ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
COLLEGE OF DEVELOPMENT STUDIES

DETERMINANTS OF FOOD SECURITY UNDER SUBSISTENCE AGRICULTURE IN ETHIOPIA: THE CASE OF HINTALO WAJIRAT WEREDA, TIGRAY REGION

By

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Title

Determinants of Food Security under Subsistence Agriculture in Northern Ethiopia. A case Study from Hintalo-Wajirat Wereda, South Eastern Zone of Tigray Region.

BY

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DEVELOPMENT STUDIES

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Acronyms

AAU	- Addis Ababa University
ADLI	-Agriculture Development Led Industrialization
AE	-Agro-Ecological zone
BARD	-Bureau of Agriculture and Rural Development
BC	-Before Christ
CSA	-Central Statistical Authority
DG	-Development Group
EPRDF	-Ethiopian People Revolutionary Democratic Front
FAD	-Food Availability Decline
FAO	-Food and Agriculture Organization
FDRE	-Federal Democratic Republic of Ethiopia
FED	-Food Entitlement Decline
GDP	- Gross Domestic Product
Ha	- Hactare
HH	-Household
IFAD	-International Fund for Agriculture Development
MOFED	-Ministry of Finance and Economic Development
NDPPC	-National Disaster Prevention and Preparedness Commission
OLS	-Ordinary Least Square
PA	- Peasant Association
PASDEP	-Plan for Accelerated and Sustainable Development to End Poverty
PRSP	-Poverty Reduction Strategy Program

Qt	- Quntal
RRC	-Relief and Rehabilitation Commission
SDPRP	-Sustainable Development and Poverty Reduction Program
SNNP	- People of Southern Nation and Nationalities
SSA	-Sub Saharan Africa
TARI	-Tigray Agricultural Research Institute
UN	-United Nations
USD	- United State Dollar
WHO	- World health Organization

Abstract

Food security is a relative concept defined as the access to food by all people at all time to enough food for an active, productive and healthy life. Food security can be achieved when households produce enough staple food for their consumption or when they have enough income to meet their food need from market. Like many developing countries, Ethiopian farmers in the highlands predominantly practice subsistence farming and are often subject to food insecuirty. The current study aims to identify the determinants in achieving food security at household level in Hintalo-Wajirat wereda, South Eastern zone of Tigray region , Northern Ethiopia. The data was collected from both primary and secondary sources. A multi stage cluster sampling procedure were employed to sellect households from the wereda. Households were selected using systematic random sampling procedure proportional to size from the selected gots of the study area . A total of 210 households were interviewed using a semi structured questionnaire based interview schedule from three agro-ecological zones of the wereda. A two stage least square regression analysis was used to identify the determinant variables of food production and food security status of a household. Total cultivated land size and total livestock holding of the household were found to significantly($P<0.05$) ditermine grain production of the households in the wereda. The food security status of the study area was found to be significantly determined by farm grain production ($P<0.001$), grain purchased from the market ($P<0.001$) and aid/remittance support received by the households ($P<0.05$). The later two factors are mostly influenced by the food security copping strategies followed by the households, their access to market and social networks. Thus, development policies designed for the wereda should target on enhancing these determinant variables of food security and on controlling family size and population growth to improve access to and size of land. Moreover, the government and non government organization dealing with achieving food security in the wereda should emphasize on creating income generating activities so as to improve the purchasing power of households, enhance asset building mechanism , access to market and other social infrastructures.[1]

[1] Key words: food security, subsistence, agro ecological zone.

CHAPTER ONE

INTRODUCTION

1.1. Background Information

Poverty alleviation and achieving food security have been major concerns of mainstream development programs in SSA countries. It is probably the central issue of households, communities and governments especially if we look into Ethiopian realities.

Ethiopia with an area of nearly 1.1 million square kilometers and population of 61.7 million in July 1999 and an increasing population rate of 3.2% per annum (CSA, 1999:60-67), is the fourth largest in size and the second most populous in Africa. The backbone of its economy has been predominantly the agriculture sector when judging from the point of view of the people's occupation, its contribution to GDP, export of commodities and orientation of the industries.

The country is endowed with natural resources, 60% of the land mass known to have a good potential for agricultural development. Out of this potentially cultivable land only 15% is known to have been developed. The country is also known to possess the largest livestock population in Africa.

However, poverty and food insecurity remain as the major challenges to achieve economic development in Ethiopia and especially in the rural area of the country. This is due to the subsistence nature of Ethiopian agriculture, its mere dependence on rainfall and the existing backward technologies, has made peasants highly vulnerable to famine and food insecurity (Alem Abraha, 1999: 21).

This can be substantiated by the UN release which indicated the proportion of Ethiopian population living below a poverty line of one USD a day in 1998 was 50 % of the total population,

which is approximately about 29 million people (World Bank, 1992 cited in Senait Seyoum, 2000:60-67).

Moreover, the majority of people (83%) in Ethiopia are living in rural areas, where poverty is more widespread , deeper and severe than in urban areas. On the average, the income of the rural poor is 12.1% far from the poverty line, while it is 10.1% for the urban poor.

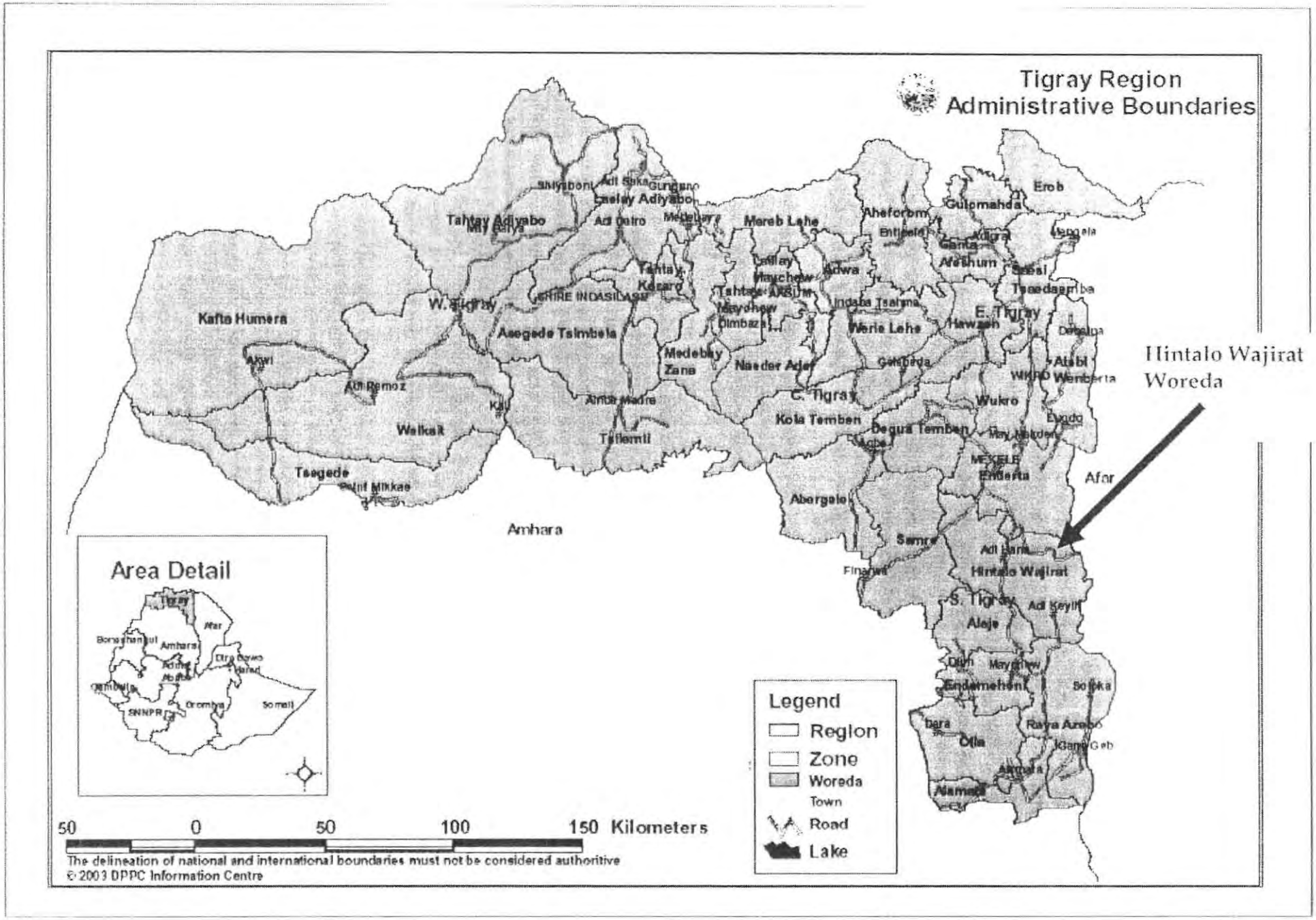
Hence, the agriculture sector has increasingly been unable to provide food for the alarmingly growing population.. In the decade between 1985 to 1994 G.C only about 83% to 94% of the total domestic food supply was provided by domestic production, which accounts about 85% of the total household food consumption (Alem Abraha ,1999, p:20). This has widened the gap between the food production and the population growth and forced the country to increase food imports and become one of the largest food aid recipients in the continent (Habtemariam Kassa, 2000:1).

Because of this, many Ethiopians live in conditions of chronic hunger with both low average daily energy supply 1880 kcal/capita/day and a very high (44%) prevalence of under nourishment (Berhanu Adenew, 2004:138).

Hence, the issue of food insecurity and efforts to achieve food security will remain the primary concern of governments and households mainly, those people in lower income or vulnerable groups in the country. In this regard, identifying the socio-economic variables that determine achieving food security of the country are vital important.

The objective of this paper is therefore, to describe the socio-economic characteristics and identify the determinant variables in achieving food security at household level in *Hintalo-Wajirat wereda*, South Eastern zone of Tigray region, Northern Ethiopia.

Graph 1 Map of Tigray and the Study Area



1.2. Statement of the problem

In Ethiopia food related crisis can be traced as far back as 250 B.C. Recent records on famine indicate that about 42 periods of food shortage (including the 1999 and 2000 G.C food crisis) have been recorded in Ethiopia. Most of these crises were geographically concentrated in two broad zones of the country. The first comprises the Central and North Eastern highlands stretching from North Showa through Wollo and Tigray , which is categorized as mixed farming production system area of highland Ethiopia (Webb, P. et al, 1992 cited in Degefa Tolesa, 2002:3-4). While the second is made up of the crescent of low laying agro-pastoral lands ranging from Wollo in the North through Hararge and Bale (the area known as Ogaden), to Sidamo and Gamo Gofa in the South (Webb, P. et al, 1992). The major reason to mention for being famine vulnerable and prone of these area are, high population pressure causing relatively shallow asset base to the population demand, natural resource degradation and their poor state of development and hence vulnerable to drought and famine.

The present study *wereda*, *Hintalo-Wajirat* is located in the first famine zone of the country aforementioned and hence all the constraints that characterize this zone are relevant to the study area. These are mainly, the land resource, especially the soils and vegetation of this part of the country have been highly degraded because of the interplay between some environmental and human factors such as climate, population pressure and the resultant over cultivation of the land, deforestation of forests and over grazing. Moreover, investigation of the history of the study area have enabled the researcher to discover the severity of the problem of food insecurity, the presence of considerable size of the population under status of food insecurity and hence recognize the worthiness to study and identify the determinant variables of food security in the *wereda* with the following objectives..

1.3. Objectives of the study

1.3.1. Main objective

The research is inspired in achieving an over all objective of improving the understanding of the extent and causes of food insecurity and importance of considering the various social, economic, political, environmental and cultural variables which determine the food production, acquisition, procurement and utilization strategies of the households in achieving food security. By so doing, it is hoped to describe and explain the household food security situation and identify the major factors contributing to the household food security and insecurity. Such farm level information are believed to help bring about improvements in policy making that will be translated to better decisions, resource allocation and sound policy formulation in the development efforts made to achieve food security in the country and in the region in general and in *Hintalo-Wajirat wereda* in particular. And possibly, this and similar efforts will also contribute towards changes in emphasis in food security research and development.

1.3.2. Specific objectives

The specific objectives set for this study were:

1. To describe the socio-economic characteristics of the farm households in the study area.
2. To identify the major determining socio-economic variables and assess the association and significance of these determinant variables in achieving food security at household level.

Through these, the major causes and determining factors in achieving food security of farm households in *Hintalo-Wajirat wereda* of south eastern zone of Tigray region, Northern Ethiopia will be identified.

1.5. Significance of the study

Ensuring sustainable food production and access to it of the people in need and effective intervention in times of emergency require enactment. This requires a through understanding of the magnitude, causes and characteristics of food insecurity, food entitlement protecting and promoting policies and the strategies of disaster prevention and preparedness. This can be done through collection, analysis and dissemination of disaggregated information about the causes, extent and severity of food insecurity (Webb, P. and Von Braun, J.1994 cited in Alem Abraha, 1999:13).

The challenge faced by governments and non government agencies has been to develop and implement policies that are effective and locally appropriate, long term and comprehensive multi-sectoral action plan to address the causes of food insecurity.

This is because there is scanty research output that identifies the factors determining food security at household level in the country. Hence, caring out such empirical research would obviously have both basic and practical purpose. It provides micro level disaggregated information which can be helpful for policy makers and development practitioners in designing appropriate development policy and to make informed decisions regarding food security development programs.

Last but not least, the study result will also add some value to the academia in narrowing the gap in the existing information for further research in the related subject that will be conducted in the country. Therefore, it is worthy to study and identify the determinant factors of food security at household level in the study area.

1.6. Scope of the study

This paper is a compilation of cross sectional household survey that focuses mainly on the description of the socio-economic characteristics of the study area and identification of the major determinant factors of food security and insecurity in *Hintalo-Wajirat wereda*, South Eastern zone of Tigray region.

As the unit of analysis is a household, the study lacks macro level variables that affect household food security status and longitudinal perspectives of the problem under consideration. Moreover, it also lacks to assess and analyze in depth household socio-economic variables in the study area and wider geographical coverage as well, due to time and resource limitations. Hence, the study result lacks zonal, regional and even national level population representation.

Moreover, as the study deals with only a one year data of food insecurity status of the households, it doesn't show the dynamics of the food insecurity status is in each household. Hence, the study lacks to show how chronic the problem is when viewed its longevity in time perspective.

1.7. Limitation of the study

The research study had faced a number of limitations during data collection and document compilation. The major limitation faced were lack of transportation, because of this, the sample area selected was limited to *gots* which have transport access only and the sampling procedure was a little bit modified. This might have reduced the quality of the data and wider representation of the *wereda*. The second suspect to be considered as a limitation faced during data collection was that there could have been reservation of openness of households in providing the right information asked regarding annual grain production and asset holdings etc. Moreover, there was also lack of relevant literature references for some of the presumed determinant socio-economic variables.

1.4. Organization of the study

The Study is organized in five main chapters.

Chapter 1-deals with an introductory and background information of the research subject, the major and specific objectives of the study, the significance and scope of the study and limitation faced during the study.

Chapter 2-deals with the review of literature, under this section, the theoretical and conceptual framework of the research problem are detailed. Moreover, what worldwide and local scientists say about the factors determining food security at household level has also been reviewed.

Chapter 3-explains what the research methodology used in the study was. How the research was conducted , what data collection and statistical procedures were used is discussed.

Chapter 4-describes the interpretation of the result obtained by the survey study, it discusses the socio-economic characteristics of the study area, the factors determining in achieving food security under subsistence agriculture , the food insecurity coping mechanisms and market participation strategies of households in the study area.

Chapter 5- provides a concluding remark of the study result and recommendations are highlighted.

CHAPTER TWO

REVIEW OF LITERATURE

2.1. Introduction

The review of literature of the study tries to provide the theoretical perspective and conceptual analysis of food security, which addresses the conceptual definition of food security, the types and forms of food security, the indicators mostly used to assess status of food security ,the causes and the determining factors in assessing the food security situation of a country.

The review also provides an overview of the food situation in the country as well as in the study *wereda*. It also tries to look in to what the development policies and strategies and the forth coming challenges are, in achieving food security in the country. Moreover, the study addresses, what the literature says on the determinant variables of food security studied in Ethiopia as well as in different part of the globe.

2.2. Theoretical perspective and conceptual frame work

2.2.1. Conceptual definition of food security and insecurity

When food security issues were first highlighted, special attention were paid to fluctuation of aggregate food supply at global, national or regional level. The question was whether a nation or a region could command enough food to meet the aggregate food requirements of its people.

Food security was conceived as macro level phenomenon concerned with national and international food reserve adequacy (Debebe H, 2000:1). Later on, food availability at one corner of the globe and hunger at the other, revealed that food availability at the global or national level does not guarantee acquisition of food at household or individual level. This has resulted a shift in

thinking in recent years from the global and national food availability concerns to household and individual food security level.

The early macro level definition on food security defines it as "Availability at all times of adequate world food supplies of basic food stuffs to sustain a steady expansion of food consumption and to off set fluctuations in production and prices" (Debebe Habtewold, 2000:17). The definition emphasized on the aggregate supply side of food at global and at market level regardless of the entitlement conditions of households and individuals. Based on this definition, different researchers provided a number of different concepts and definition of food security.

However, the recent and more widely accepted food security definition is offered by the World Bank, 1986 cited in (Debebe Habtewold, 2000:2). It defines food security as "access by all people at all times to enough food for an active and healthy life". This definition emphasizes on supply of food in sufficiency with its longevity in time, its quality in nutritional terms, ability of individuals to command food and its coverage of the entire population under consideration.

In general, Webb, P. et al,1994 conceptualized food security as follows; food security is a concept that crosses the conceptual wall between emergency relief and development activity. The risk of failure in either realm of activity determines vulnerability to an erosion of food security and decent slippery slide towards famine (Webb, P. and Von Braun, J. 1994: 13).

2.2.2. Type and forms of food insecurity

Food insecurity has both a long term and a short term aspect when viewed in time dimensions, chronic and transitory food insecurity. When a household is persistently unable to meet the food requirements of its members over along period of time marked by a continuous and constant failure to food acquisition, it is known as chronic food insecurity. While the later, transitory food

insecurity indicates a temporary decline in food security. (Tesfaye Zegeye and Debebe Habtewold, 2000:19).

Food insecurity concerns with two elements, ability to produce enough and access to it of the people in need. It is also strongly associated with shocks that briefly push the level of food consumption below the requirements.

A household can be said to be food secured only if it has protection against both kinds of insecurity. The average access to food over the long term should be nutritionally adequate, and a household should be able to cope with short term changes without sacrificing the nutritional needs of any of its members. Recent findings have also indicated food insecurity to be associated with a third dimension i.e. the utilization aspect of what is produced (Degefa Tolessa.2002:11)

2.2.3. Indicators of food insecurity

Assessment of food insecurity/security is a challenging work for researchers dealing with it as there are no universally established indicators which serve as a measuring tool. It requires a multi dimensional consideration, since it is influenced by inter-related socio-economic, environmental and political factors.

Because of this, analyzing food insecurity follows a variety of approaches ranging from mere qualitative to a combination of both qualitative and quantitative measurements (Debebe H, 1995: 9). In this context, a number of indicators have been identified. In most cases, the purpose and the depth of the study influence the choice of the indicators.

In early warning studies conducted by the then RRC and now DPPC, have used three indicators such as, food supply indicators (including rain fall, area planted and yield estimates), social stress indicators (such as market prices, availability of food in the market, labor pattern, wages and

migration) and individual stress indicators (nutritional status, disease and mortality variables) to identify food insecurity situations (RRC, 1990 cited in Debebe Habtewold, 1995:10).

But, Frankenberger,T.R. has classified these indicators in to two; as process and outcome indicators. The former provides estimates of food supply and access situations while the later provides as proxies for food consumption (Frankenberger,T.R.1992: 84 cited in Debebe Habtewold, 1995:10).

Frankenberger,T.R., as also described by Alem Abraha (1999:17) indicated that the major supply indicators include Agricultural production, access to resources, institutional development and market infrastructures. According to his observation, these indicators are in most cases aggregated and hardly serve to assess food insecurity at household level but it could provide a general picture of an area or society (Frankenberger,T.R. 1992:77 cited in Debebe Habtewold, 1995:10).

Unlike the supply indicators, access indicators are relatively effective to assess food insecurity situations at household level. The most important issue related to food access indicator is the households diversified coping strategies and their sequential responses they enter, the response varies from the disposal of productive and non productive assets to distress migration, to avert decline in food availability at their disposal.

The outcome indicators such as level and changes in food consumption and the amount of food stores serve as proxy estimates for measuring household food situation, it is capable of disaggregating at household level, unlike the food supply indicators.

The household's response to food shortfalls are also further classified by Davies, S. as insurance strategies (against the chance of failure of primary production) and coping strategies (once the Household failed to meet the expected food level) and destitution (Davies,S. 1994 cited in Debebe Habtewold, 1995:11).

The major challenge in the use of these response indicators are the difficulty associated with identifying the normal phenomenon of the household and the response of the household forced by food stress or its response to avoid risks of food stress.

On the other hand, indicators related to food availability for consumption, level and change in food intake serve as measurement to define household food insecurity (FAO/WHO 1992 cited in Debebe Habtewold, 1995:12). Fluctuation in level of food production and possession of productive capitals are also useful indicators.

Hence, there is no fixed rule as to which method to employ due to diversified characteristics of food insecurity and different level of consideration. The decision to use a particular method usually depends on the objective of the study, availability of data and degree of accuracy required (Debebe Habtewold, 1995:12). The current study follows the combination of the process indicators, and out come indicators.

2.2.4. Causes of food insecurity

Theoretical explanations for the causes of food insecurity can be depicted from the three explanatory models of the causes of famine and a recent additional dimension of food security.

(Da Corta, 1985 cited in Degefa Tolessa, 2002:12) has provided a general explanation on the causes of famine to be rapid population growth, war and civil strife, ecological degradation and drought, bad governance, political dislocation and instability as the main causes of famine. However, criticizing the weakness of its explanation in which production failure could or could not be caused by these explanations, later on, two models on the perceived causes of famine have been developed by Alamgir, M. (1980) and Sen, A. (1980). The former on food availability decline (FAD) which emphasizes on the availability side of food and the later on food entitlement decline (FED) emphasizes on the lack of the mean of acquisition of food of the households.

Alamgir, M. defined FAD as the availability of food per capita, the argument of FAD was that any factor, be it war, drought, flood etc that brings failure of food production and livestock death, especially of the subsistence farmers, may cause a decline of available food to the consumer. However, the model was criticized for over emphasizing the supply side of crop production and gives less attention to the demand side for the available food.

The other alternative explanation provided by Sen, A. emphasizes on means of acquisition of food, which explains as follows. In the absence of national, regional, or local level availability decline, famine could occur due to the absence of access to command what is available at one corner of a country. Hence, food availability in the country or in the market doesn't provide the access to a person to consume it. This entails entitlement or access to food as a crucial factor to food security. Access of households to the basic resources (assets) and public services determine the possibility of increasing entitlement to food. However, these factors are necessary but not sufficient condition to influence food security.

Moreover, recent studies have identified a third dimension that affects household level food security, i.e. the utilization dimension, which refers to adequate utilization of food emphasizing management and utilization of food, to meet specific dietary needs (Debebe Habtewold,1995:8 and Degefa Tolessa, 2002:11).

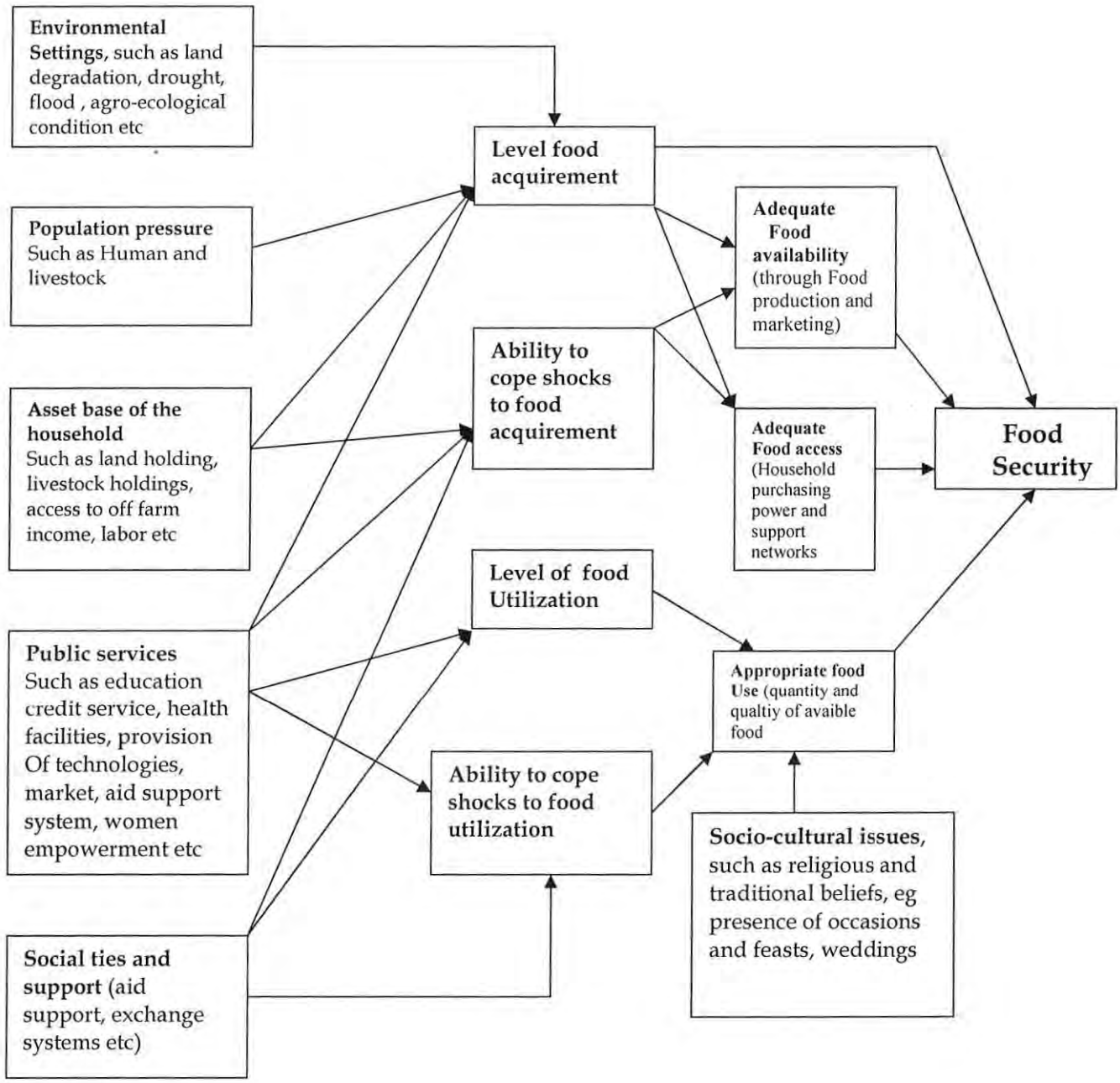
The management and utilization of food are determined by level of food utilization and ability to cope shocks to food utilization of the household to meet the specific dietary needs of the household. The characteristics of the management and utilization of resources (assets) and the different sources of food and handling patterns which facilitate the time dimension of food availability in the household in addition are crucial to the successful attainment of household food supplies in a sustainable way. The social support pattern also allows additional possibility of

exploiting the existing social ties and indigenous coping mechanisms against shocks in the society (Debebe H.1995:8).

In general, theoretical explanation of food security in the current study is a combination of the general explanation to causes of famine, the two models of famine and the third dimension of household food utilization.

Much of literature on food security point towards a number of factors operating in an interactive ways to condition food security of households. Hence, the current study consists five major components that affect food security of households as given in figure1.2 below, these are the environment where the household lives, the status of population pressure, the asset base of the household , the social and cultural setting of the household, and the access to rural social services. All these variable work interactively to affect the household's level and ability to cope shocks to food acquirement and utilization and hence to achieve food security.

Figure 1.2: A flow Chart of the Determinants of Household Food Security



Source: Modified from Webb, P. et al , 1994 and Degefa Tolessa, (2002)

2.2.5. Determinants of food security status of a household.

2.2.5.1. Conceptualizing the determinants of food security status.

A number of inter-related factors determine food security situation of a country or a household. It varies from immediate factors which affect food supply at household level to the basic factors which condition the overall economic system of a given country (IFAD, 1992 cited in Debebe Habtewold 1995:8).

The food security condition of a household is mainly associated with factors affecting the processes of food acquisition, procurement strategies and socio-economic conditions of the society the household belongs. It is generally affected by two major determinants, availability of food and accessibility to it (Debebe Habtewold, 1995:8).

The former is further influenced by a third determinant in which different sources of food and handling pattern including the characteristics of management and utilization of these resources, which improve the time dimension and stability of food availability in the household. While the later, Access to different basic resources (such as cash, labor, land, market and public services etc) and the pattern of social support that the household obtains have greater impact on the procurement strategies of food supplies and access to food (Debebe Habtewold, 1995:8 and Degefa Tolessa, 2002:3-12).

The social support pattern also allows additional possibility of exploiting the existing social ties and indigenous coping strategies against shocks in the society. Accordingly, swift identified a number of claims ranging from households to against governments these include a variety of support arrangements; loan and gift systems, assistance in food and other productive resources, exemption in community contribution and government tax and securing international assistance (Swift, J.1989 cited in Debebe Habtewold, 1995:9).

Moreover, evidence from IFAD had also demonstrated the above claim factors to be influenced by the availability of ample resources and the structure and mechanism of controlling and managing them (utilization dimension). And the economic structure and political conditions of a given country, through their influence on policies and other factors, do also highly determine the food situation (through food production and acquisition options) in a household and hence, in the level and pattern of food intake at the household level (IFAD 1992 cited in Debebe Habtewold, 1995:9).

2.2.5.2. Identification of the determinants of food security status.

Many empirical studies all over the world have indicated that food security is affected by many interactive determinant variables of the environmental, socio-economic and political settings of the country. The variables treated here under would be those that have direct or indirect relations with food production and food security of the household.

A study done by James, L. and Maria T.R.(1999) indicated that household expenditure and household size had negative effect on calorie availability and food security. Where as, variables such as land availability, gender of household head, migration and seasonality didn't have any significant effect on calorie availability independently (James, L .G. and Maria, T.R., 1999).

In general, variables such as household expenditure, household size, household composition, seasonality and location, household income, child characteristics (sex and age), maternal characteristics (educational level), and household characteristics (expenditure per capita and percentage of household members less than five years of age) were found to be the major determinants of food and nutrition security/insecurity in the study areas (James, L .G. and Maria, T.R., 1999).

Study done by David et al, 1994 on determinant variables of household consumption had considered variables such as net household food production, net cash income per adult equivalent

(AE), household off farm cash income (off farm work plus remittance), net energy availability to the household, Asset variables (such as cultivated area per AE, number of cash crop holdings, livestock holdings per AE, presence of remittance in family, and fallow area proportion) , household structures such as household dependency ratio, number of non elderly adult resident in a family, age of household head, education of household head, gender of household head and proportion cotton area planted, an interaction term between proportion of cotton land with pesticide usage per hectare and control of money (agricultural sale) by women as explanatory variables in their chosen household food security strategies.

Among all these variables, it was found that only land area cultivated, household off farm cash income (weather from cash crop or off farm work), number of non elderly adult resident in a family were the major determining factors food security at the household level when considered energy availability as proxy to food security (David, L. and Michael ,T.W.1994).

Other complementary studies on role of urban farming on child food and nutritional security considered variables such as income, season, health and time of maternal care factors, food sufficiency and dietary adequacy factors. Among these factors, farming influenced by access to land and season was found to be the major determinant factor food security (Maxwell, D.G.1995).

Identification of determinants variables of income diversification in three zones of Burkina Faso revealed that land holding per adult equivalent, saving and livestock holding had found to be the major determinants of income diversity and food security (Thomas, R. et al. 1992).

Examination of the dynamics of food insecurity and poverty through the determinants factors of household earnings in low-income societies of India had compared the variables that primarily influence the earnings of households, such as year of schooling, educational attainment and training gained on the job captured by experience of the worker. The study revealed that education

and specialized skills (training) was a determinant factor for earnings of the dwellers (Madhura, S. 1997).

On the other hand, study result of Kalirajan et al, had found that gender, age or experience (farmers with non formal education), maternal health status to be the major determinants of food security (Kalirajan, K.P. and Tshand, R.1985).

Among eleven factors identified as the determinant factors of household food security in Sidama, Gurage and Hadiya zones of Ethiopia, it was only five of them that had a significant impact in determining the state of food security at household level.These are, agro-ecology, wealth status, pest and disease incidence, low soil fertility and *enset* farm size (Shiferaw Tesfaye. and Tesfaye Zegeye.2004).

Factors such as, sex of household head, age of household head, education, farm size, size of cultivated land, vertisol proportion, fertilizer cost, livestock holdings and off-farm income and technology adoption had been used to identify which of them were the determinant factors of household food security status in study done at Moretina Jiru district of the central highlands of Ethiopia. Among these factors, education, farm size, size of cultivated land, vertisol proportion, fertilizer cost, livestock holdings and technology adoption were found to be the major determining factors of food security status in the study area (Setotaw Ferede, Gezahegn Ayele and Hailemariam Teklewold. 2004).

Studies conducted by Degefa Tolesa (2002) to identify the determinant variables for the availability of food in the household and food security status of Oromiya zone of Ethiopia showed that age of household head, family size and size of crop harvest were significantly associated with food security. Age of the family head and size of crop harvest were positively associated with food security. Where as, family size was negatively associated with food security of the households.

In general, most of the studies reviewed indicated that the following variables seasonality, location, land holding per adult equivalent, livestock holding, household size, household composition (dependency ratio, number of non elderly adult in a family), age or experience, gender of household head, household income and household per capita expenditure, household diversification, education and specialized skills (training) and pest and disease incidence and amount of grain harvest were found to be the major determinant factor of food and nutrition security. The details are discussed here under.

Cereal grain production

Subsistence farmer's food security status is dominantly dependent on household cereal grain production. This argument has been supported by many empirical studies all over the world. Studies done in different parts of Ethiopia confirm similar argument. A study conducted in north wollo confirms that cereal production had positive effect on food security. The study indicated that a 100kg increase in cereal production reduced the probability of food insecurity in the household by 10.5 % (Ramakrishna, G. and Asefa Demeke, 2002).

A study done in oromiya zone of Ethiopia has also confirmed similar positive result. It indicated that per capita aggregate production had positive and significant effect in food security; the study revealed that a 100kg increase in per capita aggregate production calculated at sample mean resulted in 10% increase in the probability of food security in the household (H Kidane, ZG Alemu and G kundhlande, 2005).

Income diversification

Household off farm income was found to be a determinant factor in food security. A study done on calorie availability, child nutritional status and nutritional security indicated that, the more diversified the family income is, the more food secured the family will be in terms of calorie

availability (James, L .G. and Maria, T.R., 1999). Even though, out of the total income share, the majority was contributed from on farm production, off farm income had positive but small effect on calorie availability and food security. This is In line with results of (David, L. and Michael, T. W.1994).

Research done in rural Mozambique and Accra had also found that household total income have a determining factor in child nutritional status (Sahn, D., and Alderman, H. 1997 and Ruel, M. et al, 1999 respectively cited in James, L .G. and Maria, T.R., 1999: 1965).

On farm income represents a very high proportion of the total income of the household in the rural households of Mozambique. At the same time, cash cropping and livestock were also found to be important income source of households. However, cash income, which could be obtained from cash cropping and off-farm work, had little effect as source of calorie (consumption) and in assuring food security in the specific study. This was due to the fact that consumption shares across all three districts are dominated by own production of staples in the rural households of Mozambique. On the other hand, cotton production when combined with pesticide use had positive impact on calorie production. The more the family used pesticide on cotton farm, the more the family will have better food (calorie) production and food security (David. L. and Michael T. W., 1994).

It was also found that cash crop production has a systematic association with food security status of the household. The proportion of farmers growing cash crop (coffee, eucalyptus etc) was higher among the food secured farmers than among the food insecure households. About 26% of food insecure farmers and 42% of food secure farmers grow coffee; where as, 47% of the food insecure farmers and 64% of the food secure farmers grow eucalyptus trees (Shiferaw Tesfaye and Tesfaye Zegeye. 2004).

In line with these findings, income diversification was found to have statistically significant positive impact on calorie consumption and food security (Von Braun, J. Puetz , D. and Webb, P. 1989; Von Braun, J., De Haen, H. and Blanken, J. 1991; Kennedy, E. 1989; Kennedy, E. and Cogill, B. 1987 cited in David. L.T. and Michael T.W., 1994: 160).

Income diversification could also serve as income fluctuation stabilizer. Studies done on this subject indicated that households who had greater income diversity, the Sahelian and Guinean residents were found to have negative and significant effect on level of income fluctuation of households (income instability) due to its income smoothing effect of income diversification activity. The effect was not significant in the sudanian zone households, where households were more dependent on income from local cropping activity. Thus, the more income diversity out side local cropping led to less income and consumption instability that is, the household will have better income and consumption smoothing opportunity in the household (Tomas, R. et al, 1992).

Moreover, it was also found that non cropping income had the major share of the total income in study conducted in Burkina Faso, with highest income share from the poor agro-climatic sahelian zone households and lesser proportion of income from the migrant remittance in the better zone of the Guinean (Tomas, R. et al, 1992).

Thus, non farm sector did also contribute to real income of rural households and food security; it could provide employment and stimulate agricultural production and food security (Chin, D.L. 1979: 284).

Farm input utilization

Many evidences prove that farm input utilization especially improved technologies did improve farm productivity and production and hence affect household food security positively.

Studies conducted in Ethiopia, resulted both positive for some improved technologies and negative effects for others. The adoption of improved technologies such as improved varieties had positive effect on household food security status. A 10% change in the intensity of technology adoption increased the probability of being food secured by 3.4%, more over, for a 10% increase in share of improved crop verities, the level of food security increased on average by 6.4% of the minimum requirement for the food secured households This indicated the higher response of technology adoption to food security (Setotaw Ferede., Gezahegn Ayele. and Hailemariam Teklewold., 2004). But, Farmers who used fertilizer in their farm were found to be food in secured as compared to those farmers who didn't use fertilizer. The negative relationship occurred due to the larger share of fertilizer cost in crop production. The cash constrained farmers often get fertilizer on credit basis and farmers have to settle their fertilizer credit immediately after crop harvest, this is indeed the time when crop prices get low. As a result, farmers are prompt to sale significant proportion of their grain production to repay the input loan, this had ultimately resulted in food insecurity and its negative relationship with fertilizer use in the households (Setotaw Ferede, Gezahegn Ayele. and Hailemariam Teklewold, 2004).

A study done by Degefa Tolessa (2002) has also showed a mixed effect of improved technology utilization on availability of food in the household and food security status. The utilization of farm credits, improved seeds and herbicides and irrigation indeed had enhanced the volume of food available at the household level and improved food security status, however, per capita food availability has declined for the farmers who utilized commercial fertilizer and insecticides he

provided the reason for the undermined contribution of these inputs could be due to the contribution of drought and pest experienced in the particular study area.

Input utilization have been found to be affected by a number of factors, sustentative studies do support to the advocates of the argument that farmers with small farm size make an effort to utilize limited resources more efficiently and thus adopt new technologies at a faster rate (Alluadin, M. and Tisdel,C.A.,1988).

Inputs utilization of intermediate goods such as, seeds, fertilizer and pesticides were found to be more intense on small farm size than on larger ones. This could be due to availability of backyard manures in families with larger farm size, which is also associated with the household wealth in having larger size of livestock per unit of land in traditional agriculture. Or, due to the higher food demand from the households with small farm size and high demand to improve land productivity and provide sustainable food supply for the family. In general, Giovanni A., concluded that Intermediate inputs were found to be the most significant parameter of the production function together with land elasticity than labor and capital. (Giovanni, A., 1985).

Soil quality

Soil quality is also expected to affect food security through its impact on crop production and productivity. Low soil fertility and state of food security indicated that they had systematic association. Farmers who reported to have soil fertility problem tend to be more food insecure than those who had not reported the problem. Study conducted in Ethiopia indicated that, the proportion of farmers who reported to have the problem was higher among food insecure farmers than among the food secure farmers (Shiferaw Tesfaye. and Tesfaye Zegeye.2004).

Household expenditure

Household level of expenditure could also affect food security. Indications of households expenditure-calorie (food) elasticity was found to be high in better off (relatively food secure) households. Those families with higher income had better (higher) expenditure for food calorie (James, L .G. and Maria, T.R, 1999).

In contradiction with this finding, higher expenditure-calorie elasticity was also found in poor households of rural people when referring to calorie availability (Alderman, H. and Huggins, P. 1992; Alderman, H. 1986; Sahn, D. 1988, cited in James, L .G and Maria, T.R, 1999 : 1963).

Referring to child nutritional status, household expenditure did improved child nutrition at both age groups (less than 23months) and more strongly in the age group (b/n 24-60months), which is observed as higher expenditure elasticity to achieve the desired nutritional status of the group. This was due to the enhancement effects of education to increase expenditure (James, L.G. and Maria, T.R., 1999).The result is also in agreement with results obtained by (Bairagi,1980, Reed, B.A., Habicht, J.P. and Niamego,C. 1996 cited in James, L .G. and Maria, T.R., 1999, p: 1967).

Household size

Under the context of small holder agriculture where productivity is low, households with large family size are normally vulnerable to food insecurity problem. It was found a result that the greater the household size had large negative effect on food security when measured in terms of calorie availability. The larger the family size will be, the more food insecure, as there will be less calorie available to the household, the impact is increasing even though at declining rate. It was justified that the relationship could be due to the ability of larger households to start to solve the negative effects of an additional household member through exploiting the economies of scale in consumption (James, L .G. and Maria, T.R., 1999).

The negative effect was strong in smaller household size, due to the fact that additional member to the family had limited opportunity in rural areas to improve household income and food availability but, stronger social networks in rural area eventually begins to compensate this effect. But, larger household size did found to affect positively the child nutritional status in the age group (24-60months) unlike to the effect of the age group(less than 23months) in the calorie availability variable to represent food security (James, L .G. and Maria, T.R., 1999).

In line with the above study, it was also found that family size had significant and negative effect on food security. It was indicated that a household whose family size increased by an additional person did decreased the probability of household to be food secured by 11%. In addition, each additional person added to the family, decreased the level of food security by 32% for the entire sample studied and 23% for the food secured households (Setotaw Ferede., Gezahegn Ayele. and Hailemariam Teklewold.2004).

In contradiction with these studies, food secure families were found to have a relatively higher family member than food insecure families in the study done in Sidamo, Gurage and Hadiya zones of Ethiopia (Shiferaw Tesfaye. and Tesfaye Zegeye.2004).

It was also investigated that demographic variables such as household size had no significance in any of the zones included in the study with regards to its effect on income diversification of households (Tomas, R. et al, 1992).

On the other hand, H. Kidane, ZG. Alemu and G. kundhlande, (2005) have found similar negative and significant effect of family size to food security. They found that each additional family member had caused a probability of a 5% decrease in food security status.

Household composition

The household composition (dependency ratio or the percentage of children or elderly people in the total family size) had positive effect on calorie availability when it is used as proxy for food security. It was found that family with higher percentage of children or elderly people were found to have higher calorie or was found to be relatively food secured than the lower percentage taken household size the same. He explains the situation as follows, the family with higher percentage of children or elderly people had low calorie requirements (have lower number of adult equivalents) than those of young adults, thus, the same per capita sums could be used to provide more food for smaller number of adult equivalents, creating a positive effect (James, L.G. and Maria, T.R., 1999).

Unlike to the calorie availability parameter, larger percentage of children, those who are less than five years old in the household had negatively affected child nutritional status (poor height-for-age ratios). Families with higher percentage of children less than five years old will have poor nutritional status and hence, poor height to age ratio. This seem to reflect the higher demand on maternal time that a larger number children exert, short period b/n births which can result lower birth weights and poorer post natal growth or in light of calorie availability it can have higher calorie or resource allocation pattern with in the household that doesn't favor young children (James, L .G. and Maria, T.R., 1999).

On the other hand, it was also found not only that the number of non elderly adults in the household had negative and significant effect on calorie production and availability, but also, the more addition of non elderly adult person to the family resulted the more the family will be food insecure due to less availability of calorie for the household. This is in contrary with the wide

belief that land is abundant and labor is constraining resource in the small holder sector (David, L. and Michael, T. W., 1994)

But, other studies also found that dependency ratio had no significance with regards to income diversification of households (Tomas, R. et al, 1992).

Land availability

Land holding was also found to be a determinant factor of household food security. Relatively land rich households nearly all reached 80% of their calorie requirement; this indicated that a household with larger land holding was found to be in better position of food security than those of land poor households (David, L. and Michael, T. W., 1994).

The size of resource endowments like farm land, do determine the state of food security in the household. Accordingly, the size of cultivated land had positive and significant influence on household food security in a study conducted in Moretna Jiru district of central highlands of Ethiopia. For each additional land unit cultivated by the household, increased the probability of the household to be food secured by 11 %. Moreover, each additional unit of land cultivated increased food security by 32% on average for the entire sample and by 24% for the food secured households (Setotaw Ferede, Gezahegn Ayele and Hailemariam Teklewold.2004).

Similarly, Farm households who had larger *enset* farm in Sidamo, Gurage and Hadiya zones of Ethiopia were found to be more food secure than those households who had less Moreover, it was also observed that food security status was found to be associated with the trend of farm size. About 48% of food insecure farmers and 20% of food secure farmers reported that the size of *enset* farm had been decreasing (Shiferaw Tesfaye. and Tesfaye Zegeye.2004).

Not only size of the land but also having access to land, even if it is small, was often critical in determining income, but actual size of land was not highly correlated with either income or

consumption outcomes, since land poor households can purchase food with income obtained through off farm work. The central role of land holding in determining the income and consumption is largely a result of serious market failure (food market participation rate especially the proportion of net food buyers to sellers), limited off farm income earning opportunities, unavailability of food in the market and high price if any were the factors forced households to depend on their land for own production (Von Braun, J. and Pandya-Lorch, R. 1991, Lipton, M. 1985).

Study done on urban agriculture as alternative food security strategy in Kampala, access to land had significant positive effect on nutritional status of children in non farming households than in farming households of different in come groups. It had also found significant effect of land holding on calorie availability (production). The result indicated that non farming households who had access to land had relatively better food security measured in terms of better nutritional status and calorie availability. The food security effect was even more pronounced in very low income (poor) households (Maxwell, G.D.1995). This is also in support of the results obtained by (Von Braun, J. and Pandya-Lorch, R. 1991, Lipton, M.1985).

Comparing the very low and low income group of households among farming and non farming households, a significant higher level of short term food sufficiency was observed in the very low income group of the farming households than in non farming families, despite the same spending on food per person per day. This was due to availability of un purchased food from farming (Maxwell, G.D.1995)

In the low income group family, the amount of money spent on food were found to be significantly less in farming households than in non farming family of the same group. This indicates that farming was the major income source for expenditures. The result indicated the importance of

access to land to the very low income non farming group of households to sustain their nutritional security in the family.

At the same time, there was insignificant difference in the amount of money spent on food by households with higher income group, among farming and non farming groups; this may imply the less contribution of land for the over all income of the household. The study indicated that the major risk of food insecurity was not the size of the parcel of land but rather the risk of loosing the access to land as observed with the weak and insignificantly correlated between the size of land and nutritional status (Maxwell, G.D.1995). This was in line with studies Von Braun, J. and Pandya-Lorch, R. (1991) and Lipton, M. (1985) that substantiate the importance of access to land for poor household families.

Level of education

Human capital, be it in the form of education or training, which can be converted in to skills, can have a positive contribution towards food security and better living standard. A supportive study on education of household head and specialized skills was also found to have a positive role for earnings of the dwellers in India. The study confirmed that educational level had an important positive and significant effect on agricultural productivity and hence, enabled farmers to efficiently utilize information to improve productivity. (Madhura, S.1997).This was similar with the results obtained by Weich, F.(1978); Chaudhri, D.P. (1979); Hayami,Y. (1969); Hayami,Y. and Ruttan,V.W. (1970); Lockheed, M.E., Jamison, D.T. and Lau, L.J. (1980) cited in Kalirajan, K.P.et al. (1985).

Similarly, formal education of farmers even though, had an effect (insignificant effect) on yield, farmers with non formal education as measured by their understanding to the technology, had

rather a significant and greater influence on yield and food security (Kalirajan, K.P. and Tshand, R.1985)

In contrast with the above positive results, education has been found to have no effect on food security of the households when we refer to calorie availability as indicator for food security (James, L .G. and Maria T.R., 1999).

Pest and disease incidence

Disease and pests are important biological factors limiting crop production. Farm households who have disease or pest incidence in their farm are expected more likely to be food insecure. In light with this, it was found that pest "*enset* bacterial wilt" incidence was systematically associated with food security status of farmers in Sidamo, Gurage and Hadiya zones. The proportion of farmers with the problem of the pest was higher among the food insecure group of farmers than among the secure group of farmers. About 45% of the food insecure farmers and 37% of the food secure farmers were found to report the pest incidence problem (Shiferaw Tesfaye and Tesfaye Zegeye.2004).

Gender of household head

Gender was found to be a determinant factor for earnings as well as food security. Study on this issue indicated the female sex the head of the family it becomes, the less income the family will obtains (Kalirajan, K.P. and Tshand, R., 1985 and Madhuras, S. 1997).

Considering earnings as an indicator for food security, study done on the causes of differences in earnings in Malaysian workers, considering year of schooling, working experience, ability and others as variable to explain the differences in wage differences. It was found that women earn considerably less than men for the reasons of difference of skills and wage discrimination due to employment of women in low paying occupations than men (Chapman, B.J.1985).

It was also found that gender of household head had no significant effect in the study with regards to income diversification of the households (Tomas, R. et al, 1992). This was also in line with the results of (James, L .G. and Maria T.R., 1999).

Livestock holding

In Ethiopia, Livestock is often used as indicator for wealth status of farm households. In line with this, studies found that livestock ownership positively and significantly influenced household food security in Ethiopia.

Each additional livestock had increased the probability of food security by 4%. While the level of food security increased on average by 10% for the entire sample and by 7.3% for the food secured households (Setotaw Ferede, Gezahegn Ayele. and ailemariam Teklewold.2004).

Moreover, households that had larger livestock size were found to be more food secure than those households who had lesser in studies done in Sidama, Gurage and Hadiya zones of Ethiopia (Shiferaw Tesfaye. and Tesfaye Zegeye.2004).

Relationship of livestock holdings with income diversification indicated that, the higher livestock holding a family have, the greater income diversification will be, however, wealth represented by livestock holding had no income instability effect rather than increasing the ability of diversifying income of the household. Thus, the more the family has livestock's, the more the family will have income diversifying opportunities rather than increasing the household income (Tomas, R. et al, 1992). This result was in line with the result obtained by (David, L. and Michael, T., 1994).

Age of household head

Age of household head could affect food security status in two ways. Older households may have better position in terms of resources and cause variation in food security of the household. In light of this, a study conducted in Sidama, Gurage and Hadiya zones of Ethiopia revealed that

significant difference in age of household head between food secure farmers and food insecure ones. The average age of food secure households was found to be older (50years) while that of insecure farmers was a bit younger (47years) (Shiferaw Tesfaye and Tesfaye Zegeye.2004).

Moreover, age (experience) was found to be more important than basic literacy skills in determining the earnings and had positive effect on earnings (Kalirajan, K.P. and Tshand, R. 1985). Where as, in contrast to this result, it was also found that age of household head to have no significant effect with regards to income diversification of households (Tomas, R. et al.1992).

Migrant remittance

Many evidences have been reported else where in favor of Migration and migrant remittance to have an impact on household farm income and food security in developing countries. Households do participate in migration as a strategy to overcome income and production constraints as a result of credit and insurance market failures forcing households to self finance their production and income risks (Edward, T. J.1996: 900). Hence, labor migration by one or more family members can be an effective mechanism to avert risk in income and production at household.

Migrant remittance may have direct and indirect positive effect on household farm income and food security by influencing investment, however, it is found to be sensitive to initial asset holdings, liquidity of assets or size of complementary input requirements of households (Edward, T.J. 1996).

The non marketable land rights has resulted a significant positive effect on income through its influence on remittance. Where as, initial livestock assets had significantly reduced this effect. This could be due to the demand created by the non marketable land for complementary investment on land. However, Livestock holdings, which are relatively liquid assets, can be sold or used as collateral to secure funds or compensate income shortfalls. Thus, it was found to be

positively influenced by family land holdings, family size, and education and family contacts at the migrant destination.

In contradiction to this study, it was found no effect of this particular variable on food security of the households as well as calorie availability when families had or had not a migrated member (James, L .G. and Maria, T.R., 1999).

Seasonality

Seasonal variation can also have significant effect on the status of household food security through affecting scarcity and/or availability of household food stocks. Farmers do either sale or purchase food grains based on their food reserve status. In light of this, it was found that sale and purchase of food (in this case *kocho*) had a systematic relationship with the status of food security of households. The proportions of farmers who are selling food during the drought season were higher among the food secure households than the food insecure households. A bout 30% of food secure and 8% of the food insecure households sold during the drought season (Shiferaw Tesfaye. and Tesfaye Zegeye. 2004).

Similarly, the proportion of farmers purchasing food during drought period was higher among the food insecure households than the food secure ones. A bout 63% of the food insecure farmers and 19% of food secure farmers bought food during the drought season (Shiferaw Tesfaye. and Tesfaye Zegeye. 2004).

On the other hand, calorie availability and food security were found to decline substantially at the on-set of the rain and at harvest season as compared to the rainy season. However, the difference in calorie availability during the post harvest season did not differ significantly with the rainy season (James, L.G. and Maria, T.R., 1999). How ever, this study didn't explain why food security did

increase during rainy season and why it declined during the harvest period. Even though it is understood there will be a decrease in food availability during the early rainy season .

Location

Agro-climatic conditions of an area determine the type and level of production and food status of households. In light of this, systematic association was observed between self declared food security status of Sidama, Gurage and Hadiya zone households and agro-climatic zones. The proportion of food secure farmers was higher among the highlanders than the lowlanders. A bout 86% of the food secure farmers are found in the high-altitude zone where as, only 14% of the food secure farmers were found in the low altitude zones (Shiferaw Tesfaye and Tesfaye Zegeye.2004). In contrary to these results, it was found that household income per AE (adult equivalent) had not any association with agro-ecological zonation in Burkina Faso. The water deficit zone, the sahelian and the water abundant zone the Guinean zone had both the highest average income (Tomas, R. et al, 1992).

Maternal health

Maternal health could affect household food status through its impact on women productive performance, level of food acquirement and utilization. Sick women could not handle domestic work burden and responsibilites, she may not also able to participate in income generating activities to improve family income and food security status. Moreover, in rural farming communities women undertake large portion of the farm activities, Hence, the well being of women will affect household farm production and food security. In contradiction with this, Studies indicated family receiving prenatal care didn't affect food and nutrition security of households (James, L .G. and Maria, T.R.1999).

2.3. Food security situation in Ethiopia

2.3.1. Introduction

The food insecurity problem is no where else more severe than in Ethiopia. The population of Ethiopia might be among the most nutritionally deprived population in the world. This is a result of the combined effects of the availability of poor access to infrastructure and basic social services and poor agricultural production in the country. This has caused frequent transitory and chronic food insecurity problems in the country.

Evidences have indicated that per capita cereal production has steadily declined over time for more than 45 years (FDRE,1996). The relative adequacy of food supply has dropped from 78% in 1969-71 to 72% in 1990-1991 (FAO,1996). Moreover, the actual annual consumption of cereals in the country is estimated to be on average 20% below the minimally accepted nutritional standards. The average per capita calorie intake is only 71% of the requirements. This has aggravated the prevalence of under nutrition. (FDRE, 1996).

Each year on average an estimated 4 million people fail to secure enough food for themselves and thus, need help (FRDE,1996).The likely trend of the population is to increase significantly in the coming 20 years, studies indicated that, using the low variant projection, the population of Ethiopia is going to grow to 120 million by the year 2020 (CSA,1999).

Estimation of food production and requirement done by Yohannes Kinfe (1996) also indicated huge food deficit at the turn of 21st century. The deficit is estimated to be 3.9 to 4.2 million tons, if the medically recommended daily intake of 2100 calories per capita is to be achieved by the year 2005 (Yohannes Kinfe. 1996 cited in Alem Abraha, 1999: 21). With this regard, the issue of food insecurity and efforts to achieve food security will remain the primary concern of households and governments.

2.3.2. General overview of subsistence farming and livelihood in Tigray

The largest part of Tigray region is relatively dry area and subject to drought, farming in the northern highlands is nearly entirely dependent upon rainfall, which ranges from 450-980mm annually and is strongly seasonal and erratic. The main cropping season, called, *meher*, is from mid June to September, this is the period when rains are concentrated. Production varies depending on soil type, drainage and altitude, but the basic pattern is pervasive (Hoben, A.1973 cited in Patricia, H. 2006:1-15).

There are three altitude zones in Tigray, *kolla* (lowland, <1300ma.s.l), *weina dega* (mid high land, 1300-2200ma.s.l) and *dega* (highlands, >2200ma.s.l).The low land crops include Maize (*Zea mays*), pearl millet (*Genus penissetum*) and sorghum (*sorghum spp.*) , mid high land crops are wheat (*Triticum spp.*), barely (*Hordeum Vulgare*); and tef (*Eragrostis tef*) and crops of the high land are barley and potato(solanum tuberosum) are dominant. Pulses , e.g. field pea (*Pisum sativum*) and lentils (*Lens escuelenta*), oil seeds, vegetables and spices are also produced.

Crop productivity is generally low due to factors such as soil degradation and erratic rainfall. Depending on the type of crop and soil, land must be ploughed two to six times per year to permit granulation. Oxen are required for laughing due to dry climate and heavy soil, cattle provides traction power for 95% of grain production and also provides, milk, meat, dung, income and personal savings (Gebremedihin et al, 2000 and FAO 2004 cited in Patricia, H. 2006:1-15)

Animals have traditionally been grazed on natural grazing in Tigray. But, grazing land do not meet minimum nutritional requirement, particularly in dry season. The availability of natural grazing land has been reduced substantially since much of the grazing land is converted to farm lands. Currently, livestock feed sources in Tigray include; crop residue , 45%; grazing land, 35%; browse 10% and crop aftermath, 8%.

The farming calendar has several labor peaks and there is a relatively marked gender division of labor, only in plaughing and sowing are usually considered to be strictly male tasks. Plaughing starts in March to April for the *meher*, it also occurs in September to October for pulses (Yared Amare, 1999 and Beyene, 2003 cited in Patricia, H.2006:1-15), as farming is plough based, which gives importance to male labor in the farming system, this puts those households who lack male labor in a serious disadvantage (Yared Amare,1999 cited in Patricia, H. 2006:1-15).

Labor demand peaks are between June and August, when field must be cultivated , weeded and harvested. Since weeding is heavy, highly time demanding and is done by women and it occurs during the period when food shortages are greatest, such demand have serious negative health consequences. Harvesting begins in October and lasts through November to December presenting another labor demand peak in the region. Hence, labor demand is large over short period of time due to cropping calendar.

Food availability is also strongly seasonal, the month of greatest food shortage are typically from late May to September, but this varies according to land and rainfall distribution. In general, in the highlands, households have relied on own grain production to satisfy their requirements for staple food and only purchase grain when harvest are insufficient.

Grain sales have been the most important source of cash income. In area where livestock are important, animal and animal product sale are also source of cash, particularly of hide, skin, cheese, eggs and butter, although, their contribution to the total household income are usually reported to be small, other sources of cash income are sales of pulses, *tela* and other local alcoholic beverages such as *teji,* and skilled work, such as weaving, healing, carpentry, building and iron work, which can be a significant source of income but only a few of individuals possess these skills (Yared Amare, 1999 cited in Patricia, H. 2006:1-15).

Weldegiorgis, 1996 also noted that because farms in Tigray are very small, they are incapable of producing marketable surpluses; his survey indicated that only 21% of the respondents engaged in some kind of non agricultural employment and only 18% had some skills with which they could generate income.

2.3.2.1. Food production situation in *Hintalo-Wajirat wereda*

Hintalo- wjirat wereda is part and parcel of the famine prone zone of the region .Food production in the *wereda* is basically subsistent which is vulnerable to food insecurity. The major crops harvested according to the ranking given by the *wereda* agricultural office experts are *tef*, bean, wheat, lentil and the minor crops are sorghum, maize, barley and others. According to the *wereda* document sources (unpublished data, *wereda* Bureau of Agriculture), the rainfall distribution and crop production was better in the survey year (1999E.C) compared to the last ten years. The annual grain production was about 588,000 quintal from the land size of 34,000 ha (see figure2.1).

Figure2.1. Annual grain production pattern of *Hintalo-Wajirat wereda* (1992-1999e.c)

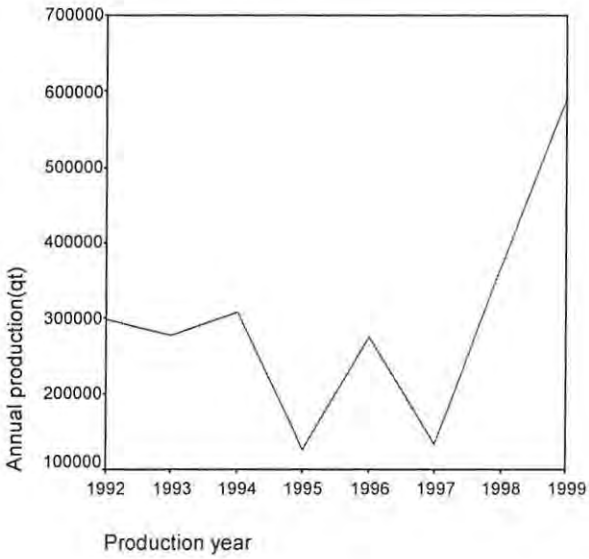
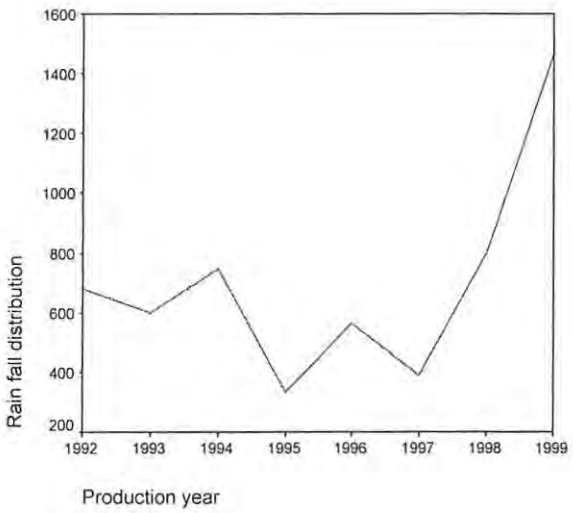


Figure2.2.Annnual rainfall distribution pattern of *Hintalo-wajirat wereda* (1992-1999e.c)



2.4. Development policies and strategies of Ethiopia.

2.4.1. Over all development policy and strategy of Ethiopia

After years of political instability and economic stagnation, Ethiopia has taken measures to implement political and economic reform since 1991/92. Since then, the government has taken reforms to achieve food self sufficiency and reduce food insecurity, and to reduce food aid dependency.

The main development objective of the Ethiopian government is poverty eradication. Hence the country's development policies and strategies are geared towards this end. To achieve this development objective, the government has formulated a guiding strategic framework for five year period (2005/6 -2009/10G.C) called plan for accelerated and sustained development to end poverty (PASDEP). The PASDEP represents the second phase of the poverty reduction strategy program (PRSP), which has began under the sustainable development and poverty reduction (SDPRP) that covered the years, 2002/3-2004/5.

PASDEP carries forward important strategic directions pursued under sustainable development and poverty reduction program (SDPRP), which include the rural development strategy, food security and scaling up of the efforts to achieve the millennium development goals (MDGs). The objective of PASDEP is to define the nation's overall development strategy for the coming five years and outline the major programs and polices in each of the major sectors.

Agriculture development led industrialization (ADLI) strategy is among the pillars of SDPRP. The objectives of ADLI is to bring about industrial transformation through bringing agricultural development .The wider belief of ADLI is that in order to accelerate and expand industrial development and increase overall economic growth, it is essential to develop the agricultural sector. This is crucial to ensure the provision of inputs for the industrial sector as well as to fulfill

food requirements of the country. Moreover, the agricultural sector employs the vast majority of the labor force and the main sector as the main source of foreign exchange for the economy (MOFED, 2006:1-2).

In the last few years, ADLI has made efforts to improve agricultural production and productivity through huge investment on agriculture. Evidence from CSA indicated that a tripled expenditure (from 85 million to 421 million as in 1995/6 to 1997/98) of the current Ethiopian government finance on agriculture as compared to the derg regime (CSA, 1989 and 1999 cited in Senait Seyoum, 2000:64). The government has placed the attainment of standard calorie intake from the current level of 1500kcal/day to about 2000kcal/day at the center of its agricultural development strategy. The government also planned to double per capita income over 15 years and reduces substantially the existing food gap within the next five years. (FDRE, 1996 cited in Senait Seyoum, 2000:64).

2.4.2. The food security program of Ethiopia

The national food security strategy got its name from the national disaster prevention and preparedness (NDPPS) ratified in 1993 and later, renamed as the national policy for disaster prevention and management. As part of its food security strategy, the national strategy has drafted the regional food security strategies of Tigray, Amhara, Oromiya and SNNP regions, and identifying 157 vulnerable districts in these regions to bring about food security in the food vulnerable regions of the country. (Senait Seyoum, 2000:61).

The strategy is designed to address problems of shortfalls in food production, vulnerability to falls in consumption and incomes and consequent hanger that the country has faced repeatedly, through adaptation of development alternatives to bring about lasting solutions. The effort to reduce vulnerability is central to the five year plan strategy of the years 2005/6-2009/10.

The measures are to reduce variability in crop production and overall food availability, through more irrigation and water control, diversification of crops and better integration of market, transport and information links, maintenance of macro-economic stability, expansion of off-farm employment and income earning opportunities, butter functioning of credit markets, provision of health services and nutrition.

Moreover, the strategy has established institutional capacity for early warning and response to famine treats and structural setting up at regional, *zonal*, *wereda* and local level is a step forward in disaster management, in order to enable the overall implementation of the national food security program to manage the shift from the cycle of dependence on emergency relief (MOFED,2006:1).

2.4.3. Challenges in achieving food security in Ethiopia.

There are some drawbacks that need to be tackled in achieving food security in the country, some among others are;

a. Misconception of food insecurity as it occurs in the general context of poverty and vulnerability which doesn't warrant any explicit focus on food security and the belief that it can be solved in the normal course of development. This has reduced particular attention that could be given to alleviate the food insecurity problems.

b. The complementarities and trade offs between achieving self sufficiency through domestic production and export of agricultural commodities in the long run and urgency and current reliance on external aid to meet the demand by the majority of food insecure population.

c. Availability of inappropriate institutions and lack of effective instruments of the current policies, in that the current policy emphasizes and gives advantages to the better potential areas, its recommended inputs and technologies arc appropriate to those productive potential areas who are easier to serve and better able to take the advantages of the services provided to them, leaving the drought prone vulnerable segment of the population at disadvantage

d. At last but not least, is the lack of data to support effective policy formulation and implementation in the area of food security (Senait Seyoum, 2000:60-77).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Description of the study area

Hintalo-wajirat district is located in south eastern zone of Tigray region, northern Ethiopia. The total land holding area under different land use system in the region is estimated to be 623,906 ha. Out of this land holdings, land use for annual crops accounts 88.1%, permanent crops 1%, grazing land 1.5%, fallow land 6%, wood land 0.3% and other uses 3.1% (CSA,2003).

Hintalo-Wajirat district is located 35km south-east of the regional city Mekelle. The altitude of the district ranges from 1400 m up to 2500 m a.s.l. The mean annual temperature and rainfall is about 28°c and 650 mm respectively.

The district is classified in to three agro-ecological zone; high land (*dega*), mid highland (*weina dega*), and lowland (*Kola*) according to the traditional agro ecological classification of the district Bureau of Agriculture and Rural Development. The district has 20 peasant associations with a total estimated human population of 148,700.

The estimated livestock populations of the district include cattle 97,619 heads, sheep, 17148; goats 31157; equines 17,694; camels 1156; poultry 46137 and bee colonies 7789.

The major crops grown in the district are *tef*, wheat, horse bean and lentil where as, the minor crops are sorghum, maize, barley, millet, vegetables and root crops in their order of importance (unpublished data: *Wereda* Bureau of agriculture).

3.2. Method of data collection

3.2.1. Sample size determination

Assuming that 15:85 population proportion of food secure and insecure households in the study area respectively, and following the Dixon and Leach's (1978:10) sampling procedure, a total of 210 Households from the six villages were determined and selection of households from the sampling frame list were made using systematic probability sampling method proportional to size.

$$N=P\ (1-P)\ (Z_a)^2 + e$$

Where **N** -is the size of the sample to be determined.

P- Is an estimate of population assumed to be food insecure (p=85 and q=15).

$\mathbf{Z_a}$- The standard normal (z=1.96) value corresponding to the desired level of Confidence 95% for the area under the normal curve to the left of Z.

e -The maximum acceptable error margin (0.05).

Table3.1. Households sample size distribution of the *gots* in the study *wereda.*

Tabia (PA)	*Kosher*(village)	*Got*	%	HH size
Hiwane	*Aybeto*	*Mekabirshin*	19.3%	40
	Mayni	*Tsaeda emini*	11.2%	25
Adi mesno	*Adi kolkola*	*Mesgi*	15.7%	29
	Maekel adi	*Afekalih*	12.8%	30
Adi keyih	*Adi keyih*	*Beri*	29.1%	60
	Afegedem	*Adi miedi*	11.8%	26
Total			100	210

3.2.2. Sampling procedure

The Study was conducted through a survey research. Data was collected from both secondary and primary sources. Secondary sources such as books, journal articles and office archives were used to substantiate the study result. The primary data was collected using a semi-structured questionnaire based interview schedule from farm households. Discussion was also made with key informants of the extension agents and government officials such as bureau of agriculture and rural development (BARD) at different administrative levels to get general impression about the food insecurity situation in the study area. .

The study area was purposefully selected from the zone based on its severity of drought and food insecurity experiences. Study area sampling was made at different stages, using a multi-stage cluster sampling method. This are at agro-ecological zone level , at PAs (locally called *tabias*) level, at villages level (locally called *kushet*), and *gots* level. The 20 peasant associations (PAs) found in the *wereda* were first clustered in to three general Agro-ecological zones, highland (*dega*), mid highland (*weina dega*) and lowland (*kola*).

Then one PA from each agro-ecological zone, two villages from each PAs, and one *got* from each village were selected purposefully based on its transport accessibility. Farm households were selected using a systematic random sampling from sampling frame. The sampling frame was prepared from the list of household heads obtained from each PA bureau of agriculture. The sampling frame were organized from the list of households heads found as development groups (DG) and direct support safety net member lists in each *got*.

The list of development groups is available in each PAs bureau of agriculture for the purpose of any development activity coordination in the PAs. The list are prepared from household heads residing in each *got* without any criteria limitation for selection; it includes those households capable of participating in any development activity. However, the DG excludes aged and disabled

household heads. Hence, to make the sample households more representatives of the sample *gots*, the old and disabled household heads in the study area, which are usually more vulnerable to food insecurity, were listed exhaustively from each *got* from the safety net direct support lists and included into the sampling frame list.

3.3. Analytical model

Food security status of a household are determined by three major factors. The production, acquisition and utilization factors. A household may have sufficient land and other resources, such as labor and capital, to grow its own food. Or, he may have enough income to purchase food at the prevailing prices.

A household could also receive assistance in the form of aid or borrowing from formal programs or informal networks. These factors affect food security of the household positively. Where as, the food security status of a household could also be affected negatively by the improper utilization of the crop produced or the income earned by the household. Hence, food security of a household is a function of the three parameters mentioned above.

However, the factors that affect the crop production do also affect the food security status, and hence create the problem of endogenity. To reduce this endogenity problem, a 2 SLS regression model with 15 Instrumental variables were used. The instrumental variables are supposed to be correlated with the potential endogenous variable and uncorrelated with the error term. The instrumental variables used were agro-ecological zone, sex of household head, number of dependants in the family, labor force, household head educational status, Access to land, livestock ownership, number of oxen in the household, access to off farm income, total off farm income, access to credit, access of women to decision making in the Household, access to support of domestic chore, presence of permanent grain storage, occurrence of spouse sickness.

The model has used two step regression estimation, in the first step a crop production function equation was used to estimate the predicted crop production of the households. This predicted value of the crop production was used in the second step with other exogenous proxy variables, which are used to represent the food acquisition and food utilization parameters of food security function.

In the first step estimation procedure, it was assumed that crop production will be influenced by the household assets and capital. Asset was represented by age of household head, Land size, labor or family size of the family, Livestock size and agro ecological zone) and capital was represented by access to fertilizer, access to improved seed and access to irrigation.

In the second step of food security estimation, it was expected that a household could acquire food through a combination of purchase, rent of its resources, borrowing and remittance. Thus, food acquisition was represented by total amount of food purchased from the market, amount of borrowed grain , total grain received from labor and oxen rents and amount of grain received from remittance (aid). Where as, total grain consumed for feast was used as proxy for the food utilization aspect of food security function.

3.3.1. Model specification

The functional relationships of the two equations are as follows.

CROP PRODUCTION = f (ASSETS + CAPITAL)

FOOD SECURITY= **g** (PV (CROP PRODUCTION) + FOOD ACQUISITION + FOOD UTILIZATION)

Where, **ASSETS** is a vector of household asset variables:

AGE OF HOUSEHOLD HEAD is the age (in yrs) of the head household.

LAND SIZE is the total land size (in tsimad) cultivated by the household during the harvest year.

FAMILY SIZE is the total family size (heads) of the family.

LIVESTOCK SIZE is the total livestock holding (in TLU) owned by the family

WEINADEGA is a proxy used to represent the effect of agro ecological zone.

CAPITAL is a vector of intermediate input factors of production.

ACCESS TO IRRIGATION is a dichotomous variable indicating whether the household had access to use irrigation or not.

ACCESS TO USE OF FERTILIZER is a dichotomous variable indicating whether the household had access to use fertilizer or not.

ACCESS TO USE OF IMPROVED SEEDS is a dichotomous variable indicating whether the household had access to use improved seed or not.

FOOD ACQUISITION is a vector of variables:

TOTAL FOOD GRAIN PURCHASED (in qt.).

TOTAL FOOD GRAIN BORROWED (in qt.).

TOTAL FOOD GRAIN RECEIVED FROM LABOR AND OXEN RENTS (in qt.).

TOTAL FOOD GRAIN RECEIVED FROM REMITTANCE (AID) (in qt.).

FOOD UTILIZATION is represented by a proxy variable for TOTAL GRAIN CONSUMED FOR FEAST (in qt.)

3.3.2. Variable specification

The dependent variable for the grain production function of the first stage regression model is the total grain production (in qt) for the survey year. Where as, the dependent variable for the household food security function of the second stage regression model is expressed in terms of the number of months during which households could get enough food for the survey year.

Independent variables affecting grain production of the household.

X1 = weina dega Agro-ecological zone (dummy variable, 1 if household reside in *weina dega* 0 other wise).

X2 = Land/farm size in *tsimad* (continuous variable).

X3 = Livestock holdings in TLU (continuous variable).

X4 = Family size (continuous variable)

X5 = Age of household head (continuous variable)

X6= Access of use fertilizer (dummy variable, 1 if yes, and 0 otherwise).

X7 = Access to improved seeds (dummy variable, 1 if yes, and 0 otherwise).

X8= Access to irrigation (dummy variable, 1 if yes, 0 otherwise)

Independent variables affecting Household food security status.

X1= Grain production of the household (continuous variable).

X2= Total grain purchased form the market. (Continuous variable).

X3= Total grain received from aid. (Continuous variable).

X4= Total grain borrowed in the year. (Continuous variable).

X5= Total grain received from labor and oxen rents. (Continuous variable).

X6= Total grain consumed for feast (continuous variable).

3.4. Research hypothesis

Dependent variables:

The Dependent variable, for the grain production function was grain production (in qt). Where as, the dependent variable for the food security function was number of months a household could get enough food from their subsistence cereal production of the survey year. It was obtained from the direct question forwarded to the households as "for how many months did you think your grain production of the year (1999e.c) fed the family". The data was collected for one year harvest prior to the survey year, this was done purposefully to get data for one whole year in order to determine the transitory food (in) security status of the households, rather than infer from a data obtained for part of a year, as food security of the households varies seasonally with in the year.

Independent variables affecting the grain production of the household.

Weina dega Agro-ecological zone: represents the agro-ecological location of the households. May have an effect on grain production status of households. It is hypothesized that households who reside in the *weina dega* will have better soil quality and less erratic rainfall than those who reside in the *kola* and *dega* agro-ecological zone. and hence *weina dega* agro-ecological location will be positively associate with better grain production .

Land/farm size: In subsistence agriculture land and labor are the main production inputs. A household with larger land/farm size will have better probability for food production those households who have no or smaller farm land. Thus, Land size is positively associated with better food production.

Livestock holdings: represents the total livestock number in TLU a household owned. Households who have higher number of livestock will have better level of food production, because those households who have larger livestock size have higher probability use it as input for production,

through drought power supply or sale it to purchase other production inputs. Hence, the family will have better chance to better grain production at household level, thus, it will positively affect grain production.

Household family size: represents the total household family size. This can be viewed through its contribution to overall labor power in the family (in terms of number of male or female adults in the household). Households with higher family size and better proportion of adults, be it male or female, labor force will have better grain production either through labor sale or exchange and thus better opportunity to get additional income, in which this income can be used to purchase production inputs. Or, families with higher family size and labor force can directly utilize its own labor in his farm and boost production. It can then positively affect farm production.

Age of household head: age of household head can be hypothesized in two ways, older household heads that are expected to accumulate more assets (endowments) through longer period of their life time can be expected to have better probability to improve productivity through their experience, accumulated knowledge and also better capable to dispose their assets during shocks in production. In the contrary, older farmers can be hypothesized as having less access to resources, information and technology and high risk averters to use improved technologies and hence poor farm production. Thus, it may be expected to affect farm both positively and/or negatively.

Access of fertilizer use: those households who have access to use fertilizer will have better level of food production since improved agricultural technologies increase farm production and productivity in the household and hence better food production than those who do not use fertilizer. Thus, it will be positively associated with food production.

Access to use improved seeds: households who use improved seeds will have better level of food production since improved seeds perform better than the local varieties and increase farm

production and productivity there by improve food production per farm in the household. There fore access to use improved variety will be positively associated with food production.

Access to irrigation: households who have access to irrigation ,will be capable to produce grain more than once per year hence, those households who are accessible to irrigation will have better food production than those who do not, there fore access to irrigation is positively associated food production.

Independent variables affecting Household food security status.

Grain production of the household: under subsistence agriculture farm production is obviously the main determinant factor to achieve food security at household level. Thus, households who have better farm production will have better food security status. Hence, farm production will positively associated with food security of the household.

Total grain purchased form the market: In the absence of enough farm production, households will face consumption short falls and the food security status of the household deteriorates, in such situations, the majority of households coping strategy to food shortage is purchasing grain from the market. Those households who are more food insecure do purchase more grain from the market. This indicates that grain purchase from the market is negatively associated with food security of the household.

Total grain received from aid/remittance: households who do not have enough farm production and resources to dispose are usually those households who are severely food insecure and are dependent on aid and remittance from formal programs or informal networks. Because those households are resource poor, the more they are provided with food aid support the more they become food secure, and hence, aid/remittance amount is positively associated with food security of the household.

Total grain borrowed in the year: usually one of the transitory food insecurity coping strategy used by small holder households is borrowing grain from better off households that will usually be paid back in the next harvest. Those household who face more consumption shortfall during the year will borrow more grain to compensate their consumption shortfall. Thus, it is hypothesized that the amount of grain borrowed by the household is negatively associated with food security status of the household.

Total grain received from labor and oxen rents: households do have different sources of income. Some among the others are the income they receive from renting (selling) their labor and oxen. The payment could be received either in cash or in kind. In this study it was hypothesized that the amount of the grain received from the rent of labor and oxen, do add some income to the household and enhance the food security status of the household. Hence, it was hypothesized that grain received from rent of labor and oxen will be positively associated with food security of the household.

Total grain consumed for feast: the post harvest management of grain produced is also an important factor to influence food security of the household. The amount of grain consumed by the household during social and cultural occasions and festivals is one factor among others. Households do usually consume significant amount of grain in such occasion in the periods immediately after harvest this deteriorates the amount of grain produced by the households and cause consumption short fall at the end of the year and aggravate the food insecurity status of the household. Thus, the amount of grain consumed for feast by the household is hypothesized to be associated with food insecurity negatively.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1. Introduction

Food security is affected by many interactive determinant variables of the environmental, socio-economic and political settings of the country and the household. Majority of the empirical studies have dealt with identifying the determinant factors of food security and insecurity based on the factors that affect the overall incomes of the household.

However, there are some fragmented studies that tried to address and identify the determinant factors of food security and insecurity based on subsistence production at household level. The current study tries to identify the factors that determine household food security of subsistence producers.

Accordingly, this chapter deals with the result obtained by the research and will be presented in five sections. The next section tries to explain the different socio-economic characteristics of the study area, *hintalo-wajirat wereda.*

The third and fourth sections will deal with the food security situation and food insecurity coping mechanism in the study area and market participation strategies of the households under study. For ease of analysis, the households were divided in four food security status groups based on self determined number of months the family had access to food. These are *Group 1*, those households who had access to food supply for less than four months; *Group2*, those households who had access to food supply from 4 to 8 months, *Group 3*, those households who had access to food supply from 8 to 12 months and *Group 4*, and those households who had food supply for more than 12 months.

Where as, the fifth section describes the characteristics of the regression model used to identify the determinant variables of grain production and food security status of a household under the subsistence agriculture of *hintalo-wajirat wereda* and it will also try to discuss the parameter estimates of the regressor variables used in the models and the relationship of these determinant variables with their respective dependent variables.

4.2. Socio-economic characteristics of the study area

This section of the paper briefly highlights the demographic and social characteristics of the population in the study area. The issues treated here would be those that have direct or indirect relations with food production and food security of the household.

Food production of a household could be affected by a number of factors. Rainfall distribution and soil qualities vary with agro-ecological zones, thus, agro-ecological zone is one of the factors that are believed to affect food production and productivity and food security status of households in the study area. The descriptive study of the data (see table 4.1) indicated that the average grain production of the study area was about 7.33 qt. The agro-ecological distribution of the households in this study indicated that 31%, 28% and 41% of the sample households reside in weina dega, dega and kolla agro-ecological zones. And the educational status of the households in the study area also indicated that about 42% of the sample households were literate ,who are capable of read and write.

The family size and composition affects the family labor productivity and efficiency , the calorie production and availability in the family and hence food security status.

The mean of family size of the study population, the labor force and the number of dependants in the family was found to be 4.61 heads, 2.27 man days and 2.33 heads respectively and the average

age of head of the households in the study area was found to be 45yrs. The sex distribution of the household head in wereda also revealed that about 71% were men headed households.

In traditional agriculture, land and labor are the significant production inputs to the peasant farmer. In this study it has also been confirmed that land ownership was a significant factor to food security. Not only access to land, but also the size of land holding was also found to be significantly important factor in food production and food security. Land size is considered a critical production factor that determines the type of crops grown and the size of crop harvested. Literature indicated that About 80% of the increase of agricultural output in Africa has been attained through the expansion of cultivated land (Degefa Tolessa, 2002). In the current study, out of 206 households participated in the study, 97% of the household studied had land, and only 3% of the households were landless. The result in table 4.1 below indicated that the average land holding size of the study area was 2.92 *tsimad* (0.73ha).This indicated that the average land holding size of the study area is below the national average land holding (0.86ha) (CSA,1995).

Livestock holding of the farm household is one of the most important farm assets of the family especially when the family experiences asset liquidity constraint, livestock do help the family to solve their financial constraints. In times of food shortages, families can sell their livestock holdings and purchase food crops, hence livestock holding do affect grain production and household food security. In light of this, in the current study, the livestock ownership was about 72% .The average livestock holding in TLU equivalent and number of oxen in the household of the study area was 3.03 TLU and 0.96 head respectively.

The potential contribution of technological innovations towards tackling food insecurity is through stabilizing and improving food crop production and yield. At the current rapidly growing population and the declining arable land, the elimination of chronic food insecurity is highly linked with the use of productivity increasing technological innovations, which are helpful in the

intensification of agriculture. The most important intermediate inputs used in Ethiopia as well as in the study area were modern fertilizer, improved seed utilization, irrigation technology.

The assessment of the access of households to these production improving intermediate inputs of the study area indicated that 15%, 16% and 24% of the households interviewed in the study had access to fertilizer, improved seeds and irrigation infrastructures respectively.

Survey respondents who did not use modern fertilizer were asked for the reason why they did not use modern fertilizer. 25.6% of them, who are most of them from the *kola* agro-ecological zone, were due to the reason of shortage of rain, 15.5% and 11.6% were due to share cropping out of land and they used manure in their land respectively. Where as, 10.1% of them were due to high cost of fertilizer and 3.9% were due to fear of unable to repay the fertilizer cost taken on credit basis. While the remaining percentage was due to many other reasons such as, transportation problem (far distance from residence to their farm land), sandy nature of the soil of their farm lands, etc.

Those households who did not adopt improved seed, have provided reasons why they didn't use improved seed in their farm land. The reasons were 12.6% of them was due to their land was share crop out to other farm household and 12.1 % was due to shortage of rain in their village, where as, 8.7% of them gave the reason that high improved seed cost and incapable to purchase it, while the remaining percentage of the respondents were due to various reasons such as farmers had their own improved seed at home and didn't need to take improved seed provided by the extension service (4.3%), and some of the households provided the reason that improved seed were not available in the village (3.4%), etc where as, 25.6% of the respondents gave the reason that they had enough production and didn't need to use improved seed provided by the agricultural extension service.

Provision of formal credit could also influence food production and food security of the household. This is because, the level of indebtedness of rural families in developing regions has been increasing over years, peasants both men and women headed households depend on village lenders for credit under terms and conditions that worsen their condition.

As producers, they are unable to meet the requirements of production such as purchase of fertilizer, seeds and raw materials. At times they need money for their daily living; they largely depend on village money lenders for their credit, as asset liquidity constraint is a problem to subsistence farmers. But, in most cases the exclusion of the poor from government credit service facilities is attributable to constraints such as bureaucratic procedures, preference of banks for large loans, collateral requirements imposed by the banks and defaults on previous loans (Wickrama, K.A.S. and Keith, P.M.1994).

In the current study, the access of households to formal credit was about 24% of the sample households. The majority of them didn't take formal credit due to the following reasons. 46% of the households didn't take credit because they didn't fulfill the requirements asked by the credit scheme, where as 16.4% of them didn't take credit because they are afraid of the capacity to repay it. Moreover, 5.8%, 2.4 % and 1% of them didn't take credit because of short repayment period, high interest rate and unavailability of credit in their village respectively. Where as, 8.2% of the total didn't also take credit because they had enough income and had no financial constraint.

The ability of the household to diversify and earn additional off farm income could also influence farm production and status of food security. However, some households may not be able to diversify their income since entry constraints exist for many activities and therefore the ability to take up particular activities will mostly distinguish the better off households. In this aspect, result from the current study showed that 72% of the households studied had access to off farm income

and were capable of diversifying their household income. Mean of the off farm income of households were about 680 br per annum.

The household might also receive remittance from formal programs relatives and neighbors and receive help in time of consumption shortfalls. Aid/remittance is one of the social support system in many parts of developing countries and especially in Ethiopia where the support is provided to food insecure household to enable them relieve from hanger and improve their valnerability to food insecurity. In this study, only 14% of the study population had access to aid support from either the formal government direct safety net program or support from relatives and neighbors.

The immediate victims of food insecurity have traditionally been farmers who are the very producers of food. This is because majority of the farm households depend on their own produce and are less dependendent on markets to meet the bulk of their consumption requirements.

Literature indicated that production turnover is mostly once a year and at most twice, in which, 95% of production comes from main season only. Moreover, long period is involved between plantation and harvest period, which in addition to low productivity levels, has constrained grain availability from own production. Consequently, many rural households run the risk of food insecurity for several season of the year. Where as, seasons following harvest are those in which one could find large volume of available grain, not only, at household level, but also, at market level.

As far as, peasant household is concerned these seasons following harvest is the major marketing season. Some studies indicated that 79% annual sale of farmers occur in the period between January to March (Gebremeskel, Jayne and Shaffer, 1998).

Such seasonal fluctuations of grain availability both at household as well as at market level and thus household food insecurity could be related with farmers post harvest grain management system and capacities. Smoothing out food consumption seasonally could be determined by the

extent, to which there exists an efficient post harvest grain management system not only, at community and macro-economic level, but also at household level.

Inappropriate utilization of grain at home could be either through poor storage facilities or through improper consumption of grains in time of cultural and social occasions. Recent findings emphasized that factors regarding proper utilization of grain at home need to be considered when dealing with achieving food insecurity at household level. Farmers utilize a considerable proportion of their annual production for various ceremonies, celebrations and festivals immediately in the post harvest periods.

Occasions and festivals made in the household had a significant impact on calorie availability and household food security status. Because those households who celebrate occasion do consume large amount of grain and money at a single moment and hence reduce the grain availability for the family that could have been used to extend the number of months the family could access food. The current study indicated that 54% of the households have made feasts and occasions in their home. On average about 0.61qt/head/year have been consumed for the feast in the study area. And only 27% of the households had permanent grain storage at home.

In addition to the influence of the above factors on food production and food security, the absence of women empowerment at household level and at community level could also affect the household income status, resource management , especially food grain resources management, and household grain production and food security. It is often asserted that female headed households are more subject to economic stress than joint or male headed households. Because women are disadvantaged in their access to jobs as well as in their access to education and in rates of pay and hence deteriorate their food security status (Beatrice, L.1995). Resource control and decision making power given to women affects food security positively. Because, women do allocate more resource on food and on other basic consumption needs. Hence, households who give more

resource control power to women are expected have better food security status than those who do not give more power to women. More over, access of households to support of domestic chore would reduce the work burden women are facing and this could reduce the probability of sickness of the women spouse , who is mostly the responsible person to take care of the domestic work and hence could improve the access of the women to income generating activities. This will obviously improve the household income and status of food security. The current study revealed that 42% of the women spouse of the sample households had at least equal power to make decision with men. And only 10% had got external labor support to domestic chore in the household. And 39% of the women spouse had problem of sickness in the survey year. Thus, the study indicated that the status of the socioeconomic characterstics, judjed by most of the these variables is found to be very poor.

Table 4.1. Descriptive Statistics of the socio-economic variables of the study area.

Variables	N	Mean	Std. D
Total grain production(in qt.)	206	7.33	5.53
Sex of household head (dummy,1 if men, 0 otherwise)	206	0.71	0.45
Age of household head (in yrs)	206	45.03	15.97
Family size (in heads)	206	4.61	2.34
Number of dependants in the family (<15yrs and >65yrs)(in heads)	206	2.33	1.55
Labor force in man days (b/n 15 yrs and 65yrs inclusive)(in man days)	206	2.27	1.32
Access to land (dummy,1 if yes, 0 otherwise)	206	0.97	0.17
Total land size (in tsimad)	206	2.92	1.89
Livestock ownership (dummy, 1 if yes, 0 otherwise)	206	0.72	0.45
Total livestock holding in TLU.	206	3.03	3.39
Number of oxen in the household (in heads)	206	0.96	1.02
household head educational status(dummy, 1if read or write 0 otherwise)	206	0.42	0.50
Access to off farm income (dummy,1 if yes, 0 otherwise)	206	0.72	0.45
Total off farm income (in br/annum)	206	679.78	975.11
Access to fertilizer (dummy,1 if yes, 0 otherwise)	206	0.15	0.36
Access to improved seed (dummy,1 if yes, 0 otherwise)	206	0.16	0.37
Access to irrigation (dummy, 1 if yes, 0 otherwise)	206	0.24	0.43
Access to credit (dummy,1 if yes, 0 otherwise)	206	0.24	0.43
Access of women to decision making in the Household (dummy, 1 if yes, 0 otherwise)	206	0.42	0.50
Access to external support of domestic chore(dummy,1 if yes, 0 otherwise)	206	0.10	0.30
Presence of permanent grain storage (dummy, 1 if yes, 0 otherwise)	206	0.27	0.45
Occurrence of spouse sickness (dummy, 1 if yes, 0 otherwise)	206	0.39	0.53
Presence of feast in the household (dummy,1if yes, 0 otherwise)	206	0.54	0.50
Total grain consumed for feast (in qt)	206	0.61	1.30
Access to aid support (dummy, 1if yes, 0 otherwise)	206	0.14	0.35
Weina dega (dummy, 1if weina dega agro-ecology ,0 otherwise)	206	0.31	0.46
Dega (dummy, 1if dega agro-ecological zone ,0 otherwise)	206	0.28	0.45
Kolla (dummy, 1if kolla agro-ecological zone ,0 otherwise)	206	0.41	0.49
Valid N	206		

NB: 1hactare is equivalent to 4 *tsimad*

.1 cattle-1TLU, 1horse=1TLU, 1mule= 1.15TLU,1 Donkey= 0.65TLU, 1camel=1.45TLU, 1Chicken=0.005TLU.
source: Ramakrishna, G. and Asefa Demeke. 2000.

4.3. Food security situation and coping strategies of households in the study area.

Food security status of a country or a society or a household is determined by a number of socio-economic, political and cultural variables. Households under different socio-economic, political , environmental and cultural settings have different food security status .

In this study it was assumed that food security status of the household can be affected by the level of farm grain production of the household, by the levels of food acquisition of the household such as the different income opportunities that determine the capacity of the household to purchase food grain from the market at the prevailing prices, access to aid support of the household be it from the formal government support programs or the different social networks of the household, by the amount of grain borrowed of the household and by the grain obtained from labor and oxen rents.

The household food security could also be affected by the level of utilization of household grain. Given the effects of those various factors on food security, the food security status of *Hintalo Wajirat wereda* have been found to be very poor.

Descriptive study of the data (see table 4.2) indicated that the average food security status of the household in the study area was about 8.3 months of having access to food. However, the comparison of food security status among agro-ecological zones covered by the study (table not provided) indicated that the *weina dega* agro-ecological zone had better food security status, on average having 9.39 months of access to food as compared to the other two agro-ecological zones namely the *kola* agro-ecological zone (7.91 months) and *dega* agro-ecological zone (7.88 months) of food access.

In subsistence agriculture ,farm production is the major determinant variable of food security. Similarly, in the current study, farm production and purchase of grain from market was the major share of achieving food security. The mean of grain production of household in the study area was about 7.33 qt per year. And the mean food grain purchased from the market per household was

also about 1.48 qt per year. However, the contribution of grain received from aid, grain received from rent of labor and oxen and grain borrowed by the household was very low. The study indicated that 0.022 qt, 0.171qt and 0.26 qt per year respectively. Similarly the contribution of Household grain consumption was also very small (0.615 qt) as compared to grain production.

Table 4.2. Mean value of the factors affecting food security of a household.

Variables	Mean	Std.D	N
Food security expressed in number of months a HH had enough food	8.296	3.45	206
Predicted value of grain production (in qt.)	7.326	5.02	206
Total food grain purchased (in qt.)	1.479	2.13	206
Total grain received from aid (in qt.)	.022	.20	206
Total grain borrowed (in qt.)	.026	.13	206
Total grain received from rent of labor and oxen (in qt.)	.171	1.38	206
Total grain consumed for feast (in qt.)	.615	1.30	206
Valid N			206

A multiple response of households coping mechanism during food shortages (see table 4.3) also indicated that majority 71.5%, 24.2% and 18.4% of the sample household mentioned that off farm work, selling livestock and asking for aid was the major food shortage coping mechanism and source of compensating consumption shortfalls in the study area respectively.

Some empirical evidences have reported in support of the major source of income and coping strategy to be off farm work in the study area. other sources of cash income other than livestock and livestock product sales such as, sales of pulses, *tela* and other local alcoholic beverages (such as *teji*) and skilled work, such as weaving, healing, carpentry, building and iron work, which can be a significant source of income were also practiced in Tigray. But only a few of individuals possess these skills (Yared Amare.1999).

Similarly, Weldegiorgis, 1996 has also noted that because farms in Tigray are very small, household farmers are incapable of producing marketable surpluses and hence they do involve in non agricultural activities. His study indicated that 21% of the respondents engaged in some kind

of non agricultural employment and only 18% had some skills with which they could generate income.

Table 4.3. A Multiple response of household copping mechanisms in periods of food crop Shortages.

Coping strategies	yes		No	
	count	%	count	%
Borrow grain	16	7.7%	191	92.3%
Exchange pulse with food grain	23	11.1%	184	88.9%
Exchange livestock with food grain	8	3.9%	199	96.1%
Sell livestock	50	24.2%	157	75.8%
Off farm work	148	71.5%	59	28.5%
Ask aid support	38	18.4%	169	81.6%
Sell house property	26	12.6%	181	87.4%
Migrate part of family	5	2.4%	202	97.6%

4.4. Household market participation strategy in the study area.

Under Ethiopian conditions in general and that of Tigray region in particular, where smallholders are dominantly subsistent, the production of food plays a significant role in household food security. In correlated condition where smallholders dispose only about 20% of their crop production, the role of markets and distribution aspect of food security is limited (Desalegn, 1984).

Food availability is strongly seasonal, the month of greatest food shortage are typically from late May to September, but this varies according to land and rainfall distribution. But, these seasons following harvest are the major marketing season for peasant farmers. Some studies indicated that 79% annual sale of farmers occur in the period between January to march (Gebremeskel, Jayne and Shaffer, 1998).

In general, in the highlands, households have relied on own grain production to satisfy their requirements for staple food (Yared Amare, 1999). However, depending on their food production status, Households do also use different market participation strategies.

Grain sales have been the most important source of cash income under subsistence production and households only purchase grain when harvest is insufficient (Yared Amare, 1999). In light of this,

the current study (table not provided) also revealed that out of the total 207 households covered by the study, 42% of them did sold a portion of their food crops in the market to satisfy their cash requirement during the survey year. Where as, 50.2% of the sample households did purchased food grain from the market to compensate their grain shortfalls.

Out of the total 87 households who sold portion of their grain, higher proportion of them (60.5%) were from the from the food secure *group4* households. Where as, less proportion of households (19%) were from the food insecure *group1* household. Moreover, out of the 104 households who purchased grain from the market higher proportion of them which is 43.3% and 24% were from *group 2* and *group 3* households. Where as, 15.4 % and 17.3 % were from the food secure *group 4* and food insecure *group1* households.

This seem to indicate that higher proportion of the food insecure households had bought food from the market because they were unable to provide their food requirement from farm production and grain purchase from the market was used as a coping strategy in the household. Where as, lower proportion of the food secure households had only purchased from the market because they were capable to provide the majority of their family grain demand from their farm production.

Analysis of the period when do farm households sale their surplus grain and purchase food grains during shortfalls (table not provided) indicated that significant proportion of households from all the food security status groups did sold grains in between the months of October to December, the proportion of households were 31.6% from *group4*, 21.1% from *group3*, 31.6% from *group2* and 15.8% from *group1* households.

Where as, among those households who sold their crop in the months between January to march, the majority of the households (54.1%) were from the food secure *group 4*, 24.3% from the *group2* households but only 8.1% were from the food insecure *group1* households.

similarly, majority of those households (59.1%) and (75.0%) who sold their grain during the months between April to June and July to September respectively were from the food secure, *group 4* food status category. Only 4.5% and 0% of the food insecure *group1* households did sold their grain during these periods respectively.

The analysis is inline with the expectation of Yared Amare 1999, who confirmed that the majority of food better off households sold their grain during the period of food shortages (May to September) in the farming calendar of the farming households.

When we look at the period when households do purchase food grain from the market (table not provided) indicated that 34% and 40% from the food insecure *group1* and *group 2* households do purchased food grain during immediate harvest period of October to December, where as, only 14.3% from the food secure households did purchase food grain during this period.

Similarly, out of the total households who participated in the study the majority, 30.6% and 44.9% from *group1* and *group2* did purchased their food grain during January to March and only 14.3% from *group4* households did also purchased their food grain during this period.

At the same time, 37.8% and 32.4% from *group 1* and *group* 2 and 32.6% and 30.2% from the same groups did purchased their crop during food shortage seasons of April to June and July to September respectively. Only 16% and 14% from the food secure *group4* households did purchased during April to June and July to September respectively.

This has also indicated that the majority of the food insecure *group 1* and *group2* households did purchased food grain almost through out the year, both during the immediate after harvest and during the season of food shortfalls in the farming community. On the contrary, majority of the food better off household did sell their surplus grain during the season of food shortfalls in the farm households and took advantage of the market prices.

4.5. Determinants of food security status of the farm household in the study area.

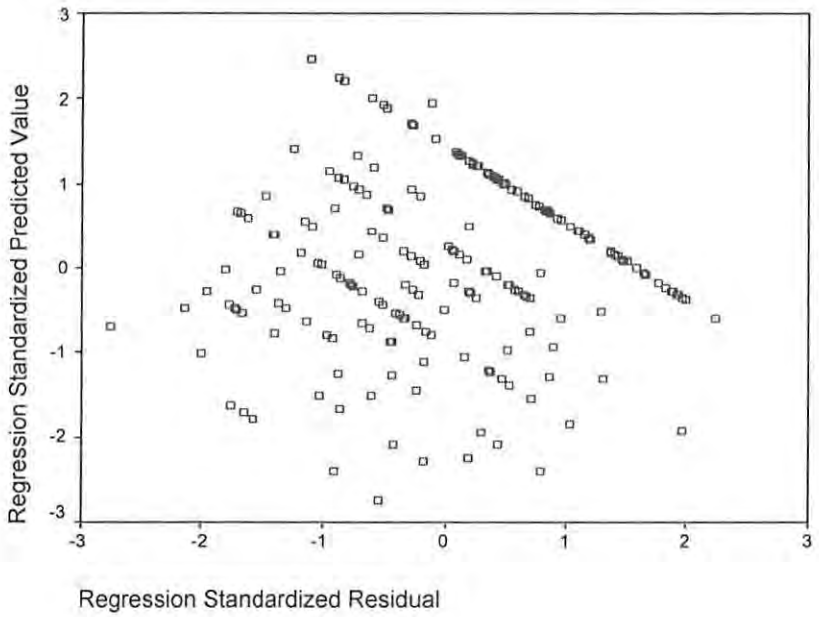
4.5.1. Model characteristics of the regression equation.

To identify the determinant variables of farm grain production and household food security status in *hintalo-wajirat wereda* a total of 206 households were used in the regression model. In the first step of the 2SLS regression estimation for the grain production function, eight regressor variables, which are expected to affect grain production were included in the model. These are weina dega agro ecological zone, age of the household head, land size of the household, family size, livestock holding, access to irrigation, access to fertilizer use and access to use of improved seed. The goodness of fit of the model indicated that the adjusted R square was 0.65. This indicated that 65% of the variation in grain production of the households was due to the variation in the explanatory variables included in the model. The mean of the ANOVA for the over all regression was very highly significantly ($P<0.001$) different from zero.

Similarly, in the second stage regression model of the food security function, apart from the predicted value for the grain production estimated in the first stage, five exogenous variables to farm production that represent the food acquisition and utilization parameters were used to identify the significant determinant variables that best describe the dynamics food security status of households in the *wereda*. The model fit of the food security function have also proved to be good. The adjusted R square was 0.536. This explains that 53.6% of the variation in food security status of the households was due to the variation in the regressor variables included in the model. The mean of the regression model for the over all analysis of variance was also very highly significantly ($P<001$) different from zero.

Moreover, the scatter plot of the standardized predicted value of the dependent variable food security status of a household with the standardized residuals (see figure 4.1) had also showed that except some residuals which influenced the data set in the negative direction, the majority the distribution of the error terms with the dependent variable was found to be randomly distributed. Outlier detection has also been carried out by plotting the scatter plot of the data set. Out of the total 210 households, data sets for four household have been detected as outlier and thus was excluded from the model.

Figure 4.1: scutter plot of the standardized predicted value of the food security status of a household with the standardized residual.



4.5.2. Parameter estimates of the factors affecting the farm production of a household.

Out of the eight variables hypothesized to affect farm production and included in the first step of the 2SLS regression model, namely, weina dega agro-ecological zone, age of household head, total cultivated land size, total livestock holding, access to irrigation, access to fertilizer, access to improved seed, only two variables were found to be significantly associated with the dependent variable annual grain production (see table 4.4).

These variables were total cultivated land size and total livestock holding of the household. The signs of the regressor variables were also similar with the hypothesis made except for weina dega agro ecological zone.

The other variables such as, weina dega agro-ecological location of the household, access to irrigation and family size of the household, even though, they were insignificant at 5% level, they had some effect on grain production of the household at 20% the level of confidence.

Table 4.4. Parameter estimates of the regression model for the grain production of a household.

The dependent variable: annual grain production (in qt).

Variables	Un standardized Coefficients B	Standardized Coefficients Beta	t value
Constant	-0.95 (1.49)		-0.64
Age of household head (in yrs)	0.02 (0.03)	0.050	0.51
Total cultivated land size (in tsimad)	1.47 (0.62)	0.501	2.4*
Total livestock holding in TLU	0.40 (0.20)	0.247	2.04*
Family size (in heads)	0.28 (0.21)	0.118	1.32
Access to fertilizer (dummy, 1 if yes, 0 otherwise)	1.55 (3.48)	0.101	0.45
Access to improved seed (dummy,1 if yes, 0 otherwise)	1.67 (3.35)	0.111	0.5
Access to irrigation (dummy,1 if yes, 0 otherwise)	2.82 (2.43)	0.219	1.16
Weina dega agro-ecological zone (dummy, 1if weina dega , 0 otherwise)	-1.57 (1.16)	-0.132	-1.35

NB. *** =very high significant ($p<0.001$); **= highly significant ($p<0.01$); *= significant ($p<0.05$)
. Figures in parenthesis are Standard errors.

Household cultivated land size

Land is the main stay of subsistence farmers in developing countries; hence, access to land and the size of the parcel will have a significant role in farm production of the household.

The current study revealed that total cultivated land size of the household had significant positive association ($p<0.05$) with grain production of households under the study (see table 4.4). A one tsimad increase of the cultivated land size will improve household grain production by a half of a quintal .

Empirical studies have indicated in support of the significance of land holding in grain production. David, L. et al (1994) indicated that land holding was found to be a determinant factor of calorie production and over all calorie availability in the household in rural Mozambique. Relatively land rich households nearly all reached 80% of their calorie requirement; this could be due to strong dependence of calorie availability in subsistence farmers to land holding. This might have resulted that a household with larger land holding to be found in better position of calorie production than those of land poor households (David, L. and Michael, T.W. 1994).

The size of resource endowments like farm land, do determine the state of farm production and calorie availability in the household. Accordingly, the size of cultivated land had positive and significant influence on household food production. In correlated condition, a study conducted in Moretna Jiru district of central highlands of Ethiopia has supported this argument. Each additional land unit cultivated by the household, increased the probability of the household to be food secured by 11 %. Moreover, each additional unit of land cultivated increased food security by 32% on average for the entire sample and by 24% for the food secured households (Setotaw Ferede , Gezahegn Ayele and Hailemariam Teklewold. 2004). This is due to the fact that land size had strong association with calorie production and thus improves the food production and food security of the households in these study areas.

Household livestock holding.

Livestock possession particularly the ownership of farm oxen forms cornerstone of farm economy. Livestock ownership and its size have been used as an indicator of wealth and source of input for farm production in the rural farming households. It has also been serving as saving bank in the rural community. This is because; livestock can generates cash income which can be used to purchase food grain to insure food security or implements and other inputs to improve productivity.

Especially in Ethiopian farming condition, oxen ownership is highly associated with crop production, as drought power is obtained from oxen; it is the main input in farm production in the country. Moreover, livestock play a crucial role in improving and sustaining food production in fragile environments by the use of manure as fertilizer to improve soil quality.

In light of this, in the current study, it was assumed that livestock ownership and the size will affect food production of households positively, the more the family owns livestock animals the more the family will produce more and become food secured due these reasons. Table 4.4 above revealed that livestock size had positively and significantly associated ($p<0.05$) with farm production. An increase of livestock size of the household by one TLU caused an increase of grain production by 0.247 of a quintal.

Studies done by Serotaw, F. et al, 2004 indicated that Livestock size positively and significantly influenced household food security in Ethiopia. The study indicated that each additional livestock had increased the probability of food security by 4%. While the level of food security was increased on average by 10% for the entire sample and by 7.3% for the food secured households (Setotaw Ferede, Gezahegn Ayele and Hailemariam Teklewold. 2004).

Moreover, households that had larger livestock size were found to be more food secure than those households who had lesser in studies done in Sidama, Gurage and Hadiya zones of Ethiopia

(Shiferaw Tesfaye. and Tesfaye Zegeye. 2004).The reason could be due to the important role of livestock ownership to improve farm production or it could also be due to the direct contribution of livestock product to farm household consumption and diversify household cash income from livestock product sales to purchase food grain. These studies did not specify how the livestock size contributed to food security.

In support of the impact of livestock ownership on income diversification and hence food security status, study done by Tomas, R. et al, 1992 , David, L. and Michael, T. (1994) indicated that Livestock ownership had influence on income diversification and hence food security.

4.5.3. Parameter estimates of the determinants of household food security status.

Considering the six variables specified for the food security function, the 2 SLS regression has selected three significant variables, which most determined the food security status of households in the study area (see table 4.5). These are farm grain production, total grain purchased from the market and grain received from aid/remmitance. Their signs were also consistent with the pre-determined hypothesis. Food grain production and total grain purchased by the household were very highly significantly ($P<0.001$) associated with food security status of the household. Grain production was positively associated with food security, where as, amount of food grain purchased from the market had negative association with food security status of the household.

Moreover, food grain received from aid/remittance were significantly ($P<0.05$) and positively associated with food security status of the household. The total grain received from labor and oxen rent has also better influence on the food security status of the household even though its impact was at 10% level significance. The effect of total grain borrowed and amount of grain consumed had insignificant and negative role to affect the food security status of the household in the study area.

Table 4.5. Parameter estimates of the regression model for the food security status of a household.

Dependent variable: number of months a household had enough food.

Variables	Un standardized Coefficients B	Standardized Coefficients Beta	t value
(Constant)	6.95 (0.35)		19.78
Total grain purchased (in qt)	-0.74 (0.09)	-0.46	- 8.68***
Total grain received from aid (in qt)	1.86 (0.81)	0.11	2.23*
Total grain borrowed (in qt)	-0.97(1.29)	-0.04	- 0.75
Total grain received from labor and oxen rent (in qt)	0.22(0.13)	0.09	1.71
Total grain consumed for feast (in qt)	-0.04 (0.13)	-0.02	- 0.33
Predicted value of grain production (in qt)	0.33 (0.03)	0.48	9.49***

NB. *** =very high significant ($p<0.001$); **= highly significant ($p<0.01$); *= significant ($p<0.05$)
. Figures in parenthesis are Standard errors.

Annual grain production

Subsistence farmer's food security status is dominantly dependent on household cereal grain production. Similarly, result of the current study, indicated that farm grain production was very highly significantly ($P<0.001$) and positively associated with food security status of the household. The regression coefficient of this particular variable was 0.48. This indicates that holding the other variables constant, an increase of grain production by one quintal will improve the food security status of a household in the study area by 0.48 of a month.

Studies done in different parts of Ethiopia confirm similar argument. A study conducted in north wollo confirms that cereal production had positive effect on food security. The study indicated that a 100kg increase in cereal production reduced the probability of food insecurity in the household by 10.5 % (Ramakrishna, G. and Asefa Demeke, 2002).

A study done in oromiya zone of Ethiopia has also confirmed similar positive result. It indicated that per capita aggregate production had positive and significant effect on food security. The study revealed that a 100kg increase in per capita aggregate production calculated at sample mean

resulted in 10% increase in the probability of food security in the household (H Kidane, ZG Alemu and G kundhlande, 2005).

Total grain purchased from the market.

In the absence of own grain production farming households face food consumption shortfalls. In such periods, they do smooth their consumption by purchase food grain from the market to satisfy the food grain demand of the family. The main cash income for households to purchase food from the market is usually sell of household assets or off farm work and other means of income diversifications. Hence, off farm income have substantial share to cover the expense of grain purchased from the market.

In light of this, the current study revealed that the amount of grain purchased by the household was very highly significantly ($P<0.001$) but negatively determined the food security status of the household in *Hintalo-Wajirat* wereda. The regression coefficient for total grain purchased was about 0.46. This indicates that those households who purchase one quintal more grain from the market are those households who are less food secure by 0.46 of a month, and those households who are less dependent on farm production to sustain their livelihood. The main reason that made total grain purchased to affect food security significantly, could be due to the higher access (72%) of households to off farm works in the study area.

In support of the currentresult, a study done on calorie availability in the household of Mozambique, also indicated that, the more diversified the family income is, the more food secured the family will be in terms of calorie availability, off farm income had positive but small effect on calorie availability and food security, as families with better off farm income could purchase food grain from the market and improve food security status of the household (James, L .G. and Maria, T.R.1999)..

The amount of the grain the household is capable to purchased deponds on the capacity of the household to expend money on it. Thus, household level of expenditure on food could also affect food security. Indications of households expenditure-calorie (food) elasticity was found to be high in better off (relatively food secure) households. Those families with higher income had better (higher) expenditure for food calorie (James, L .G. and Maria, T.R, 1999).This indicates that ,in aggreement with the current findings, those households who have better access to income generation did purchased (expend) more on food and become food secured.

In contradiction with this finding, higher expenditure-calorie elasticity was also found in poor households of rural people when referring to calorie availability. (Alderman, H. and Huggins, P. 1992; Alderman, H. 1986; Sahn, D. 1988, cited in James, L .G and Maria, T.R, 1999 : 1963). The contradiction of these studies could be explained by the preference, strategies and level of food security needed by the respective households.

Grain received from aid/remittance

Considering the rural economy which is primarily agricultural, households hold three initial endowments, Land, labor and livestock. In the absence of these three factors of production, households become dependent on aid and remittance from formal programs, informal networks or family migrant remittance.

In the current study, the amount of grain received from aid support was found significantly ($P<0.05$) and positively associated with food security status of the household. The regression coefficient of the variable was 0.11.This entails that as a household receive one quintal of aid grain, the food security status of the household improves by 0.11 of a month. In fact the change in the status of food security was found to be very small, this low aid elasticity of food security, could be due to the very small (14%) proportion of households who were aid recipient as compared to those households who do not receive aid. This might have affected the regression estimation.

Many evidences have been reported else where in favor of aid in the form of migrant remittance to have an impact on household farm income and food security in developing countries. Households do participate in migration as a strategy to overcome income and production constraints as a result of credit and insurance market failures, forcing households to self finance their production and income risks. As a result, migrant remittance may have direct and indirect positive effect on household farm income and food security by influencing investment (Edward, T. J.1996: 900).

However in the present study, those, the majority of the aid recipient households in the study area were not aid recipient from migrant remittance, aid in general had significant role to affect food security status of households. The households in the current study were aid recipients from the non migrant friends and relatives of the households, and all were land owners. Thus its effect could be explained with either its influence on investment and production enhancement. Or on directly influencing the family income and consumption.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

Hintalo-Wajirat is one of the most severely land degraded, resource poor and food insecure *wereda* of the region.This has been evidenced from various literatures reviewed and from the current empirical study conducted. All the three agro-ecological zones in the study area have faced at least three months of food deficit. Even though, variation could occur among households and agro-ecological zones and farming systems, the condition of food insecurity is very evident in almost all the *weredas* and specifically in the areas under study.

Various interactive factors have contributed to the food insecurity condition of the *wereda.* The majority determinant variables which had significant effect on food security status of the households were the farm production and productivity of households and the availability of access to means of food acquisition in the *wereda.* The farm production and productivity of households in the *wereda* was mainly influenced by the land holding size and livestock holdings of the farmers. Where as the means of food acquisition in the study area was mainly determined by the capacity to of the households purchase food from the market. The majority of the capacity of the households to purchase food was influence by the access of the households to off farm work. The access of the farming community to off farm income provided the opportunity to smooth their consumption shortfalls of the food insecure households. This has enhanced the overall income of the farm households and help to improve their livelihood through purchasing food in periods of failure of farm production. Similarly, the different coping strategies used by the households during food insecurity periods have also indicated that off farm work and selling livestock were the major strategies employed by the farming community. The livestock asset of the household has

significantly influenced not only, the farm grain production, as observed in the production function, but also, it has complemented the overall income and consumption of the household through livestock and livestock product sales, and has played a significant role in minimizing the food insecurity situation of households.

Access to market facilities has also played a significant role in reducing income shortfalls and food insecurity in the *wereda*. Higher proportion of food insecure households had used off farm work as means of cash income and food purchase from the market to fight against food insecurity and majority of the food secure households did also used livestock and grain selling as means of fulfilling other basic necessities for the family. Hence access to market facilities had played a significant role in the *wereda*.

The role of aid support in achieving food security of the household was also significant. Hence, it can be concluded that, the food security situation of the study area were found to be associated not only with the farm production and productivity of households but also with over all household income enhancing opportunities, the food insecurity copping strategies and social networks support system of the households and with the level of institutional and infrastructural development of the study area.

The food security situation of the households in the study area could be enhanced through appropriate and targeted policy interventions, especially geared to wards improving the grain production and productivity, improving income earning opportunities of the food insecure households and improving the access to land and irrigation of the households and enhancing the asset building of the community especially livestock holding of the household.

This might require reviewing and improving the land tenure system and family planning and population control policies of the country .These policy interventions should emphasize on controlling the household family size and population growth in the *wereda*, and hence, reduce land

fragmentation and improving the land parcel size of the existing land holders and improve access of new emerging families to land as well.

Moreover, policy designs should give due emphasis on improving water harvesting alternatives in the water deficit areas and the expansion of irrigation infrastructures where ever possible in the study *wereda.* Measures should also be taken on provision of demand driven and agro-ecologically appropriate technological inputs and provision of social services such as credit services and agricultural and health extension services to improve the rate of technology adoption and utilization capacity of the farmers and hence improve grain production and productivity.

Last but not least, any development interventions geared to wards food security achievement, be it from the government or non government organization, should emphasize on improving the income generating activities and access to market facilities of the farm households.

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Acronyms

AAU	- Addis Ababa University
ADLI	-Agriculture Development Led Industrialization
AE	-Agro-Ecological zone
BARD	-Bureau of Agriculture and Rural Development
BC	-Before Christ
CSA	-Central Statistical Authority
DG	-Development Group
EPRDF	-Ethiopian People Revolutionary Democratic Front
FAD	-Food Availability Decline
FAO	-Food and Agriculture Organization
FDRE	-Federal Democratic Republic of Ethiopia
FED	-Food Entitlement Decline
GDP	- Gross Domestic Product
Ha	- Hactare
HH	-Household
IFAD	-International Fund for Agriculture Development
MOFED	-Ministry of Finance and Economic Development
NDPPC	-National Disaster Prevention and Preparedness Commission
OLS	-Ordinary Least Square
PA	- Peasant Association
PASDEP	-Plan for Accelerated and Sustainable Development to End Poverty
PRSP	-Poverty Reduction Strategy Program

Qt	- Quntal
RRC	-Relief and Rehabilitation Commission
SDPRP	-Sustainable Development and Poverty Reduction Program
SNNP	- People of Southern Nation and Nationalities
SSA	-Sub Saharan Africa
TARI	-Tigray Agricultural Research Institute
UN	-United Nations
USD	- United State Dollar
WHO	- World health Organization

Glossary of local terms

Dega	- Local name given to the highland agroecological zone
Got	-The local name given in Tigray region for the administrative unit below kushet.
Kola	-local name given to the low land agroecological zone
Kushet	-The local name given in Tigray region for the administrative unit of the kebele
Tabia	-The local name given in Tigray region for the administrative unit of the peasant association.
Tsimad	- Nomenclature given to a quarter of hectare of land
Weina dega	- Local name given to the mid highland agroecological zone
Wereda	- An administrative unit in Ethiopia that is below regions and zone but above peasant association and kebele

Appendix

Annex 1: Mean annual grain production(in qt) and rainfall(mm) of *Hintalo-wajirat wereda* (1988-1999e.c)

S/N	Year of production	Size of land sown (ha)	Amount grain harvested (qt)	Amount of rain fall (mm)
1	1988/89	--	--	455.1
2	1989/90	--	--	421.2
3	1990/91	--	--	817.9
4	1991/92	35074.0	299332.37	460.5
5	1992/93	35214.62	277617.68	541.9
6	1993/94	32678.62	308230.12	694.4
7	1994/95	32627.175	127045.00	362.9
8	1995/96	34091.53	273630.33	533.0
9	1996/97	33438.2	133138.40	405.0
10	1997/98	34091.63	370404.48	795.0
11	1998/99	34091.63	588269.58	1466.0

Source: *Wereda* bureau of Agriculture (2000e.c)

Annex 2: Population size by household and sex of *Hintalo-wajirat wereda by tabia* (PA)

S/N	Name of Tabia(PA)	Household size	Male HH	Female HH	Individual male	Individual female	Total population	Area (ha)
1	Sebebera	906	730	176	2165	2066	4231	5323.8
2	*Gonka*	660	454	206	1661	1637	3298	15357
3	*Senale*	1940	1282	658	4837	4863	9700	22018
4	*Adi mesno*	1188	841	347	2845	3095	5940	5762
5	*Adi keyih*	1239	992	247	3144	3052	6196	5091
6	*Tsehafti*	1416	997	419	3523	3559	7082	23517
7	*Bahri tseba*	1786	1426	360	4321	4609	8930	7081
8	*Hagere selam*	2052	1630	422	5110	5150	10260	9858
9	*Ara Asgede*	1804	1602	202	4539	4480	9019	22061
10	*Fikire alem*	1529	1265	264	3826	3820	7646	7196
11	*Mai nebri*	1068	845	223	2543	2798	5341	5501
12	*Hareko*	1928	1676	252	4754	4885	9639	9788.5
13	*Metkel*	1624	1255	369	4083	4038	8121	7501.4
14	*Dejen*	1473	1157	316	3648	3719	7367	6046
15	*Andi weyane*	1527	1101	426	3770	3866	7636	5914
16	*Hintalo*	1289	1110	179	3149	3296	6445	5418.2
17	*Muja*	1389	1175	214	3400	3543	6943	12248
18	*Hiwane*	1791	1519	272	4379	4575	8954	6007
19	*Adi awena*	1363	1120	243	3349	3464	6813	7997
20	*Adi gudem*	1824	1532	292	4152	4989	9141	3622
	Total	29800	23709	6097	73198	75504	148702	193309

Source: Wereda Bureau of Agriculture(2000e.c)

Annex 3: Livestock population of the *Hintalo-Wajirat wereda*

S/N	Tabia (PA)	Cattle	Sheep	Goat	Mule	Donkey	Horse	Camel	Chicken	Bee cl
1	*Sebebera*	6949	917	1041	590	153	271	27	520	380
2	*Gonka*	2015	38	700	2	252	--	37	946	358
3	*Senale*	6929	917	1041	277	1009	4	43	1839	460
4	*Adi mesno*	3317	1593	1960	46	993	25	24	1496	500
5	*Adi keyih*	4081	241	879	36	1579	1	14	1803	766
6	*Tsehafti*	6530	1894	2035	7	1080	6	150	4238	962
7	*Bahri tseba*	3359	756	1254	13	760	--	61	1904	791
8	*Hagere selam*	14975	4682	3855	59	1060	24	162	11778	260
9	*Ara Asgede*	9612	869	2922	30	1274	9	207	2845	513
10	*Fikire alem*	3569	101	904	5	495	--	112	1678	329
11	*Mai nebri*	6389	103	879	36	1579	1	14	1803	766
12	*Hareko*	4970	128	2685	48	920	1	59	3565	5
13	*Metkel*	2724	807	903	1	516	--	--	1305	89
14	*Dejen*	3814	852	1209	7	853	1	--	1276	178
15	*Andi weyane*	4043	2020	1660	20	665	6	132	1914	235
16	*Hintalo*	1890	472	2364	10	668	2	38	2301	287
17	*Muja*	4730	181	1688	15	1042	1	14	1848	520
18	*Hiwane*	3375	1112	2184	7	764	4	2	1608	361
19	*Adi awena*	2794	805	903	29	288	3	69	735	13
20	*Adi gudem*	1554	705	91	20	114	13	3	735	16
	Total	97619	17148	31157	1258	16064	372	1156	46137	7789

Annex 4: Household level semi- structured questionnaire

Questionnaire used to identify the determinant variables of food security under subsistence agriculture in Hintalo-wajirat wereda, south eastern zone of Tigray region, Northern Ethiopia.

Name of enumerator_____ Questionnaire number: _____

To the Interviewee:
This is to politely request your cooperation to fill the questionnaire as detail as provided; we would like also to insure you that the personal data you will provide will be kept confidential and will not be used for other purpose other than the intended thesis research.

Location

1. Name of Region_____ Religion_____
2. Name of *Zone*_____
3. Name of *wereda*_____
4. Name of *Tabia*_____
5. Name of *kushet*_____
6. Name of *got*_____

6. What is the agro-ecological zonation of the household?

- *Dega* (1) □
- *Weina dega* (2) □
- *Kola* (3) □

Household characteristics

1. What is the sex of the household head?
   - Male (1) □
   - Female (0) □
2. What is the age of the household head? _____
3. what is your Total Family size: No_____(fill in table1)

Table1: household demographic characteristics

S/N	Name of Family member	Sex	Age	Relationship to the head	Age group(yrs)		
					<15	15-65	>65
1	Household head:						
2							
3							
4	Total Family member						

Household land ownership

1. Did you had access to land last year?
   - Yes..... (1).....□
   - No ..... (0).....□
2. If your answer for question number1 is yes, how much is total cultivable land size you had last year? (in tsimad)_____

3. What type of land ownership status did you had last year?
   - Owner (1) □
   - Rent (2) □
   - Share cropping (3) □

4. What size of your cultivable land is under each category during the survey year?
   - Total land size Owned_____
   - Total land size rented_____
   - Total land size share cropped_____
   - others_____

5. Did you had certificate of land ownership for the land you owned?
   - Yes (1) □
   - No (0) □

6. If your answer for Q5 is yes, do you fill secure (have no fear of reallocation)?
   - Yes (1) □
   - No (0) □

7. How much of your total land did you used for the following land use?
   - Cultivated(in tsimad)_____
   - Fallow land(tsimad)_____
   - grazing land_____
   - plantation land_____

8. What major cereal/crop did you produce in your crop land? (fill in table 2 below)

Table2: land ownership for major cereal crop

S/N	Type of major crop sown	Rain fed Size of land allocated		Irrigated land size	soil Quality		
		summer	spring		G	M	B
1	teff						
	wheat						
	maize						
	barley						
	Sorghum						
	millet						
	bean						
	lentil						
	total						

Note: G represents for good quality, **M;** medium quality and **B;** poor quality

Major cereal crop production

9. What was the total amount of harvest for each crop (in local unit)?
   Conversion factor in standard unit (kg) _____ (fill in table 3)

Table3: major cereal Crop production

S/N	Type	Local unit	Total produced by rain fed		Irrigated
			summer	spring	
1	teff				
2	wheat				
3	maize				
4	barley				
5	Sorghum				
6	millet				
7	bean				
8	lentil				
9	total				

10. Did you think your produce from your farm lands is enough for your family consumption for the whole year?
    - Yes (1) □
    - No (0) □
11. If your answer for Q10 is yes, do you have surplus food more than a year's consumption?
    - Yes (1) □
    - No (0) □
12. If your answer for Q11 is no, For how many months do you think your crop production (is enough) for will fed the family? _____
13. If your answer for Q11 is yes, for how many more months? _____
14. How is your ability to cope with food shortage in the past five years?
    - Increased (1) □
    - Decreased (2) □
    - No change (3) □
15. If your answer for Q14 is "increased" what do you think is the reason?
    - specify_____
    - _____
16. If your answer for Q14 is "decreased" what do you think is the reason?
    - specify_____
    - _____

Quality of land

17. What do you think was the quality status of your total land on average?(for detail fill in table 2 above)
    - Good (1) □
    - Medium (2) □
    - Poor (3) □
18. What is the size of land under each quality category of your land?
    - Good quality land size (local unit)_____
    - Medium quality land size_____
    - Poor quality land size_____

19. How is the quality status of your soil/land/ as compared to five years time?
    - Improving (1) □
    - Decreasing (2) □
    - The same as before (3) □

Degree of income diversification

1. Which income diversification activity does the household involved?
    - On Farm (1) □
    - Off farm (2) □
    - Both (3) □
2. What type of on farm income diversification activity does the household involved?
    - Food crop production (1) □
    - Cash crop production (2) □
    - Livestock production (3) □

Table 4.Off-farm income diversification

S/N	Type of off farm	unit	Income in money /grain per day				Total income per year
			Unit price	Work In hrs/day	Income /day	Labor days/year	
1	Agricultural labor rent						
2	Transport(animal rent out)						
3	Firewood and charcoal trade						
4	Wild fruit collection and sale						
5	weaving						
6	pottery						
7	Sale of local drink						
8	Traditional healery						
9	Hair dressing						
10	Private construction						
11	Food for work (Cash for work						
12	Community service-guarding, administration etc						
13	Others?						
	Total non farm income						

Household coping mechanism

1. what measures do you take to get food for the family when you face food shortages until the next harvest?
   - Borrow cereal crops (1) ☐
   - Exchange commodity for cereals (2) ☐
   - Sell household assets (3) ☐
   - Ask for aid (4) ☐
2. If your answer for Q1 is to exchange commodity with cereals, what type of commodity do you exchange?
   - Crops exchange (1) ☐
   - Livestock exchange (2) ☐
   - Labor exchange (3) ☐
3. If your answer for Q1 is to sale household assets to purchase cereal crop, what commodity do you sale?
   - Crop sale (1) ☐
   - Livestock sale (2) ☐
   - Labor sale (3) ☐
   - Permanent assets sale (4) ☐
4. What strategies/insurance mechanism/ do you use to avoid risk of food shortages?
   - Farm diversification (1) ☐
   - Off farm work in the village (2) ☐
   - Migration out of the *wereda* (3) ☐
5. Dpd you sold portion of your cereal crop produce in time of money constraint last year?
   - Yes (1) ☐
   - No (0) ☐
6. If your answer for Q5 is yes, when did you sold your crops?
   - October –December (1) ☐
   - July –September (2) ☐
   - April –June (3) ☐
   - January-March (4) ☐
7. Did you buy cereal crops during food shortfalls last year?
   - Yes (1) ☐
   - No (0) ☐
8. If your answer for Q7 is yes, when do you buy?
   - October –December (1) ☐
   - January-March (2) ☐
   - April –June (3) ☐
   - July- September (4) ☐
9. Did you exchanged cereal crop with other commodity last year?
   - Yes (1) ☐
   - No (0) ☐
10. How much food (cereal) crops do you think is on average enough for the family consumption for one month? _____

Livestock ownership

1. Did you had livestock Animals last year?
   - Yes (1) ☐
   - No (0) ☐
2. If your answer for Q1 is yes, what type?

Table5: Livestock ownership

S/N	type		total №	TLU conversion	Total TLU	Animal Loses due to disease		
						heads	TLU	total
1	bovine	Oxen						
		Cow						
		Heifer						
		calf						
2	equine	Donkey						
		Horse						
		Camel						
		Mule						
3	avian	Chickens						
	total							

3. Do you had livestock disease problem last year? Fill in Table 5
   - Yes (1) ☐
   - No (0) ☐
4. Did you ever have lost animals in the last five years because of animal disease?
   - Yes (1) ☐
   - No (0) ☐
5. If your answer for Q4 is yes, how many? Fill in Table 5
   - Number of heads_____

Education level

1. Did the household head had any access for any kind of formal or informal education or training?
   - Yes (1) ☐
   - No (0) ☐
2. If your answer for Q1 is yes, what type?
   - Formal (1) ☐
   - Informal (0) ☐

Table6: Household education background

S/N	Family member	Relationship	Informal education	Formal Education level					
				Read only(1)	Write Only(2)	Read and Write(3)	<6grade (4)	>6grade (5)	others
1	Household head	head							
2									
3									
4									
5									
6									
7									
8	others								

3. Did any member of the household have ever get training or shared an experience with other farmers?
   - Yes (1) ☐
   - No (0) ☐
4. If your answer for Q3 is yes, when and how many times? _____
5. what is the distance to the Agricultural extension center from your residence(in hrs)_____
6. Do you get extension visit by extension worker?
   - Yes (1) ☐
   - No (0) ☐
7. If your answer for Q6 is yes, how frequent?
   - visits per week_____
   - visits per month_____
   - visits per year_____

Access to irrigation

1. Did you hadaccess to irrigation water last year?
   - Yes (1) ☐
   - No (0) ☐
2. If your answer for Q1 is yes, what is the size of the irrigated land? Total irrigated land size_____Fill in Table 7

Table7: Access of households to irrigation

S/N	Type of crop irrigated	Size of land irrigated	Proportion of irrigated land to total cultivated land	Amount harvested(qt)
1				
2				
3				
4				
	total			

Access to fertilizer

1. Do you think you can get modern fertilizer easily when you need it:
   - Yes (1) ☐
   - No (0) ☐
2. If your answer for Q1 is yes, did you use a modern fertilizer in your farm land the previous year?
   - Yes (1) ☐
   - No (0) ☐
3. If your answer for Q2 is yes, what proportion of your farm is covered by modern fertilizer?
4. Did you use manure in your farm land in the previous cropping year?
   - Yes (1) ☐
   - No (0) ☐
5. If your answer for Q4 is yes, what size of your farm is covered by manure in the previous year?_____

Table8: Household access to fertilizer

S/N	Type of sown	size cultivated	land size fertilized	Cost of fertilizer	
				Unit price	Total cost
1	Rain fed-				
2					
3					
4					
5	Irrigated-				
6					
7					
8					
	total				

6. If your answer for Q2 is no, do you really need to get modern fertilizer?
   - Yes (1) ☐
   - No (0) ☐

7. If your answer for Q6 is yes, what was the problem? What was the reason?
   - It is costly/money constraint (1) ☐
   - Shortage of water (2) ☐
   - It is not available in the community (3) ☐
   - Others_____
8. If your answer for Q6 is no, what is the reason? _____

Access to improved seeds

1. Do you think you can get improved seeds easily in times of when you need it?
   - Yes (1) ☐
   - No (0) ☐
2. If your answer for Q1 is yes, did you use in your farm an improved seed last year?
   - Yes (1) ☐
   - No (0) ☐
3. If your answer for Q2 is yes, what size of your cultivated land was covered by improved seed? (in tsimad)_____

Table 9: Access of Households to improved seeds

S/N	Type of sown	Total size	size sown by local	Land sown by improved	Improved seed expense	
					Unit cost	Total cost
1	Rain fed-					
2						
3						
4	Irrigated-					
5						
6						
	total					

4. If your answer for Q2 is no, why? What was the reason?
   - It was costly/money constraint (1) ☐
   - It is not as productive as local variety (2) ☐
   - Poor storage, preparation quality and test (3) ☐
   - Others_____

Money/grain remittance

1. Did you get any money/grain remittance from outside of the household last year?
   - Yes (1) ☐
   - No (0) ☐
2. If your answer for Q1 is yes, from whom?
   - Non migrant friends/relatives (1) ☐
   - Migrants family member (2) ☐
   - Government (3) ☐

3. If your answer for Q1 is yes, which type and how much? (fill in table 10)

Table10: Household commodity remittance

S/N	commodity type received (grain, livestock, money)	Commodity type	Amount recieved per year		
			1	2	3
	grain				
	livestock				
	money				
	total				

4. If any food aid given from government in your community? Since when? _____
5. If you have migrant family member, which type of migration?
   - Seasonal migration (with in a year) (1) ☐
   - Temporary (1- 2years) (2) ☐
   - Permanent (> 2 years) (3) ☐

Household decision making and resource control

1. If the household is involved in off-farm income generating activity, who is involved from the household?
   - Women (1) ☐
   - Men (2) ☐
   - Both (3) ☐
2. How many (in labor days) each are involved in the household?
   - Total household off farm income _____ labour days? _____
   - Total Women income per year? _____ labor days? _____
   - Total Men income per year? _____ labor days? _____

Table 11: household resource control

S/N	Type of job	Total income obtained by the family	Income obtained by men	Income obtained by women	Proportion of income obtained by	
					women	men
	Total					

Table12: Decision matrix by women in the household.

S/N	Type of activity	Decision made by			remark
		Women	Men	both	
1	Who decides what type of crop to grow				
2	Who decide for what purpose to spent the income obtained by men				
3	Who decide the expenditure of the income obtained by women				
4	Who decide what amount and type of food to be purchased for the family consumption				
5	Who decide the amount and type of food crop to be sold if any				
6	Who decide what amount of food crop to be stored for lean season				
7	Who decide which and when, the assets (livestock) to be sold				
8	Who decide which and when , the assets (livestock's) to be purchased				
9	Who decide the household labor allocation? Who works what type and where				
10	Who decide what amount money/grain to be borrowed				
	Ratio of count(R)=Count/10				
	% of decision (R x 100)in the household				

Note: resource control will be by women (1), if % of women ≥50%

Access to credit

1. Do you think you can obtain formal credit easily when you need it?
   - Yes (1) ☐
   - No (0) ☐
2. If your answer for Q1 is yes, did you borrowed last year?
   - Yes (1) ☐
   - No (0) ☐
3. If your answer for Q1 is no, can you get informal credit?
   - Yes (1) ☐
   - No (0) ☐
4. Do you use the money borrowed for purchasing food crops?
   - Yes (1) ☐
   - No (0) ☐
5. If your answer for Q4 is yes, how much of it was allocated for food purchase?

Table 13: Allocation of money borrowed for food purchase.

S/N	Total money borrowed with in a year	Amount money used for food purchase	Unit food price for purchase	Total food purchased per year

6. If your answer for Q1 is no, why, what is the reason?
   - No credit service at all in the village (1) □.
   - Credit center is far from homestead (2) □
   - Do not fulfill Credit requirements/collateral/ (3) □
   - Interest rate is very heavy (4) □
   - Repayment duration to short (5) □
   - Too small amount of credit ceilings (6) □

Storage availability and quality

1. Do you have permanent storage facility for storing your food crop harvested or purchased?
   - Yes (1) □
   - No (0) □
2. If your answer for Q1 is yes, from what is your storage facility is made of?

   _____
3. If your answer for Q1 is no, where do you store your food for lean seasons?

   _____
4. what type of food storage facility do you think is good to minimize food lose(from rat and storage pests) _____
5. What do you think is the quality of your storage facility?
   - Good (1) □
   - Medium (2) □
   - Bad (3) □
6. Do you think the storage you have, did reduced any wastage and storage loses of your food crop?
   - Yes (1) □
   - No (0) □
7. If your answer for Q8 is yes, to what extent did it reduced the storage lose?
   - High (1) □
   - Medium (2) □
   - Small (3) □
8. Do you think the ability of the family to reduce storage loses and food utilization has changed in the past five years? (In storage lose; in post harvest lose management and other indoor wastage etc.)
   - Yes (1) □
   - No (0) □

9. If your answer for Q8 is yes, how do you think is the change?
   - Increasing (1) ☐
   - Decreasing (2) ☐
10. What do you think is the reason for the change in Q9? _____

External labor support to domestic chore

1. Dpd you get external labor support for women domestic chore/work last year?
   - Yes (1) ☐
   - No (0) ☐
2. If your answer for Q1 is yes, do you think the labor support you obtained reduced women domestic labor burden?
   - Yes (1) ☐
   - No (0) ☐
3. If your answer for Q2 is yes, did the labor support helped the women reduce her time constraint to be involved in productive activity?
   - Yes (1) ☐
   - No (0) ☐
4. If your answer for Q3 is no, why_____
5. If your answer for Q3 is yes, do you think the involvement in productive activity of the women improved the ability to cope food shortage?
   - Yes (1) ☐
   - No (0) ☐
6. If your answer for Q5 is no, why_____

Presence of spouse sickness

1. Had the spouse been sick in last year?
   - Yes (1) ☐
   - No (0) ☐
2. If your answer for Q1 is yes, did the spouse ever get health service?
   - Yes (1) ☐
   - No (0) ☐
3. if your answer for Q2 is yes, what is the distance of the health service from your homestead? (in hrs)_____
4. If your answer for Q4 is yes, do you think the maternal health services has improved the health status of the spouse.
   - Yes (1) ☐
   - No (0) ☐

Presence of feast in the family

1. Did you use your grains/livestocks for holidays or special occasions other than the normal family consumption in last year?
   - Yes (1) ☐
   - No (0) ☐
2. If your answer for Q1 is yes, how many holidays per year? how much food grain, livestock and cash did you consumed for the occasion. Fill in table 14

Table 14: frequency of holidays in the Household.

S/N	Type of holidays	Frequency per year	Food grain consumed				Livestock heads slaughtered				Total food consumed
			Crop type	In kgs	price	Total in Br	Livestock type	head	price	Total in br	

3. If you have any expenses in cash other than the cereal and livestock for the festivals, how much?_____.

Declaration

I the undersigned declare that this Thesis is my original work and has not been presented for any degree in any other university and that all the sources of materials used for the Thesis have been duly acknowledged.

Name MOGES ALENE Signature _____ Date July 21, 2008

This Thesis has been submitted for examination with my approval as university advisor.

Name Abdulkarim Seid Signature _____ Date _____