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Determinants of Food Security among Rural Households: In the case of Sahila Woreda Selected Kebeles

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Abstract

This study investigated the determinants of food security among 115 rural households in drought-prone Sahila Woreda, Ethiopia. Using a quantitative cross-sectional design and multistage sampling, data on demographics, agriculture, institutions, and food security (measured by Food Consumption Score) were collected. Descriptive statistics revealed a 57.8% food insecurity rate, highlighting a critical food shortage. Probit regression identified eleven significant determinants, with socio-economic and institutional factors having the strongest marginal effects. Steep farmland slope increased insecurity by 20.56%, while crop rotation (18.79%), plot ownership (17.89%), livestock ownership (16.38%), and contact with development agents (15.41%) were the most protective. Education (12.43%), plot area (8.53%), fertilizer use (8.47%), row planting (7.12%), family size (3.21%), and credit access (1.20%) also positively influenced security. In contrast, sex, age, farming experience, and distance to homesteads were insignificant. The findings underscore that food insecurity is primarily driven by land degradation, weak institutional support, input scarcity, and limited human capital. To enhance sustainable food security, targeted interventions are imperative. These must prioritize land management practices, secure land tenure, livestock development, strengthening agricultural extension services, and investments in human capital development to build resilience and improve rural livelihoods in Sahila Woreda.

Keywords: *Food Security, Probit Regression, Rural Households, Sahila Woreda, Socio-Economic Factors*

1. Introduction

Food security is a multi-faceted concept that has undergone tremendous changes over time ever since its inception in the 1970s. Its definition provided by the 1996 World Food Summit is still very relevant; according to this definition, food security exists whenever all people have physical and economic access to sufficient, safe, nutritious food that meets their dietary needs and food preferences for an active and healthy lifestyle. This definition has been developed by modern researchers. For example, Zhou (2020) defines food security as an approach from the socio-economic perspective that focuses on the interplay of supply side components such as institutions and availability of natural resources and demand side components such as population growth and consumption patterns. Kerr (2023) pays particular attention to the importance of agricultural transformation in solving the problem of food insecurity and focuses

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on three main conditions of food security: availability of food, income to buy food, and increases in agricultural productivity. To be able to feed nine billion people by 2050, it is important to make systemic progress in food governance and sustainable increases in agricultural production.

Despite its capacity for agricultural production, Sub-Saharan Africa still faces issues with food security on a continental scale. Despite the fact that agriculture provides jobs for two-thirds of the labor force and constitutes 30 to 60 percent of GDP in all countries on the continent, the continent's agricultural productivity is lower than that in other continents due to low extension services, lack of access to better inputs, and climatic vulnerability (FAO, 2022). Following the food price crisis in 2008 and the subsequent volatility of food prices, food systems in Africa have become vulnerable to shocks, causing policy attention to be paid to agricultural development and food self-sufficiency (African Union, 2023). Climate change is another risk factor, reducing yields by 20 percent by 2050 for staple foods such as maize, sorghum, and millet (IPCC, 2022).

The Ethiopian economy relies on agriculture, which forms 34% of the GDP and absorbs 81% of the labor force. The agrifood industry contributes to 48% of GDP and 77.2% employment opportunities (Diao et al., 2023). Despite large government investments in the Agricultural Transformation Agency and the Growth and Transformation Plan, the food security status of Ethiopia is tenuous since 4.0 million people depend on food aid from November 2023 to January 2024 (FEWS NET, 2024). Due to conflicts that lead to displacement, climatic factors such as drought, and structural factors in agriculture such as poor performance of markets, limited availability of quality inputs, and lack of extension services, the northern, central, southern, and eastern parts of Ethiopia are forecasted to face crisis and emergency situations (FAO, 2023). The unparalleled drought between 2020 and 2023 adversely affected cattle production, while El Niño-induced drought conditions led to the failure of the meher harvest in many areas in 2023. This underscores the importance of doing research in relation to the local context. A case in point is Sahila Woreda, in the Wag Himra Zone of the Amhara Region.

Moreover, production is constrained by insufficient availability of quality seeds, fertilizers, drugs, extension service, market and credit. According to the PReSERVE Project funded by the USAID, the value chains of shoat, potatoes, haricot beans, and fish are very important to increase food security in the woreda. The current research aims at filling the gap in knowledge by investigating the demographic, socioeconomic, and institutional factors affecting food security in households. In spite of the intervention, there has not been much research conducted on food security factors in Sahila Woreda.

2. Statement of Problem

Even after many years of investments in agriculture development and policy reform efforts, food insecurity persists as an endemic problem in rural Ethiopia, with Wag Himra Zone and Sahila Woreda among the zones with high levels of food deprivation in the country. The Food Security Analysis Unit (FSAU)/Famine Early Warning Systems Network (FEWS NET) reports (2024) indicate that the number of people requiring food assistance in Ethiopia is likely to be higher for the third consecutive year, with 4.0 million requiring food assistance between November 2023 and January 2024. The IPC (Phase 3) and IPC (Phase 4) food security outcomes are likely to occur in the northern and northeast parts of Amhara region, such as

Sahila Woreda. The livestock herds have been severely affected by drought that occurred between 2020-2023, El Niño conditions have led to the failure of meher harvest in some areas in 2023, and the budgetary challenges faced by the Productive Safety Net Program have limited distribution periods from six months to four (FEWS NET, 2024; FAO, 2023).

In light of the fact that acute malnutrition is approaching the critical and extremely critical threshold and that deaths from hunger are being reported in conflict-affected areas, the above combination of factors has forced vulnerable families to be on the brink of humanitarian disaster. A good illustration of the above challenges can be observed in Sahila woreda, which is a drought-prone area characterized by poor agricultural performance, food insecurity, and lack of livelihood diversification. Families in the woreda practice subsistence agriculture on small farms through traditional methods, without having access to improved seeds, fertilizer, extension, markets, or financial services. The above problems have been reinforced by the remote location, poor infrastructure, and aftereffects of regional conflict in the woreda.

The USAID-supported PReSERVE project has identified four key value chains – shoat, potato, haricot bean, and fish – as important starting points for improving food security in the Sahila Woreda; however, agriculture in this area remains low input and output, with farmers practicing agriculture for their subsistence consumption (PReSERVE, 2023). It is vital to acknowledge the existing lack of knowledge regarding the determinants of food security among households in this specific setting amid substantial investments by the Ethiopian Government via the Agricultural Transformation Agency and development partner programs. The existing literature on the factors affecting food security in Ethiopia has been focused on other areas featuring different livelihoods and agro-ecological settings, so it cannot be generalized to the specific conditions of the Sahila Woreda (Fikru, 2009; Schị et al., 2015; Million et al., 2019).

In addition to this, the COVID-19 pandemic, the drought experienced from 2020 to 2023, failure of crops due to El Niño effect, and displacement caused by conflict are only a few of the shocks witnessed recently that have brought about radical changes to the dynamics and determinants of food security, thus making any pre-shock results irrelevant to direct current efforts (FEWS NET, 2024; FAO, 2023). Interventions in development risk being out of touch with the reality of the Sahila Woreda household without empirical evidence from the specific location.

Several interrelated gaps emerge from the existing literature, which this study attempts to fill. There is a geographical gap since past studies have primarily concentrated on high-potential agricultural areas in Ethiopia, with very few studies done on drought-prone Wag Himra Zone and Sahila Woreda. There is also a temporal gap since past studies were done prior to the 2020-2023 drought period and El Niño-induced crop failure and conflict-induced displacement.

In addition, there is a lack of contextual knowledge, owing to the absence of research on the institutional dimension of the ongoing initiatives for agricultural transformation such as PReSERVE. In terms of methodology, there is a lack because previous research tended to employ methodologies that were restrictive and failed to grasp the complex interlinkages between the institutional, socio-economic, and demographic dimensions. It is still unknown about the relevance of education, household size, inputs use, livestock holding, access to credit, extension contact, and institutional support in shaping food security outcomes, especially in Sahila Woreda. This research addresses these interrelated gaps by providing in-depth, locally grounded, and methodologically sound empirical evidence about the factors affecting food security in Sahila Woreda (Gebre et al., 2021; Worku et al., 2023; PReSERVE, 2023).

3. Research Questions

1. What are the demographic factors that significantly influence food security among rural households in Sahila Woreda selected kebeles?
2. What are the socio-economic factors that significantly influence food security among rural households in Sahila Woreda selected kebeles?
3. What are the institutional factors that significantly influence food security among rural households in Sahila Woreda selected kebeles?

4. Objectives of the study

The main objective of this study is to determine the demographic, socio-economic, and institutional factors that influence food security among rural households in selected kebeles of Sahila Woreda, Wag Himra Zone, Amhara Region, Ethiopia.

Specifically, the study sought to:

- Examine the influence of household demographic characteristics (sex, age, education level, family size, and farming experience) on food security.
- Assess the effects of socio-economic factors (chemical fertilizer use, row planting practices, tropical livestock unit, access to credit, crop rotation, and average plot area) on food security.
- Analyse the role of institutional support factors (frequency of contact with development agents, extension services, and plot ownership) in determining household food security.

5. Theoretical Review

Food Security Theory and Measurement

The concept of food security has evolved from a narrow focus on food availability to encompass access, utilization, and stability dimensions. One of the definitions of food security remains to be the one that was provided during the World Food Summit in 1996, stating that food security is attained when all people have physical, social and economic access to adequate, safe and nutritious food (FAO, 1996). These four aspects availability (presence of food), access (ability to gain food), utilization (nutrient absorption) and stability (stability over time).

The entitlement theory developed by Sen (1981), based on the foregoing premise, provided a paradigmatic shift whereby it argues that starvation is a result of defects in the entitlement system that dictates whether one can command food through production, exchange, employment, or inheritance and not a reduction in food supply. In the perspective provided by Sen, food insecurity is basically a question of access influenced by entitlements of food endowments and exchange. The foregoing theory, which underscores the importance of household resources in influencing the outcome of food security, has found wide application in food security studies.

The Sustainable Livelihood Approach, which views households as having five types of capital human, social, natural, physical, and financial capital, has made a substantial contribution to theoretical understanding. This approach recognizes that households use these capitals to achieve their livelihood objectives through different livelihood strategies, including food

security. Shocks, trends, as well as capitals and livelihood strategies of households, affect the achievement of food security outcomes, indicating the flexibility of livelihood strategies.

The assessment of food security within a family can be measured by using the Food Consumption Score (FCS) method that was developed by the World Food Program (WFP, 2008). In order to determine the FCS, one needs to measure how often eight specific foods are consumed during seven days. This measure can be defined as a composite score that takes into account the frequency of consumption of specific foods in terms of their nutritional value. Taking into account that diversity of food intake is associated with adequate intake of nutrients, the chosen approach is consistent with the theory of food diversity as a proxy variable of food security.

Agricultural Production and Food Security Theories

Agricultural production theory, rooted in neoclassical economics, conceptualizes farmers as rational decision-makers combining inputs to maximize output given technology and resource constraints. Relationships between inputs and agricultural output have been widely studied using the production function framework (Cobb & Douglas, 1928), with expansions that include human capital variables like education and experience. By differentiating between technical and allocative efficiency, the stochastic production frontier approach (Aigner, Lovell, & Schmidt, 1977) enhanced theory and made it possible to identify causes of inefficiency and avenues for productivity increase.

Climate-Smart Agriculture (CSA) is a contemporary model of agriculture which combines the issues of food security, adaptation and mitigation into three major pillars such as reduced greenhouse gas emissions, adaptation and building resilience to climate change, and increased productivity and income in a sustainable way (FAO, 2010; Lipper et al., 2014). The theory, which focuses on achieving the goal of food security in the face of climate change through transformation in the use of crop varieties, fertilizer and sustainable land management practices, serves as a guide for agricultural policies in developing countries.

Technology adoption theory is a framework which helps to understand the factors behind farmers' adoption decisions, and this is founded on the diffusion of innovations concept of Rogers (1995). As per this theory, factors such as personal characteristics like education, risk attitude and farm size, along with institutional support, market forces, and social relationships, play an important role as determinants of the characteristics of innovations such as relative advantage, compatibility, complexity, trialability, and observability. Rogers (1995) posits that adoption is a five-step process involving awareness, interest, evaluation, trial, and adoption stages. Contemporary extensions of the theory incorporate principles of behavioral economics.

Institutional Theory and Food Security

Institutional theory provides a framework for understanding how formal and informal rules shape behavior and outcomes in agricultural systems. As defined by North (1990), institutions are rules governing a particular society. They may be formal institutions such as laws, rules, and property rights or informal institutions such as customs, traditions, and norms. The influence of institutions on the food security status of households is through the manner in which they determine access to markets, financing, information, and productive resources. Effectiveness of institutions determines market participation, technology adoption, and investment in agriculture, all of which affect household food security and well-being. To

understand how land tenure systems, lending institutions, extension organizations, and farmer organizations affect agricultural productivity and food security outcomes, institutional approach has been employed.

It has been empirically found that the institutional effectiveness, rule of law, and quality of governance affect agricultural productivity and food security in a significant manner; hence, the idea of institutional quality has considerable relevance. The absence of institutional quality may lead to problems such as coordination failures, information asymmetry, and market failure, which will affect agricultural transformation and food security. Conversely, effective institutions can contribute to small farmers benefiting from agricultural development through market integration, access to inputs, and technology. Therefore, this theoretical framework makes the case for the use of institutional variables, such as extension service, credit access, and land rights in empirical work.

Gender and Food Security

Feminist economics presents an economic theory that can help understand the link between gender and food security in relation to gender-related roles, norms, and inequalities. This theory suggests that women are usually disadvantaged in terms of labor, land, finance, and even extension services, resulting in lower production and contribution to food security in households (World Bank, 2011). Time allocation is affected by gender roles and responsibilities: Women often have a lot of responsibilities related to childcare, cooking, and other household chores that prevent them from engaging in profitable agriculture. The theoretical model stresses the importance of systemic intervention in order to ensure equal food security outcomes because gender inequality is not merely a restriction of individual women but rather an institutional issue.

6. Empirical Literature Review

Demographic Factors and Food Security

Education: There is evidence of positive correlation between food security and education. As cited by Gebre et al. (2021), in the rural parts of Ethiopia, there is an increase of 14.2 percent chance of food security with each additional year of education at the 1 percent level of significance. According to Kassa and Berhanu (2022), households who had any education were 2.4 times more food secure than uneducated ones because of the use of better seeds and fertilizers owing to education. Anang et al. (2020) found that completion of primary education led to a significant increase in food consumption scores.

Family Size: The evidence on the relationship between family size and food security is contradictory. In the case of Tigray, more family labor was positively associated with food security, as reported by Ayele and Seid (2021). Every additional person increased the amount of food consumed by 3.8%. On the other hand, in the case of southern Ethiopia, every extra person was negatively correlated with food security and decreased the chances of having food security by 4.2%, due to rising demand for food, as observed by Tesfaye and Tiruneh (2022). In addition, as noted by Alemu and Endalew (2023), families with greater than six people face food insecurity.

Age: There is mixed evidence regarding the influence of age and food security. According to Kassa and Berhanu (2022), the younger the age of the head of the household, the more food secure they were, reducing food security by 1.2% for each additional year. However, Gebre et

al. (2021) did not find any significant effect of age on food security. Anang et al. (2020) argued that there may be a nonlinear relationship but did not find any significant effect. The lack of effect of age was reported by Mekonnen et al. (2023) in the case of conflict-affected regions.

Sex: Gender effects on food security are controversial. Owing to unequal distribution of resources, it was found out by Ayele and Seid (2021) that food security in women-headed households was 18% less. No gender disparities were observed by Gebre et al. (2021), which means that some actions from the government might have resolved existing differences. Anang et al. (2020) showed that higher household welfare motivation caused more variety of foods in women-headed households. It is stated by Osabohien et al. (2022) that gender affects food security primarily through unequal access to resources. It is also mentioned by Doss et al. (2023) that reducing gender disparities could decrease food insecurity in Africa by 10 to 15 percent in eight countries.

Farm Experience: Nevertheless, the results with regard to experience are not clear. Experience exhibits non-linear impacts such that the lower amounts of experience increase the food security, whereas higher amounts have low impacts, as per Gebre et al. (2021). In contrast, Kassa and Berhanu (2022) reported that for every extra year, food security increased by 0.8% at the 10% significance level. According to Anang et al. (2020), the relationship is non-linear with optimal experience that limits the positive impacts.

Socio-Economic Factors and Food Security

Chemical Fertilizer: The positive effect of fertilizer usage on food security is very well documented empirically. As noted by Hailu & Deresa (2021), fertilizers have reduced the probability of food insecurity by 22% and increased the crop income of Ethiopian households by 37%. In a study conducted by Ahmed and Abebe (2022), fertilizers have increased annual income levels by 42% amongst 350 farm households. The use of fertilizers has led to a 15% increase in food consumption compared to those not using fertilizers, as per Worku et al. (2023). According to the panel analysis carried out by Sherif and Tsegaye (2024), continuous fertilizer usage has cumulative effects on soil fertility and food security. A meta-analysis carried out by Tesfaye et al. (2024) amongst 156 Sub-Saharan African studies has shown a consistent positive effect.

Row Planting: Row planting has emerged to be one major way that can help increase production. As stated by Hailu and Deresa (2021), row planting improved household food security in Ethiopia and increased maize production by 28%. The use of row planting increased crop yield by 24% and agricultural income by 18%, as noted by Ahmed and Abebe (2022). Nevertheless, due to labor shortages and lack of adequate information, the adoption rate is quite low (less than 30%), as indicated by Worku et al. (2023). As argued by Achem and Oteh (2020), the largest productivity gain has been obtained through row planting and other techniques.

Livestock Ownership: However, evidence suggests that livestock generally has a positive effect on food security. Worku et al. (2023) established that every additional unit of livestock increased food consumption by 6.8% at the 1% significance level. It has also been observed by Hailu and Deresa (2021) that livestock ownership substantially reduced the probability of food insecurity, particularly those with diverse portfolios. Nevertheless, nonlinear effects were observed by Alemu and Endalew (2023), which resulted from the reduction of marginal effects owing to overgrazing at higher stock levels. Mekonnen et al. (2023) observed that livestock loss due to violence reduced food consumption scores by 40%, whereas Achem and Oteh (2020) observed livestock serving as a shock absorber.

Credit Access: Credit positively affects food security and production, as indicated by several empirical evidences. As revealed by Ahmed and Abebe (2022), access to funds increased food security by 28%, and increased adoption of fertilizers by 42%. Access to credit increased the chances for adopting new technologies by 2.1 times, as highlighted by Gebre et al. (2021). Access to credit was associated with 25% lower food consumption, as suggested by Worku et al. (2023). However, Kassa and Berhanu (2022) found barriers such as lack of social capital, assets, and education. According to Osabohien et al. (2022), credit constraints affect between 40 to 60% of African smallholder households, focusing on context-based interventions. Credit helps in coping with shocks and smoothing consumption, as indicated by Sherif and Tsegaye (2024).

Crop Rotation: The practice of crop rotation has also been related to positive impacts on food security. As stated by Ahmed and Abebe (2022), crop rotation led to lower pests by 15%, raised crop production by 22%, and improved soil fertility by 19%. As mentioned by Worku et al. (2023), the users of crop rotation gained 14% in food consumption compared to non-users. Risk aversion, extension contacts, and farm size were identified as significant factors for adoption by Hailu and Deresa (2021). Crop rotation is positively associated with food security and soil quality in various contexts, according to Achem and Oteh (2020).

Plot Area: A positive relationship exists between plot size and food security, as seen in many studies. For every extra hectare, food consumption increased by 12.3% at 1% significance level, according to Hailu and Deresa (2021). Worku et al. (2023) found out that land size positively affected crop production and food security. Although there were decreasing marginal returns as a result of lower soil fertility levels, Achem and Oteh (2020) found out a consistent positive relationship in Sub-Saharan Africa.

Slope of Farmland: Since there is variation in erodibility and moisture retention capacity, Hailu and Deresa (2021) found out that flat areas were correlated with food consumption scores that are 14% greater than those of steep slopes. In a similar manner, Ahmed and Abebe (2022) established that adoption of soil conservation techniques depended on slope. Worku et al. (2023) revealed that slope correlated with productivity and conservation practices.

Institutional Factors and Food Security

Interaction with Development Agents: Agricultural productivity and food security have been often associated with extension contact. In Worku et al. (2023), it is observed that every contact with development agents increased the probability of adopting better technology by 16.2 percent and substantially improved food security in Ethiopia. The study reveals that households, which were provided proper advice on time and were relevant to their needs, were benefited the most, while the quality of extension contact was more important than the number of contacts. Similarly, in Gebre et al. (2021), households receiving extension contact were 1.8 times more likely to adapt better practices, making the extension contact important for food security.

As per their findings, the households with few social networks and sources of information were found to have the most pronounced extension effects, emphasizing the importance of extension services for the poor. As noted by Hailu & Deresa (2021), the quality of extension services played a significant role in food security, as often and relevant interactions had the most beneficial results. In the comparative study carried out by Achem & Oteh (2020), it was found that there existed positive correlation between food security, productivity, and extension services in a number of African countries.

Plot Ownership: The association between food security and agricultural investments has been positively correlated with secure land ownership. There is much improvement of food security with plot ownership in Ethiopia, as stated by Ayele & Seid (2021). Plot ownership is associated with a 14% increase in crop yield compared to the rented land and sharecropping. The difference in investment incentives might be one of the causes of the difference in the yield. Long-term productivity increases and investments in soil conservation depend on land ownership security. Land ownership security plays a significant role in adoption of long-term agricultural investments and food security, according to Gebre et al. (2021). It was established that tenure security facilitates investment in tree planting and soil conservation. Kassa & Berhanu (2022) revealed that food security in Ethiopia increased because of land certification which promoted land tenure security and investment incentives. Households which got their land certificates consumed 11% more food. In their review of land tenure systems in Africa, Achem & Oteh (2020) proved that land ownership is always associated with higher agricultural productivity and food security.

7. Conceptual Framework

The sustainable livelihoods approach (DFID, 1999) and Sen's (1981) Entitlement Approach provide the conceptual framework of the study where the three related groups of variables, namely, demographic, socioeconomic, and institutional, decide the household food security status. There are various demographic factors that determine the status of household food security, like sex, age, level of education, family size, and agricultural experience. Education enhances information access and technology use, while the family size determines the availability of labor force and consumption needs (Gebre et al., 2021; Kassa & Berhanu, 2022). Use of fertilizers, row planting, possession of livestock, availability of credit, crop rotation, plot size, and slope are some of the socioeconomic factors affecting agriculture production and income generation (Hailu & Deresa, 2021; Ahmed & Abebe).

The institutional determinants such as interaction with development agents and plot ownership affect food security since they determine the access to information, technology, credit, and tenure security (Ayele & Seid, 2021; Gebre et al., 2021). This approach recognizes the relationship between these variables: extension contacts contribute to the use of various methods, whereas education and credit enhance the application of fertilizers (Worku et al., 2023). Under the conceptual route, the households' resource endowments are affected by the demographic variables that also influence the institutional access and the adoption of socioeconomic practices that result in agricultural production and food consumption outcomes (Alemu & Endalew, 2023). The empirical test will be performed with the help of a probit regression model that estimates the household food security depending on the presented variables. Marginal effects will demonstrate the effect of each determinant (Sherif & Tsegaye, 2024).

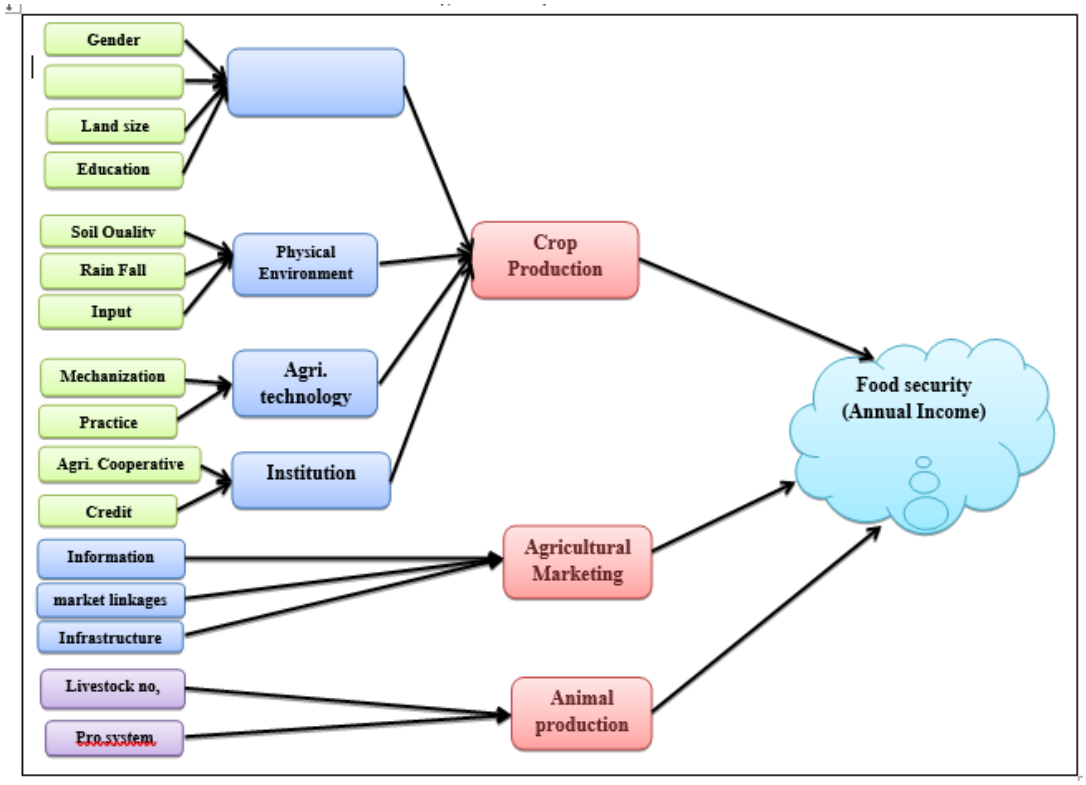

Figure 1 Conceptual framework of the study

Source: Adopted from various sources

8. Methods

Research Approach and Design

This study employed a quantitative research approach to investigate the determinants of food security among rural households in Sahila Woreda. Because it allows for the systematic measurement of variables, statistical testing of hypotheses, and extension of findings to the larger population of rural families in the study area, the quantitative approach was chosen (Creswell, 2005). Because it enables the estimation of the magnitude and significance of relationships between independent variables and food security outcomes using econometric techniques, this approach is especially suitable for identifying the institutional, socioeconomic, and demographic factors that influence food security. Additionally, the quantitative approach makes it easier to compare results across various family characteristics and circumstances, making it possible to determine which elements are most closely linked to food security.

The research used a cross-sectional survey research design whereby data is gathered from a sample of the population at a particular point in time. This type of design is suitable for this study because it helps gather data from many individuals in an efficient manner, provides information on the current state of food security as well as characteristics of the households, and it provides means of identifying relationships between variables (Robson, 2011). The use of cross-sectional design in agricultural economics research is common and the design is capable of using regression analysis in order to identify variables affecting food security. Individual and household level data is obtainable through the use of survey design and it

provides comprehensive information about institutional access, input usage, agricultural practices, demographic information, and food security outcomes.

Sample Size and sampling Technique

The sample size of 162 rural households distributed over five kebeles of Sahila Woreda was selected through a multistage sampling process. For the first phase of this selection, five kebeles were purposely selected with consideration of accessibilities, agricultural development activities, and diverse agro-ecologies. Yamane's (1967) formula was applied in the second phase in order to calculate the sample size of 115 households at 95% confidence level. Five kebeles namely Kebele 1 (18), Kebele 2 (25), Kebele 3 (26), Kebele 4 (21), and Kebele 5 (25) were proportionally allocated taking into account their population sizes. In the third phase of this sampling process, basic random selection was applied in order to select households randomly from each kebele.

The formula is presented hereunder using 95% confidence level.

$$\boldsymbol{n = \frac{N}{1+N(e^2)} \quad = \frac{162}{1+162(.05)^2} = 115}$$

Where, **n** is the sample size,

N is the population size

e is the level of precision or significance level.

Therefore, the researcher approaches 115 respondents using simple random sampling technique as a sample size.

Table 1: Sample size Determinations

No	Village	Total number of HHs	Number of Sample size
1	Barwa	25	n= 25/162*115=18
2	Menderecherkos	35	n= 35/162*115=25
3	Silazge	37	n= 37/162*115=26
4	Guaroch	30	n= 30/162*115=21
5	Akign	35	n= 35/162*115=25
	Total	**162**	**115**

Source: Survey data, 2024

Method of Data Analysis

Data in quantitative form was obtained from the questionnaire survey to calculate the descriptive statistics through the use of tables, graphs, frequency distribution, percentages, mean, and standard deviation. This method is selected due to its simplicity of use and understanding. Data collection takes place during the analysis of the survey by means of description, tables, percentages, graphs, and diagrams where appropriate. This research is equally descriptive (cross-sectional) and exploratory (qualitative data, secondary data) because the main objective of the research is to find out the factors that affect food security and the measures that have been put in place in the area of study. Analysis of data undertaken by using the Statistical Package for the Social Sciences (SPSS version 27.

Model Specification

The probit regression analysis model was used in this study for identifying factors affecting food security of rural households in Sahila Woreda. This is because it provides consistent estimation of parameters when dealing with dichotomous dependent variables and also assumes normality of errors, making it a more appropriate model compared to the logit model because of the data nature in this study (Greene, 2018). The dependent variable, that is, food security is coded as a dichotomous variable where 1 indicates food security (Food Consumption Score > 42) while 0 represents food insecurity (Food Consumption Score ≤ 42).

The probit model specification is:

$$P(Y = 1|X) = \Phi(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k)$$

If $P(Y = 1|X)$ represents the probability of a household being food secure, then Φ refers to the cumulative distribution function of the standard normal distribution; while β_0 represents the intercept term; β_1 to β_k represent the parameters associated with the independent variables; X_1 to X_k represent the independent variables. The probit regression model employs maximum likelihood estimation to find the parameters that maximize the probability of the observed sample.

The marginal effects (dy/dx) were calculated for each independent variable, representing the change in the probability of being food secure associated with a one-unit change in the independent variable, holding other variables constant at their means. Marginal effects are more interpretable than probit coefficients and enable comparison of the magnitude of effects across variables.

The model specification is:

$$P(FS = 1) = \Phi(\beta_0 + \beta_1 SEX + \beta_2 AGE + \beta_3 EDUC + \beta_4 FAMSIZE + \beta_5 FERTILIZER + \beta_6 ROWPLANT + \beta_7 TLU + \beta_8 CREDIT + \beta_9 CROPROT + \beta_{10} DA\_CONTACT + \beta_{11} PLOTAREA + \beta_{12} DISTANCE + \beta_{13} SLOPE + \beta_{14} OWNERSHIP + \beta_{15} EXPERIENCE)$$

Where FS represents food security status, and all other variables are defined in Table 1 below. This model specification is consistent with theoretical frameworks and empirical literature on food security determinants (Gebre et al., 2021; Worku et al., 2023).

Operational definitions of variables

Food Security: Household food security status measured using the Food Consumption Score (FCS), operationalized as a binary variable (Food Secure = 1 if FCS > 42; Food Insecure = 0 if FCS ≤ 42). FCS is computed as the sum of frequency × weight for eight food groups consumed over the past seven days.

Sex: Gender of the household head, measured as a binary variable (Male = 1, Female = 0). This captures gender-based differences in access to resources and agricultural productivity.

Age: Age of the head of the household in years, measured as a continuous variable. The younger the farmer, the more likely he is innovative and physically fit.

Education Level: Years of formal schooling completed by the household head, measured as a continuous variable (0-12 years). Education enhances access to information and technology adoption.

Family Size: Total number of household members expressed in adult equivalent units, measured as a continuous variable. Larger families provide more labor but also increase consumption needs.

Farm Experience: Number of years the household head has been engaged in farming, measured as a continuous variable. Experience contributes to accumulated knowledge and adaptive capacity.

Chemical Fertilizer: Use of inorganic fertilizer on farmland, measured as a binary variable (Used = 1, Not Used = 0). Fertilizer use enhances crop yields and household income.

Row Planting: Practice of planting crops in rows with uniform spacing, measured as a binary variable (Practiced = 1, Not Practiced = 0). Row planting improves plant growth and yields.

Livestock Unit (TLU): Livestock holding was converted to tropical livestock units using standardized conversion factors and was measured as a continuous variable. Livestock offer income, manure, and draft animals.

Access to Credit: Household access to formal or informal credit services, measured as a binary variable (Accessed = 1, Not Accessed = 0). Credit enables input purchase and investment.

Crop Rotation: Practice of rotating different crops on the same land across seasons, measured as a binary variable (Practiced = 1, Not Practiced = 0). Crop rotation improves soil fertility and reduces pests.

Average Plot Area: Average size of cultivated plots in hectares, measured as a continuous variable. Large landholdings enable higher production.

Average Distance from Homestead: Average walking distance from home to farmland in minutes, measured as a continuous variable. Longer distances reduce management intensity.

Slope of Farmland: Topography of the farmland measured in binary form (flat = 1, sloping = 0). The flat land is more productive due to reduced soil erosion.

Contact with Development Agents: Number of extension contacts with development agents in the past year, measured as a continuous variable. Extension improves information and technology adoption.

Plot Ownership: Land tenure status, measured as a binary variable (Owned = 1, Rented/Sharecropped = 0). Secure tenure enables long-term investment.

Reliability and Validity Testing

Reliability and validity testing are essential prerequisites to ensure data quality, measurement accuracy, and replicability or research findings (Creswell & Creswell, 2018).

Reliability

The term used to refer to the reliability of a measurement tool is the tool's consistency, accuracy, and repeatability (Hair et al., 2019). It demonstrates the lack of biases in measuring instruments and the consistency with which they deliver results at various times and from different components of the measurement tools. For measuring the reliability of the measurement tool, the Cronbach's Alpha was employed where scores ranging from 0 to 1 are considered good if greater than 0.7 (Hair et al., 2019). The pre-test was carried out on 12 respondents in a kebele other than those within the study area.

Table 2 Reliability of the variables

Variables	No. of samples	Cronbach's alpha value
Chemical fertilizer	102	.832
Farm experience	102	.865
Row planting	102	.802
Tropical livestock unit	102	.779
Access to Credit service	102	.746
Crop rotation	102	.824
Extension contacts with Das	102	.738
Average plot area	102	.759
Average distance of the plots from homestead	102	.814
Slope of farmland	102	.763
Plots Ownership	102	.752

Source: Survey, 2024

Validity

Validity is the degree to which a tool measures what it claims to measure (Creswell & Creswell, 2018). In this study, content validity has been used for accuracy of measurement. Content validity is concerned with the inclusion of a sufficient number of items that reflect the concept that has to be measured (Creswell, 2005). The process of establishing content validity involved the following activities: Data were gathered from credible sources and experienced respondents in the study area; The survey instrument was developed from earlier works with revisions made on the basis of literature review and theories; and the questionnaire was piloted with 12 selected respondents prior to main survey. The pilot test was conducted with revision in questionnaires made in order to improve their clarity, arrangement of questions, eliminate repetitive and irrelevant questions.

9. Result

Demographic Characteristics of Sample Households

The demographics of the sampled HHs were deemed important in offering insights and an intuition about the general characteristics of a certain area under consideration. As a result, a description of certain significant traits of sample responders has been made.

Table 3 Description of Demographic & Socio-Economic Variables

Variables	Labels	Frequency	%	Crop yield difference	
				Mean	Std. Dev
Sex	Female	12	11.8	9.6	4.08
	Male	90	88.2	10.86	3.73
	Total	102	100	10.71	3.77
Religion	Orthodox	87	85.3	10.57	3.57
	Muslim	15	14.7	11.53	4.82
	Total	102	100	10.71	3.77
Marital status	Single	7	6.9	13	4.58
	Married	83	81.4	10.44	3.56
	Divorced	9	8.8	10.5	4.91
	Widow	3	2.9	13.5	2.29
	Total	102	100	10.71	3.77

Source: Survey, 2024

Sex of Household Head

Only 11.8% of the respondents had families that were headed by women, while 88.2% of the respondents came from male-headed households. The difference in the mean crop yield between the male-headed and female-headed households was 1.26 quintals (10.86 and 9.60 respectively). Some of the problems that hinder the performance of female-headed households include lack of physical strength and many responsibilities within the households that decrease agricultural productivity. These findings are supported by those of Tawonda et al. (2009) in Ethiopia and Ekbom et al. (2012) in Kenya.

Religion

The proportion of the respondents who were Orthodox was 85.3%, while Muslims constituted 14.7%. Crop yields for Muslim households were higher by 0.864 quintals (11.53 quintals) compared to those of Orthodox households (10.57 quintals). This may have been caused by the fact that Muslims can cultivate crops on a daily basis, whereas the Orthodox have St. Days during which they do not cultivate any crops. These findings concur with those by Yezihalem (2007) in Northern Ethiopia.

Marital Status

The most common group among the respondents was those who were married (81.4%), while others were widowed (2.9%), divorced (8.8%), and single (6.9%). As opposed to the single (13.00 quintals) and widower (13.50 quintals) respondents, the married respondents harvested their crops at relatively low means (10.44 quintals). This is contrary to the results obtained by Adebiyi & Okunola in 2013 in Nigeria.

Table 4 Description of Demographic & Socio-Economic Variables

Explanatory variables	N	Mini	Max	Mean	Std. Dev
Age	102	21	55	25.4	0.527
Educational Status	102	1	4	1.97	0.814
Family Size	102	1	6	3.06	0.888
Number of Dependents	102	0	4	2.15	0.989
arable land size/timed	102	1	9	3.22	1.57011
Plot distance from homestead/km	102	1	5	1.7	0.83
Irrigable land size/time	102	1	9	3.22	0.502
Number of oxen	102	1	5	2.45	0.753

Source: Survey, 2024

Table 4 presents the continuous demographic and socio-economic characteristics of the 102 sampled households. The average age of household heads was 25.4 years, with a range of 21 to 55 years. This implies that the farming community is relatively young and hence more likely to be physically able to engage in farming activities. On a scale of 1 to 4, the average level of education was 1.97 showing that most respondents were educated up to elementary levels or even lower. There was a slight dependency burden of productive members of the family considering the average family size of 3.06 with the average number of dependents being 2.15. The mean size of land owned by households was 3.22 units (from 1 to 9) with quite a high standard deviation of 1.57, implying great heterogeneity in land ownership. Mean distance of land from the homestead was 1.7 kilometers, implying not too far travel distances for agricultural activities. Little accessibility to irrigation was implied by the mean size of land suitable for irrigation, which was 3.22 units with very little standard deviation (0.502). Average number of oxen was 2.45 (from 1 to 5) per household, showing moderate holdings of livestock for farming activities and transport purposes.

Cross-Tabulation of Food Security by Demographic Factors

Table 5 presents the cross-tabulation of food security status by demographic characteristics including sex, religion, and marital status. The percentage of food security among male-headed family types was higher (44.4%) compared to female-headed family types (25.0%), and chi-square test ($p = 0.040$) revealed that there is statistically significant correlation between food security and sex. From the result, it can be observed that there were significant differences in food security across various demographic groups. Though not statistically significant ($p = 0.169$), Muslim households had high food security level (53.3%) compared to the Orthodox ones (40.2%). Highest food security level was observed among single household types (71.4%), widowed family types (66.7%), divorced family types (55.6%), and married households (37.3%). Nevertheless, this correlation was not statistically significant ($p = 0.163$). Among all the variables used, only sex was correlated with food security at conventional levels; religion and marital status were not.

Table 5 Cross-Tabulation of Food Security by Demographic Factors

Demographic Factor	Category	Food Secure	Food Insecure	Total	Chi-Square (χ^2)	p-value
Sex	Male	40 (44.4%)	50 (55.6%)	90 (100%)	4.21	0.040**
	Female	3 (25.0%)	9 (75.0%)	12 (100%)		
Religion	Orthodox	35 (40.2%)	52 (59.8%)	87 (100%)	1.89	0.169
	Muslim	8 (53.3%)	7 (46.7%)	15 (100%)		
Marital Status	Single	5 (71.4%)	2 (28.6%)	7 (100%)	5.12	0.163
	Married	31 (37.3%)	52 (62.7%)	83 (100%)		
	Divorced	5 (55.6%)	4 (44.4%)	9 (100%)		
	Widowed	2 (66.7%)	1 (33.3%)	3 (100%)		
Total		**43 (42.2%)**	**59 (57.8%)**	**102**		

*Note: ** $p < 0.05$, significant*

Source: Survey, 2024

Distribution of Household Food Security Status

The distribution of the food security status of the 102 sampled households in Sahila Woreda has been given in Table 5. It can be seen from the results that out of the 102 sampled households, 59 (57.8%) were food insecure while the rest 43 (42.2%) were food secure. Therefore, it can be concluded from the above findings that the majority of the sampled households in the study area suffer from food insecurity, which makes the problem even more serious for the region. While the FCS ranges from 12 to 68, the mean FCS is 35.6 (SD = 12.4). The percent of food insecurity among the households (57.8%) is consistent with the previous studies done in similar drought-hit areas of Ethiopia where the rates of food insecurity generally vary between 50% and 70% (Gebre et al., 2021; Worku et al., 2023).

Table 6: Distribution of Household Food Security Status

Food Security Status	Frequency	Percentage	Cumulative Percentage
Food Secure (FCS > 42)	43	42.2	42.2
Food Insecure (FCS ≤ 42)	59	57.8	100.0
Total	**102**	**100.0**	—

Source: Survey, 2024

Cross-Tabulation of Food Security by Socio-Economic Factors

Households using chemical fertilizer had significantly higher food security rates (51.5%) compared to non-users (23.5%). The chi-square test ($p = 0.000$) indicates a highly statistically significant association between fertilizer use and food security.

Table 7 Food Security Status by Chemical Fertilizer Use

Fertilizer Use	**Food Secure**	**Food Insecure**	**Total**
Used	35 (51.5%)	33 (48.5%)	68
Not Used	8 (23.5%)	26 (76.5%)	34
Total	**43 (42.2%)**	**59 (57.8%)**	**102**

Chi-square = 13.42, p = 0.000

Source: Survey, 2024

Cross-Tabulation of Food Security by Institutional Factors

Households with extension contact had significantly higher food security rates (56.0%) compared to those without contact (28.8%). The chi-square test (p = 0.002) indicates a highly statistically significant association between extension contact and food security.

Table 8: Food Security Status by Contact with Development Agents

Contact with Das	**Food Secure**	**Food Insecure**	**Total**
Yes (1+ contacts)	28 (56.0%)	22 (44.0%)	50 (100.0%)
No (0 contacts)	15 (28.8%)	37 (71.2%)	52 (100.0%)
Total	**43 (42.2%)**	**59 (57.8%)**	**102 (100.0%)**

Chi-square = 9.68, p = 0.002

Source: Survey, 2024

Econometric Estimation Results

As mentioned above, the Probit regression model was applied in the analysis of factors affecting food security (income from farming). This regression model was applied in the analysis of data collected. As indicated in Table 9 below, the independent variables in the regression model, constant variable, and other coefficients including the marginal effect of the explanatory variables were found to be statistically significant at 95 percent confidence level.

Table 9 The Econometric regression Result: Probit Model

Food security (Farm income)	**Coef.**	**Marginal effect (dy/dx)**	**Std. Err.**	**Sig**
Sex	-.08523	-.03451	.08023	0.398
Age	-.05375	-.02634	.023757	0.247
Education level	.38305	.12435	.048763	0.000
Family size	.0718636	.03219	.0692756	0.032
Chemical fertilizer	.1457563	.08473	.03336	0.005
Farm experience	.053147	.00452	.072355	0.436
Row planting	.125243	.07126	.045324	0.011
Tropical livestock unit	.234516	.16383	.087273	0.000
Access to Credit service	.048732	0.01214	.053245	0.015
Crop rotation	.284715	.18793	.04510	0.001
Extension contacts with DAs	.213411	.15412	.071657	0.007
Average plot area	.13874	.08537	.077465	0.014

Average distance of the plots from homestead	-.14132	-.07985	.045621	0.956
Slope of farmland	.318564	.20564	.031441	0.003
Plots Ownership	.275475	.17893	.035112	0.018
_cons	-.87434		.412374	0.000

Source: Survey, 2024

10. Discussion

The results of the probit regression analysis revealed that eleven factors influence the food security of rural households in Sahila Woreda and their marginal effects were between 1.20% and 20.56%. The most influential variable among the demographics was the education level; thus, for each extra year of education, the probability of achieving food security increases by 12.43% ($p<0.01$), which is confirmed by the findings of Gebre et al. (2021), Kassa and Berhanu (2022), and Alemu and Endalew (2023).

As opposed to the findings of Tesfaye and Tiruneh (2022) in southern Ethiopia, family size has a positive impact on food security, with its marginal effect being equal to 3.21% per additional member ($p<0.05$). This implies that the factor's influence depends on the specific context; therefore, there are some areas, such as resource-abundant areas where more labor can contribute to productivity, where the effect is positive. Ayele and Seid (2021) revealed a positive impact of labor availability in Tigray.

Socio-economic variables such as crop rotation were found to have the most impact (18.79%, $p<0.01$), similar to what was documented by Ahmed & Abebe (2022) and Worku et al. (2023) in the context that crop rotation leads to better soil fertility, decreased pest attacks and stable yields. Also, in line with Hailu & Deresa (2021) and Worku et al. (2023), the farm slope exhibited the largest marginal effect (20.56%, $p<0.01$), indicating the severe erosion hazards and limitations on production in the sloping areas of this drought prone area. As documented by Worku et al. (2023) and Mekonnen et al. (2023), the tropical livestock unit positively influenced the level of food security by 16.38% ($p<0.01$), which is due to its direct consumption, financial gain, manure, and animal traction. As per Hailu & Deresa (2021), Ahmed & Abebe (2022), and the meta-analysis findings of Tesfaye et al. (2024), the application of chemical fertilizer and row planting enhanced food security by 8.47% and 7.12%, respectively.

The influence of institutions was significant where there was an increase in food security for every encounter with development agent by 15.41% ($p < 0.01$), hence supporting the studies by Worku et al. (2023) and Gebre et al. (2021), who argued that extension access helps in technology adoption. Just like what Ayele and Seid (2021), Gebre et al. (2021), and Kassa and Berhanu (2022) discovered, where they noted that secure tenure enables farmers to invest in soil conservation in the long term and production improvements, plot ownership increased food security by 17.89% ($p < 0.05$). Plot ownership, land management, tenure security, and livestock development need to be prioritized due to their highest marginal effects.

The four statistically insignificant variables of gender, age, farming experience, and distance from homestead failed to achieve statistical significance owing to contextual considerations such as the low number of households headed by women, lack of age diversity (average age of

25.4 years), dominance of environmental shock that undermines experience, and the relative low and narrow distance range of plots (average distance of 1.7 km). The sustainable livelihoods approach (DFID, 1999), which underscores the importance of multi-sectoral efforts incorporating investments in physical, social, human, and financial capital for achieving food security in Sahila Woreda, is reinforced by these results.

11. Conclusion

This research examined the factors that affect the level of food security of rural households in Sahila Woreda, where it was observed that 57.8% of the sampled households faced food insecurity, thereby indicating the level of food deprivation faced by households in Sahila Woreda. There were eleven determinants identified by the probit regression analysis, and the marginal effect values of the most important determinants were: slope of farmland (20.56%), crop rotation (18.79%), plot ownership (17.89%), livestock ownership (16.38%), and contact with development agents (15.41%). Apart from the above-listed determinants, education (12.43%), plot area (8.53%), fertilizer (8.47%), row planting (7.12%), family size (3.21%), and credit (1.20%) are also considered to be important. It can be concluded that food poverty in Sahila Woreda is the consequence of complex interactions between land degradation, weak institutions, tenure insecurity, lack of inputs and lack of human capital.

While the ranking of marginal effects clearly shows that land management, tenure security, and livestock development should be given priority in policy interventions, the multivariate model's insignificance of sex, age, and experience suggests that institutional and structural constraints, rather than personal traits, are the main causes of food insecurity. These results have wider ramifications for agricultural development strategies in similar drought-prone woredas throughout the Amhara Region, showing that integrated approaches that address several constraints at once are necessary for improving food security sustainably rather than isolated sectoral interventions.

12. Implications of the Study

There are serious implications of the findings in terms of agricultural policies with regard to Ethiopia’s Growth and Transformation Plan and the current PReSERVE campaign. First, the high impact of slope management (20.56%) suggests that investment in terracing, soil and water conservation, and sustainable land management is the best way to maximize the benefits for food security. Therefore, it is important to scale up conservation programs and link them to agricultural extension. Second, high impacts of extension contacts (15.41%) and plot ownership (17.89%) indicate the importance of continuous land certification programs and improved farmer to farmer extension programs, as well as funding for the development agents. Third, livestock development programs such as improvement of veterinary services, feeds, and marketing should be emphasized due to high impact of livestock (16.38%).

Finally, the relatively low impact of credit access (1.20%) indicates that future initiatives need to consider combining credit access with other programs like extension, inputs, and markets in order to create significant benefits. Credit alone cannot provide any benefits; therefore, future research needs to evaluate the effectiveness of intervention packages in this context. Further longitudinal research designs are needed in order to understand the dynamics of food insecurity in this region, and gender analysis is also important for understanding the differences between men and women. Comparative studies on similar drought-prone woredas will be useful in

understanding the variation in food insecurity determinants and designing appropriate policies in the Amhara Region.

13. Recommendations

Based on the empirical findings, the following recommendations are proposed to enhance household food security in Sahila Woreda.

- **Strengthen Sustainable Land Management:** Land characteristics exhibited the largest contribution to household food security. Therefore, local and regional agricultural authorities should strengthen integrated soil and water conservation programs, particularly in erosion-prone areas. Expanding terracing, watershed management, and other sustainable land management practices can improve soil fertility, reduce land degradation, and increase agricultural productivity over the long term.
- **Promote Crop Rotation and Sustainable Farming Practices:** Crop rotation emerged as one of the strongest determinants of household food security. Agricultural extension services should promote diversified cropping systems through farmer training, demonstration plots, and improved access to legume and other rotation crops. Integrating crop rotation with improved agronomic practices such as row planting and the use of improved seed varieties can further enhance productivity while maintaining soil health.
- **Improve Land Tenure Security:** Secure land ownership significantly contributed to improved household food security. Strengthening land registration and certification systems, while enhancing local land administration and dispute resolution mechanisms, can increase farmers' confidence to invest in long-term land improvements and adopt productivity-enhancing technologies.
- **Enhance Livestock Production Systems:** Livestock ownership was positively associated with household food security. Livestock development programs should focus on improving veterinary services, animal nutrition, breed improvement, and market access. Supporting livestock value chains and strengthening producer cooperatives would enable households to diversify income sources and improve resilience against agricultural shocks.
- **Strengthen Agricultural Extension Services:** Frequent interaction with development agents significantly improved food security outcomes. Increasing the capacity of agricultural extension systems through additional personnel, regular technical training, and improved logistical support would facilitate wider dissemination of improved agricultural technologies and management practices.
- **Expand Farmer Education and Knowledge Sharing:** Educational attainment positively influenced household food security. Adult literacy programs, continuous agricultural training, and farmer-to-farmer knowledge exchange should be strengthened to improve farmers' technical skills, decision-making capacity, and adoption of modern agricultural technologies.
- **Improve Access to Agricultural Inputs:** Access to fertilizer contributed positively to food security. Policymakers should strengthen agricultural input supply systems by ensuring timely availability, affordability, and equitable distribution of fertilizers and improved seed varieties, particularly for resource-constrained households.

- **Expand Rural Financial Services:** Although the marginal effect of credit access was relatively modest, improving access to affordable rural finance remains important. Financial institutions should develop flexible agricultural credit schemes with simplified lending procedures that enable smallholder farmers to invest in productivity-enhancing inputs and technologies.
- **Support Youth and Women in Agricultural Development:** Targeted interventions that strengthen the participation of women and rural youth in agriculture should be prioritized. Skills development, entrepreneurship training, improved access to productive resources, and support for income-generating activities can enhance household resilience and contribute to sustainable food security.
- **Strengthen Monitoring, Evaluation, and Evidence-Based Planning:** Local government institutions should establish robust monitoring and evaluation systems to regularly assess food security interventions and inform policy decisions. Continuous collection and analysis of agricultural and household food security data will facilitate adaptive management, improve accountability, and enhance the effectiveness of future development programs.

Overall, improving household food security in Sahila Woreda requires an integrated policy approach that simultaneously strengthens sustainable agricultural production, natural resource management, extension services, rural finance, education, and institutional capacity. Coordinated implementation of these interventions is likely to generate greater and more sustainable improvements in household food security than isolated sector-specific initiatives.

List of Abbreviations

DA	Development Agent
DFID	Department for International Development
FAO	Food and Agriculture Organization
FCS	Food Consumption Score
FEWS NET	Famine Early Warning Systems Network
FSAU	Food Security Analysis Unit
GTP	Growth and Transformation Plan
HH	Household
IPC	Integrated Food Security Phase Classification
IPCC	Intergovernmental Panel on Climate Change
PReSERVE	Poverty Reduced Sustainably in an Environment of Resilient and Vibrant Economy
SPSS	Statistical Package for the Social Sciences
TLU	Tropical Livestock Unit
USAID	United States Agency for International Development
WFP	World Food Program

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Author's Contributions

Girma Ayalew: Conceptualization, Methodology, Data collection, Formal analysis, Investigation, Writing – original draft, Writing – review and editing.
Anchinesh Endaylalu: Conceptualization, Methodology, Validation, Writing – review and editing, Supervision.

Statements and Declarations

Consent to Participate

Informed consent was obtained from all individual household respondents included in the study prior to data collection. Participants were informed of the study's purpose, the voluntary nature of their participation, and their right to withdraw at any stage without consequence.

Consent for Publication

Not applicable. This manuscript does not contain any individual person's data, images, or identifiable information requiring separate publication consent.

Declaration of Conflicting Interests

The authors declare that there is no conflict of interest with respect to the research, authorship, and/or publication of this article.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors used AI tools, namely ChatGPT and Gemini, to improve the language, grammar, clarity, and readability of the text. These tools were not used to generate original research content, data, analysis, interpretations, or conclusions. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the accuracy, integrity, and originality of the published article.

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