Research Paper: Rural Households' Food Security Status in Arsi Zone, Oromia National Regional State, Ethiopia

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ABSTRACT

Purpose: The study designed to scrutinizing the status of rural households' food security in Arsi Zone, Oromia National Regional State, Ethiopia.

Methods: Primary and secondary data were collected through questionnaires, interviews, FGD, and desk review from total of 336 randomly selected households. To capture clear and comprehensive picture of the household's food security status in the study area, Household Food Balance Model, dietary diversity, coping strategy index, mean, and cross-tabulations of frequency distribution were used.

Result: The number of households prone to food insecurity in the study area accounts for 69.94% which could not acquire minimum daily allowance, 2100kcal during the study period. The result from the Household Food Balance Model indicates that the daily average per capita available for the household was 1743.21, which is far from the nationally recommended 2100kcal.

Conclusion: The result from the HDDS revealed that the domination of monotonous dietary for the household in the study area. The coping strategy index shows the presence of moderate to severe food insecurity. Therefore, the issue of food security must receive attention from the government, donors, and other concerned bodies to improve the household-level food security status.

1. Introduction

Chronic hunger affect an estimated 842 million and 223 million people in the global and Sub-Saharan Africa in 2013, respectively, which could have left behind those countries found in SSA to achieve the MDGs (Wonder, 2014). In addition, the level of undernourishment has been significantly very high in the region which accounts for 32.7% between 2011-2013 (Wonder, 2014). According to the report of FAO one could understand that the percentage of people who suffer from poverty, undernourishment, and food insecurity declined,

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but at a slow rate. For instance, the numbers of people undernourished in the 1990s were more than one billion and declined to 925 million in 2010. Those 925million people were the ones which could not have access to sufficient food to meet their dietary energy requirements (Ballard et al., 2011). Similarly, the number of people unable to acquire sufficient food to meet their daily minimum dietary energy requirements over one year in low and middle-income countries accounts for 775million in 2014-16 (FAO et al., 2017).

The attempt made by different countries to reduce the level of undernourishment has been progressive and crucial since the 1990s. But, the number of people suffering from the problem of undernourishment at the global level is very high, estimated to be 805 million (show the level of chronically undernourished in 2012-4). This indicates that one out of nine people does not have enough food to eat worldwide. The trend of hunger lessening shows significant differences within and between regions across the globe. The largest proportion, which has been estimated to be 79 1million, lived in developing regions in 2012-4. The level of undernourishment in Africa, Sub-Saharan Africa, and Ethiopia is very high which accounts for 226.7, 214.1, and 32.9million, respectively (FAO, IFAD, & WFP, 2014).

According to ADB (2014) cited in Abdulahi (2017), Ethiopia is one of the developing countries that suffer from serious food insecurity and famine. Chronic and transitory food insecurity affects a large portion of the population of the country. Also, according to CSA and WFP (2014) and CARE (2014) in Ethiopia, the number of people who live below the poverty line and are unable to afford the minimum calorie intake for a healthy and active life is estimated to more than 30 per cent, i.e. earning less than $1.25 a day (CARE 2014). In addition, the country has seen a serious challenge of malnutrition in which 44% of children under five years of age are stunted and 10% are affected by acute malnutrition. Moreover, at the national level, the number of households who were food energy deficits accounts for 40% at the threshold of 2,550 kilocalories per adult equivalent per day.

Arsi zone is considered as a food self-sufficient area in the country as a general picture. However, as the report from the office of rural and agricultural development of 2019/20 indicates, depending on the rainfall condition, the rural households faces different level of food insecurity. The status of food insecurity differs from woreda to woreda as well as household in different kebeles.

There are several studies such as Meskerem & Degefa (2015) and Abduselam (2017) conducted on the assessment of food security status across Ethiopia, most of which investigated the food security situation in the low producing area of the country. These studies failed to show the broader picture of the problem understudy. Besides no research has been conducted in Arsi Zone on the status of rural household food security. Thus, this study is attempted to assess the household level food security status with the help of different measurements in the study area.

2. Literature Review

Concepts

The concept of food in/security has been the concern of academicians, politicians, and policy-makers for a long period. The definition and concept of the term evolved through time since different elements in the concepts and definitions were defined and redefined in different times (Hoddinott, 1999; Weingärtner, 2004).

The concept of food security goes back to 1943 when forty-four forward-looking governments met at the Hot Springs Conference of Food and Agriculture (CFS, 2012; De Muro & Mazziotta, 2010; Pangaribowo et al., 2013) in Virginia, USA to consider the goal of freedom from want concerning food and agriculture (CFS, 2012; Weingärtner, 2004). Accordingly, they come up with "freedom from want" which refers to a secure, adequate, and suitable supply of food for every man, woman, and child (CFS, 2012; De Muro & Mazziotta, 2010; Pangaribowo et al., 2013).

In the 1970s the concept of food security looks from the food-supply point of view which stressed ensuring that all people all over the world have enough food to eat (Pangaribowo et al., 2013). Thus, the World Food Conference held in Rome in 1974 following the succession of poor harvests worldwide defines food security as "availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices"(CFS, 2012; De Muro & Mazziotta, 2010).

The concept of food security in the 1980s went from the availability dimension of food to the entitlement concept following the work of Sen (1981). Sen argued that the availability of food does not tell us how starvation develops without the falling in their availability, and nor does tell us why some people starved and the others, not during the falling of food availability. Therefore, ac-

cording to him, this is the matter of ownership, which he called an entitlement. According to Pangaribowo et al. (2013), Sen advocates that the food-related problem could govern by production and agricultural activities as well as by the structure and processes governing the entire economies and societies. In line with this, sufficient or adequate food supply alone does not ensure food security unless the poor and vulnerable people also had physical and economic access to that food (CFS, 2012).

More or less a more comprehensive and inclusive definition of food security appear in the 1990s when the world food summit (FAO, 1996) defines the concept. Accordingly, food security exists "when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (Castell et al., 2015; CFS, 2012; De Muro & Mazziotta, 2010; Leroy et al., 2015). This definition consists of various vital dimensions of food security such as availability, access, utilization (Castell et al., 2015; Deitchler et al., 2010), and stability (CFS, 2012). Hence, this study attempts to consider this definition to investigate the status of household-level food in/security.

The reverse is food insecurity which is defined as the limited or uncertain availability of nutritionally adequate and innocuous foods or the limited or uncertain capacity for acquiring adequate foods by socially acceptable means. At the time when individuals encounter food decline in food quality, variety or desirability, and reduction in food intake at the time, it results in the outbreak of low food security (Castell et al., 2015).

Theoretical Framework

To have better understanding about the food security situation a clear understanding of the theory of food security is very crucial. Thus, this study considers the 'general explanation' theory, and the food availability decline model and food entitlement decline model. As the argument of 'general explanation theory' the performance of household food security was determined by drought, flood, land degradation, inaccessibility to productive resources and population pressure. It results in disruption of agricultural production and attributes the household to decline in food availability (Devereux, 2009).

The rural household food security situation depends on their own production or sell livestock and purchase food grain in the market. Thus, food security is the interplay between food availability and entitlement. This is why the food availability decline model and food entitlement decline model were considered for the study. Food Availability Decline model is fixed towards understanding of the main deterrents for an increased agricultural production which would result in decline in food availability. The key advocate of the model is that, anything which disturbs food production, such as drought and flood by reducing the availability of food for prolonged period causes famine. Food Entitlement Decline model was coined for the first time by Sen 1981. He advocates the mere existence of food in the economy or in the market does not entitle a person to consume and famine could persist without aggregate availability decline. Sen profoundly believes that it is access to food that plays a crucial role in securing command over food.

3. Methodology

Study Area

Arsi zone is one of the zones in Oromia National Regional State found at 175km from the capital city of the country, Finfinnee on Finfinnee-Adama-Bale Robe main road. It gained the name Arsi from the Oromo ethnic groups that inhabit the area for a long period. It shares boundary lines with East Shewa Zone in the north and northwest, West Arsi Zone in the south and southwest, Bale Zone in the south, southeast and east, West Hararge Zone in the north and northeast, and Afar National Regional State at the extreme north. Astronomically the zone lies between 7008'58''N - 8049'00''N latitude and 38041'55''E - 40043'56''E longitude. Having a total area of 21009Km^2, it accounts for about 5.8% of the total area of the Regional State (FEDOoAZ, 2010).

Biophysical Profile of the Zone

The climate of the zone is known by different agro-climatic zones due to its diverse altitude. It is predominantly characterized by moderately cool (40%) followed by cool (34 %) annual temperature. Cool/cold type of thermal part is found in the highland areas of Chilalo, Bada, Gugu, Enkolo, and Kaka Mountains. whereas moderately warm temperature is found in the lowland areas of Gololcha, Amigna, Seru, and Merti districts as well as in Wabi Shabelle river valleys and Awash Gorges. The mean annual temperature of the zone range between 20-250c in the lowland and 10-150c in the central highland of the zone. However, there is a slight monthly variation of temperature in which February to May are the hottest months while October to January is the coldest months. The mean annual rainfall of the area varies from 633.7 mm at Dera station (located at an altitude of

1680 meters amsl) to 1059.3 mm at Bekoji station (located at an altitude of 2760 meters amsl). Generally, Arsi Zone receives abundant and well-distributed rainfall both in amount and season (AZFECO, 2016; Yazachew & Kasahun, 2011).

The area is known by diversified physiographic structures in which altitude varies between 805meter (the lowest point) found at the extreme east of Seru district in Wabi Gorge and on 4195 meters (highest peak) at Mountain Kaka (Yazachew & Kasahun, 2011). The major physiographic division of the area includes Mountain ranges, Massifs, High Plateau, Low plateau and Associated Lowlands, and Lowlands (FEDOoAZ ,2010).

The zone is naturally endowed with enormous rivers and streams. It has a high network or density of perennial rivers and streams. Chillo-Galema mountain ranges are the major water source for the main perennial rivers of the zone. It is the source of Wabe-Shabelle tributaries such as Wabe, Robe, Elele, Megna, Gololcha, Ejersa, and Shenen rivers, and also the sources of Awash river basins and tributaries such as Keleta, Chulule, Arba, and Awash. The zone has shares a boundary line with lakes Ziway and Langano with East Shewa, and Melka- Wekena and Koka with Bale and East Shewa zones, respectively (FEDOoAZ, 2010).

The soils in the area are composed of diversified types and natures formed from current volcanic activities. The most dominant soils are Chromic and Pellic Vertisols (30%), Luvisols (13%), Cambisols (23%), Andosols (4%), Lithosols (6%), Fluvisols (2%), and others such as Phaeozems, Orthic Solonchak, Calcic xerosols, Eutric regosols, Gypsic Yermosols, Mollic Gleysols and Orthic Acrisols (11%). This creates a conducive and fertile soil for different agricultural activities (FEDOoAZ, 2010).

As a result of diversified physiographic structure (altitude), temperature, rainfall, and parent material from which soils are derived the area host different kinds of natural vegetation. But, the natural vegetation once densely and extensively covers the land of the area due to human interventions, currently found at some pockets of Munesa- Shashamene, Arbagugu, and ChilaloGalema State Forest and the eastern peripheral lowlands of Amigna, Seru and Gololcha and the lowland of Ziway Dugda (FEDOoAZ, 2010).

The available natural forests of the area provide habitats for different kinds of wild animals. Even though the deterioration of wild animals due to human intervention on their habitats, the area possesses different species of wild animals such as Mountain Nyala, leopard and Menelik'sbushbuck, lion, warthog, and hippopotamus. These wild animals are restricted to Chilalo Galema mountain range forest and Delfaker (the only controlled hunting Game Reserve areas of the Zone), Kaka mountain, Munesa –Shashamene State forest, Arbagugu State Forest, and the eastern lowland of Amigna, Gololcha, and Seru districts and around and in Lake Ziway and Langano where population interferences are non or low (AZFECO, 2016).

Socio-Economic Profile of the Zone

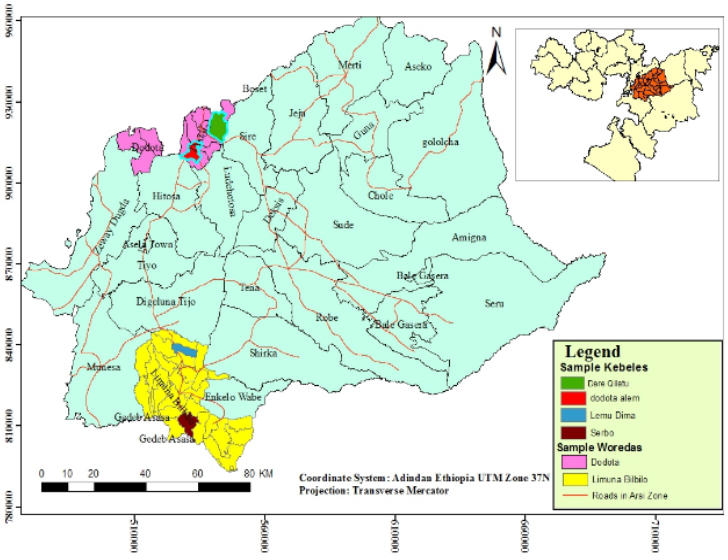

Figure 1. Map of the study area (Source Ethiopian GIS database)

From a demographic point of view, the total population of the area accounts for 3,377,806 with 1,695,152 males and 1,682,654 females. The number of people who inhabit the urban area of the zone accounts for only 13.13% which is below the national level (AZFECO, 2016). This reveals a huge number of populations in the area live in the countryside. The dependency ratio is very high in which the dependent population accounts for 47.58% (0-14years + above 65) and independent account52.42% (15-64years). The crude population density of the zone is moderate (123person/km^2) as compared to the most densely populated zones of the country (Yazachew & Kasahun, 2011).

Agriculture is the main economic activity in the zone in which people engage in crop cultivation, livestock and poultry raising, and beekeeping. Crop cultivation is the most dominant economic activity which is rain-fed. Smallholder farmers share the largest total crop production and total land under cultivation which accounts for 96.2% and 96.45%, respectively. The main crops cultivated are cereals, pulses, oilseeds, vegetables, fruits, root crops, and others. In line with this state farms engaged in crop production in the area (Yazachew & Kasahun 2011).

Methods and Materials

Philosophical Underpinning

The ontological and epistemological stands, theoretical perspectives, methodological strategies, and specific methods of data collection and analysis are the building block of the research. The theoretical perspective which is guided by the epistemological stance espoused, which in turn determines the methodological strategies and methods for data collection and analysis should be defined and formulated clearly and comprehensively in the research (Crotty, 1998; Gray, 2004, 2017). This tells us the presence of hierarchal structures between ontology, epistemology, methodology, and methods.

Among the two quite opposite ontologies in western thought, the ontology of being which accentuates the existence of reality as represented by identifiable properties denoted by symbols, words, and concepts as opposed to formlessness, chaos, interpenetration, and absence of ontology of becoming (Gray, 2004, 2017) has been adopted for this study. It is since the felling and shortage of food reflected in the form of famine, food consumed by people, and the like exist in reality.

In line with the ontological stance, it is important to consider the epistemological perspective which enlightens the way of understanding and explaining how we know what we know (Crotty, 1998). The epistemological perspectives which guide this study are objectivism and constructivism since using one of them does not comprehensively and entirely pave a way to study food in/security.

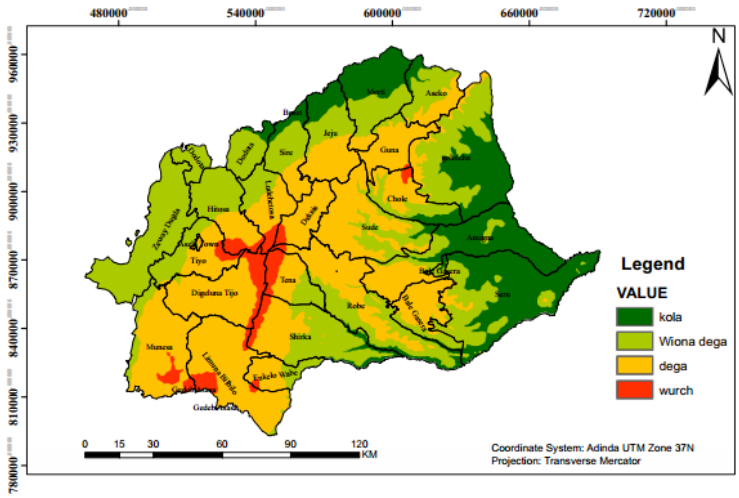

Figure 2. Agroclimatic map of Arsi Zone (Source: Ethiopian GIS database)

Objectivism is an epistemic view that advocates the presence of reality independent of the human mind and the concern of the researcher are all about discovering this objective truth (Gray, 2004, 2017). The theoretical perspective fits with this epistemic view and is well-suited with the objective of the study is positivism. Its central argument is the presence of reality external to the researcher and these realities are tested directly through scientific investigation. Therefore, in the food security analysis data on the socio-economic and demographic profile, amount of crop produced, sold, and reserve for consumption, received from relatives, and resource ownership was objectively collected with questionnaires and structured interviews and were analyzed objectively with different statistical instruments.

The second epistemic perspective adopted for the study is constructivism. Its main argument is truth and meaning do not exist in some external world but are created by the subject's interactions with the world. Meaning is constructed not discovered, so subjects construct their own meaning in different ways, even concerning the same phenomenon (Creswell, 2009; Crotty, 1998; Gray, 2004, 2017). Thus, the perception of people to the coping strategies and feeling of food insecurity was not understood and comprehended similarly or at the same level. Similarly, their perception and knowledge can emerge from their personal feeling and understanding which create a variation on the meaning.

Though positivism and interpretivism emerge from a different epistemological perspective they are under the umbrella of similar ontology, i.e. ontology of being. Thus, to study in detail and comprehensively the rural household food security status and come up with valid and reliable findings and strong conclusions the researcher believes using both objective reality and subjective views in amalgamation is very crucial.

Research Designs and Approaches

Plano Clark & Creswell (2015) identify quantitative, qualitative, and mixed types of research approaches; and the three approaches are not as discrete as they first appear. The research approach adopted for this study is a mixed design since food security status cannot be studied with only a single approach. Likewise, they argue that researchers could employ mixed-method studies when they believe the use of both quantitative and qualitative data would provide a better understanding of the research problem. The use of quantitative or qualitative methods had some weaknesses, and the use of both (quantitative and qualitative) concurrently result in neutralizing the weakness of each method (Creswell 2014). Similarly, Creswell (2012) argue that the use of quantitative and qualitative research method (mixing the two) can help us to understand the problem and research question better than either method.

Thus, a concurrent/convergent parallel mixed-method research design was employed for the study. According to Creswell (2014) and Plano Clark and Creswell (2015), it refers to the collection of data simultaneously (quantitative and qualitative data), merging the data and using the result to understand the problem. They argued that the basic rationale for this study is that one data collection form supplies strengths to offset the weaknesses of the other form and that a complete understanding of a research problem results from collecting both quantitative and qualitative data. Thus, the issues of food security cannot be studied alone quantitatively or qualitatively. This helps the study to overcome the problem that emerges due to the use of quantitative or qualitative approaches alone.

The approach was steered by the principles and procedures of survey research design. The reason for the use of the design is one of the commonly employed in mixed research approach helps to infer to the total population, and in-depth analysis of the concern of different stakeholders. It allows to ask about many things at one time, that it is compatible with cross sectional design for the time frame of the study. The reliability and validity are critical in the study. Thus, the issue of stability, internal reliability and inter-observation consistency were checked to realize the reliability of the study. Moreover, the research validity was attained through careful sampling, appropriate instrumentation and statistical treatments of the data.

Sources, Types, and Tools of Data Collection

The necessary data for this study were generated from both primary and secondary sources. Primary sources were households selected as a sample from the sampling frame in the study area and FGD. Secondary sources were different documents and reports in the agricultural offices of the woreda and zone and any other necessary written document accessed from the internet, available books, magazines, journals, and published or unpublished documents. The tools/instruments employed in the study were questionnaires (structured and unstructured), interviews (structured and unstructured), observation, FGD, and trans-walk based on the objectives intended to achieve.

Sampling Procedures

Multi-stage sampling procedures have been used to select the necessary sample for the study. First, after the woredas stratified according to their amount of wheat production in quintals purposive sampling was employed to select two woredas (Limu Bilbilo- from wheat-producing and Dodota-from less wheat-producing) from the study zone and two kebeles each from the selected woredas (Sarbo, Lemu Dima, Dire Kiltu and Dodota Alem) to generate sample households for the study. Second, once the study woredas and kebeles for the study were identified based on the amount of wheat production, simple random sampling was employed to select the sample households from the selected sample kebeles for the study. This is because it reduces the level of bias that might outbreak during the selection of the sample. Third, samples for interviews (6 FGD containing women more knowledgeable informants, households, principals of the woredas and zone) were selected purposively to generate in-depth information. The total number of sampled households was generated from the target population (households in the selected kebeles) based on their proportion of total households.

Sample Size Determination

Sample size determination is one of the technical areas which require the researcher's ability to decide the appropriate sample size for the study based on the purpose of the study. According to Cohen et al. (2000), there is no clear-cut answer for how much sample size is appropriate for the study undergoes; rather it depends on the purpose of the study and nature of the population under investigation. Therefore, to reduce the sampling error incurred due to inappropriate sample size, time for the study, heterogeneity or homogeneity of the population under study, costs for the study, and the like; it is important to limit the sample size under study. Thus, according to Kothari (2004), if the study population is finite in number, the following mathematical formula is appropriately used to determine the sample size for the study. Therefore, at 95% confidence level, 5% significance level (degree of freedom is=1-0.5=0.5), and the standard variate at 95% significant level is 1.96, the total sample size for the study is 336 households.

$$n=\frac{z^2.p.q.N}{e^2(N-1)+z^2.p.q}=\frac{(1.96)^2(0.5)(0.5)(2690)}{(0.05)^2(2690-1)+(1.96)^2(0.5)(0.5)}=336$$

Where, n= refers to the number of sample size

P= degree of freedom

q= population proportion (q = 1 – p = 1 – 0.5 = 0.5)

e= significance level

N=total population

z= the value standard variate at acceptable significance level (1.96 at 95%)

Methods of Data Analysis

The food security status of the households was analyzed with the help of total calorie consumption per day (kcal), household dietary diversity score, and coping strategy index in this study. This is since there is no single standard measures of food security exist. The household kcal food intake per day (kilocalories per day per household) is used to measure the dietary energy available for the households. The dietary energy available for the households measured in terms of kcal has been derived from the available food grain supply based on EHNRI's food composition Table 1. It was done based on the Household Food Balance Model which has been employed by different scholars (Messay, 2001; Degefa, 1996; Eshetu, 2000) for calculating the balance between grains gained and lost. The kcal amount per 100gram was calculated based on the types of food consumed by the households since the calorie equivalence of the grains is varied based on their end product prepared for consumption. The mathematical formula for Household Food Balance Model is:

NGA = (GP + GB + FA + GG) - (HL+ GU + GS +GV)

Where, NGA= Net grain available/year/household

GP= Total grain produced/year/household

GB= Total grain bought/year/household

FA= Quantity of food aid obtained/year/household

GG= Total grain obtained through gift or remittance/year/household

HL= Post-harvest losses/year

GU=Quantity of grain reserved for seed/year/household

GS=Amount of grain sold/year/household

GV=Grain given to others within a year

In line with the dietary energy availability for households, HDDSwas employed to measure households' food security. It is used to measure the different food groups consumed by the member of the household within the previous 24hours. It is selected for the study since obtaining data is straightforward, applicable at the household or individual level, and a more diversified diet is highly correlated with such factors as caloric and protein adequacy, the percentage of protein from animal sources (high-quality protein), and household income (Swindale & Bilinsky, 2006).

The coping strategy index was used to analyze the ways or methods households cope with the shortfalls of food or food shortage. It is the tool used to measure the behavior of the households during the period of food shortage. According to Maxwell & Caldwell (2008), CSI is an indicator of household food security that is relatively simple and quick to use, straightforward to understand, and correlates well with more complex measures of food security. It is used to measure what the household does during the period of food shortage.

4. Findings

The Socio-economic and Demographic Characteristics

It is very decisive to see the socio-economic and demographic characteristics of the population to have a clear picture about the study area. Accordingly, the result from Table 2 below reveals that the sampled households which account for 80.95% were male and the rest 19.05% were female. Despite, the educational level of the households was not similar across the sample kebeles, the highest proportion of the household heads cannot read and write followed by a primary school, read and write, and secondary school which accounts for 47.31%, 25.30%, 13.10%, and 13.10%, respectively. The percentage share of the household heads attends tertiary education or graduate with certificate and above share only 1.19%. Therefore, it requires more and more work to improve the educational level of the farmers since educational status or level determines new technology and innovation adoption and cope with new knowledge and ideas to increases their production and productivity.

In terms of marital status, 86% of the farmers were married and only 0.30% were single. The rest 13.7% were divorced and widowed. This tells as the presence of stable marital status. Muslim and Orthodox Christianity is the dominant religion in the study area which accounts for 56.25% and 34.52%, respectively. Whereas, the rest were 5.65 % catholic, 1.49% protestant, and 2.08% other religious followers.

Resources Ownership Status of the Households

Discussing and seeing the resources ownerships of the households in the study area is very vital since on one hand or another determines their food security status. They determine the food security status of the farmers as they are the sources of foods, cash, and as means of agricultural production. The well-off (have adequate livestock) farmers were better in the status of the food security in the study area than the poor. Almost all the livestock in the study area were indigenous and relatively they were less productive.

As can be seen in Table 3 above, there is a high disparity in the number of different livestock possession among the households which range between 0 to 5. It is obvious this put a tremendous effect on the level of food security/insecurity of the households since directly or indirectly linked with the supply status or access side of food. In line with this fact, the average number of different species of livestock possessed by the households is low.

Table 1. Distribution of sample size across selected woredas and kebeles

Woreda	Kebele	Total HHs	Sample
Limu Bilbilo	Sarbo	622	78
	Lemu Dima	721	88
Dodota	Dire Kiltu	611	78
	Dodota Alem	736	92
Total		2690	336

Table 2. The socio-economic and demographic characteristics of the households

		kebele of household head				Total	%
		Dire Kiltu	Limu dima	Sarbo	Dodota Alem		
sex	Male	70	76	59	67	272	80.95
	Female	8	12	19	25	64	19.05
Total		78	88	78	92	336	100
Educational level	Not read and write	24	40	41	54	159	47.31
	Read and write	7	9	10	18	44	13.10
	Primary	24	26	21	14	85	25.30
	Secondary	20	12	6	6	44	13.10
	Certificate and above	3	1	0	0	4	1.19
Total		78	88	78	92	336	100
Religion	Orthodox	27	58	18	26	116	34.52
	Muslim	33	27	57	59	189	56.25
	Catholic	6	3	3	7	19	5.65
	Protestant	5	0	0	0	5	1.49
	Others	7	0	0	0	7	2.08
Total		78	88	78	92	336	100
Marital status	Married	74	78	67	70	289	86.00
	Single	0	0	1	0	1	.30
	Divorced	3	4	3	13	23	6.85
	Widowed	1	6	7	9	23	6.85
Total		78	88	78	92	336	100

Sources: Computed from the survey result

JSRD

Table 3. The livestock ownership of the households

Kind of livestock	Sum	Mean	Range	Minimum	Maximum	Variance
Number of oxen	717	2.13	5	0	5	1.113
Number of cows	390	1.16	5	0	5	.553
Number of calves	291	.87	4	0	4	.701
Number of goats	409	1.22	11	0	11	6.947
Number of sheep	1251	3.72	15	0	15	11.383
Number of poultry	2351	7.00	20	0	20	20.098
Number of donkeys and horses	497	1.48	4	0	4	.770

Source: Sample survey

JSRD

In-country like Ethiopia where traditional agriculture dominates the economy without doubt productive assets such as draught power obtained from oxen critically determine the agricultural production and productivity. The study result indicates that 74% of the households have access to farm oxen whereas the rest 24% were not. The distribution of oxen among households who have their own is not equal. Among the households that possess their own oxen, 47% have at least a pair of oxen for cultivating their land. The households that owned more than two oxen account for 36%. The rest 17 % of the households in the study area possess only one ox. Those households owned a single ox cultivate their land through borrowing (ploughing one day for him and the next day for the other) and sometimes renting from the other on daily basis. The study by Meskerem and Degefa (2015) realize that the presence of wider gap in available dietary energy between households who possess one ox and four oxen. This reveal that draught power obtained

from oxen put tremendous effects on the food security status of the rural households.

Access to land or land ownerships

As can be revealed in Table 4 below, the percentage share of households' access to land accounts for 94.5, while 5.4 percent were landless. It is clear that one of the productive assets, land, plays a crucial role in the agricultural production and productivity on one hand and the food security status of the people on another way. Thus, for the landless in the study area null or lack of this productive asset put a tremendous effect on their food security status as revealed by the group discussants. To fulfill their shortage of land for cultivation they use sharecropping, purchasing from others on yearly basis, and renting. Their main challenging factor during renting and purchasing from others was the expensive cost of the land.

Measures of food security status

Dietary energy supply analysis (Kcal)

Dietary energy available is one of the techniques used to measures the food security component specifically the food adequacy level which is measured with the help of kilocalorie content. The household kcal food intake per day (kilocalories per day per household) is used to measure the dietary energy available for the households. The dietary energy available for the households measured in terms of kcal has been derived from the available food grain supply based on EHNRI's food composition Table 5. It was done based on the Household Food Balance Model which has been employed by different scholars for calculating the balance between grains gained and lost. The kcal amount per 100gram was calculated based on the types of food consumed by the households since the calorie equivalence of the grains is varied based on their end product prepared for consumption.

The result of the study indicates that the main sources of household food requirements are own production, purchase from the market, and food aid. Cereals, pulses, fruits, vegetables, and livestock products are the main food items used for home consumption and present for the market. Cereals and pulses with their end product dominate household dietary energy supply. The main dietary energy supply of the rural households in the study area obtained from barely, wheat, teff, pulses and maize which shares 23.02, 17.42, 16.40, 14.27 and 13%, respectively. Thus, the study intentionally considers these food sources to calculate household dietary energy supply. Thus, the result from the Household Food Balance Model indicates that the overall food energy available for the household was 1,180,918,862.50. This tells us the daily average per capita of 1743.21, which is far from the nationally recommended 2100kcal. From this result, one can understand the presence of food insecurity in the surplus producing areas like Arsi Zone which is considered as the wheat and barley producing corridor in the country. This justifies mere availability of food crops at a national or regional level is not a guaranty for food security at the household's level.

As can be seen from Table 6 below, in taking in to account the minimum national recommended Kcal allowance for an adult in Ethiopia the number of food insecure households accounts for 69.94%. The rest 30.06% of the study rural households were food secure. Thus, from this general picture it is possible to infer that the presence of high food insecurity situation in the study area.

It is the right time to identify the mean difference in the dietary energy availability of households living in different kebeles in the study area. To assess the dietary energy availability of the household's one-way ANOVA was used since four main independent categorical groups (kebeles of household) and one dependent continuous variable (dietary energy measured in Kcal) exist. Thus, the following null and alternative hypotheses were formulated.

Table 4. Household access to land

		.00	.25-.75	1.00	1.1 -2.0	2.1 – 3.0	3.1 – 4.0	>4.00
Kebeles of household head	Dire kiltu	5	15	9	21	20	5	3
	Limu Dima	4	5	6	32	35	4	2
	Sarbo	3	12	15	36	7	3	2
	Dodota alem	6	15	10	42	14	2	4
Total		18	45	40	131	76	14	11
Percent		5.4	13.4	11.9	39.0	22.6	4.2	3.3

Sources: Computed from the survey result

Table 5. Total quantity of grain available and dietary energy equivalent by types of crops

Types of food crops	Total quantity (Qtls)	Total dietary energy (kcal)	Dietary energy per quintal (kcal/Qtls)
Teff	566.50	91,319,800.00	161,200.00
Barely	1608.25	363,898,727.50	226,270.00
Wheat	3567.00	610,599,060.00	171,180.00
Maize	627.50	80,213,325.00	127,830.00
Pulses	131.00	18,379,300.00	140,300.00
Vegetables	213.00	13,376,400.00	62,800.00
Oil seeds	33.50	3,132,250.00	93,500.00
Total	6746.75	1,180,918,862.50	-

Source: Organized from survey data based on EHNRI composition table

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Table 6. The status of sample household food security

Category	Count	Percent
Food secure	101	69.94
Food insecure	235	30.06

Source: Computed from survey data

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Ho: There is no significant difference in the dietary energy availability for households in different kebeles.

Ha: There is a significant difference in dietary energy availability for households in different kebeles.

As can be seen from the above Table 7, there is a significant difference in the mean dietary energy availability among households living in different kebeles in the study area. A significant difference in the dietary energy availability (Kcal) exist among household found in different kebeles since the significant value is less than 0.05 or the F-vale is higher as seen from the above table. But it does not tell us which group is different from which groups. Thus, it is possible to conduct post hoc tests to identify where the mean differences exist. From the post hoc table illustrated as following in Table 8 the presence of significant difference in the availability of dietary energy among households in different kebeles since the p-value is less than 0.05 (p=0.000). Thus, at 0.05 significant level except for Dodota alem and Dire kiltu or vice versa, there are clear mean differences in the dietary energy availability.

Dietary diversity analysis (HDDs)

The dietary diversity included in this study consists of a simple count of food groups consumed by the member of the household in the previous 24 hours in the home. It is a measure of access dimension of food security in counting the number of food groups consumed by the member of the household in the past 24hours. Kennedy et al., 2010 indicate that the household dietary diversity tells us household economic access to food (dietary energy). It is mainly related to the economic capacity of the households to access diversified foods. Studies reveal that increment in the dietary diversity is correlated with the socio-economic status and household food security level (special household energy availability).

Table 7. Dietary energy availability for households in Kcal

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	110676522.870	3	36892174.290	48.099	.000
Within Groups	254645547.122	332	767004.660		
Total	365322069.992	335			

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Table 8. Dependent variable: Dietary energy availability for households in Kcal

	(I) kebele of household head	(J) kebele of household head	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Scheffe	Sarbo	Limu dima	-727.60404*	136.19602	.000	-1110.2987	-344.9094
		Dire kiltu	703.86923*	140.23832	.000	309.8162	1097.9223
		Dodota alem	583.85668*	134.79763	.000	205.0913	962.6220
	Limu Dima	Sarbo	727.60404*	136.19602	.000	344.9094	1110.2987
		Dire kiltu	1431.47327*	136.19602	.000	1048.7786	1814.1679
		Dodota alem	1311.46072*	130.58702	.000	944.5267	1678.3948
	Dire kiltu	Sarbo	-703.86923*	140.23832	.000	-1097.9223	-309.8162
		Limu Dima	-1431.47327*	136.19602	.000	-1814.1679	-1048.7786
		Dodota alem	-120.01256	134.79763	.851	-498.7779	258.7528
	Dodota alem	Sarbo	-583.85668*	134.79763	.000	-962.6220	-205.0913
		Limu Dima	-1311.46072*	130.58702	.000	-1678.3948	-944.5267
		Dire kiltu	120.01256	134.79763	.851	-258.7528	498.7779
LSD	Sarbo	Limu Dima	-727.60404*	136.19602	.000	-995.5200	-459.6881
		Dire kiltu	703.86923*	140.23832	.000	428.0015	979.7369
		Dodota alem	583.85668*	134.79763	.000	318.6915	849.0218
	Limu Dima	Sarbo	727.60404*	136.19602	.000	459.6881	995.5200
		Dire kiltu	1431.47327*	136.19602	.000	1163.5573	1699.3892
		Dodota alem	1311.46072*	130.58702	.000	1054.5784	1568.3430
	Dire kiltu	Sarbo	-703.86923*	140.23832	.000	-979.7369	-428.0015
		Limu Dima	-1431.47327*	136.19602	.000	-1699.3892	-1163.5573
		Dodota alem	-120.01256	134.79763	.374	-385.1777	145.1526
	Dodota alem	Sarbo	-583.85668*	134.79763	.000	-849.0218	-318.6915
		Limu Dima	-1311.46072*	130.58702	.000	-1568.3430	-1054.5784
		Dire kiltu	120.01256	134.79763	.374	-145.1526	385.1777

*. The mean difference is significant at the 0.05 level.

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As can be seen from Table 9 above, most of the households in the study area consume the food groups under cereals (97.3%), legumes (84.9%), condiments (86.3%), and vegetables (72%) within the past 24 hours. While none of the households never consume fish and seas food groups, and few of them consume meats (0.6%), fruits (5.65%), eggs (11%), sugar/honey (19.65%), and roots and tubers (20.55%). This tells us the differences in the number of food groups consumed by the households in the study area. Concerning the number of food groups consumed by the households, one of the interviewees from Dire kiltu kebele (Dodota woreda) indicates that it is difficult to obtain different food groups and she sold (like eggs) for the purchase of others (like condiments). Her interview directly translated from Afaan Oromo:

I was born and grow her in Dire kiltu. I live here for the past 62 years. I have six hens and I sold twenty-five eggs per week on average. What I experience and learned from my ancestor was selling the food groups like eggs for the purchase of condiments like sugar, coffee, and tea. Eating eggs means missing these condiments. Eggs, fruits, and meat are the food groups of the rich or the wealthiest groups of my community.

As Ruel (2003) reveals one of the techniques employed to define the cutoff points for assessing the varying level of dietary diversity in the community is creating terciles and sometimes quintiles. Thus, the tercile of dietary diversity score was used in this study to classify the household in the study area. A scale was established as low (1-4), medium (5-8), and high (9-12). The result displayed in Table 10 below, reveal that the highest proportion of the household fall in the first tercile which means consumes low dietary diversity. The number of households in the low dietary diversity score was 79.4percent. Whereas, the number of households in the medium and high dietary diversity score accounts for 12.5 percent

and 5.1 percent, respectively. From the study result, one can conclude that the presence of food insecurity since most of the households fall in the low dietary diversity groups. It means the households in the study area frequently consume monotonous types of food groups.

Copping strategies (CSI)

The coping strategy index was used to analyze the ways or methods households cope with the shortfalls of food or food shortage. It is the tool used to measure the behavior of the households during the period of food shortage. According to Maxwell & Caldwell (2008), CSI is an indicator of household food security that is relatively simple and quick to use, straightforward to understand, and correlates well with more complex measures of food security. It is used to measure what the household does during the period of food shortage.

As can be illustrated in Table11 above, the response of focus group discussants to the food shortfall or lack of money to buy was stratified according to the severity level of the responses. The responses indicate the various perception of the respondent to the question of food shortfall or indicate how the respondents manage the food shortfall. It is obvious that the severity level of the coping mechanisms or strategies is not equally weak or strong (i.e., it goes from least severe to very severe mechanisms). For instance, relying on less preferred or less expensive food is the least severe strategy than staying an entire day without eating or sending a member of the household to beg which is one of the most severe strategies.

The household coping strategy index score was obtained by multiplying the row score/frequency by the severity weight of the strategy. As the result of the group discussants indicate the household CSI score was 62. The number (62) is a general picture that seems nothing to tell the severity of food insecurity. But, according to Maxwell & Caldwell (2008), a higher score specifies a greater level of coping, and hence increased food insecurity. Thus, the food security situation in the study area was moderate to severe since the result of the CSI is higher. Likewise, since most of the households use moderate coping mechanisms and a few severe mechanisms it is possible to conclude the food security status was moderate to severe. Moreover, the result from the CSI directly correlated with an average calorie available for the household in the study area which was 1743.28 kcal per day which indicates the lower-calorie available for the household.

Table 9. Food groups consumed by households in Arsi Zone

Food groups	Limu-bilbilo (n=168)		Dodota (n=168)		Total %
	Count	%	Count	%	
Cereals	159	94.6	168	100	97.3
Root and tubers	42	25	27	16.1	20.55
Fruits	13	7.7	6	3.6	5.65
Vegetables	125	74.4	117	69.6	72
Fish	0	0	0	0	0
Eggs	23	13.7	14	8.3	11
Meat	2	1.2	0	0	0.6
Legumes	138	82.1	146	86.9	84.5
Milk and its products	63	37.5	27	16.1	26.8
Sugar/honey	37	22	29	17.3	19.65
Condiments	153	91.1	137	81.5	86.3

Source: survey result from 24 hours recall period

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Table 10. Household classification into tercile based on the number of food groups consumed

Tercile	Count	Percent
Low (1-4)	267	79.4
Medium (5-8)	42	12.5
High (9-12)	17	5.1

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Table 11. Coping strategies grouped and ranked by FG of household

	In the past 7 days, if there had been times when you did not have enough food or money to buy food, how many days has your household had to:	Row score	Severity weight	Weighted score= frequency * weight
A	Relay on less preferred or less expensive food	5	1	5
B	An entire day without eating	0	4	0
C	Send a member of a household to beg	0	4	0
D	Gather wild fruits, hunt/harvest immature crops	1	4	4
E	Limit portion at mealtime	6	1	6
F	Consume seed stock held for next season	2	4	8
G	Send household members to eat elsewhere	2	3	6
H	Borrow food, or rely on help from friends or relatives, government	4	2	8
I	Restrict consumption by an adult for small children to eat	3	2	6
J	Feed working members of the household at the expense of non-working	4	2	8
K	Reduce the number of meals eaten in a day	5	1	5
N	Work on others in exchange for food	3	2	6
	Total			62

Source: Computed from field survey

key to the ranks 1: least severe

2: moderately severe

3: severe

4: very severe

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5. Discussion

Food in/security is one of the pressing challenges of the world particularly for the developing nations. It will continue to be the center of discussion and studies since chronic and acute food insecurity is worsened by climate variability across the globe. It has been pronounced and become critically serious in developing nations specifically in SSA countries. In the situation in Ethiopia, rural households, which depend on rainfed agriculture suffer acute and chronic food insecurity depending on the trends of climate.

It is measured with different scales to identify whether the households were food secure or insecure. The food security status of the household in the study area was measured in terms of Kcal availability, dietary diversity, and coping strategy. As the result of the study in Arsi Zone, Oromia National Regional State indicates the presence of moderate to severe food insecurity. The overall Kcal availability for the households in the study area is 1743.28 which is so far from the nationally recommended 2100kcalper day. Similarly, the result from the dietary diversity score and coping strategy index indicates the presence of food insecurity.

In an area like Arsi Zone where surplus producing region researchers give a little emphasis for the study of food in/security status. This is because most of the time researchers and investigators perceive studying the food security status as insignificant in surplus-producing areas. But the finding of this study come up with the presence of moderate to severe food insecurity in the Arsi Zone which is considered as the granary of cereal crops (wheat and barley) in Ethiopia. Thus from the result of the study the researcher recommend 1) researcher in the area of food in/security should turn their attention to the area of a surplus producing region to investigate the food security situation at the grassroots and contextualize the food security issues 2) the policy designer should deeply look into the result and finding from different geographical localities during policymaking in the area of food security 3) donor and NGOs also should look into the surplus producing area when they try to assist needy people (like food aid).

Ethical approval

Ethical approval was granted, and official approval would be sought at all levels from the concerned bodies. All participants (humans) were given full informed

consent individually using voice recorder, present and published their images in the research report with no identification of respondents at the time of recruitment. Every respondent was explained the potential risks and benefits of participation, as was their right not to answer any question if they didn't want to and stop taking part at any point. Participation in the study would be posed only minimal risk of discomfort, and no research participant was forced against his/her will to provide information. All information obtained through this research has been kept confidential, and access to the data would be limited to research team members. In order to maintain confidentiality, information described using codes, data was analyzed without disclosing individual identity and no participant names were included in the reports or presentations. The data storage requirements would remain until the full report could be written, published, and all possible datasets would be carefully communicated to the concerned bodies.

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Conflict of Interest

The authors declared no conflicts of interest.

References

Abduselam, A. (2017). "Food Security Situation in Ethiopia: A Review Study." *International Journal of Health Economics and Policy* 2(3):86–96. doi: 10.11648/j.hep.20170203.11.

AZFECO. (2016). "Arsi Zone Socio-Economic Profile of the Year 2007 and 2008."

Ballard, T., Coates, J., Swindale, A., & Deitchler, M. (2011). "Household Hunger Scale: Indicator Definition and Measurement Guide."

CARE. (2014). "Achieving Food and Nutrition Security in Ethiopia: Findings from the CARE Learning Tour to Ethiopia."

Castell, G. S., Pérez Rodrigo, C., Ngo de la Cruz, J., & Aranceta Bartrina, J. (2015). "Household Food Insecurity Access Scale (HFIAS)."

CFS. (2012). "Coming to Terms with Terminology: Food Security, Nutrition Security, Food Security and Nutrition, and Food and Nutrition Security. Thirty-Ninth Session."

Cohen, L., Manion, L., & Morrison, K. (2000). *Research Methods in Education*. 5th Edition. London: RoutledgeFalmer.

Creswell, J. W. (2009). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. 3rd Edition. Thousand Oaks, California: SAGE Publications, Inc.

Creswell, J. W. (2012). *Educational Research: Planning, Conducting, And Evaluating Quantitative and Qualitative Research*. 4th Edition. Boston: Pearson Education, Inc.

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. 4th Edition. Thousand Oaks, California: SAGE Publications, Inc.

Crotty, M. (1998). *The Foundations of Social Research: Meaning and Perspective in the Research Process*. London: SAGE Publications.

CSA and WFP. (2014). "Ethiopia: Comprehensive Food Security and Vulnerability Analysis (CFSVA)."

De Muro, P., & Mazziotta, M. (2010). "Towards a Food Insecurity Multidimensional Index (FIMI)."

Deitchler, M., Ballard, T., Swindale, A., & Coates, J. (2010). "Validation of a Measure of Household Hunger for Cross-Cultural Use."

Devereux, S. (2009). "Why Does Famine Persist in Africa?" *Food Sec. (2009), University of Sussex, Brighton BN1 9RE, UK* 1:25–35. doi: 10.1007/s12571-008-0005-8.

FAO, IFAD and WFP. (2014). "The State of Food Insecurity in the World 2014: Strengthening the Enabling Environment for Food Security and Nutrition."

FAO, IFAD, UNICEF, WFP, and WHO. (2017). "The Future of Food and Agriculture – Trends and Challenges."

FEDOoAZ. (2010). "Physical Geography of Arsi Zone."

Gray, D. E. (2004). *Doing Research in the Real World*. London: SAGE Publications Ltd.

Gray, D. E. (2017). *Doing Research in the Business World*. London: SAGE Publications Ltd.

Hoddinott, J. (1999). "Choosing Outcome Indicators of Household Food Security."

Kothari, C. R. (2004). *Research Methodology: Methods and Techniques*. 2nd Edition. New Delhi: New Age International (P) Ltd.

Leroy, J. L., Ruel, M., A. Frongillo, E., Harris, J., & J. Ballard, T. (2015). "Measuring the Food Access Dimension of Food Security: A Critical Review and Mapping of Indicators." *Food and Nutrition Bulletin* 36(2):167–95. doi: 10.1177/0379572115587274.

Maxwell, D., & Caldwell, R. (2008). "The Coping Strategies Index: Field Methods Manual. Second Edition."

Meskerem, A., & Degefa, T. (2015). "Household Food Security Status and Its Determinants In Girar Jarso Woreda, North Shewa Zone Of Oromia Region, Ethiopia." *Journal of Sustainable Development in Africa* 17(7).

Pangaribowo, E. H., Gerber, N., & Torero, M. (2013). "Food and Nutrition Security Indicators: A Review. FOODSECURE Working Paper 04."

Plano Clark, Vicki L., and John W. Creswell. (2015). *Understanding Research: A Consumer's Guide*. 2nd Edition. USA: Pearson Education, Inc.

Sen, A. (1981). *Poverty and Famines: An Essay on Entitlement and Deprivation*. London: Oxford University.

Swindale, A., & Bilinsky, P. (2006). "Household Dietary Diversity Score (HDDS) for Measurement of Household Food Access: Indicator Guide (v.2)."

Weingärtner, L. (2004). "The Concept of Food and Nutrition Security: Food and Nutrition Security Assessment Instruments and Intervention Strategies. BACKGROUND PAPER No. I."

Wonder, B. (2014). "Smallholder Value Chains for Food Security. A Scoping Study with Particular Attention to Farmer Groups and Innovation Platforms Based on Landcare Principles." *Report to the Australian International Food Security Research Centre (AIFSRC)*.

Yazachew, E., & Kasahun, D. (2011). "The National Regional Government of Oromia Physical and Socio- Economic Profile of Arsi Zone and Districts': Bureau of Finance and Economic Development – Regional Data and Information Core Process."