock and bi-product sales generate 12% of income (mean of 1,906 ETB) and crop trade contributes 11% (mean of 1,713 ETB).

The remaining 25% of the household income portfolio is fragmented across various survivalist off-farm and non-farm endeavors. These include the sale of firewood and charcoal (7%), agricultural and non-agricultural wage labor (5%), operating small shops or selling local food/drinks (5%), service delivery like animal loading or haircuts (4%), handcrafting (2%), civil service salaries (2%), and miscellaneous other income sources (4%).

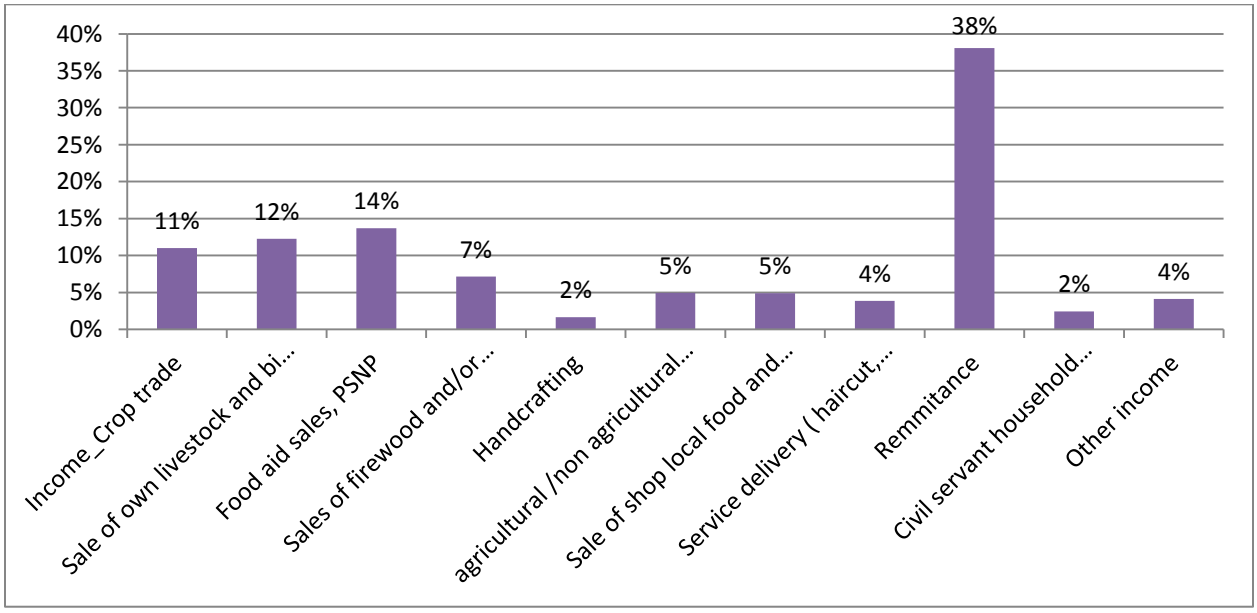

Figure 3: Percent income share of the livelihoods

Source: Own production (2026)

The dominance of remittances (38%) is an extraordinary finding that underscores the role of out-migration as a primary structural coping mechanism in North Wollo. Due to severe land scarcity, steep terrain topography, and recurrent droughts in the *Kolla* and *Dega* zones, local agricultural growth is physically constrained. Consequently, households actively deploy young family members via rural-to-urban migration (e.g., to Addis Ababa or regional towns) or international migration (primarily to Gulf countries) to send money home. As noted by Tefera and Cho (2023) in their analysis of Amhara Region household dynamics, remittances serve as a crucial cash buffer that keeps vulnerable rural households afloat, directly financing food consumption during the lean season and decoupling household purchasing power from localized crop failures.

A striking revelation in the data is that income derived from food aid sales and the PSNP (14%) outpaces the income generated from direct crop trade (11%). This pattern is a classic diagnostic indicator of a structurally food-insecure agricultural system. It indicates that production from crop cultivation is largely insufficient to create marketable surpluses; households consume what little they harvest and depend heavily on institutional safety nets to provide baseline food or cash liquidity. According to Berhane et al. (2020), while the PSNP successfully prevents outright starvation and asset depletion in moisture-stressed districts of northern Ethiopia, a household income share from safety nets that exceeds crop commercialization signals that local farming remains locked in a low-productivity subsistence trap.

The fact that livestock sales (12%) contribute more to cash income than crop trade (11%) aligns with the classic economic behavior of mixed smallholder systems in Ethiopia. Crops in Meket Woreda are grown primarily for direct home consumption to ensure basic survival. Livestock, conversely, acts as the household's bank account. When liquid cash is required for non-food emergency expenses, land taxes, or grain purchases, households selectively sell small ruminants (goats/sheep) or poultry. This behavior supports findings by Abebe et al. (2024), who observed that in drought-prone highlands, livestock income acts as an indispensable stabilizing force against volatile crop yields caused by erratic seasonal rainfall.

The minor shares captured by activities like handcrafting (2%), wage labor (5%), and service delivery (4%) point to a lack of high-value non-farm opportunities in Meket Woreda. Instead, the 7% contribution from selling firewood and charcoal indicates that households are forced to engage in environmentally degrading, low-return coping strategies when primary agriculture

fails. As established by Worku et al. (2025), this type of survivalist diversification yields low economic returns (manifested in your table's low mean values for labor and crafts), which helps explain why income dispersion remains so high and poverty persists despite households working multiple jobs.

4.2. Hazards/Risks of the Study Area

4.2.1. Frequency of shocks

Figure 4 illustrates the distribution of households according to the frequency of environmental and economic shocks they experienced over the specified recall period. The result revealed that 100% of your sampled households (N = 286) have experienced at least one shock. Not a single household in your study area reported zero shocks, which is a powerful statistical indicator of severe, systemic vulnerability in Meket Woreda.

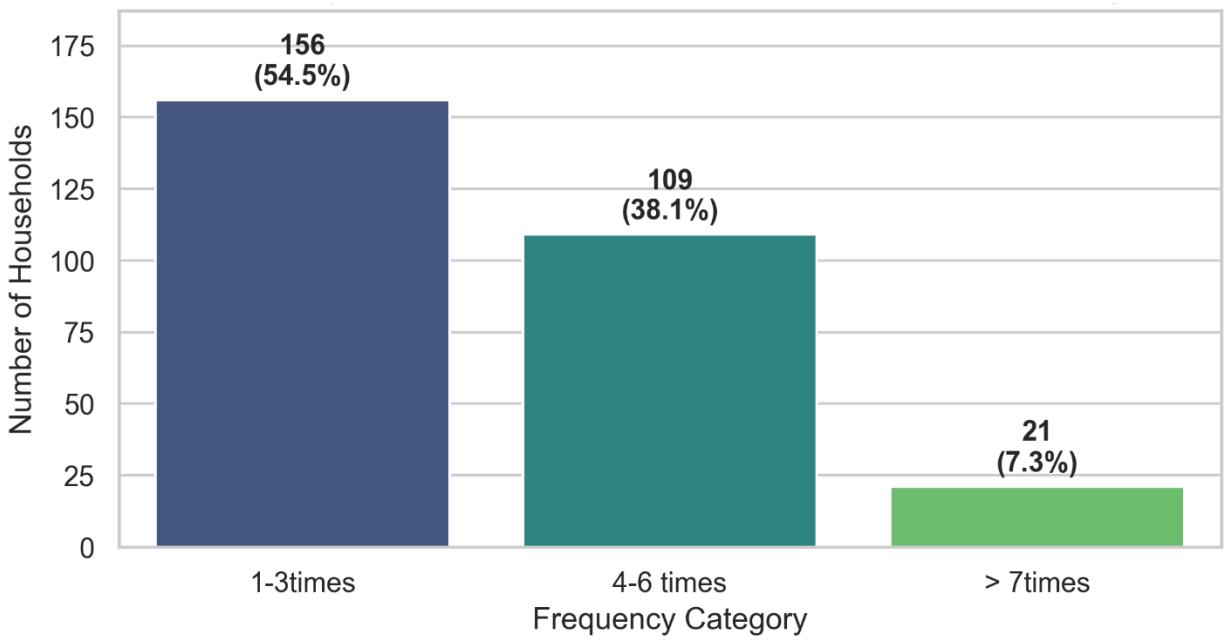

Figure 4: Frequency of Shocks with Household Counts and Percentages

Source: Own production (2026)

The result shows that shock exposure is universal among smallholder farmers in Meket Woreda. Out of the total 286 surveyed households, the largest proportion fell into the low-to-moderate shock category, with 54.5% (n = 156) experiencing 1 to 3 shocks. However, a highly concerning portion of the sample faces chronic, repetitive disruptions. More than one-third of the

households, 38.1% (n = 109), reported experiencing a high frequency of 4 to 6 shocks. Furthermore, a severely vulnerable group consisting of 7.3% (n = 21) of the sampled population endured an extreme frequency of more than 7 shocks within the same timeframe. Cumulatively, 45.4% of the smallholders in the study area are subjected to 4 or more distinct shock events, signaling that multi-shock environments are a structural norm rather than an exception in this region.

Experiencing a single shock is challenging for a smallholder, but experiencing 4 or more distinct shock events (as seen in 45.4% of households) creates a compounding crisis. In rural households, the first shock is typically met with basic, non-destructive coping mechanisms, such as adjusting dietary intake or dipping into small cash savings. However, when a second, third, or fourth shock hits in quick succession, these initial safety buffers are overwhelmed.

As argued by Dercon et al. (2021), recurrent shocks force smallholder families into destructive asset-depletion strategies. To survive, households are compelled to sell off their primary productive capital such as breeding livestock, draft oxen, or tools or lease out their land through disadvantageous sharecropping arrangements, severely undermining their future agricultural capacity.

The 38.1% of households enduring 4 to 6 shocks and the 7.3% enduring more than 7 shocks point toward a classic "vulnerability trap. When the frequency of shocks is high, this crucial recovery window disappears. Smallholders are struck by a subsequent shock while still reeling from the effects of the previous one. Research by Weldegebriel and Prowse (2024) in the Amhara Region indicates that this constant state of emergency prevents households from shifting into forward-looking investments, such as buying high-yield fertilizer inputs or improved seed varieties. Instead, it traps them in a cycle of survivalist behavior focused strictly on immediate caloric defense.

These findings provide the missing structural explanation for the income trends analyzed in your previous section. In Section 4.W, your data revealed that Productive Safety Net Programme (PSNP)/food aid and remittances make up 52% of the aggregate household income portfolio, overshadowing direct crop trade. The high frequency of shocks continuously destabilizes local crop harvests and livestock health. Because smallholders face regular shocks, their local

agricultural yields remain volatile and insufficient for long-term food security. As a direct result, families must rely on continuous cash transfers from migrated relatives (remittances) and institutional safety nets (PSNP) to buffer against these recurrent disruptions.

4.2.2. Reasons for Shock Vulnerability

Understanding the frequency of shocks is only the first step in vulnerability mapping; analyzing *why* smallholders remain susceptible to these shocks is crucial for designing targeted resilience policies. This section examines the repetitive nature of shocks hitting households in Meket Woreda alongside the underlying institutional, environmental, and asset-based constraints that drive their vulnerability.

To understand the root causes of this high susceptibility, households were asked to identify the primary reason for their vulnerability to these shocks. The responses are distributed across five main structural drivers. Climate variability and change was identified by 24.8% (n = 71) of respondents as the leading cause. Lack of resources for timely action was cited by 24.1% (n = 69) of households, reflecting severe liquidity and capital constraints. Then, lack of early warning information was reflected by 22.7% (n = 65), pointing to significant institutional information gaps. In addition, inadequate technological adoption/use was reported by 18.9% (n = 54) as a major barrier to shock mitigation. Finally, limited livelihood assets was responded by 9.4% (n = 27) of the households.

Climate variability and change (24.8%) ranks as the top trigger of vulnerability, which is expected in the rain-fed farming systems of northeastern Ethiopia. However, climate exposure alone does not automatically result in household food insecurity; rather, it is the combination of environmental shocks with institutional gaps that creates severe crises. The fact that 22.7% of smallholders lack early warning information indicates that meteorological forecasts and climate advisory services are not effectively reaching local communities. Without reliable, localized early warning updates, smallholders cannot adjust their agricultural calendars, shift to short-duration crop varieties, or implement destocking strategies before a drought or frost hits. As supported by Gebrehiwot and van der Veen (2020), information asymmetry in rural Amhara regularly turns predictable weather anomalies into severe economic shocks for smallholders.

Even when smallholders anticipate a coming shock, their capacity to act is severely restricted. A substantial 24.1% of households state that a "lack of resources for timely action" is their primary source of vulnerability. In Meket Woreda, where average household incomes are heavily reliant on external safety nets and remittances, liquid savings are minimal. When a shock occurs such as a sudden spike in food prices or an outbreak of crop pests farmers lack the financial savings needed to purchase alternative food supplies or pest treatments immediately. This resource scarcity explains why 45.4% of households end up stuck in a high-frequency shock cycle: they lack the initial capital to protect their livelihoods during the first shock, leaving them highly vulnerable to subsequent shocks. This aligns with Dercon's (2021) asset-erosion theory, which notes that poor households are often forced to use short-term survivalist coping mechanisms that undermine long-term recovery.

Inadequate technological adoption (18.9%) is another critical driver keeping smallholders vulnerable. Agricultural production in the woreda remains dominated by traditional practices. Modern, risk-mitigating inputs such as small-scale irrigation schemes, drought-tolerant crop seeds, and modern storage facilities are underutilized. According to Kassie et al. (2020), adopting improved agricultural technologies acts as an effective defense against climate volatility. When smallholders face barriers to adopting these tools whether due to high costs, limited local availability, or inadequate agricultural extension services their production remains highly sensitive to minor environmental variations.

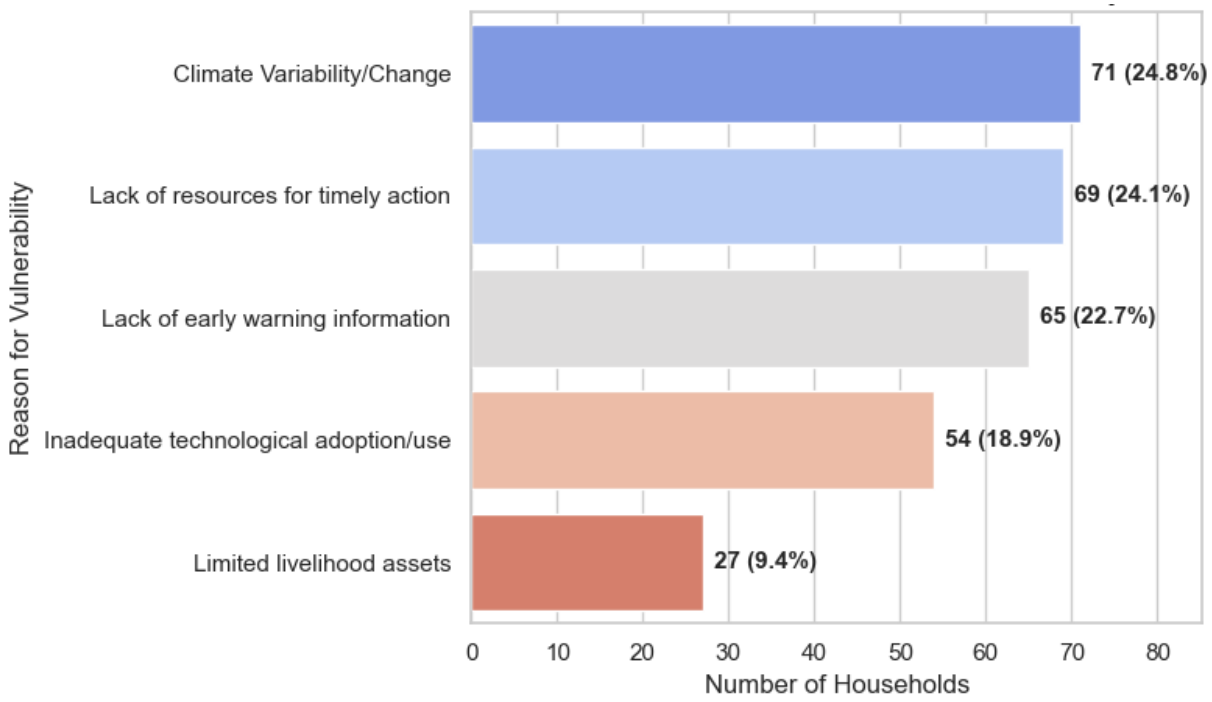

Figure 5: Main Reasons for Shock Vulnerability

Source: Own production (2026)

4.3. Food Insecurity of the Households

The empirical metrics outline a household food consumption profile heavily dominated by carbohydrates and plant proteins, while severely lacking essential micronutrients and animal-sourced foods. Staple carbohydrates form the absolute foundation of the local diet, with Cereals exhibiting an overwhelming mean consumption frequency of 6.9 days out of a maximum of 7. Plant proteins are also consistently consumed, with Pulses reaching a high mean frequency of 6.4 days. Notably, pulses are the only food group where the minimum reported consumption is 1 day, showing that every single household in the sample consumed pulses at least once during the recall week. Flavor enhancers (Condiments) also appear frequently, averaging 5.5 days.

A stark transition is visible when examining lipids and sweeteners. Oil and fat items are consumed an average of 4.2 days per week, though a high standard deviation points to substantial differences in purchasing power among households. Similarly, Sugar and honey inputs show an intermediate mean consumption frequency of 3.3 days. The most alarming finding is the exceptionally low intake of fresh produce and animal proteins. Vegetables and

leaves are consumed on average only 2.0 days a week, while Root and tubers (1.2 days) and Fruits (1.0 day) are rarely included in household meals.

Most critically, animal-sourced proteins are virtually absent from typical weekly diets. The mean consumption frequency for Meat and eggs drops to a negligible 0.8 days, while Milk and milk products record the absolute lowest average at just 0.5 days per week. For both animal-product categories, the minimum baseline is 0 days, revealing that a vast majority of smallholder families did not consume any meat, eggs, or dairy products during the entire 7-day period.

Table 13: Food consumption of the households across the past 7 days

Food Group	**Mean**	**Min**	**Max**	**Std**
Cereals	6.9	0	7	0.6
Pulses	6.4	1	7	1.0
Vegetables and leaves	1.2	0	7	1.3
Fruits	2.0	0	7	1.6
Meat&Eag	1.0	0	7	1.0
Milk and milk products	0.8	0	7	1.3
oil and fat	0.5	0	7	1.2
Sugar/honey	4.2	0	7	2.4
Condiments	3.3	0	7	2.3

Source: Own production (2026)

When looking at the overall sample mean (Asfaw et al.) = 24.2), the surveyed households collectively suffer from insecure dietary access. When disaggregated by agro-ecological zone, the descriptive mean scores display a distinct geographical gradient, though they remain bound within the same food security threshold: Woigna dega (Temperate Midland) recorded the highest descriptive mean score which is 25.3. On the other hand, Kolla (Warm Lowland): Occupies the middle position with a mean score of 24.6. In addition, Dega (Cool Highland): Recorded the lowest descriptive mean score (22.5). Critically, the mean score for every single agro-ecological zone falls within the ‘Borderline’ food consumption category. This indicates that regardless of altitude or climate zone, the typical household in the study area relies heavily on staples and lacks consistent, daily access to micronutrient-dense food groups such as animal source proteins, fruits, and pulses. The One way ANOVA result shows that there is no statistically significant relationship between FCS and agro-ecological location of the rural households (F-statistic: 1.8518, P-value: 0.1588).

Table 14: Food consumption score of the households across the agro-ecology zones

AEZ	count	mean	std	min	25%	50%	75%	max	One Way Anova
Dega	97	22.5	9.0	2.5	17.5	21	24.0	59.5	F-statistic: 1.8518
Kolla	72	24.6	11.6	2	14.9	24	29.1	56.5	P-value: 0.1588
Woigna dega	117	25.3	11.2	2	18.5	23	30.0	68	

Source: Own production (2026)

According to the standardized World Food Programme (WFP) thresholds, household food consumption status is classified into three distinct categories based on nutrient density and dietary frequency: Poor (< 21), Borderline (21.5 to 35), and Acceptable (> 35). Table 14 reveals a severe state of food insecurity across the entire study area. A staggering 87% of all surveyed households have inadequate food consumption, with 44% classified as Poor and 43% classified as Borderline. Only a small minority (13%) have managed to maintain an Acceptable food consumption status.

Dega (Highland Zone) ecological zone stands out as the most severely affected by extreme food insecurity. Over half of its households (53%) fall into the Poor category, while only 10% achieve an Acceptable diet. High-altitude constraints such as cold stress/frost, acute soil degradation, and tiny, fragmented land plots severely limit crop diversity here, locking families into high-vulnerability profiles.

Descriptively, the Kolla (Lowland Zone) show a slightly lower prevalence of the "Poor" status (36%) compared to the other zones, but they feature the highest concentration of Borderline households (49%). This suggests that while agro-pastoral adaptations or food assistance floor-effects might prevent total dietary collapse for some, the vast majority are still hovering right on the edge of severe deprivation. Finally, despite being traditionally labeled as the agricultural "sweet spot" of rural Ethiopia, the Woigna dega (Midland Zone) still show deep vulnerability, with 43% Poor and 44% Borderline households.

Table 15: Food security status of the households based on food consumption score (FCS)

FCS Category	Dega		Kolla		Woigna dega		Total	
	Number	Pct	Number	Pct	Number	Pct	Number	Pct
Acceptable	10	10%	11	15%	15	13%	36	13%
Borderline	36	37%	35	49%	52	44%	123	43%
Poor	51	53%	26	36%	50	43%	127	44%
All	97	34%	72	25%	117	41%	286	100.00%

Source: Own production (2026)

The high prevalence of food insecurity observed in this study, where a striking 87% of households fall into the poor or borderline food consumption categories, strongly aligns with contemporary empirical findings across vulnerable rural landscapes in Ethiopia. For instance, recent macro-regional assessments recorded household food insecurity rates ranging between 79% and 88% in the agrarian watersheds of South Wollo and the East Hararghe Zone, reflecting a deep-seated crisis within rural communities (Weldearegay and Assefa, 2021a). This overwhelming commonality confirms that the structural pillars of rural food security in Ethiopia are undergoing severe strain. As noted by Asfaw et al. (2021), widespread dietary deficiencies in these regions are increasingly driven by cross-cutting macro-shocks such as intense food price inflation, skyrocketing costs of agricultural inputs (seeds and fertilizers), and shrinking per capita landholdings which drastically diminish household purchasing power and subsistence capabilities regardless of geographic location.

Crucially, the statistical convergence of food insecurity across the studied agro-ecologies (as indicated by the non-significant inferential test) challenges foundational literature but matches recent shifts in Ethiopian food systems research. Traditionally, pioneering agro-ecological frameworks (Hurni, 1998) and subsequent case studies posited that the temperate midlands (*Woigna dega*) offer a significant climatic buffer and better dietary outcomes compared to the moisture-stressed lowlands (*Kolla*) or frost-prone highlands (*Dega*). However, the lack of a statistically significant difference in this study corroborates the "homogenization of vulnerability" thesis increasingly observed in contemporary literature (Worku and Tadesse, 2024). These scholars argue that modern, erratic climate variability characterized by shortened rainy seasons and unpredictable dry spells along with poorly integrated local food markets, has effectively decentralized ecological privilege. Consequently, the biophysical advantages traditionally associated with the midlands are being systematically overwhelmed by systemic

shocks, smoothing out spatial differences and leaving households across all altitudes uniformly vulnerable to borderline and poor food consumption.

Despite this overarching statistical uniformity, a closer examination of the descriptive nuances reveals distinct, ecologically localized pathways into food insecurity that mirror broader national trends. The finding that the Dega zone exhibits the highest concentration of severely food-insecure households (53% in the Poor category) directly aligns with research by (Amare and Bewket, 2025), who highlight that high-altitude Ethiopian highlands face extreme land fragmentation and severe topsoil erosion, forcing reliance on a dangerously narrow crop matrix (primarily barley and wheat) that restricts dietary diversity. Conversely, the dominant concentration of Kolla households in the Borderline category (49%) reflects the classic agro-pastoral profile documented in southern and lowland margin studies. In these lowland settings, seasonal access to livestock products like milk and meat often provides a minor nutritional floor that prevents total dietary collapse into the "Poor" category, yet keeps households hovering precariously on the borderline threshold (Nega et al., 2025). This indicates that while the end-state of food insecurity appears uniform across the dataset, the underlying biophysical triggers remain distinctly localized, suggesting that regional safety-net interventions must still tailor their mitigation strategies to match these unique environmental pressures.

4.4. Determinants of Food Insecurity

4.4.1. Multicolinarity Test Results

The problem of multicollinearity among explanatory variables was checked by using variance inflation factor (VIF) and contingency coefficient. The variance inflation factor (VIF) for continuous variables and contingency coefficient test for discreet variables provides evidence that there is no strong multicollinearity problem among explanatory variables. The VIF for each continuous explanatory variable was below 10 and the contingency coefficient for degree of association between dummy variables was below 0.75 indicating no strong relationship between explanatory variables. Thus, there was no need to drop explanatory variables from the estimation model.

4.4.2. Evaluation of Model Fitness and Goodness-of-Fit Diagnostics

Prior to evaluating the standalone coefficients of individual explanatory variables, the global performance, specification correctness, and mathematical validity of the Ordinary Least Squares (OLS) regression model must be established. The diagnostic metrics extracted from the updated estimation output confirm a highly stable and statistically sound model structure.

The F-statistic assesses the global null hypothesis (H_0) that all regression coefficients assigned to the explanatory variables are simultaneously equal to zero, meaning the model offers no predictive improvement over a simple sample mean. The model yields a joint F-statistic of 6.650. The corresponding probability value is $3.92X\ 10^{-15}$ which is less than $p < 0.000$. This provides definitive empirical proof that the independent variables included in the model are jointly significant in explaining variations in household Food Consumption Scores (FCS). The model possesses strong structural validity and is completely free from random specification bias.

The R-squared (R^2) value is 0.346. This metric indicates that the model accounts for 34.6% of the total variance observed in household Food Consumption Scores across the sample population. On the other hand, Adjusted R-squared value is 0.294. Because adding any variable to an model mechanically inflates the raw R^2, the adjusted metric penalizes the score based on the model's 21 degrees of freedom. The adjusted value of 29.4% confirms that even after accounting for model complexity, a highly robust proportion of dietary variance is explained by the chosen predictors.

An R^2 value of 34.6% is entirely normal, highly acceptable, and typical for cross-sectional household survey data in micro-econometrics and agricultural economics (Wooldridge, 2015). Unlike laboratory sciences where physical systems yield R^2 values exceeding 90%, human dietary decisions and consumption behaviors are influenced by thousands of unobservable or unmeasurable factors (such as intra-household food distribution, cultural preferences, individual taste, and highly localized micro-shocks). In household-level observational studies, an R^2 ranging between 0.20 and 0.40 indicates a robust, highly respectable fit (Gujarati, 2009).

4.4.3. Model Results

To identify the underlying household-level determinants of food security, Multiple Linear Regression was executed with the continuous Food Consumption Score (FCS) as the dependent variable (N = 286). The model allows isolating the impacts of specific socioeconomic, demographic, and institutional factors while controlling for geographic differences. Out of the variables modeled, nine distinct factors emerged as statistically significant determinants of Food Consumption Score (FCS).

Positively Significant Determinants (Drivers of Food Security)

Household Size (HH size): (□ = 1.2469, p = 0.005). Highly significant at the 1% level. Controlling for other factors, each additional family member improves the household FCS by 1.25 points. This confirms our working hypothesis that in labor-constrained agrarian systems, larger household sizes serve as vital pools of agricultural and off-farm labor, boosting overall dietary diversity and food acquisition capacity.

Livestock Ownership (TLU): (□ = 0.8434, p = 0.035$). Significant at the 5% level. An increase of one Tropical Livestock Unit scales up the household FCS by 0.84 points. Livestock function both as liquid capital buffers to mitigate seasonal stress and as direct sources of nutrient-dense food groups (milk, meat, eggs).

Total Income (□ = 0.0001, p = 0.013) & Savings (□ = 0.0003, p = 0.015): Both financial indicators are significantly positive at the 5% level. An annual income increase of 10,000 ETB yields a 1.0-point increase in FCS, while an increase of 10,000 ETB in cash savings elevates the expected FCS by 3.0 points. This reflects enhanced economic purchasing power in local food markets.

Access to Irrigation (AccessIrrigation_Yes): (□= 3.5638, p= 0.015$). Households with irrigation facilities enjoy a 3.56-point advantage in their FCS over rain-dependent households. Irrigation allows multi-cycle cropping, mitigates climate shocks, and promotes production of cash crops or fresh vegetables.

Access to Credit (Access to credit...): (□ = 2.9117, p = 0.026$). Securing formal or informal credit links to a 2.91-point bump in FCS. Credit relaxes capital constraints, letting households buy farm inputs on time or buy consumer food during lean seasons without liquidating key assets.

Negatively Significant and Counter-Intuitive Determinants

PSNP Beneficiary Status (PSNP beneficiary_Yes): (□= -3.7789, p = 0.002). Highly significant at the 1% level with a negative direction. This is a clear indicator of **Targeting Endogeneity Bias**. Because the Productive Safety Net Programme purposefully enrolls the poorest, most structurally food-insecure households, the negative coefficient demonstrates that the program successfully reaches its intended, lowest-consuming target audience rather than showing that the safety net reduces consumption.

Marital Status (Maritalstatus_Married): (□= -4.5471, p = 0.042). Married household heads exhibit an FCS that is 4.55 points lower than non-married counterparts (single, divorced, or widowed). This suggests that married households in these specific areas face higher child dependency ratios, causing dilution of food intake per capita despite a larger baseline pool of adult labor.

Distance to Market Center: (□= 0.0804, p = 0.023). Significant and positive. Counter to traditional spatial theory, every additional minute of foot-travel time to a market center correlates with a 0.08-point increase in FCS. This reveals that more remote rural households are insulated from volatile urban food price shocks, relying more heavily on reliable home consumption, local backyard gardens, and stable subsistence livestock rearing.

Table 16: Multiple Linear Regression Result of the Study

Variables	**coef**	**std err**	**t**	**P>|t|**	**[0.025**	**0.975]**
const	14.2337	6.051	2.352	0.019	2.32	26.147
AgeHH	0.0944	0.063	1.5	0.135	-0.03	0.218
HH size	1.2469	0.443	2.816	0.005	0.375	2.119
AgriLandSize	0.0282	0.732	0.039	0.969	-1.412	1.469
TLU	0.8434	0.397	2.124	0.035	0.062	1.625
Total Income	0.0001	4.04E-05	2.508	0.013	2.18E-05	0
Saving at institutions or at home	0.0003	0	2.446	0.015	4.98E-05	0
Distance to market center	0.0804	0.035	2.285	0.023	0.011	0.15
Distance to all weather roads	-0.0164	0.06	-0.275	0.784	-0.134	0.101
AEZ_Kolla	1.3896	1.497	0.928	0.354	-1.558	4.337
AEZ_Woigna dega	1.0966	1.3	0.844	0.4	-1.463	3.656
Sex_Male	1.5144	1.801	0.841	0.401	-2.032	5.061
EducationHH_Informal education(read and write)	-5.2443	5.446	-0.963	0.336	-15.968	5.479
EducationHH_Not educated	-6.5894	5.479	-1.203	0.23	-17.377	4.198
EducationHH_Primary education	-6.5936	5.397	-1.222	0.223	-17.219	4.032
EducationHH_Secondary education	-4.0438	6.246	-0.647	0.518	-16.342	8.254
Maritalstatus_Married	-4.5471	2.23	-2.039	0.042	-8.939	-0.156
Maritalstatus_Single	4.0059	3.791	1.057	0.292	-3.459	11.471
Maritalstatus_Widowed	-2.761	2.486	-1.111	0.268	-7.656	2.134
AccessIrrigantion_Yes	3.5638	1.451	2.456	0.015	0.707	6.421
PSNP beneficiary_Yes	-3.7789	1.228	-3.077	0.002	-6.197	-1.361
Access to credit from institution	2.9117	1.301	2.238	0.026	0.351	5.473

Source: Own production (2026)

The empirical findings from the multiple linear regression models provide critical insights into the structural, institutional, and demographic forces shaping household food security, shifting the narrative away from purely environmental determinism. The strong, positive significance of Access to Irrigation □= 3.5638, p = 0.015) and Access to Credit (□ = 2.9117, p = 0.026) underscores the vital role that climate-mitigating infrastructure and financial inclusion play in stabilizing household consumption. This strongly aligns with the findings of Hagos et al. (2022) in Northern Ethiopia, who argued that small-scale irrigation effectively decouples rural livelihoods from highly erratic rainfall patterns, allowing for multi-cycle cropping and production diversification. Similarly, the positive impact of credit access matches the foundational work of Abafita and Kim (2014), who noted that formal and informal credit

mechanisms relax seasonal liquidity constraints, allowing smallholders to acquire critical inputs on time and smooth consumption during lean periods.

Furthermore, the significant positive coefficient for Tropical Livestock Units (TLU) (□ = 0.8434, p = 0.035) mirrors observations by Tschopp et al. (2021) across agrarian and agro-pastoral settings in Ethiopia. Livestock serve as a crucial liquid asset or "living bank" that can be rapidly sold to cope with severe household shocks, while concurrently providing direct dietary access to high-value animal-source proteins and micronutrients. The complementary findings for Total Income (□ = 0.013) and Savings (□ = 0.015) add further weight to the market-purchasing-power thesis championed by Weldearegay and Assefa (2021b), confirming that cash liquidity directly drives food security by facilitating dietary diversity through market channels.

The highly significant, positive relationship between Household Size and Food Consumption Scores (□ = 1.2469, p = 0.005) presents an interesting divergence from standard Malthusian food-security models, yet it strongly confirms the Labor Endowment Hypothesis prevalent in specific sub-Saharan contexts. While scholars like Degefa (2005) argue that expanding family size increases consumer-to-producer ratios and worsens food strain, your finding is deeply supported by Amsalu et al. (2023). These researchers observed that in labor-intensive agricultural landscapes where modern machinery is absent, additional household members supply crucial agricultural labor and facilitate livelihood diversification into off-farm activities, raising the overall household dietary floor.

Conversely, the negative impact of a Married Marital Status (□ = -4.5471, p = 0.042) suggests a hidden vulnerability profile within nuclear families, potentially due to elevated child-dependency ratios that dilute dietary gains, an outcome previously documented by Fikre and Zegeye (2022).

On the spatial front, the positive significance of Distance to Market Centers (□ = 0.0804, p = 0.023$) initially challenges traditional economic models which claim that market proximity boosts food security. However, this paradox matches the Subsistence Insulation Effect identified by Stifel and Minten (2017) in remote parts of Ethiopia. Households located closer to primary markets are frequently exposed to severe food price inflation, urban market price shocks, and volatile cash crops. In contrast, more isolated households frequently adapt by heavily prioritizing diverse backyard gardening, traditional home production, and local livestock rearing, shielding

themselves from price shocks and maintaining a more stable, self-sufficient Food Consumption Score.

The highly significant and negative relationship between Productive Safety Net Program (PSNP) Beneficiary Status and the household FCS (= -3.7789, p = 0.002) stands as a major point for academic discussion. In econometric analysis, a negative coefficient on a social welfare variable is rarely interpreted as a sign that the program harms the population. Instead, as extensively documented by Berhane et al. (2014) and Hoddinott et al. (2012) in their nationwide evaluations of the PSNP, this reflects a classic Targeting Endogeneity Bias.

4.5. Coping Strategies

To evaluate the real-time behavioral anxiety and severity of food stress among rural households, the study disaggregated the five standardized components of the Reduced Coping Strategies Index (rCSI). While food consumption indices like the Food Consumption Score (FCS) measure actual dietary intake over a recall period, the rCSI captures the tactical, behavioral maneuvers households deploy when faced with a deficit of food or the financial means to acquire it. Figure 9 details the adoption prevalence of these coping strategies, defined as the percentage of households implementing a given strategy for at least one day out of the preceding seven days.

The empirical distribution reveals a profound and atypical behavioral pattern across the sampled smallholder population. The most widespread coping mechanism reported is restricting consumption by adults in order for small children to eat, with an adoption prevalence of 52.4% (n=150). This is immediately followed by limiting portion sizes at mealtimes, which is actively utilized by 50.3% (n=144) of the surveyed households. In contrast, strategies that modify dietary composition or rely on social capital show lower prevalence rates: 38.8% (n=111) of households rely on less preferred and less expensive foods, 36.7% (n=105) cross-borrow food or rely on assistance from friends or relatives and 35.7% (n=102) resort to reducing the absolute number of meals eaten in a single day.

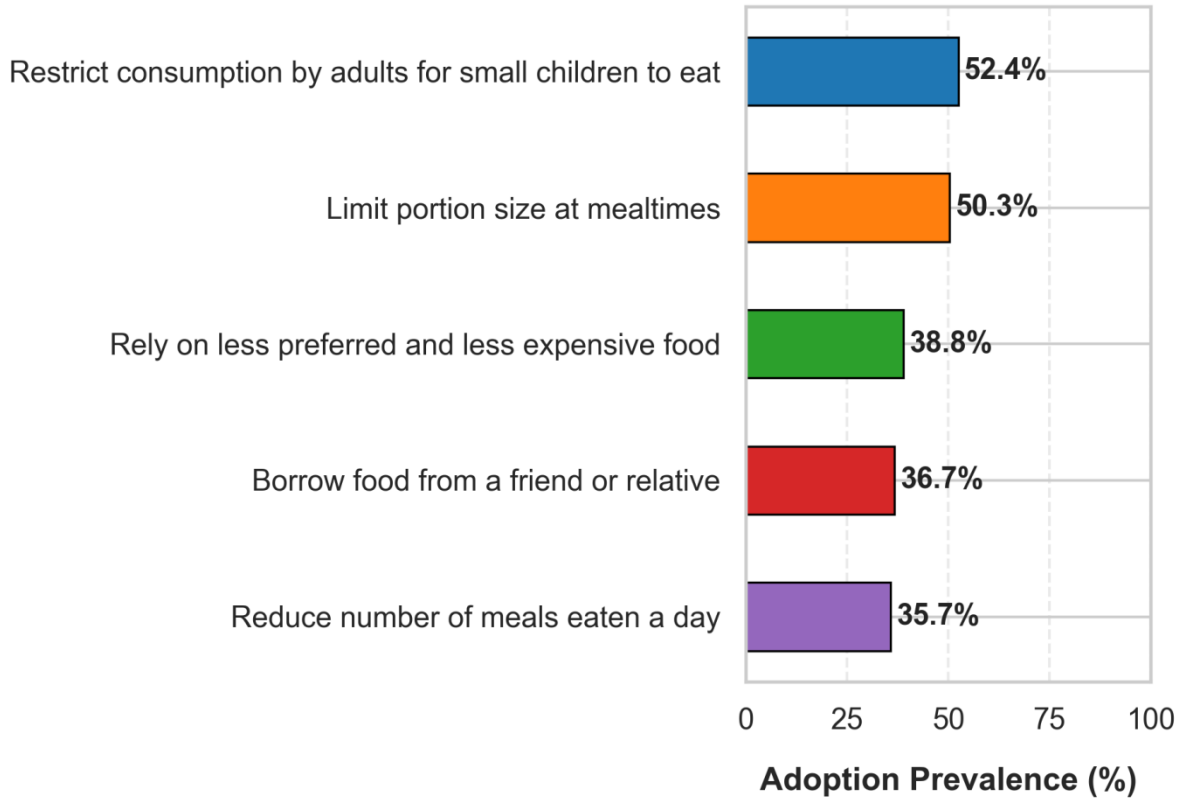

Figure: Food in security coping strategies prevalence in percentage

Source: Own production (2026)

Under normal circumstances, shifting to less expensive, lower-quality foods (such as replacing preferred teff with cheaper maize or sorghum) is the first and most widely adopted line of defense because it is easily reversible and protects total caloric volume. However, the results demonstrates an inversion of this traditional continuum. High-severity, quantitative rationing mechanisms such as maternal/adult fasting (52.4%) and portion restriction (50.3%) exhibit substantially higher prevalence rates than mild dietary shifts (38.8%). This inversion suggests that the food security crisis in the study area has progressed past simple budget constraints. Because more than half of the households are actively reducing adult food intake to shield children, it implies that localized market supplies are highly constrained, or that absolute household purchasing power has degraded so severely that substituting food types is no longer sufficient to close the consumption gap. Smallholders are forced to skip the "mild" phase and move straight into structural, physical rationing to preserve their children's baseline nutrition.

To provide a conclusive classification of household food security status based on behavioral distress, individual coping scores were compiled into the composite Reduced Coping Strategies Index (rCSI). Following internationally standardized thresholds established by the World Food Programme (WFP), the continuous rCSI scores (ranging from 0 to 43 within this population) were stratified into three ordinal severity tiers: Food Secure/Low Coping (rCSI $\leq$3), Moderately Food Insecure / Medium Coping (rCSI 4–9), and Severely Food Insecure / High Coping (rCSI$\geq$10). Figure 6 presents the proportional distribution of the surveyed households (N = 286) across these structural categories.

The aggregated index reveals a deeply polarized food security landscape within the study area. The largest single cohort, representing 46.2% (n = 132) of the sample, falls within the Food Secure category, exhibiting zero or minimal reliance on disruptive coping mechanisms. However, this stable baseline is counterbalanced by extensive systemic stress across the rest of the population: 33.2% (n = 95) of households are classified as Severely Food Insecure, cross-cutting the critical threshold where severe behavioral coping (such as adult fasting or severe portion rationing) becomes a regular weekly necessity. In addition, 20.6% (n = 59) occupy the Moderately Food Insecure transitional bracket, deploying intermediate coping tactics to handle localized food or cash deficits. Combined, a substantial majority of 53.8% of the studied population experiences active, measurable food access constraints during the year.

4.6. Early Warning System

The descriptive results reveal a severe institutional gap in disaster preparedness across the studied agro-ecological landscapes. A striking 70.0% of household heads report that an operational early warning system is completely unavailable to their household. Conversely, only a minor baseline of 30.0% of smallholders state they have functional access to timely early warning signals, weather advisories, or multi-hazard hazard forecasts.

This asymmetrical distribution of EWS access has direct, compounding consequences for household food security and Food Consumption Scores (FCS). In rain-fed agrarian contexts, smallholders who form part of the 70.0% non-accessible pool are forced into a reactive adaptation posture. Deprived of advance information regarding delayed rainfall, seasonal drought, or localized pest infestations, these households cannot modify their farming strategies

ahead of time. They are unable to change planting dates, shift to short-cycle drought-resistant crop varieties, or adjust their livestock herd sizes to match feed availability.

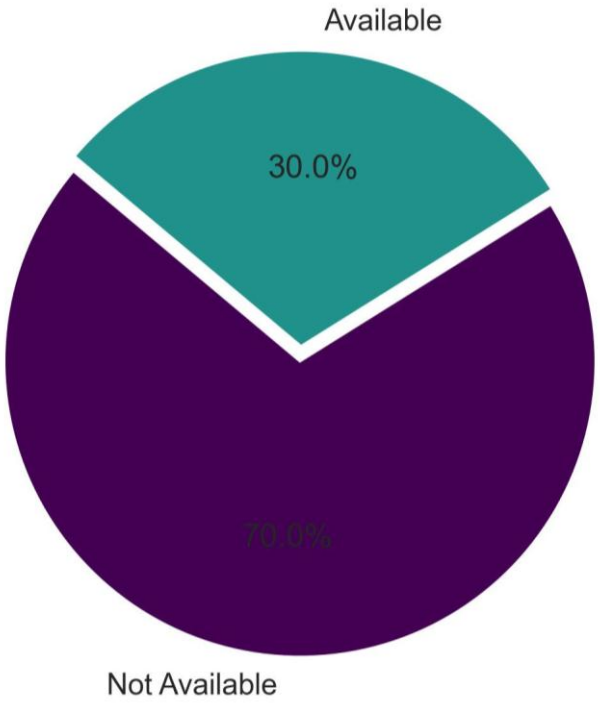

Figure 6: Early warning system (EWS) availability of the households

Source: Own production (2026)

While identifying the macro-level deficit in baseline access is crucial, designing effective climate-resilient institutional interventions requires a granular understanding of the specific information requirements of smallholder farmers. Figure 7 disaggregates the primary, self-identified Early Warning System (EWS) and agricultural information needs of the surveyed households (N = 286).

The empirical results reveal that biological and production risks take top priority for local smallholders. The largest share of households 39.5% (n = 113) identified plant pests and animal diseases as their most critical information deficit. This is closely followed by 34.6% (n = 99) of respondents who prioritized advance warnings regarding impending extreme hazards, such as localized floods, prolonged droughts, or severe frost shocks. In contrast, economic and baseline climate variables are less prioritized: 16.8% (n = 48) of households highlighted a primary need for market information (commodity prices and supply fluctuations), while only a minor subset of

9.1% (n = 26) prioritized raw meteorological parameters like absolute rainfall volume and temperature patterns.

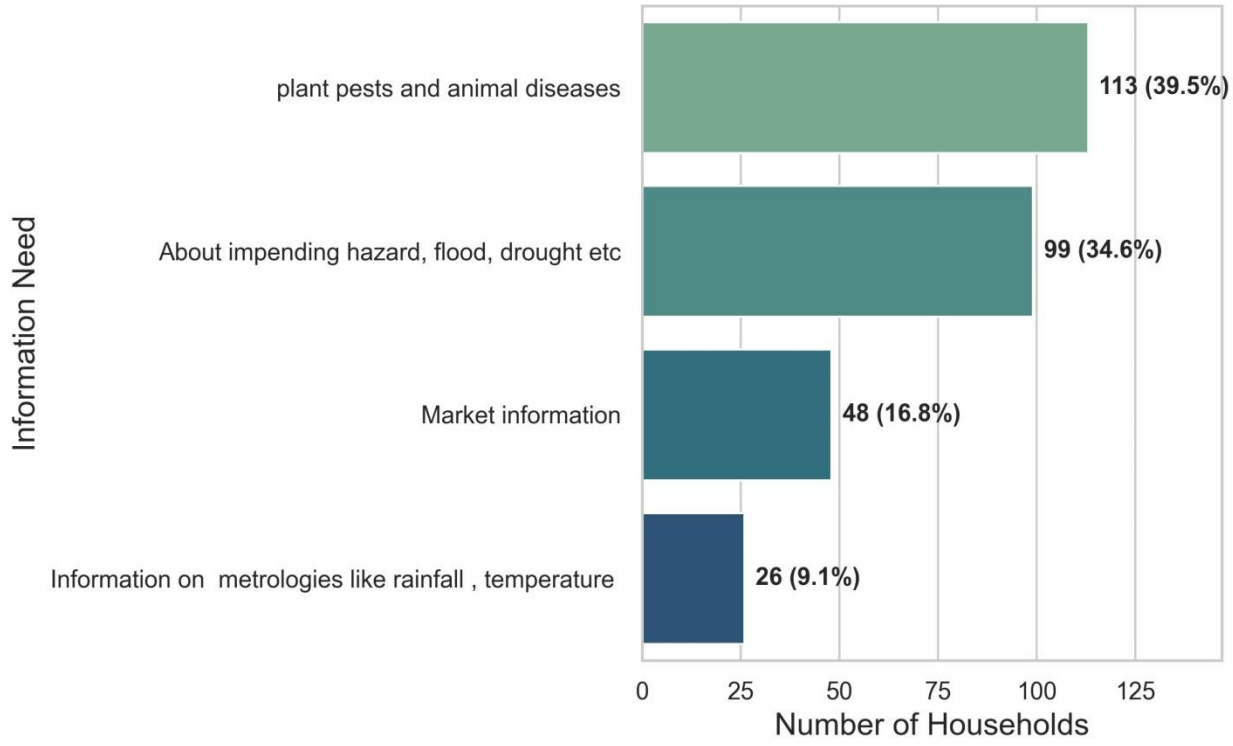

Figure 7: Early warning system (EWS) needs of the households

Source: Own production (2026)

The high demand for pest and disease info (39.5%) is strongly supported by FAO (2023) updates on the Horn of Africa. The FAO emphasizes that transboundary plant pests and climate-driven livestock diseases have become highly volatile due to changing weather patterns. As noted by Kassie et al. (2020) in their assessment of food security shocks in rural Ethiopia, a pest invasion can cause total crop failure within days. This vulnerability forces unprotected households into severe food deficits and drops their Food Consumption Scores down into the ‘Poor’ category. The 34.6% demand for extreme hazard alerts reflects the reality of increasing weather extremes across Ethiopia's various agro-ecological zones. This finding aligns with the World Bank (2024) Ethiopia Climate Risk Country Profile, which notes that seasonal transitions have grown increasingly volatile. As a result, farmers can no longer rely purely on traditional ecological knowledge to predict crop-destroying floods or terminal droughts.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

This study investigated the status and household-level econometric determinants of food security measured via the continuous Food Consumption Score (FCS) across three distinct agro-ecological zones (Dega, Kolla, and Woigna dega).

The descriptive and inferential analyses present a compelling narrative that challenges traditional geographic determinism in food security literature. Both the initial one-way ANOVA ($F = 1.8518$, $p = 0.1588$) and the final multiple linear regression model confirmed that agro-ecological placement holds no statistically independent leverage over a household's dietary quality. The geographic variables AEZ_Kolla ($p = 0.354$) and AEZ_Woigna dega ($p = 0.400$) were completely insignificant when controlling for socioeconomic characteristics. This clear homogenization of vulnerability reveals that modern structural shocks, such as localized climate variability and market instabilities, have decentralized ecological privilege. Rural households across all elevations are now uniformly exposed to a high baseline of food insecurity.

The household income in the study Woreda is highly inadequate, unevenly distributed, and heavily dependent on seasonal, non-farm, and institutional safety net sources. Rural smallholders face a structural cash-liquidity crisis, as traditional agricultural production fails to generate enough baseline income to ensure year-round food security. Instead, households rely on a fragmented mix of crop trade, livestock sales, charcoal or firewood harvesting, handcrafts, and external remittances to close their consumption gaps.

The study shows that the risk landscape in Meket Woreda is defined by high-frequency, repeating shocks that affect entire communities at once. Over 45% of the sampled smallholders have experienced multiple climate and biological hazards over the past two decades. These events are primarily driven by environmental risks, including erratic rainfall patterns, localized droughts, frost events, and crop pest invasions.

Instead, the true determinants of food security in the study area are driven by household asset endowments, financial liquidity, institutional linkages, and internal demographic dynamics. The model successfully accounted for 34.6% of the total variance in food consumption scores, driven

by nine statistically significant parameters. Dietary security is strongly driven by capital-relaxing and risk-mitigating assets. These include Access to Irrigation (□= 3.5638), Access to Credit (□= 2.9117), and Livestock Ownership (□= 0.8434 per TLU), alongside annual Total Income and cash Savings. Furthermore, the significant positive impact of Household Size (□ = 1.2469) indicates that family members act primarily as vital labor assets who enhance agricultural intensity and diversify income streams rather than functioning as resource drains.

Conversely, the significant negative coefficient of PSNP Beneficiary Status (□ = -3.7789) validates the administrative accuracy of the safety-net program, showing it successfully targets the most structurally asset-depleted households in the region. Finally, the positive significance of Distance to Market Centers (□ = 0.0804) indicates a protective isolation effect, where remote households rely on resilient subsistence farming and localized home production to shield themselves from urban food price inflation.

The households applied diverse coping strategies mostly severe strategies. Restricting adult consumption to shield young children is the most widespread strategy, adopted by 52.4% of households, followed closely by limiting meal portion sizes at 50.3%. Meanwhile, substituting preferred foods with less expensive alternatives is practiced by only 38.8% of the sample. This unusual pattern shows that families face absolute food shortages and a severe drop in purchasing power, where simply switching to cheaper food is no longer enough to close the consumption gap.

5.2. Recommendations

Based on these empirical findings, the following targeted recommendations are proposed to sustainably improve household food security in the study area:

Scale Up Small-Scale Irrigation Infrastructure

- Government and non-governmental organizations (NGOs) should invest in communal water harvesting structures, river diversions, and subsidized motor pumps.
- Transitioning households from erratic rain-fed dependency to multi-cycle, climate-resilient cropping will directly improve year-round dietary diversity through the home production of micronutrient-dense vegetables and fruits.

Deepen Rural Financial Inclusion (Credit Pathways)

- Microfinance institutions (MFIs) and rural saving and credit cooperatives (RUSACCOs) should design flexible, low-interest agricultural credit products with repayment schedules tied to harvest cycles.
- Financial literacy campaigns should be coupled with these services to incentivize formal cash savings, providing households with the necessary liquid liquidity to buy diverse foods and buffer themselves against seasonal lean periods.

Strengthen Livestock Accumulation and Veterinary Value Chains

- Regional agricultural offices should improve local veterinary service delivery, expand access to high-yield animal breeds, and introduce resilient forage production technologies.
- Supporting livestock accumulation protects a household's "living bank account" for emergency sales while simultaneously improving the direct availability of high-value animal proteins for home consumption.

Optimize PSNP Delivery and Link Safety Nets to Asset Accumulation

- Policy makers should maintain this rigorous targeting framework while explicitly linking PSNP transfers with complementary asset-building interventions.
- Enrolled households should receive priority access to the credit schemes, irrigation packages, and livestock extension services identified in this study. This pathway will help households accumulate assets and sustainably graduate from chronic food insecurity.

Adapt Agricultural Extension for Market-Isolated Communities

- For highly remote communities, agricultural extension agents should focus heavily on optimizing home-gardening practices, poultry keeping, and small-scale livestock rearing to preserve their subsistence-based dietary safety floors.
- For households closer to market centers, extension services must offer strategies to handle market shocks, such as training in crop processing and storage, to insulate them from volatile food price inflation in urban areas.

Revitalize and Institutionalize the Local Early Warning System (EWS)

- The Meket District National Disaster Risk Management Bureau should set up accessible localized early warning system to tackle the shocks and enhance the food insecurity.

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ANNEXES

Annex 1: Household questionnaire survey

FOOD SECURITY AND ITS DETERMINANTS: THE CASE OF MEKET WOREDA, AMHARA REGIONAL STATE

Postgraduate Programs Directorate, Bahir Dar University

Enter the date: yyyy-mm-dd	
Kebele Name	
Household Number From the list	[__ __ __]
What is the interviewee's age (years)?	
What is the sex of the interviewee?	**1=**Male 2=Female
Are you the head of the HH?	1= Yes 2 =No
Household Head Information	
Sex of HH head	1. Male 2= Female
Age of the HH head	_____ Years
Education status of HH head	1=Not educated, 2=Informal education(read and write) 3=Primary education 4=Secondary education 5=Diploma and above
Marital status of HH head	1=Single 2=Married 3=Widowed 4=Divorced
What is the major Occupation of household head?	1=Farming, 2=Trading, 3=Government employee, 4=Laborer, 5=Other (specify
Sex of HH members	**Age of household members per sex**
Male: _____	_____ ,____ ,____ ,____ ,_____ ,____, ____, ____, __
Female:_____	_____ ,____ ,____ ,____ ,_____ ,____, ____, ____, ___
Total	
Number of working laborers household Members	_____
Households' number of income sources	_____**(in number)**

	If you rear livestock, Would you please tell us the number of livestock you own at present?						
	Livestock	Number	Value in birr		**Livestock**	Number	Value in birr
01	Cow			07	Donkey (Adult)		
02	Ox			08	Donkey (Young)		
03	Heifer and Bull			09	Sheep and Goat (adult)		
04	Weined calf			10	Sheep and Goat (young)		
05	Calf			11	Beehives		
06	Horse/Mule			12	Chicken		

Income from Off-farm/Non-farm Activities

	Does any member of the household participate in any activity other than farming to generate income?	1=Yes 2=No
If yes Please tell me your income from off-farm/non-farm activities in the last cropping year **(2015/16 E.C)**? Put '00' if no income is gained.		

Income Source		1=Yes, 2=No	Income in *Birr*
02	Crop trade (Cereals, pulses, fruits, etc.)		
03	Livestock trade (Got, sheep, chicken, etc.)		
04	Sales of firewood and/or charcoal		
06	Handcrafting (e.g. weaving/spinning, pottery, metal works, etc.)		
07	Non-agricultural wage labor (e.g. construction, Carpentry)		
08	Sale of local food and drinks		
	Forest products		
	Income from Service delivery (haircut, etc…)		
09	Remittance Income		
10	Other (specify)_____		
	Does the income you earn from non-farm activities enable you to buy adequate food?	1=Yes 2= No	
	Is your total income over the past year is changed	1= Yes 2= No	
	If yes, how do you rate it?	1= increased 2= decreased 3=No Change	
	Why do you pursue nonfarm livelihood activities**? (Multiple Responses is possible).**	1=Have no other means of living, 2=low productivity of farming 3=Have small land to farm 4=Uncertain agricultural performance 5=To increase cash saving	

Access to basic services

Give information about the services available to your household (consider the nearest one frequently used), what times does it take to reach (travel to):		
	Institutions and Infrastructures	**Distance from home to nearest** [***basic service***]
	Distance to Home	**_____km_____ Minutes by foot**
	Nearest human health center	**_____km_____ Minutes by foot**
	Nearest animal health center	**_____km_____ Minutes by foot**
	Nearest school	**_____km_____ Minutes by foot**
	Nearest drinking water source	**_____km_____ Minutes by foot**
	Nearest market center	**_____km_____ Minutes by foot**
	Nearest all weather roads	**_____km_____ Minutes by foot**
	Does your household have access to electricity?	1=Yes 2= No
	Does any member of your household own mobile phone?	1=Yes 2= No
	Does your household have access to clean drinking water?	1=Yes 2= No
	If Yes how much time it takes	_____in minutes
	Does any member of your household have access to credit?	1=Yes 2= No

	Have you ever borrowed money in the last 12 months?	1=Yes 2= No
	If yes From who did you borrow? (Multiple answers are possible)	1=Individual money lenders 2= Friends, neighbors and relatives (=3=Micro-finance institutions 4= Saving and credit cooperatives 5=Commercial banks 6= Others (specify) ----------
	If yes For what purpose did you borrow? **(Multiple answers are possible)**	1= Agricultural input purchase 2= Livestock purchase 3= Petty trade 4= Household consumption 5= Farm implements purchase 6= Other (specify) ____

Food security Indicators

Food Consumption Score (FCS): Could you please tell me ***how many days*** in the past week (for the last 7 days) your household has eaten and drinks the following foods **during the day and at night [breakfast, lunch, dinner, snacks]. Record number of days 0 – 7. Insert 0 for items not eaten over the last 7 days**?

No	**Food Group**	Number of days	1= Own production 2=Purchased 3=Gift/assistance
	Cereals →Rice, millet, sorghum, maize, wheat, barley, **eg-** bread (kitta, Genefo, injera, spaghetti, macaroni, pasta, biscuits ….		
	Root and tubers potato, yam, cassava, white sweet potato		
	Vegetables and leaves such as onion, tomatoes, green beans, peas, lettuce, spinach, other dark green leaves		
	Fruits (banana, apple, lemon, tangerine,mango, papaya, apricot, peach, etc?		
	Meat, ,(tire siga, key wat, minchet, lamb, kikil, goat, chicken, doro wot, other birds poultry, fish		
	Eggs		
	Pulses/legumes/nuts →Beans, peas, lentils or nuts shiro wat, misir wat, beans, Kolo?		
	Milk and milk products		
	Oil/fats		
	Sugar/honey , sugarcane,		
	Condements (tea, coffee, salt, garlic, spices, tomato / sauce)		

Section 2: CONSUMPTION COPING STRATEGIES: Now I will ask you about the number of days, in the last 7 days, that your household may have done some of the following actions to cope with lack of food or money to buy food. [number of days from 0 to 7 days]

In the past 7 days, if there have been times when you did not have enough food or money to buy food, how often has your household ……

	had to rely on less preferred and less expensive foods?	
	had to borrow food, or rely on help from a friend or relative?	
	had to limit portion size at mealtimes?	
	had to reduce number of meals eaten in a day?	
	had to restrict consumption by adults in order for small children to eat?	

	had to Purchase food on credit?	
	had to Gather wild food, hunt, or harvest immature crops?	
	Consume seed stock held for next season?	
	Send household members to eat elsewhere?	
	Send household members to beg?	
	Feed working members of HH at the expense of non-working members?	
	Skip entire days without eating?	

Section 3: LIVELIHOOD COPING STRATEGIES: Now I will ask you about some of the following actions that your household may have done during the last 30 days to cope with the lack of food or money to buy food. 1= No, because it wasn't necessary 2= No, because the strategy does not apply for my household 3= Yes 4= No, because I already apply this strategy within the last 12 months		Code
	During the past 30 days, did anyone in your household……..	
	Have to sell household assets/goods (jewelry, furniture,) to buy food due to lack of food or money to buy food?	
	have to sell a higher number of livestock than usual to generate cash to be able to buy food (nonproductive livestock) due to lack of food or money to buy food ?	
	have to borrow money to buy food due to lack of food or money to buy food ?	
	have to engage in unusual sale of charcoal/firewood/grass due to lack of food or money to buy food ?	
	have to sell productive assets other than livestock land, farming tools due to lack of food or money to buy food ?	
	have to reduce essential non-food expenditures such as education, health, etc. due to lack of food or money to buy food ?	
	have to reduce expenditure on livestock and agricultural inputs to buy food due to a lack of food or money to buy food	
	have to sell last breeding and/or transport animals to be able to buy food due to lack of food or money to buy food ?	
	have to engage in begging or other demeaning income activities due to lack of food or money to buy food ?	
	had to migrate to the area you are in due to lack of food or money to buy food ?	

End of Questionnaire.

Thank you for your time in responding to the questions.

Annex 2: Focus Group discussion

1. What are the main sources of livelihoods in the district?
2. Do you think that the following basic services are available and accessible in your area?
3. What is the trend of food insecurity problem in your area? i.e. has the situation improving, Worsening or Staying the same? Why?
4. What are the factors that affect households to food insecurity?

5. What type of households is most vulnerable to food shortage?
6. What are your suggestions to improve food insecurity problem of the district?
7. What do you think should be done by the government, or other partners to ensure that the households in these community have sustainable livelihood or recover from shock in a sustainable way or are weaned off aid?
8. What do you think are the response strategies to cope with the shocks and stress and livelihood resilience?

Annex 3: Key informant interview guideline

1. What are the main sources of livelihoods in the district?
2. What type of shocks or stresses that have happened in the district?
3. What do you think should be done by the government, r other partners to ensure that the households in this community have sustainable livelihood or recover from shock in a sustainable way or are weaned off aid?
4. Can you briefly describe the overall current disaster risk management system?
5. Would you please describe the activities done by your institution before, during and after disaster situation in Ethiopia? In which of DRM phases your organization focus?
6. Do you think the present Ethiopian disaster risk management system follow the multi hazard and Multi sectorial approach
7. What do you think are the response strategies to cope with the shocks and stress and livelihood resilience?
8. What do you think should be done by the government, or other partners to ensure that the households in this community have food security from shock in a sustainable way or are weaned off aid?

Annex 4: Conversion Factors to Estimate Tropical Livestock Unit equivalents

Animal category	**TLU**	**Animal category**	**TLU**
Calf	0.25	Donkey (young)	0.35
Weaned calf	0.34	Camel	1.25
Heifer	0.75	Sheep and Goat (adult)	0.13
Cow and Ox	1.00	Sheep and Goat (young)	0.06
Horse	1.10	Chicken	0.013
Donkey (adult)	0.70		

Source: Storck et al. (1991)