COLLEGE OF DEVELOPMENT STUDIES CENTER FOR FOOD SECURITY STUDIES

FOOD SECURITY STATUS OF URBAN SMALLHOLDER LIVESTOCK PRODUCERS IN ADDIS ABABA: THE CASE OF AKAKI KALITY SUB CITY

BY

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SEPTEMBER, 2021

ADDIS ABABA, ETHIOPIA

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Statement of the Author

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Adviser's Approval

Under my guidance and knowledge Tesfaye Bejiga has done the thesis entitled Food Security status of urban smallholder livestock producer in Addis Ababa: the case of Akaki Kality sub city. I evaluated the thesis and certify its submission for public defense.

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ABBREVIATIONS

AAU	Addis Ababa University
AMR	Anti-Microbial Resistance
ASF	Animal Source Food
CAPSA	Center for Alleviation of Poverty through Sustainable Agriculture
CDF	Cumulative Distribution Function
CSA	Central Statistical Agency
EMA	Ethiopian Mapping Agency
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agriculture Organization of United Nation
FI	Food Insecurity
FS	Food Security
FSN	Food Security and Nutrition
GDP	Gross Domestic Product
HFIAP	Household Food Insecurity Access Prevalence
HFIAS	Household Food Insecurity Access Scale
ICASEPS	Indonesian Center for Agro Socio Economic and Policy Studies
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
LSF	Livestock Source Food
LSPs	Livestock Production Systems
MOA	Minister of Agriculture
MoFED	Minister of Finance and Economic Development
NGO	Non-Governmental Organization
OLM	Ordinary Logistic Regression
SDGs	Sustainable Development Goals
SPSS	Statistical Packages for Social Science
TLU	Total Livestock Unit
UN	United Nation
VIF	Variance Inflation Factor
WB	World Bank
WFP	World Food Program

ABSTRACT

The overall objective of this study was to assess the food security status of smallholder livestock producers in Akaki Kality sub city. Cross sectional study design was conducted and both primary and secondary data were used to collect relevant information. Primary data was collected through survey with 383 sample households and key informant interviews. Description statistical analysis and bivariate analysis was used to analyze the collected data. Moreover, HFIAS was used to measure the food security status of urban livestock producers. Demographic findings in this study showed that about 80 (20.9%) female and 303 (79.1%) male and their education status revealed that about 30 (7.83%), 104(27.15%) and 249(65.01%) were illiterate, read and write and Literate respectively. About 123(32.1%) livestock producers were only involved in livestock production and the remaining respondents participated in additional occupation. Among studied households about 213 (55.6%), 145 (37.9%), 94 (24.5%), 88 (23%), 41(10.7%) and 1(0.3%) of livestock producer households had poultry, dairy, sheep and goat, beef, bee and pig types of animals were kept in their houses respectively. The HFIAS result showed that about 29.77 %, 33.68 %, 23.76 % and 12.79 % were food secure, mildly food insecure, moderately food insecure and severely food insecure respectively. Ordered logit regression analysis was performed to identify determinants on food security of household. The finding revealed that variables Age, education, total livestock income, and TLU were negatively statistically significant to food insecure whereas variables household size, improved breed, veterinary service and access to credit were found positively statistical significant to be food insecure. In Conclusion urban livestock keeping ensure households food security, income generation and way out of urban poor households; following this urban livestock development intervention schemes, strategies, policy issues and research gap have been recommended.

Keywords: *Household Food security; Livestock production; HFIAS, Smallholder farmers, Akaki kaliti*

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

United Nation's projections indicate that the global population will reach 9.7 billion people by 2050, with a further 1.5 billion people by 2100 (UN, 2015). To meet the growing demand for food, it has been estimated that agricultural outputs will need to increase by at least 70% (FAO, 2009). Agriculture plays an essential role to serve everyone throughout the world, the global food systems, i.e. the production of crops and animals from the land, and aquaculture and fisheries rely on agriculture. In quantitative terms, agriculture is hugely dominant in food supply it provides some 90% of human calorie intake (Makkar and Beever, 2013). In addition, agriculture is the largest single occupation in the world, employing about 40% of the global population and contributing substantially to the health and well-being of populations (UN, 2015).

Agricultural sector is heterogeneous, comprising small through medium to large farmers and farms with different levels of efficiency. Smallholders, however, dominate the agricultural and livestock production landscape. Smallholder farmers mainly cultivate wheat, barley, teff, maize, sorghum, and keep cattle, small ruminants, equine and poultry (FAOUN, 2019). Livestock is an integral part of agriculture, accounting for about 45 percent to the total value of agricultural production and supporting the livelihoods of a large share of the population. More than 14 million households – or 70 percent of the population – keep livestock, including many poor. The typical herd is small, and is made of 3 cattle, 3 goats/sheep and few chickens (FAOUN, 2019).

Globally livestock contributes about 40 percent to the agricultural Gross Domestic Product (GDP) and constitutes about 30 percent of the agricultural GDP in the developing world (World Bank, 2009). Furthermore, estimates show that globally, livestock provide animal traction to almost a quarter of the total area under crop production (Devendra, 2010). Livestock act as a crucial food resource in the case of crop failures (IFAD, 2007; Kabubo-Mariara, 2009), especially in low-income areas and marginal habitats that are unsuitable for crop production. They also have the ability to recycle nutrients, utilize marginal land and by-products and turn these inedible by-products into nutritious food for humans.

Livestock production has the potential to alleviate food and nutrition insecurity via both directly by improving household diet through increasing access to Animal Source Food(ASF) and indirectly by improving income and ability to purchase more diverse foods (Randolph *et al.*, 2007; Smith *et al*., 2013). Keeping livestock is an important risk reduction strategy for vulnerable communities and important providers of nutrients (Rosegrant *et al*., 2009).

As people become wealthier they tend to consume increasing amounts of ASFs, which is mainly driven by urbanization. Urbanization has been also associated with changes in lifestyle, particularly, rising demand of livestock products. In average, urban people eat less starch staples and more meat, fruit and vegetables than rural people (ICASEPS, 2008 and Hooper *et al.*, 2008). Hence, urban livestock keepers provide high quality food, services and other valuable products to the ever-increasing urban population. Under rapid urbanization dynamics, livestock production will inevitably play an instrumental role in achieving sustainable food security in developing countries (Godber and Wall, 2014). This is because large towns and cities offer more income-earning opportunities than rural areas, and urban people are on average richer. However, poor urban dwellers eat far less livestock source food than their richer counterparts.

According to Prakash-Mani (2013) estimates, 25 percent of foods supplied in the world come from smallholder farmers in Africa, Asia and Latin America. The FAO, (2014) also projects that 80 percent of the food consumed in many developing countries in sub-Saharan Africa and Asia come from smallholder farms. There are hopes that if smallholder agriculture is improved, farmers can also improve their standards of living thereby reducing hunger in their local communities (Prakash-Mani, 2013).

The Ethiopian economy is heavily depending on smallholder farm agriculture. The contribution of the agricultural sector to GDP is the largest 41%; comprises 85% of the employment opportunity, generate 90% of the export earnings, and provides 70% of the country`s raw material demand of the large and medium scale industries (MoFED, 2012). Moreover, Ethiopia's livestock, fisheries and apiculture resources have vast untapped investment opportunities, and can play pivotal role in bringing transformation in Agriculture. Besides, Ethiopia's steady economic growth and urbanization will continue to increase the demand for livestock products become a major source of protein (Delgado *et al*., 1999; Hall *et al*., 2004; Seré *et al*., 2008). In addition, the projection of

human population and urban expansion in Ethiopia shows an increasing trend with alarming rate which in turn increases the demand for food especially of livestock origin (Hadera, 2002).

Livestock in Ethiopia is becoming one of the most important value added farming systems. It is an important source of food security through meat and milk and other dairy products, which enrich nutritional intake (Mushir and Mulugeta, 2012). Livestock-owning households experience improved nutrition through two key avenues: consumption and livelihoods (Jin and Iannotti 2014). As such they have substantial roles in reducing poverty and contributing to food security.

Livestock is essential components upon which the livelihood of a community depends and is also a necessary complement of the agricultural activity. Producing food in urban areas will support the rural production of food which is increasingly depleting. Farming in urban area can be the coping strategy for such urban poor. When properly handled and managed urban agriculture could support the urban community beyond the consumption of producers. Therefore, this study is designed to examine the food security status of urban smallholder livestock producers in Addis Ababa particularly in Akaki Kality sub city.

1.2Statement of the Problem

Urbanization is escalating over time in the expense of arable land. Specially, in developing countries, rate of urbanization is higher and competing its agricultural land in the nearby rural areas (Alemayehu *et al*., 2017). As a result, cities throughout the world are facing with unpredictable social, economic and ecological challenges. On the other hand increasing urbanization and burgeoning middle class population, improvement in income and socio-economic transformation have expanded the demand for Livestock Source Food (LSF) in developing countries (Mushir and Mulugeta, 2012) also urbanization involves improvements in infrastructure, which allow perishable goods to be traded more widely, as well as changes in food consumption patterns and habits (Delgado, 2005; Happer and Wellesley, 2019).

Moreover, a shift from a predominantly vegetable-based diet to one that includes a greater amount of LSF has already been seen over the last few decades. Similarly, the demand for livestock products is projected to grow substantially in the coming decades (Alexandratos and Bruinsma 2012; IAASTD 2009). For instance, the average per capita meat consumption is projected to rise from approximately 34 kg in 2015 to 49 kg in 2050 (Yawson *et al.*, 2017).

As noted by Assem *et al*., (2019), the acquisition of livestock in developing countries is widely recognized as a pathway out of poverty, a major income generating activity, a financial instrument, and a means of income diversification. Besides employment, livestock provides protein rich food, income for everyday expenses and social obligations, near liquid assets, a store of wealth for savings, manure for crop production and soil fertility, and transport (ILRI, 2011).

Livestock keeping in urban often a part-time enterprise benefits the poor and provides a way of diversifying livelihood activities that are accessible to vulnerable groups. Livestock also provide locally produced food products for people living near the livestock keepers (R Trevor, 2018). In spite of the critical role the livestock sector plays in the Ethiopia's economy, the sector has not received the policy-level priority it deserves (MOA, 2010). Hence, there are increasing uncertainties about how LPSs (Livestock Production Systems) might evolve under urbanization dynamics and their ability to sustainably meet the increased demand for LSF (Herrero *et al*., 2016).

According to Brousserd and Tekleselassie, (2012) stated that in Ethiopia urbanization rate is over 5%, meaning that cities expand rapidly. However, the effort done by the municipality or other concerned officials to fortify farming in the town is limited (Alemayehu *et al*., 2017). Rather urban livestock keeping is often viewed as problematic, backward, and a sign of poverty, which could partly explain the neglect of urban livestock production. Livestock producers in urban areas may face resentment from other urban dwellers (Schiere and van der Hoek, 2001); concerns regarding waste, smell and noise produced from urban livestock production (McClintock *et al*., 2014). Urban expansion also in developing countries has considerable impacts on LPSs (Thornton *et al*., 2009).

Additionally Zafar *et.al*., (2017) pointed out that constraints being faced by livestock farmers included unavailability of good animals (genetics), high prices and poor quality of feed, poor marketing infrastructure for livestock products and by-products, exploitation of the middle man, improper transportation and lack of storage/preservation due to limited access. High disease incidence and low accessibility of services and inputs are major constraint of livestock productivity (MOA, 2015).

Various scholars done their studies on the contribution of livestock to food security, mainly focused on rural parts of Ethiopia among them Bekele *et al*., (2013) in Borena and recently Kedija and Jemal (2020) done on the role of livestock for food security in Somalia, region. However, scientific evidences are limited on the food security status of livestock producing households in the study area. Hence, there is a need for research in urban smallholder livestock producer`s settings that will consider how urban livestock productions are affected in different determinants and livestock producer food security status. This study aimed to fill the gap by investigating the food security status of smallholder livestock producer`s household and their determinants in Akaki Kality sub-city.

1.3 Objective of the Study

1.3.1. General Objective

The general objective of this study is to investigate the food security status of smallholder livestock producer and its determinants in Akaki Kality sub city, Addis Ababa, Ethiopia.

1.3.2. Specific objectives to:

1. Analyze the food security status among smallholder livestock producer's household in Akaki Kality Sub City.
2. Identify determinants of food security status of small-holder livestock producers in Akaki Kality Sub City.

1.4 Research Questions

This research intended to answer the following basic questions which are derivatives of the above mentioned research objectives:

1. Which other socio-economic factors correlate with and best explain the levels of their food security?
2. What levels of food security are experienced by Small holder livestock producers in Akaki Kality sub city?
3. Which determinants affect the food security status of small holder livestock producers in Akaki Kality sub city?

1.5 Significance of the Study

The formulation of this thesis primarily can be used for academic exercise. The study was given insight and served as a document for researchers and students who are interested in such kind of topic and helped to stimulate further study in the area. Analysis of inter-linkage among urban livestock production and food security can help urban food security and safety net program and farmer and urban agriculture development commissions include service providers like extension workers, and local and international NGOs, and community groups to assess the need for assistance, judge the effectiveness of existing programs designed to help such households.

1.6 Scope of the Study

This study was focused only on urban small holder livestock producing household rather than the broad sector of agriculture, in all weredas of Akaki Kality sub city. In addition, it is limited to household who rising of animals which are used for food producing in Ethiopia cultural context and it includes cattle, poultry, small ruminant (sheep and goat), beef, bee and pig production. It is a labor intensive farming requiring only small area around small residential areas. The incomes of livestock producing household in this study considered only obtained from livestock production.

1.7 Limitation of the Study

This study has encountered a number of limitations. One of the major limitations was that it didn't consider a seasonal variation on livestock productivity, the study did not make a comparative analysis of food insecurity between livestock and non-livestock producer household and covered only in Akaki Kality sub city, Addis Ababa hence the inability to generalize based on findings to cover the entire urban livestock producer household. Again in this study the nutritional status of the livestock producer was outside the scope of this paper.

1.8 Ethical Considerations

Ethical considerations are one of the most important parts of a research. They promote integrity, reliability and validity of the research findings (Rahman, 2017; Creswell, 2013). Prior to beginning the study, the researcher was verbally introduced about the research to the participants. During the introduction, the researcher clearly explained the purpose, aims and duration of the study. Participants of the study have been freely consented; personal identities have been kept confidential and protected. There was no deliberate misrepresentation of the purpose of the study and overstatement or understatement of the findings. As well, the research has been conducted

following all the necessary steps to make it methodologically thorough as much as possible; all kinds of results and findings whether good or bad were reported; the researcher has remained impartial throughout the study to avoid interjections of personal feelings or bias; and finally submitting unreliable data, distorting opposing views and plagiarism have been avoided based on the 2019 Addis Ababa University (AAU) plagiarism policy by considering it all sources obtained from secondary data were citing and acknowledging accordingly.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

This chapter introduces concepts of food security and the contribution of livestock on food security and poverty alleviation.

2.1 Concepts and Definitions of Food Security

Definition of food security has passed through series evolutions in the aftermath of the 1974 world summit on food security (FAO, 1996). According to Kuwornu *et al*., (2013) the term has since become a household name where individuals and organizations have defined from various perspectives in their social and economic research works.

Prior to the mid 1970's, the concept of food security was viewed as sufficient food supply at the national and international levels (UN, 1975). At the 1974 world summit on food security, the term food security was defined as the availability at all times of adequate world food supplies of basic foodstuff to sustain a steady expansion of food consumption and to offset fluctuations in production and prices (UN, 1975). Food security was described by World Bank (WB) in 1986 as a situation where all people at all times have access to enough food for an active life and further defined food insecurity by distinguishing between chronic and transitory food insecurities.

According to the WB (1986), chronic food insecurity reflects continuous inadequate diet caused by the inability to acquire food, which mostly affects households persistently lacked either inability to buy food or produce food, whereas transitory food insecurity was temporary decline in households' access to enough food.

The conceptual framework of food security does not only focus on availability and accessibility to food, but also how people utilize food to meet their nutrition needs. Thus, food security is accord with nutrition security. According to Maxwell (2001) and Niehof (2010), food security is "access to enough food by all people at all times for an active and healthy life". Therefore, building food security should harmonize with food nutrition as well. Similarly, FAO further modified or updated to include food preference and nutritional value by. Thus, food security was defined as a situation where at all time, all the people have physical and economic access to sufficient, safe and nutritious food to meet their dietary need and food preference for a healthy and active living (FAO, 1996).

Kuwornu *et al*., (2013) pointed out that "safe and nutritious" was added to the concept of food security to emphasize nutritional content and safety of food whiles "food preferences" extends the food security concept to include an individual or a household's access to their preferred food.

Centre for Alleviation of Poverty through Sustainable Agriculture (CAPSA) (2015) defines food and nutrition security as follows: "Food and nutrition security exists when all people at all times have physical, social and economic access to food, which is safe and consumed in sufficient quantity and quality to meet their dietary needs and food preferences, and is supported by an environment of adequate sanitation, health services and care, allowing for a healthy and active life." This definition shows that food security is basically attached to the nutritional aspects.

To achieve food security, sufficient availability of physical supply of food is required, followed by access to food supply through production and markets (giving sufficient purchasing power) and appropriate utilization of the food to satisfy the specific dietary requirements of individuals (Yared, 2001).

After the World Summit on food security in 1974, world leaders and stakeholders acknowledged that the major food security problem confronting many countries was lack of access rather than total shortfall in food supplies, resulting from a shift from global and national perspectives to the household and individual level (Diaz and Robinson, 2001).

Livestock sector is fundamental for food security not only at the household level, for small producers who depend directly on livestock to obtain food, income and services, but also at the national level, by providing consumers access to food of high nutritional quality. In this context, animal husbandry plays important and distinct roles in the four main pillars or dimensions of food security: availability, access, stability and use/utilization (FAO, 2009a).

Availability of food

The availability dimension addresses the supply side of food security, thus, referring to the amount of food that is physically available in a population during a certain period of time (Pangaribowo *et al*., 2013).Availability refers to the physical reserve or existence of sufficient food in a household or a given place: foods that are acquired from home production, local markets or through imports (FAO, 2009a).

It is very important to emphasize the role that livestock production, especially from small producers, plays in availability of food. Small producers, face many hurdles to developing livestock activities, such as little modernization, low investment capacity, limited access to markets and great vulnerability to droughts and periodic animal diseases. In spite of these limitations, small producers' participation is important in different countries.

Livestock indirectly increase the availability of food by providing inputs for crop production. For example, livestock manure used as fertilizer and livestock supplies draft power for ploughing and other farming-related activities like threshing and water lifting. In the highlands of Ethiopia, there is a positive correlation between draft animals and crop production (Omiti 1995). Crop production on farms with inadequate traction power has low quality tillage, which encourages the use of low-value crops requiring less tillage (Sansoucy *et al*. 1995).

In developing countries, livestock production is a major source of income. For many mixed, smallholder farming systems, livestock is an important 'cash crop' (Sansoucy *et al*. 1995). The amount of income varies across regions and production systems, depending on the species and the roles of livestock in the system (Jahnke 1982).

Access to food

Access refers to the capacity of people to obtain food. According to the world food program (WFP), (2012) documented that when households and individuals possess resources, adequate to afford food with requisite and sufficient nutritional elements by a combination of own production, purchase, barter, stocks, borrowing, food aid and gifts, the situation is considered as access to food. FAO (1996) also puts "the physical and economic access to sufficient food "as the basic point of the food security definition. According to Maxwell (1996) food production is considered as a means to entitlement (access), either just to the producers or by reducing food prices to consumers.

According to FAO, (2013) reported the ability of an individual to access food largely depends on two key factors: these are economic and physical factors. The economic factor determines the amount of disposable income, distribution of and access to social support systems as well as prices of food (FAO, 2013). Whereas, the physical factor is determined by the provision of quality infrastructure including roads, communication networks, ports, railways, food storage

installations and facilities that enhances markets viability (FAO, 2013). Although the problems of hunger and malnutrition do not stop from the scarcity or insufficient availability of foods, but rather from a lack of economic access that many households face (FAO, 2013).

Food utilization

Food utilization refers to the nutrients and energy generated from food consumed for a healthy life (FAO, 2013). WFP, (2012) reported factors that ensures sufficient food utilization to include proper childcare practices, consuming meals with adequate nutritional and energy values, drinking safe water, knowledge of processing and storage of food and proper sanitation.

Food utilization or adequate use is especially important with respect to products derived from animals. According to Diego *et al.,* (2016) citied OMS/ FAO/UNU, 2007 that products of animal origin are an excellent source of high-quality proteins and essential micronutrients such as B vitamins, and oligo elements of high bio-availability such as zinc and iron. Bio-availability is especially important for mothers and very young children, who have difficulty in obtaining a sufficient quantity of micronutrients from vegetable-based diets. A small quantity of foods of animal origin may provide the necessary micronutrients for maternal health and the physical and mental development of very young children. This food security link is of particular importance for poor and vulnerable households, for which markets many times cannot provide these micronutrients, either because of their absence or the inadequacy of incomes.

Food stability

According to (FAO, 2013) definition of food security, the fourth dimension of food security is to ensure stable supply of food (food availability) and household or individual access to the food on daily basis. A household or an individual is considered food secure if they can have economic access to safe and nutritious food at all time (FAO, 2013). Livestock may be used as collateral to obtain credit, be sold to obtain income or may be consumed directly in times of crisis. Livestock can dampen the impact of negative household-level economic shocks such as unemployment, injury or illness to productive members. Kuwornu and Demi, (2013) noted that household food stability is obtained when families are not risked of being food insecure in the event of seasonal food shortages resulting from cyclical events and shocks. They further asserted that, households

can have adequate food for consumption but once there is a limitation to the regular availability and access to food, the household can still be considered food insecure.

According to Nakiganda *et al*., (2006) stated that livestock directly and indirectly involved for food stability. It may use as collateral may be consumed animal and animal product directly, to obtain credit or be sold to obtain income in times of crisis. Livestock can dampen the impact of negative household-level economic shocks such as unemployment, injury or illness to productive members. Livestock also provide energy and fertilizer for soil and have a controlling effect on diseases in farming systems, thereby contributing to overall farm productivity and thus to food security.

Livestock contributes to the food security of rural households by making an important contribution to the stability of food availability and access. This relation is established from economic perspective; livestock is a capital good, a store of wealth and a safety net of particular importance for those who have imperfect access to financial markets (Nakiganda *et al*., 2006).

According to von Braun and Kennedy (1994), Livestock production gives increased economic stability to farm households. In mixed farming systems, livestock can also serve as a form of insurance against the risk associated with crop failures, by providing alternative sources of food and income. Cash can be obtained from the regular sale of milk, eggs, butter, cheese and dung cakes and occasionally from the sale of live animals, wool, meat, hides and skins as well as from services such as draft power and transport. The daily cash flow from the sale of animal products such as milk and eggs adds to household economic stability and has been noted as an important determinant of food security.

The overview of food consumption may represent food condition in the society, specifically how people meet their nutrition. Food consumption pattern that meets nutrition needs and diversified is known as desirable dietary pattern. Diverse food can be the proxy to measure the quality of consumption and describe accessibility to food in the context of food security (Drimie *et al*., 2013). According to Drimie *et al*., (2013) dietary diversity is the predictor to analyze economic status and malnutrition, as well as food shock sensitivity; and it is relatively measurable (Headey and Ecker, 2013). Therefore, the measurement of dietary diversity can be an instrument to measure food and nutrition security.

2.2 Empirical Evidence of Livestock and Household Food Security

Improving livestock production is one useful strategy to reduce poverty and in turn improve nutrition and health (Eisler *et al*., 2014; Randolph *et al*., 2007). ASF contributes greatly to human development. For those residing in poorer communities in the developing world, livestock have and will continue to play a very important role in their livelihoods and overall health (Randolph *et al*., 2007; FAOUN, 2006b). The primary intention of livestock development in developing countries is to generate income and provide households and local communities with ASF (Randolph *et al*., 2007).

Livestock enable saving, provide security and allow resource-poor households to accumulate assets. The keeping of livestock helps finance planned expenditures as well as unplanned events such as illness. They also provide livestock products including meat, milk, eggs, manure and draught power (Eisler *et al*., 2014).

Milk, meat, and eggs provide around 13% of the energy and 28% of the protein consumed globally; in developed countries, this rises to 20 of the energy and 48% of protein (FAO, 2009). The world's 17 billion livestock (Herrero *et al*., 2009) occur in three main types of production systems: confined intensive, mixed crop– livestock, and open grazing systems. Estimates, based on data for 2001 to 2003, showed that grazing systems supply 9% of the world's meat and 12% of milk; mixed crop–livestock systems contribute 46% of meat, 88% of milk, and 50% of cereals; while intensive systems provide 45% of meat (Steinfeld *et al*., 2006; Thornton and Herrero 2009).

Livestock contributes to the improvement of household nutrition and help maintain social capital and status within communities. Livestock function as insurance policies and bank accounts in many parts of the developing world. Despite the fact that for several decades, researchers have been aware of the multifaceted roles played by livestock, much current research still focuses on individual elements, such as feed efficiency or a particular disease or breed (Eisler *et al*., 2014).

When compared to industrialized countries, these livestock systems have much lower productivity per animal and per land unit. Several factors contribute to these lower productivity levels, most of which reflect the limited resources available to these farmers. Since feed and other purchased inputs are often costly, little or no inputs are utilized in the management of these systems (Pica-Ciamarra *et al*., 2011; Randolph *et al*., 2007). In these systems, one is often able to feed these

animals with residue and forages from agricultural production, or with products such as food wastes and grain that might be infested with insects – the food that humans cannot or would rather not consume. In turn livestock provides the farmers with many beneficial products and securities (Eisler *et al*., 2014).

About 1.3 billion estimated poor people lived in developing countries their livelihoods depend either directly or indirectly on livestock keeping (WB, 2008 and FAO, 2009). Globally, livestock contributes about 40 percent to the agricultural GDP and constitutes about 30 percent of the agricultural GDP in the developing world (WB, 2009). The close interactions between crops and livestock in most developing countries differ from those found in developed countries. Mixed crop-livestock systems account for most of the meat and milk production in Asia, and 40–60 percent of the cattle, sheep, goat and poultry meat production in sub-Saharan Africa (Herrero *et al*., 2009).

Herrero *et al*., (2013) found that beef production and marketing in West Africa supports 70 million people; dairy supports 124 million people in South Asia and 24 million in East Africa; while small ruminants support 81 million people in West Africa and an additional 28 million in southern Africa (Staal *et al*., 2009). Others have estimated that more than 80% of poor Africans and up to 66% of poor people in India and Bangladesh keep livestock (FAO, 2009). The contribution of livestock to household income ranges widely, from 2% to more than 33% in a number of developing countries (Staal *et al*., 2009; Pica-Ciamarra *et al*., 2011).

Livestock in Ethiopia is an integral part of the agriculture and the contribution of live animals and their products to the agricultural economy accounts for 40%, excluding the values of draught power, manure and transport of people and products (Winrock International, 1992) and accounts 19% to the export earnings (Befekadu and Birhanu, 2000). These estimates highlight the important contribution of livestock to sustainable agricultural development. It is estimated that globally livestock manure supplies up to 12% of gross nitrogen input for cropping and up to 23% in mixed crop–livestock systems in developing countries (Liu *et al*., 2010). Inorganic fertilizer use is especially low in Africa: on average, African farmers apply just 9 kg ha–1 yr–1 of commercially produced fertilizer, and application of manure can improve the efficiency of inorganic fertilizers (Tittonell *et al*., 2008).

2.3 Contributions of Livestock to Food and Nutrition Security

In order to increase the contribution livestock's to the livelihoods of developing communities as a source of food and nutrition it requires improved understanding about livestock's multiple and complex roles. The contribution of food from animal origin to the nutritional status of the world population is well documented. Animal-source foods are nutritionally dense sources of energy, protein, and various essential micronutrients. It is important to acknowledge that the amount of energy, nutrients and minerals that animal source protein provides can be very difficult to obtain from plant sources alone (Eisler *et al*., 2014; Murphy & Allen, 2003; Smith *et al*., 2013).

For instance, plant-based diets tend to be deficient in one or more essential amino acids (lysine, methionine, and threonine), micronutrients (iron, zinc, vitamin A, and calcium) and some such as vitamin B12 tend to be more bioavailable and found naturally only in animal-source foods which many malnourished people are deficient (FAOUN, 2011, p. 8). ASFs provide several micronutrients simultaneously, which can be important in diets lacking more than one nutrient: for example, vitamin A and riboflavin are both needed for iron mobilization and hemoglobin synthesis; supplementation with iron alone may not successfully treat anemia if these other nutrients are deficient (Allen, 2005).

Staple plant-based diets are, however, inadvertently common among poor populations in developing countries. Possessing livestock can provide poor households access to a relatively regular supply of animal source food, thus, allowing one to supplement and diversify their diets (Randolph *et al*., 2007). Through the provision of meat, eggs, milk and offal, livestock directly contributes to 12.9 percent of global calories and 27.9 percent of protein (FAOUN, 2011; Smith *et al*., 2013).

Consumption of animal source food, even small amounts can be beneficial in improving the nutritional statuses as they address both micro- and macronutrient deficiencies (Eisler *et al*., 2014 & Smith *et al*., 2013). These micro- and macronutrient are having positive impacts for children, pregnant and lactating women by increase a child's energy, cognitive development, reduce morbidity from illness, and improve pregnancy outcomes (Hulett *et al*. 2013; Neumann *et al*., 2002 & Neumann *et al*., 2010).

Livestock can aid in the attenuation of seasonal fluctuation of grain availability throughout the year. For instance, milk and eggs can help sustain household food security when faced with significant seasonal fluctuations in grain availability, a common reality for many (Randolph *et al*., 2007). In addition it assumed that livestock-keeping households consume the animal-source foods they produce and that increasing productivity of livestock would impact positively on household nutrition. For both livestock and other agricultural enterprises, such connections are notoriously difficult to prove (Masset *et al*., 2011). A range of projects aiming to introduce or improve animal production suggest that livestock and their products are more likely to be sold for income than consumed by poor households (Scoones, 1992). Nevertheless, most trade in animal products occurs locally due to their perishable nature, so that the benefits of their consumption are at least distributed in nearby areas.

Furthermore, during storage, many crops are susceptible to animal and insect predication or spoilage. By possessing livestock one has the option to preserve the calories and nutrients of these perishable crops by using them as feed for their animals (Lammers *et al*., 2009). As a result these calories and nutrients can be available in the future. This helps satisfy the critical food security issue of nutrient availability timing, in that it permits more consistent nutrient availability and thus a more stable household food-security status (Lammers *et al*., 2009).

Livestock played key role in supplying calories and protein for human food through both directly production of much of the world's red meat and milk and indirectly on mixed crop–livestock systems produce 50% of cereals by providing manure, contributing to land preparation, and providing ready cash to buy planting materials or fertilizer or to hire labor for planting, weeding, or harvesting (Herrero *et al*., 2010). Thus contributions can increase the area of land cultivated, the yields and productivity achieved, the feed produced from crop residues, and, through enhanced nutrient recycling, the sustainability of those farming systems. Blummel, (2010) noted that in most mixed crop–livestock systems, the main source of animal feed consists of crop residues and this enables animal-source foods to be produced without competing with people for food.

Although on aggregate, draft power use is decreasing globally, in some regions like sub-Saharan Africa, it continues to contribute significantly to food production. It enables more land to be cultivated; can generate greater yields as a result of better weed control and more timely

operations (FAO, 2011a). All of which tend to consider the significance of livestock in the food chain and the increasing demand of animal origin food, the role of livestock in food security and food self-sufficiency is and will be important. Both supply of food and meeting preference are elements of food and nutrition security and livestock contribution to the availability of food is important in the efforts to ensure food self-sufficiency.

2.3.1 Serving as a Source of Income

Animal and animal products are a source of disposable income for many small holder farmers in developing countries. In fact, livestock are often the most important cash produce in many small holder mixed farming systems. Disposable income is important for purchase of agricultural inputs and other family needs (Melkamu and Gebreyohannes, 2014).

The proportional importance of livestock to household income differs from one culture to another even within production system. For example households that follow mixed crop livestock productions have opportunities for obtaining income from a variety of sources, thus, income from livestock probably contributes a smaller proportion to their household food. By contrast, most pastoralists depend on livestock for a large proportion of their income although this is changing (Thornton *et al*., 2002).

Livestock are often sold to generate cash, amongst others to purchase food (in times of crop failure) and purchase agricultural inputs, which in turn increase crop production. Therefore livestock as a source of cash ensure economic accessibility to food, hence key role in attaining food security

The contribution of livestock to household income ranges widely, from 2% to more than 33% in a number of developing countries (Staal *et al*., 2009; Pica-Ciamarra *et al*., 2011). The massive increase in demand for livestock products witnessed over the past few decades has created equally significant opportunities for smallholders who raise animals to meet that demand and to benefit as a result (Herrero *et al*., 2010).

Staal *et al*., (2009) stated that livestock provide direct cash income through sales of animals, or their products, or services or through employment along animal-source food value chains, livestock in poor countries contribute to food security by providing income that can be used to purchase staple food, input and other needs.

Unlike crops which are seasonal with harvest periods that do not always correspond with a one's cash needs, livestock or their products can be sold to meet these needs at any time, assuming customers or market access is available (Food and Agriculture Organization of the United Nations, 2011; Lammers *et al*., 2009 & Reist, 2007). This is particularly important when urgent needs for cash arise such as, medical bills or school fees (FAOUN, 2011; Randolph *et al*., 2007). It is estimated that livestock production and marketing are currently essential to the livelihoods of more than one billion poor people in Africa and Asia: one-seventh of humanity (Staal *et al*., 2009).

In addition to providing cash-generating opportunities for livestock producers, farm animals also have the ability to create jobs for landless community members as well as small business opportunities (Smith *et al*. 2013). Increased livestock production implies create opportunity for higher employment. For instance when we see dairying is labor intensive at farm level and women are active in production and marketing. Goats, sheep and poultry especially from backyard production systems, are an important source of part-time work, particularly for landless women and children. The meat and milk sector also provides employment for slaughter, marketing and processing (Melkamu and Gebreyohannes 2014). Livestock value chains represent a large and growing employment sector. They include farm-level production, input, and service industries to farmers; transportation of livestock and their products; and processing and marketing (Jimmy *et al*., 2013).

2.3.2. Livestock Diversity

When an appropriate diversity of food products are available and the necessary attention is given to nutritional needs, vegetarian diets can be completely nutritionally adequate; however, for many this is not the case. Food security is not only affected by food quantity but also by diversity and quality (FAOUN, 2011; FAOUN, 2013; Young & Pellett, 1994).

As many scholars stated that it is common for many small-scale farmers to raise a diversity of different types of animal; in some instances multiple type of animals are raised at the same time. At any time and place, a wide range of factors influences animal diversity among rural small-scale farmers (Lammers *et al*., 2009; Pica-Ciamarra, 2011). It would be both impossible and irresponsible to identify one animal species as the best. Different species are able to fulfill different niches. The smallholder farmers' circumstances will affect which animals are best suited

for ensuring household food security status (Lammers *et al*., 2009). It is believed that high livestock diversity act as a protective measure against household food insecurity.

Various scholars such as (Agbola *et al*., 2008; Zerai & Gebreegziabher, 2011a) on their studies indicated that households have diversified sources of income it has a positive implication on food security status of households. Diversity is also thought to be beneficial in terms of the animal source foods produced. For instance, a household may be able to protect themselves from market fluctuations by possessing a wide variety of livestock products, as they are more self-sustaining and, hence, less reliant on the procurement of market products (FAOUN, 2011; Pica-Ciamarra, 2011).

Nonetheless, little literature exists to date regarding the validated use of an animal diversity index. Thus it is difficult to evaluate and compare the diversity of livestock among smallholder farmers. For the most part, the indices that do exist evaluate ecological diversity. Some agriculture-based indices do exist, though they tend to focus on crop diversity, and the animal diversity specific tools are not suitable for the household level since they tend to investigate diversity on a much larger scale (Buiteveld *et al*., 2009).

In general, it is suggested that diversification of income sources has been put forward as one of the strategies that households employ to minimize their income variability and to ensure a minimum level of income diversification for improving poverty and food security status at of the country at national and small holder farmers or households level(Mohammed *et al*., 2018).

Consumers in developing countries have diversified their diets by increasing consumption of meat, milk and eggs. Poultry, pork and eggs have experienced the fastest rates of increase, although beef and milk consumption have grown steadily in the world's fastest growing economies. Annual meat consumption in developing countries with fast growing economies doubled from 14kg per capita in 1980 to 29kg in 2002, while milk consumption increased by 35 percent (FAO, 2006). There are predictions that in the upcoming decades, there will be a general increase in per capita consumption of livestock products globally when compared to other agricultural products, such as cereals, and that the livestock revolution will have the greatest effect in the developing world (IAASTD, 2008 and Seré *et al.*, 2007).

2.4 Conceptual Framework

The presences of smallholder livestock producers in developing country like Ethiopia play a crucial role through the production of meat, milk and eggs. They also deliver non-edible products, such as hides and skins, and provide animal draught, manure (help to maintain soil fertility) and other critical inputs to crop production. Smallholder livestock producers in urban area like Addis Ababa can enhance availability, accessibility and sustainability of animal products and byproduct. Livestock production creates job opportunity for those participated on farm animal (livestock producing) activities (Figure 2.1).

The household of livestock producers have better opportunity to consume their own animal products with in household and to sell some animal origin products to generate income for livestock producer household. At it has shown in Figure 2.1, the income from sales animal products may be used to buy other food staffs (crop and vegetable) and involved in different livelihood activities (such as transport, medical, school and so on). In addition collected income used to improve saving practice of household and buy inputs for livestock productions (feed, veterinary drug, vaccines and veterinary service) thus enhance the performance of livestock productivity; it is obvious that inputs for livestock production are necessity to improve livestock productivity and vise verse.

Overall, livestock contribute to food security in two ways weather used as a source of food or can be used as source of income. Hence household participated in smallholder livestock producing are improved their food consumption pattern, enhance capacity of livestock production and productivity and reduce food insecurity of smallholder livestock producer household and eventually made food secured household (Figure 2.1).

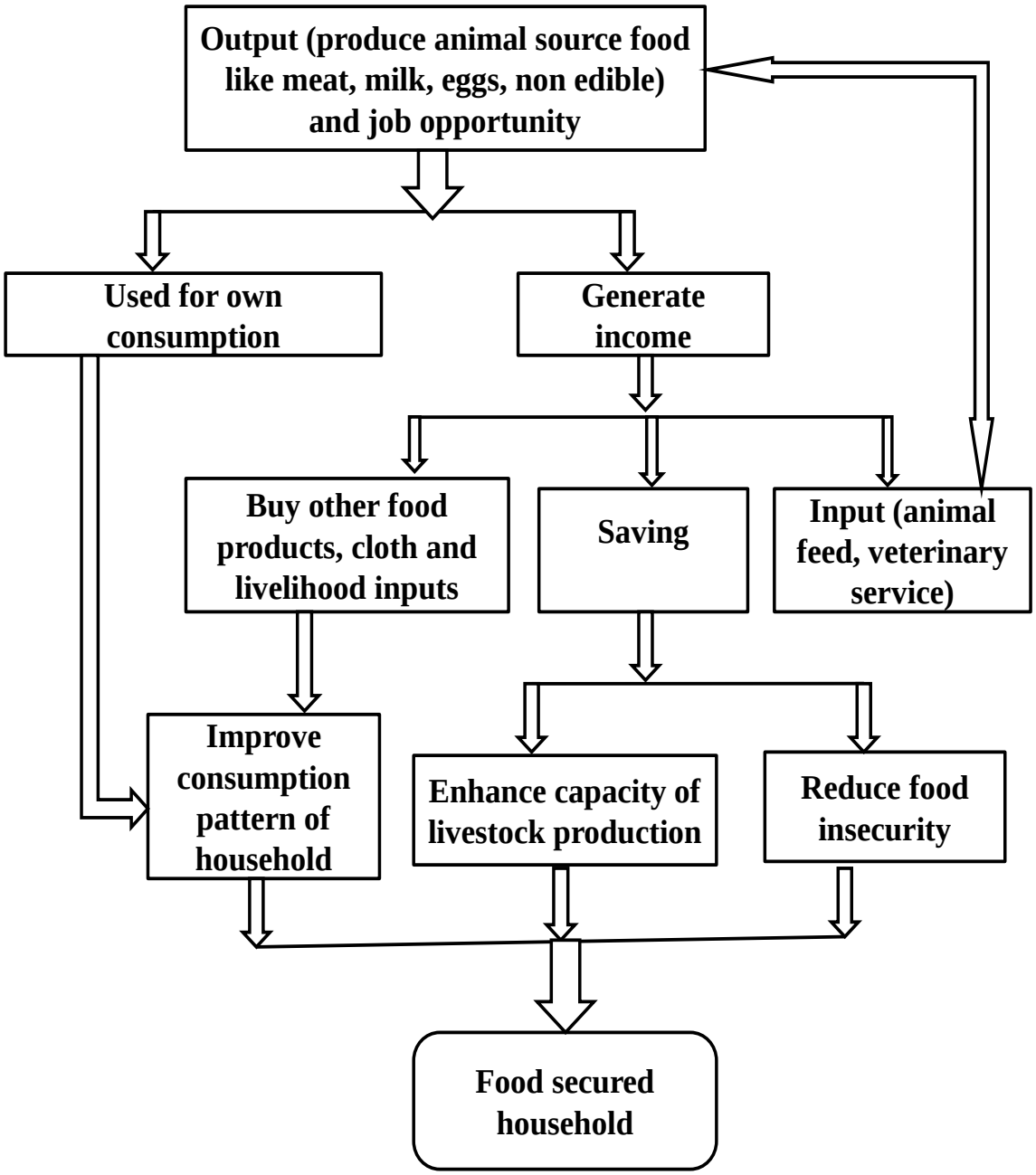

Figure: 2.1 Conceptual framework of the study

Source: Constructed based on literature review by researcher, 2020

CHAPTER THREE: DESCRIPTION OF THE STUDY AREA AND RESEARCH METHODOLOGY

3.1 Description of Study Area

Akaki Kality is the second largest sub city, situated to the south of Addis Ababa city in Ethiopia. It has an area of 12345.4 hectare. The lowest elevation point 2,060 meters and the maximum elevation is 2,340 meters above sea level. Akaki kality is situated at latitude is $8^0$53`5``N and the longitude is $38^0$47`21``E. Akaki Kality sub city shares boundary with Bole Sub-cities in the North, Nifas Silk Lafto Sub-cities in the North West and Oromia Reginal States in the South and East directions (Desybel, 2020).

Its population according to CSA of Ethiopia the projected population of 2014-2019, close to 238,355 peoples living in the sub-city, which was about 115,736 males and 122,619 females. It is one of the most crowded neighboring areas of the capital city Population density was 2018.6 per sq.km (CSA, 2013).

Each Woreda has independent administration office which represents directly the sub-city administration office. Currently the sub city is composed of 13 administrative Woredas and the structure of farmers and urban agricultural development office established in all 13 woredas (Akaki-Kaliti sub-city farmers and urban Agriculture development office, 2020).

This specific site was selected as a study area given that the performance of urban farming is relatively higher in this particular sub-City and it is a niche to rural Woredas of Oromia region. According to Sophia (2015) cited walta information center indicated that out of the ten sub-Cities, Akaki kaliti ranked first in performance in five out of ten urban agriculture practices.

Smallholder livestock producer households in Akaki-Kality sub city involved different type of food producing animal production (Table 3.1).

Table 3. 1: Number and types of animal producer households found in Akaki Kality sub city

Type of food producing animal production Practices	Number of livestock producer households
Poultry	2135
Dairy	973
Cattle fattening	454
Sheep and goat fattening	345
Beekeeping	186
Pig	7
Total	**4101**

Source: Annual report of Akaki-Kaliti sub-city farmers and urban Agriculture development office, 2020

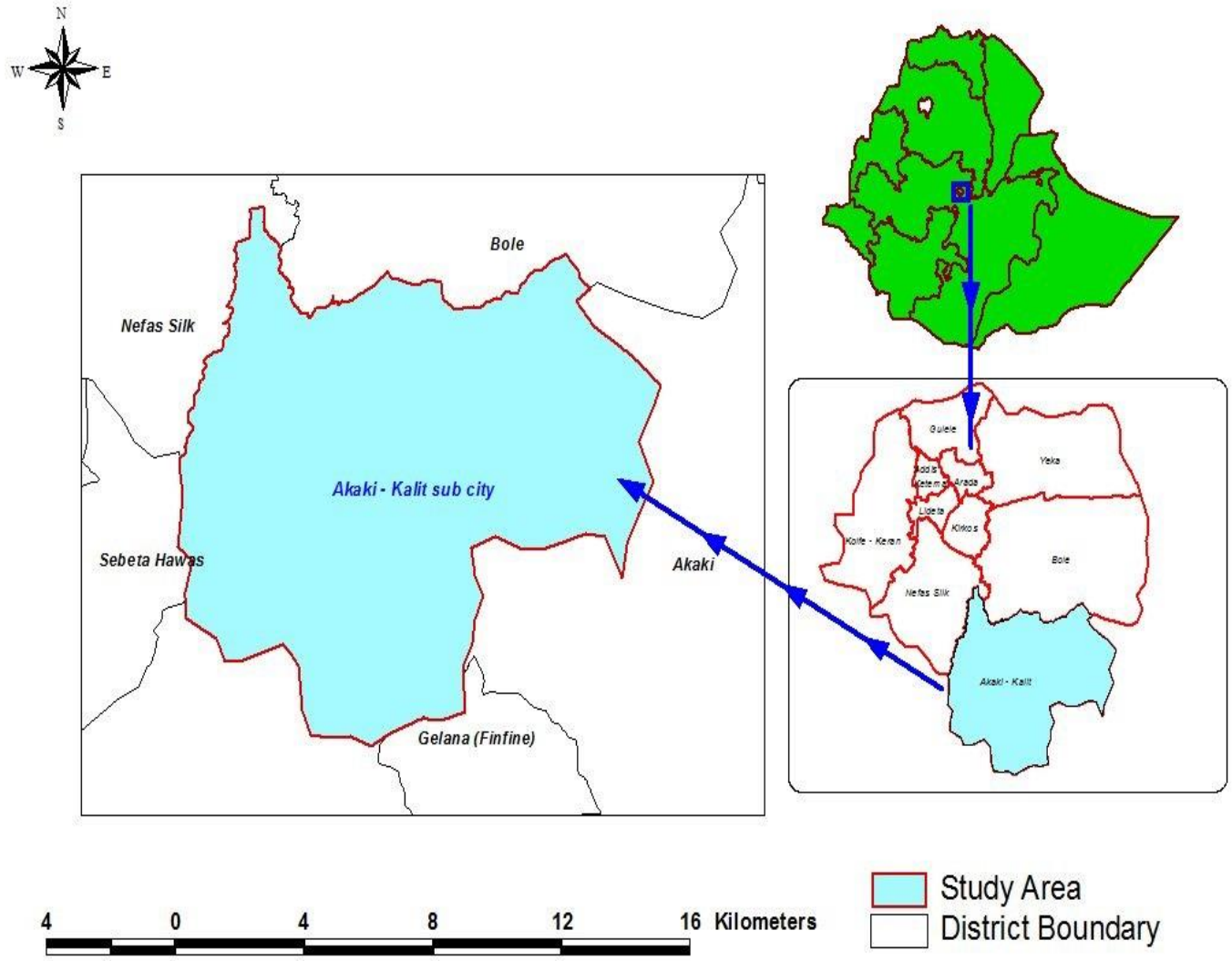

Figure: 3.1 Map of Akaki-Kality sub city

Source: CSA and EMA 2019

3.2 Study Design

Cross-sectional research design was conducted in the study. Both qualitative and quantitative approaches were used in the study design in order to produce a comprehensive analysis of the study. Discourse qualitative approach was used in order to gain a deep understanding about the urban smallholder livestock production: its main activities, its contribution to improve food security status of livestock producer households. Semi-structured interviews and key informant interview were carried out to gather qualitative type of data. Quantitative approach was used to quantify and see the relationship among variables. Household survey was carried out to collect data from urban smallholder livestock producers of Akaki Kality sub city on the socio-economic, demographic and institutional related information to identify determinants.

3.3 Sampling Techniques

The target population of the study focused on smallholder livestock producers within the homestead of the study area. Three-stage sampling procedures were used in the selection of representative samples. In the first stage, Akaki Kality sub city is purposively selected based on the availability of smallholder livestock producer household. In the second stage, all woredas of Akaki Kality sub city were selected to make the sample representative. In the third stage, random sampling technique was used to select sample households from each study woredas.

The target population of the study was composed of livestock producers at household level found in Akaki Kality sub city, Addis Ababa, Ethiopia. On the basis of the information obtained from Annual report of Akaki-Kaliti sub-city farmers and urban Agriculture development office, (2020) there were 4101 households that practice livestock production in the Akaki-Kaliti sub-City.

3.4 Sample Size Determination

Cochran (1977) developed a formula to calculate a representative sample for proportions a

$$n_o = \frac{z^2 pq}{e^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where, n_o is the sample size, z is the selected critical value of desired confidence level,

p is the estimated proportion of an attribute that is present in the population,

q =1 − p and e is the desired level of precision (source)

I want to calculate a sample size of a large population whose degree of variability is not known. Assuming the maximum variability, which is equal to 50% (p =0.5) and taking 95% confidence level with ±5% precision, the calculation for required sample size will be as follows—

p = 0.5 and hence q=1-0.5 = 0.5; e= 0.05; z =1.96

$$n_o = \frac{z^2 pq}{e^2}$$

$$n_o = \frac{(1.96)^2(0.5)(0.5)}{(0.05)^2} = 384.16 = \underline{\underline{384}}$$

According to Annual report of Akaki-Kaliti sub-city farmers and urban Agriculture development office, (2020) total population is known; which is 4101 to determine sample size I used Cochran sample size determination and he pointed out that if the population is finite, then the sample size can be reduced slightly. This is due to the fact that a very large population provides proportionally more information than that of a smaller population. He proposed a correction formula to calculate the final sample size in this case which is given below

$$\frac{n_o}{1 + \frac{(n_o - 1)}{N}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Here, n_o is the sample size derived from equation (1) and N is the population size. Now, I calculated the sample size for the population of our study

Where, population size is N = 4101, According to the formula (1), the sample size will be 384 at 95% confidence level with margin of error equal to (0.05). I used the correction formula to calculate the final sample size.

Here, N = 1285, n_o= 384 (determined by using (1))

$$\frac{n_o}{1+\frac{(n_o-1)}{N}} = \frac{384}{1+\frac{(384-1)}{4101}} = \underline{\mathbf{351}}$$

To prevent the missing value consider 10% contingency of calculated sample size

351x 10% = **35**

Total sample size: 351 + 35 = **386**

Proportional and equivalent sample sizes were selected from all Woredas because the intention of the study was to understand the food security status of smallholder livestock producer's household found at all woredas of Akaki-Kality sub city. Hence, it was assumed that the sampling technique provides a good representative sample of smallholder livestock producer households for the sub-city.

With regard to the sample size of each Woreda, the method of proportional allocation was used under which the sizes of the samples from each woredas were kept proportional to the sizes of woredas. That is, if Pi represents the proportion of population included in woredas *i*, and n represents the total sample size, the number of elements selected from stratum *i* is equal to n multiplied by Pi or n x Pi (Kothari, 2004)

$$i = \text{n x p}i \qquad \text{and} \qquad \text{P}i = \text{N}i/\text{N}$$

Based on this proportional formula the proper sample size from each woreda were determined and described below in Table 3.2.

Table 3. 2**:** Proportional sample size selection from each woredas of Akaki Kality sub city

Woredas	**Number of livestock producer household (N)**	***(i* = n x p*i) &* (P*i* = N*i*/N)**	**Household selected (n)**
Woreda 01	274	386 x $(\frac{274}{4101})$	26
Woreda 02	353	386 x $(\frac{353}{4101})$	33
Woreda 03	379	386 x $(\frac{379}{4101})$	36
Woreda 04	196	386 x $(\frac{196}{4101})$	18
Woreda 05	85	386 x $(\frac{85}{4101})$	8
Woreda 06	116	386 x $(\frac{116}{4101})$	11
Woreda 07	228	386 x $(\frac{228}{4101})$	21
Woreda 08	223	386 x $(\frac{223}{4101})$	21
Woreda 09	422	386 x $(\frac{422}{4101})$	40
Woreda 10	574	386 x $(\frac{574}{4101})$	54
Woreda 11	708	386 x $(\frac{708}{4101})$	67
Woreda 12	259	386 x $(\frac{259}{4101})$	24
Woreda 13	284	386 x $(\frac{284}{4101})$	27
Total	**4101**		**386**

Source: proportional calculation using Kothari, 2004 formula

3.5 Data Collection Methods

Data was collected from smallholder livestock producer households found in Addis Ababa, Akaki Kality Sub city which were conducted from June 2020 up to October 2020. Two types of data were collected; primary and secondary data.

3.5.1 Primary data collection methods

Individual sample households were asked questions in their premises using questionnaire. The questionnaire covered different topics to capture relevant information about the demographic and socio-economic characteristics of the respondents. The questioners prepared in English and later were translated in to Amharic, the local language. These questioners were made pretested using ten non-selected sample smallholder livestock producer household and there was a minor problem then accordingly a corrective action would be made to improve the relevance of the questions for the study household.

Tools of Primary Data Collection

Household surveys

In order to gather information about small holder livestock producer`s household on status of food security, household survey was carried out using Close-ended questionnaire The questionnaire was compiled by using information derived from measurements that have also been applied by other researchers, and from key informant interview carried out by the researcher. HFIAS questionnaire was used to collect information about household dietary habit and food insecurity experience.

Key informant interviews

As a first step, gather seven key informants who are familiar with the conditions and experiences in the areas where the survey was conducted. The samples of key informant were government officials such as Akaki Kality farmers and urban agriculture development administration manager and staff, woredas extension expert and animal feed manufacturer and retailer. The interview questions were explained to the key informants to be understandable and it might take from 20 up to 30 minute. The options were given whether to participate or not and also were informed that they can choose to leave or refuse to answer a question at any time. The person (author)

conducted the key informant interviews (the “Interviewer”) followed the Key Informant Interview Guide. The Interviewer should read each question to the key informant and then read the probes listed below that question.

3.5.2 Secondary data collection methods

Secondary data is important to enrich the research paper and which were collected from different sources. Secondary data involved reviewing of literature most of which were obtained from books, websites, published and unpublished reports from relevant governmental offices, district report, NGOs and international research organizations involved on urban agriculture particularly livestock production were major sources for collecting secondary data. The city Administration directives and strategies towards urban agriculture were reviewed from Addis Ababa city government farmers and urban agriculture development commission, and different findings including journals and articles were review from government and NGOs.

3.6 Methods of Data Analysis

3.6.1 Qualitative Data Analysis

Qualitative data generated through key informant interviews were processed manually. The collected data were described and summarized to make appropriate analysis and draw meaningful interpretation or conclusion.

3.6.2 Quantitative Data Analysis

The survey data collected were edited code enter into a computer for analysis and descriptive statics were done by using Statistical Packages for Social Science (SPSS) and the other food security and Regression analysis done by STATA 14 software.

Descriptive statistics

The study used descriptive statistics for analyzing the quantitative data. The descriptive statistics were used to describe: frequency, percentage, mean, range, standard deviations to describe the characteristics of the respondents.

Food security Analysis

The HFIAS consists of two types of related questions. The first question type is called an occurrence question. There are nine occurrence questions that ask whether a specific condition associated with the experience of food insecurity ever occurred during the previous four weeks. Each severity question is followed by a frequency of-occurrence question, which asks how often a

reported condition occurred during the previous four weeks. Each occurrence question consists of the stem (timeframe for recall), the body of the question (refers to a specific behavior or attitude), and two response options (0 = no, 1 = yes). Each HFIAS frequency-of-occurrence question asks the respondent how often the condition reported in the previous occurrence question happened in the previous four weeks. There are three response options representing a range of frequencies (1 = rarely, 2 = sometimes, 3 = often) Food and Nutrition Technical Assistance (FANTA) Project (Swindale and Ohri-Vachaspati, 2005).

The HFIAS indicator categorizes households into four levels of household food insecurity (access): food secure, mild, moderately and severely food insecure. Accordingly, households were grouped into four categories (levels).

i. A household is food-secure if it scored '0' or '1' in the first FI frequency of occurrence question and '0' in Q2 to Q9;
ii. Mildly food-insecure if the first FI frequency of occurrence item has '2' or '3' or the second item has '1,' '2,' or '3' or the third item has '1' or the fourth item has '1' and items Q5 to Q9 score '0';
iii. Moderately food insecure if item three = '2' or '3' or item four = '2' or '3' or item five = '1' or '2' or item six = '1' or '2' and item seven to nine = '0'; and.
iv. Severely food insecure if item five = '3' or item six = '3' or item seven = '1,' '2,' or '3' or item eight = '1,' '2,' or '3' or item nine = '1,' '2,' or '3' (Coates, *et al*., 2007 and Shone, M., *et al*., 2017).

Regression Analysis

In Ordered Logit Model (OLM), the dependent variable is ordered in nature (Greene, 2003). In this case, the ordinary regression analysis is based on a latent regression of ordinal scales, where there is a clear classification between the categories of the dependent variable (Gujarati and Porter, 2009). The categorical dependent variable (level of food insecurity) takes the values (0, 1, 2, . . . , j) for some known integer J (Wooldridge, 2010). In addition, it is a function of a set of explanatory variables. The latent regression of the level of food insecurity Y_i^* is expressed as (Moon, 1988):

$$Y_i^* = X_i\beta + \varepsilon_i \qquad (1)$$

where Y_i^* is the latent unobservable variable that has more than two ordered or classified categories and denotes the level of FI observed in the home i, X_i is the matrix of a set of explanatory variables that determine the choice made by the household i, β is the vector of parameters to be estimated, and ε_i is a random error term distributed identically and independently.

In the OLM, the ordinal variable Yi is a function of another variable Yi*, according to household choice i between the alternatives (0, 1, 2, . . . , j) and in relation to several threshold points μj (μ0 = −∞ y μ_j) = ∞ , as demonstrated in the following formulas (Wooldridge, 2010):

$$Yi = \begin{cases} Y\ 0\ si\ Y\ * \leq\ \mu \\ 1\ si\ \mu 1\ \leq\ Y * \leq\ \mu 2 \\ 2\ si\ \mu 2\ \leq\ Y * \leq\ \mu 3 \\ 3\ si\ Y * >\ \mu 3 \end{cases} \qquad (2)$$

The FI variable is divided into four categories of increasing order and is coded as: 0 = food security, 1 = mild insecurity, 2 = moderate mild insecurity and 3 = severe mild insecurity. The logistic distribution function of the model is considered by Moon (1988). In this case, the probability of a response for a given household (i) according to the number of categories (j) is expressed as:

$$P\ [Y_i = j\ |X_i] = P\ [\mu_j{-}1 < Y * \leq \mu_{j\ i}] = F\ (\mu_j - X_i\beta) - F\ (\mu_j{-}1 - X_i\beta) = \frac{e^{(\alpha j + Xi\beta)}}{1 + e^{(\alpha j + Xi\beta)}} \qquad (3)$$

Where F represents the standard logistic cumulative distribution function (cdf) of εi, β are the regression coefficients for X_i, and α_j is the intercept for j logit. The empirical application of the regression of the OLM, following Grimaccia and Naccarato (2018), is expressed as:

$$g(Y) = \text{logit}(Y) = \alpha_j + \beta 1x1 + \beta 2x2 + \ldots + \beta nxn + \varepsilon_i \qquad (4)$$

The categorical dependent variable (FI levels), measured by the HIFIAS score, is analyzed based on observable exogenous variables. The αj parameters, called thresholds or breakpoints, are in

increasing order ($\alpha 1 < \alpha 2 < \ldots$). Their number is $j = 1, 2, \ldots, j - 1$, where j is the number of categories of the ordinal variable (Grimaccia and Naccarato, 2018). In this research, $j = 4$.

3.7 Study Variables and model specification

Dependent variable of this study was food security status of smallholder livestock producer household and measured by using HFIAS food security measurement scale. HFIAS is ordered in to four categories, namely food secure, mildly food insecure, moderately food insecure and severely food insecure.

The independent variables used in the study are demographic, socio-economic and institutional factors that could affect the dependent variables of the study population. Here below explanatory/independent variables were considered as to have positive as well as negative influence on food security status of smallholder livestock producer household. Demographic and socio-economic characteristics included gender, marital status, education status, main occupation, family size and number of children family members. Institutional characteristics included access to credit, extension service, veterinary service, improved breed and livestock production training were measured and inputted into the ordinary logistic regression model.

Age of household head: Age is a continuous explanatory variable. As age of a household increases, it is assumed that farmers could acquire more knowledge and experience. They are more risk averter and their chance to become more food secure increases with age. In another ways according to Abdullah *et al*., (2017) citing Mango, age has an effect on the food security status of households and was anticipated to negatively correlate with household food security status. Thus, it is hypothesized that age of the household heads and food security are both positively and negatively correlated.

Sex of household head: is a person who economically supports or manages a household or for reason of age or respect is considered as head by other members of the household. Male-headed households have more access to agricultural technologies and more security to farmland as compared to female-headed households (Gladwin *et al.,* 2001). Households of single women (unmarried with children, divorced and/or widowed) which tend to be relatively poorer (Mrkic, *et al.,* 2010) and therefore more likely to be food insecure. Sex of household head is considered as an important determinant of food security and it is a dummy variable (i.e. 1 if it is male and 0

otherwise). Thus, male headed households are more likely to be food secure than female headed households.

Educational level/status of household head: It is a category variable and in this study categorized household head in to illiterate, read and write or literate. Education is an important variable determining household food security where educated households have a better chance of managing their farm by adopting improved practices, which in turn increases total yield. Nnadi and Akwiwu (2008) asserted that an educated farmer is in a better position to practice what he/she might have learnt from school in their farming projects. Education status was therefore expected positively correlate with household food security status.

Marital status of household head: a category variable was coded as follows; the marital status of the household in this study categorized in to four such as single, married, divorced and windowed. Married household caregivers are alleged to be better off in terms of their food security status in relation to their unmarried counterparts (Adenike, 2016). Therefore the married one anticipated to positively correlate with the food security status of a household compared with others.

Household size: represented the sum of members residing in a home together at the time of the study. The chances for a large household size to be poor are high (Obi and Tafa, 2016) and therefore add more pressure on the household in terms of the number of people required to feed (Sekhampu, 2013). On the other hand, household size can mean the availability of family labor by delegating important farming activities to other household members; this is likely to boost the food security situation of a household (Etwire, *et.al.*, 2013). Hence, the effect of household size on household food security status may not be predetermined.

Number of children: The econometric modeling also features household size in terms of numbers of "adult persons" and "children" as explanatory variables consistent with the findings by Garret and Ruel (1999) which demonstrated that family size and composition may affect food security status of the household. A household with high numbers of children may be forced to devote fewer resources to purchasing food in order to attend to other needs of children including health, clothing and education (Bahta *et al.*, 2017). A negative relationship was therefore expected between high numbers of children versus household food security.

Livestock income: it refers to all the income generated from sale of livestock and livestock products (like meat, milk and egg) and by products was prudently used to finance the purchase of household commodities such as grains, salt, coffee, tea, salt, cooking oil, sugar, etc. (ILRI, 2008). The study quantified the average incomes obtained by livestock producers from selling of livestock and their products. It was measured in Ethiopian birr. Income determines the household's access to food. It was expected to be positively correlated with household food security and income.

Livestock holding in TLU: It is a continuous variable measured in number. Households with relatively larger number of animals can get better product on their production and achieve sustainable food security. Studies by ILRI (2008) showed that food secure households were associated with high livestock asset ownership, indicating that increased cash incomes primarily came from livestock, through the sale of live animals, milk, meat, hides and skins. Thus, Households who possess large livestock size are expected to be less vulnerable to food insecurity.

Main occupation: Income from the livestock production may not be the only source of income for the urban household. The success of households and their members in managing food insecurity is largely dependent on their ability to get access to off-farm/non-farm job opportunities, which could serve as livelihood diversification strategies (Reardon, 1997; Barrett *et al*., 2001). A household with an employed individual increases its ability to consistently acquire food (Mark, *et al.*, 2014). Hence, it is expected that the availability of off-farm/non-farm income is positively associated with household food security.

Access to credit: refers to the ability of a household to obtain finance either as formal credit, referred to as debt from commercial banks, and/or semi-formal credit. This variable excludes informal credit (debts obtained from friends and relatives). Access to credit was therefore taken as a dummy; if the respondents had access to credit they were coded with a numeric value 1, and 0 if otherwise. Credit, if acquired timely, can increase the likelihood of household procuring production necessities (Kuwornu, *et al*., 2012). This could improve production and thus the household food situation (Iftikhar, *et al*., 2017). Access to credit by households was therefore anticipated to be positively correlated with household food security status.

Improved breed: has been used for improving productivity. Nowadays breeding schemes may take other aspects important for livestock sustainability into account like disease-resistance, heat-stress endurance, reproductive performance and longevity (FAO, 2016). Animal breeding technologies and exotic breeding material can be an opportunity for improving animal production and productivity. According to CSA (2015a), 98.66% of cattle, 99.78% of sheep, 95.86% poultry, and almost all goats (99.99%) in the country Ethiopia are indigenous breeds that have poor production and reproductive performance. Unavailability and high prices of better-performing, genetically improved heifers and chickens is the key bottleneck (Yisehak, 2008). Improved breed is a dummy variable taking value of 1, if a livestock producer used improved breed and 0 otherwise. Hence, using improved breed has positive association with household food security status.

Extension service: Provision of extension service to livestock producers focused on creating and transferring knowledge and skills. According to Wossena *et al*., (2017) study the effects of access to extension services in rural Nigeria indicated that extension access had a positive relationship with poverty reduction. Hence we expect extension service positive relation with food security.

Veterinary service: Improving animal health through treatment of infected animals, prevention and control animal disease strategy includes animal management on the farm at low costs such as better reproductive management and introduction of biosecurity procedures will contribute to a sustainable livestock sector and Food Security and Nutrition (FSN) by increased productivity and produced quality ASF. Healthy livestock are more productive than diseased livestock and production is exposed to less fluctuations. According to Hussein and Janekarnkij (2013) conducted in Jigjiga district of Ethiopia reported that access to veterinary service was found to have positive and significant impact on household food security. It is a dummy variable taking value of 1, if livestock producers used veterinary service and 0 otherwise. Hence, using veterinary service has positive association with household food security.

Improved feed: Feed in livestock systems is often the input that is most costly for the producer. Inadequate supply of feed for the existing livestock population and poor quality of the available feed resources are the two main factors that contribute to the low production and productivity of livestock. It is a dummy variable taking value of 1, if livestock producers used improved animal

feed and 0 otherwise. Hence, using formulated feed has positive association with household food security.

Table 3. 3: Explanatory variables used in the ordinary logistic regression modeling on factors determining the households' food security status and their expected outcomes.

Explanatory Variable	**Type**	**Measurement**	**Exp. sign**
Demographic and Socio-economic factors			
Age of household head	Continuous	age in years	+/-
Household size	Continuous	Number	+/-
Number of children	Continuous	Number in the household	–
Sex of household head	Dummy	0 Female, 1 Male	+
Marital status of household head	Category	Single, Married, divorced, windowed	+
Educational status	Category	Illiterate, Read and write, , Literate	+
TLU	Continuous	Number	+
Livestock income	Continuous	Number	+
Main occupation	Dummy	1 = employed, 0 = unemployed	+
Institutional			
Access to credit	Dummy	access to credit or not; 1 = yes, 0 = no	+
Training livestock production	Dummy	1=yes 0=no	+
Improved feed	Dummy	1 = formulary feed 0 =not	+
Improved breed	Dummy	1=yes 0=no	+
Veterinary service	Dummy	1=yes 0=no	+
Extension service	Dummy	1=yes 0=no	+

Source: compiled by authors based on literature review

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Characteristics of livestock producer households

4.1.1 Demographic and socio economic characteristics of livestock producer households

It is vital to describe sampled livestock producer households characteristics. Characteristics such as age, marital status, sex, main occupation, educational status, family size, adult and children number and total livestock income, TLU were considered important. This is because the asset base and household demographic structure of the household has implications on flexibility and capabilities with respect to livestock production and consumption. Consideration of household demographic features offers one of the platforms on which to analyze variations relevant to this study.

The educational level of the urban livestock producer households in the study area is presented in Table 4.1. As can be seen from the Table 4.1, out of 383 respondents 30 (7.8%) are illiterate, 104 (27.15 %) can read and write. The remaining respondents about 249 (65.01%) were literate. Most of sampled livestock producers found in Akaki Kality sub city were categorized under who received formal education. This showed that livestock producer household head in Akaki Kality sub city involved in livestock production practice were characterized with different level of education.

Sex distribution in the sampled of survey participants of the study were 303(79.1%) males and 80(20.9%) females. The marital status of the sampled livestock producer households also varies. The married constitute 256 (66.8%) of the total sampled households, whereas the divorced, widowed and single constitute about 32(8.1%), 53(13.8%) and 42(11%) respectively.

The results of this study on main occupation of livestock producer (Table 4.1) indicated that out of total sampled households about 75(19.6%), 74(19.3%), 54(14.1%), and 57(14.9%) participated additionally on formal employment, crop production, private business and retired by their main occupation respectively. Households whose main occupation were only livestock production farming represented about 123(32.1%) of sampled livestock producers in Akaki Kality sub city.

Table 4. 1Demographic characteristic of sampled livestock producer households

Variables	Categories	Frequency	Percent
Sex	Male	303	79.1
	Female	80	20.9
	Total	**383**	**100**
Marital status	Single	42	11.0
	Married	256	66.8
	Divorced	32	8.4
	Widowed	53	13.8
	Total	**383**	**100**
Educational status	Illiterate	30	7.83
	Read and write	104	27.15
	Literate	249	65.01
	Total	**383**	**100**
Main occupation	Livestock production	123	32.1
	Formal employment	75	19.6
	Crop production	74	19.3
	Private business	54	14.1
	Retired	57	14.9
	Total	**383**	**100**

Source: Authors' computation based on field survey data, 2020

4.1.1.1 Type of livestock ownership

Type of Livestock holding and species composition per household in Akaki Kality sub city were variable. The results presented in Table 4.2. indicated that about 213 (55.6%), 145 (37.9%), 94 (24.5%), 87 (22.7%), 41(10.7%) and 1(0.3%) of livestock producer households have poultry, dairy cattle, sheep and goat, beef, bee and pig types of animals were kept in their households respectively. There were livestock producers having more than one type of animal productions and it represented about 117(30.6%) of the sampled households (Table 4.2).

Table 4. 2 Livestock producer household response based on their type of animal ownership

Variables	livestock	Categories	Frequency	Percent
Animal type	Poultry	Yes	213	55.6
		No	170	44.4
	Dairy	Yes	145	37.9
		No	238	62.1
	Sheep and goat	Yes	94	24.5
		No	289	75.5
	Beef	Yes	87	22.7
		No	296	77.3
	Bee	Yes	41	10.7
		No	342	89.3
	Pig	Yes	1	0.3
		No	382	99.7
	Having more than one type of animal	yes	117	30.5
		No	266	69.5

Source: *Authors' computation based on field survey data, 2020*

4.1.1.2 Socioeconomic Characteristics of Respondents

Table 4.3 showed that a summary of the socioeconomic characteristics of livestock producer household respondents. The age of the respondents ranged from 26 to 84 years old and the mean and standard deviation of this variable were about 52.47 and 9.965 respectively. The family size within the study livestock producer households were ranged between 2 and 14 members and it`s mean value was 6.6632 and standard deviation was 2.24865. Number of children's their age less than 15 years old within the study livestock producer households were ranged from 0 to 7 and it`s mean and standard deviation were 2.099 and 1.806 respectively. Adult family size with in livestock producers household in the study area revealed that between 1 to 10 and it`s mean and standard deviation of this variable were 4.59 and 1.68 respectively.

To estimate the annual income of livestock producer households obtained from milk products knowing of lactation length is important various scholars determines the period through which a cow continues giving milk in one milking time is the length of lactation. According to Asefa *et al.,* (2015) stated that the overall lactation length of indigenous cattle was 203.54 other scholars

such as Kedija, (2007), Adebabay, (2009) and Mulugeta and Belayneh, (2013) revealed that 7.29 month, 9.8 month and 9.13 month respectively. But according to CSA, (2013) noted that lactation length of dairy cow about 6 month.

Similarly with that of milk product to estimate the annual income obtained per hen/poultry of those poultry producer households knowing the amount of eggs obtained per hen per annum is crucial for this many scholars define on it like Lemlem and Tesfaye (2010) reported that 173eggs, 185 eggs and 144 eggs/year/ hen for White leghorn, Red Island Red and Fayoumi chicken under village household condition.

Based on the above assumption total income obtained from livestock per year per household was calculated and the result of this study as showed in table 4.3 that total income obtained from livestock production per annum revealed that from 0 to 309300 in Ethiopian birr and it`s mean and standard deviation were 47323 and 47364.87 respectively. Similarly table 4.3 summarized that the average total number of livestock within livestock producer households were 9.9898 and it`s minimum and maximum number of livestock in the household were between 1 to 314.

Dairy cattle production

Results of this study on number and dairy cattle per household indicated in table 4.3 that the number of animals per household varies from 1 to 5 cows. The average number of dairy cattle per household is 1.99 animals with standard deviation equals to 0.99650 (Table 4.3).

Sheep and goat production

Sheep and goat are the most important small ruminants kept by urban livestock owners. Of 383 livestock producer household in Akaki Kality sub city about 94 (24.5%) of urban livestock producer households own sheep and goat. The number of sheep and goat per livestock producer households varies from those with 1 sheep and goat to those with 20 sheep and goats with average number of 6.66 animals per household (Table 4.3).

Poultry production

Poultry are the other component of livestock activity practiced by urban livestock producers. Out of 383 livestock producer about 212(55.3%) of them keep poultry. The number of poultry per

household varies from the range of farms that have about 1 poultry to those which have up to 300 poultry with average number of 49.07 poultry per household (Table 4.3).

Beef production

Beef productions are other components of livestock production activities practiced by Akaki Kality sub cities livestock producer household. In this study about 86 (22.45%) respondents were beef producer households. The number of beef per household varies from those with 1 to 8 in number and it can be seen in table 4.3. Average number and standard deviation of beef production per households was 3.37 and 1.77 respectively (Table 4.3).

Beekeeping

Bee production is also common livestock activity practiced in Akaki Kality sub city. The result of this study revealed that the number of hives per household varies. Number of hives having per household varies from 1 to 4 hives. The average number and standard deviation of hives per household were 2.07 and 0.9052 respectively (Table 4.3).

Pig production

Pig production in Akaki Kality sub city based on the annual report of Akaki Kality farmers and urban agriculture development office stated that households participated in pig production not more than seven households. In study only one of pig producer household was taken as a sample (Table 4.3).

Table 4. 3 Summary of socioeconomic characteristics of livestock producer household

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Age of household head	383	26	84	52.47	9.965
Family size with in household	383	2.00	14.00	6.6632	2.24865
Number of children (15 ≤ years) with in household	383	0	7.00	2.0992	1.80621
Number of Adults with in household	383	1.00	10.00	4.5901	1.68038
TLU	383	1	314	10.27154	39.89258
Total income from livestock	383	0	309300	47323	47364.87
Number of dairy production	145	1.00	5.00	1.9931	.99650
Number of poultry production	212	1.00	300.00	49.0708	53.31832
Number of sheep and goat production	94	2.00	20.00	6.6596	4.65949
Number of beef production	86	1.00	8.00	3.3721	1.77596
Number of bee hive	41	1.00	4.00	2.0732	.90527
Number of pig production	1	40.00	40.00	40.0000	.

Source: Authors' computation based on field survey data, 2020.

4.1.2 Institutional characteristics of livestock producer households

From the total of 383 sampled livestock producer households only 135 (35.4%) of them were use improved breed to enhance productivity and production, whereas the reaming 246 respondents (64.6%) were not. Credit facilities are important institutional services to enhance livestock production and productivities of livestock producer households via provide input purchase and ultimately for utilization of new technologies. However, in this livestock producer households survey about 103 (27%) respond yes for the access to credit while 279 (73%) respondents have no access to credit (Table 4.4).

The percentage of livestock producer households that attended training on livestock production was 85 (22.4%). The majority of respondent about 295 (77.6%) of urban livestock producer households did not attend any livestock production related training. Of 383 livestock producer households respond about 181(48.4%) were get veterinary service in different times whereas 193

(51.6%) of the respondent did not get. Extension services are offered through training and visit. Out of 383 urban livestock producers about 179 (49%) of the total respondent were visited by extension staff at different times with different proportions. The rest of 186 (51%) respondent did not visited by extension staff (Table 4.4).

Table 4. 4 Institutional characteristics of study livestock producer household

Variables	**Categories**	**Frequency**	**Percent**
Improved breed	Yes	135	35.4
	No	246	64.6
Access to credit	Yes	103	27
	No	279	73
Training on livestock production	Yes	85	22.4
	No	295	77.6
Veterinary service	Yes	181	48.4
	No	193	51.6
Extension service	Yes	179	49
	No	186	51

Source: Authors' computation based on field survey data, 2020

4.2 Food security status of livestock producer households

Descriptive analysis was executed to examine the general characteristics of food security status of livestock producer households; totally about 383 sampled were collected in this study from Akaki Kality sub city of all woredas. The food security status of livestock producer households was determined by using HFIAS measurement scale. Out of 383 samples the food security status of livestock producer households in Akaki Kality sub city were about 114 (29.77 %), 129 (33.68 %), 91 (23.76 %) and 49 (12.79 %) food secure, mildly food insecure, moderately food insecure and severely food insecure respectively (Table 4.5).

The observed result of food security status was occurred may be due to the fact that urban livestock producer households were able to consume their animals product, produce adequate food at the household level, there is an increasing demand for animal products in the growing cities, increasing populations hardly need livestock and their products such as meat and milk, for

consumption and trade. Livestock producer households that were categorized under severely food insecure about 49 (12.79 %) could be experienced the worst conditions of food insecurity, such as cutting back on the number and size of meals; running out of food or going a whole day or night without eating. On the contrary, households that fell under the food secure category about 114 (29.77 %) did not experience any condition related to food insecurity or rarely experienced worry.

Table 4.5 Food security status of livestock producer households in Akaki Kality Sub city

Variable	Description	Frequency	Percent
Food security status of livestock producer household	Food secure	114	29.77
	Mild food insecure	129	33.68
	Moderate food insecure	91	23.76
	Severely food insecure	49	12.79
Total		**383**	**100**

Source: Household Survey (2020)

4.3. Determinants of Food Security Status of livestock producer households

4.3.1Bivariate Analysis between the Household Food Security Status and the Explanatory Variables

A bivariate correlation analysis ascertains whether there is an empirical relationship (association) between two variables in question. In the bivariate analysis, this paper makes use of the Pearson's Chi-square to hypothesized determinants of livestock producer households food security status, 10 categorical explanatory variables were inputted in the bivariate model. Nine were found to be statistically significant (Table 4.6). It`s Pearson's correlation coefficients with $p < 0.05$ were taken as significant. These variables included sex, marital status, education status, main occupation, access to credit, improved breed, veterinary service, improved feed, extension service and training on livestock production. The statistically significant variables from the bivariate analysis were subjected to further statistical analysis; the ordinary logistic regression model was employed to establish a better understanding of their influence in determining smallholder livestock producer household food security status in Akaki Kality Sub city.

Food security status of livestock producer household based on their marital status variable indicated that the presence of statistical difference, which were from 256 married respondents, about 73(19.06%) 90(23.5%) 67(17.49%) and 26(6.79%) respectively had food secure, mildly

food insecure, moderately food insecure and severely food insecure. Out of 42 single livestock producer households respondent about 18(4.7%), 15(3.92%), 6(1.57%) and 3(0.78%) respectively had food secure, mildly food insecure, moderately food insecure and severely food insecure.

The result showed that from a total of 303 male headed household respondents, about 98 (25.5%), 108 (28.2%), 71 (18.54%) and 26 (6.79%) respectively were food secure, mildly food insecure, moderately food insecure and severely food insecure. In another way out of 80 female headed household respondents, about 16(4.18%), 21(5.48%), 20(5.22%) and 23 (6.01%) respectively had food secure, mildly food insecure, moderately food insecure and severely food insecure status (Table 4.6). Based on this result the proportion of households head across the status of gender showed high prevalence of being severely food insecure in female headed livestock producer compared to male headed producer.

The prevalence of livestock producer household being severely food insecure on their educational status of household head in this study revealed statistically significant (p- value < 0.05). Livestock producer households had less probability to become severely food insecure as the level of household head education increase, with Illiterate 9 (2.35 %), Read and write 25 (6.53%) and literate 15(3.92%).

Out of 260 livestock producer households who replied on other source of income beside to livestock production, about 78 (20.37%), 99 (25.85%), 59 (15.4 %) and 24 (6.27 %) were food secure, mildly food insecure, moderately food insecure, and severely food insecure status respectively. The remaining 123 livestock producer household respondents that had only livestock production, about 36 (9.4 %), 30 (7.83 %), 32 (8.36 %) and 25 (6.53 %) had food secure, mildly food insecure, moderately food insecure, and severely food insecure status respectively (Table 4.6).

In the present study, livestock producer households they used veterinary service was statistically significant ($p < 0.05$) and Out of 383 livestock producers respondents about 181 respondents had the opportunity to receive veterinary service and among them 81 (21.54%), 65 (17.29%), 25 (6.65 %) and 10 (2.66 %) had a food secure, mildly food insecure, moderately food insecure and severe food insecure status respectively (Table 4.6).

The result of this study in Table 4.6 demonstrated that only 135 livestock producer household were used improved breed and about 69 (18.11 %), 39 (10.24 %), 23 (6.04 %) and 4 (1.05 %) had food secure, mildly food insecure, moderately food insecure and severely food insecure status respectively and it was statistically significant ($p < 0.05$).

Furthermore, the proportion of food security status also showed a variation in access to credit. Out of 382 livestock producer households respondent only 103 had opportunity to access credit and among them about 57 (14.92%), 21 (5.50%), 17 (4.45%) and 8 (2.09%) had food secure, mildly food insecure, moderately food insecure, and severely food insecure status respectively. In this study the result in Table 4.6 indicated that improved feed had a variation on food security status of livestock producer household from a total of 371 respondent 169 were used improved animal feed to their livestock and about 68 (18.33%), 67 (18.06%), 21 (5.66%) and 13 (3.5%) had food secure, mildly food insecure, moderately food insecure, and severely food insecure status respectively. the remaining 202 were used other animal feed source.

Table 4.6 also showed that there was a variation between livestock producer households who had got extension service and did not have it. Out of 380 livestock producer household responds about 179 respond had opportunity for extension service of which 78 (21.37%), 50 (13.7%), 32 (8.77%) and 19 (5.21%) had food secure, mildly food insecure, moderately food insecure, and severely food insecure status respectively.

Table 4. 6 Correlation between livestock producer household's food security status and explanatory variables.

Description of variables	Categories	Food security status				Total	Chi square	(p-value)
		Food secure count (%)	Mildly Food insecure count (%)	Moderately food insecure count (%)	Severely food insecure count (%)			
Marital status	Single	18(4.7)	15(3.92)	6(1.57)	3(0.78)	42	27.7251	0.001***
	Married	73(19.06)	90(23.5)	67(17.49)	26(6.79)	256		
	Divorced	14(3.66)	10(2.61)	4(1.04)	4(1.04)	32		
	Widowed	9(2.35)	14(3.66)	14(3.66)	16(4.18)	53		
Sex	Male	98(25.5)	108(28.2)	71(18.54)	26(6.79)	303	25.0870	0.000***
	Female	16(4.18)	21(5.48)	20(5.22)	23(6.01)	80		
Education status	Illiterate	2(0.52)	11(2.87)	8(2.09)	9(2.35)	30	72.8441	0.000***
	Read and write	13(3.39)	24(6.27)	42(10.97)	25(6.53)	104		
	Literate	99(25.85)	94(24.54)	41(10.70)	15(3.92)	249		
Main occupation	Livestock	36(9.4)	30(7.83)	32(8.36)	25(6.53)	123	13.0805	0.004***
	Otherwise	78(20.37)	99(25.85)	59(15.4)	24(6.27)	260		
Veterinary service	Yes	81(21.66)	65(17.38)	25(6.68)	10(2.67)	181	53.5914	0.000***
	No	32(8.56)	60(16.04)	65(17.38)	36(9.63)	193		
Improved breed	Yes	69(18.11)	39(10.24)	23(6.04)	4(1.05)	135	53.480	0.000***
	No	44(11.55)	90(23.62)	68(17.85)	44(11.55)	246		
Access to credit	Yes	57(14.92)	21(5.50)	17(4.45)	8(2.09)	103	43.951	0.000***
	No	57(14.92)	108(28.27)	74(19.37)	40(10.47)	279		
Improved feed	Improved	68(18.33)	67(18.06)	21(5.66)	13(3.5)	169	34.070	0.000***
	Otherwise	44(11.86)	60(16.17)	65(17.52)	33(8.89)	202		
Livestock production training	Yes	30(7.89)	28(7.37)	18(4.74)	9(2.37)	85	1.868	0.600
	No	83(21.84)	100(26.32)	73(19.21)	39(10.26)	295		
Extension service	Yes	78(21.37)	50(13.7)	32(8.77)	19(5.21)	179	38.110	0.000***
	No	27(7.4)	72(19.73)	57(15.62)	30(8.22)	186		

Pearson's chi-square, ***significant at 1%, **significant at 5% and * significant at 10% level of significance.

Source: Household Survey (2020)

4.3.2 Ordinary logistic regression

The variables that were significant from the bivariate analysis were subjected to a collinearity diagnosis using the Variance Inflation Factors (VIF) test before running the ordinary logistic regression model. VIF factors estimate how much the variance is inflated. Many researchers suggest that explanatory variables with a high VIF (usually from 5 to 10 and above) suggest a problem of multi-collinearity and that the violating predictors be excluded from the model. In this study two variables namely adult family size and children family size had a VIF value higher than 10 and were thus excluded from further analysis. The VIFs of the rest covariates in this study were found less than 3 and it indicates that there is no multi-collinearity between the covariates.

In the ordinary logistic regression modeling a p-value greater than 0.05 ($p \geq 0.05$) indicates a better fit of the model to data. The number of observation was 344. The LR chi-squared test with a value of 220.33 (P-value= 0.000) showed that models fits the data well as compared to null. The pseudo- R Square in this study was (0.2408) and it mean that about 24.1% of variation in the dependent variable is explained by the independent variables; this suggests that goodness of fit of the model.

Ordinary logistic regression model was used to identify determinants of food security status on urban smallholder livestock producing households found in Akaki Kality sub city. Accordingly, variables assumed to had influence on livestock producer households food security in different contexts were tested in the model and out of 10 variables nine of them were found to be statistically significant (p-value ≤ 0.05). Among variables fitted into the model was educational status, sex, marital status, main occupation, access to credit, veterinary service, extension service, improved feed and improved breed were found to be statistically significant in determining livestock producing household food security status.

The result of table 4.7 revealed that educational status of livestock producer household head was found to be significant at the 1% level ($p = 0.000$) and negatively correlated with the household food insecurity status, which is similar to what was expected, with a beta coefficient (β) = -0.4746391 and an odds ratio (Exp(β)) = 0.6368648. The model predicts that education status, the odds of a livestock producer household to be food secure is more likely while holding all other independent factors constant. Similarly, researches done by De Cock *et al*., (2013) in South

Africa, Maitra and Rao (2015) in Kolkata, India and Zhou *et al*., (2017) in Pakistan indicated that education of household head positively contributed to food security. This may be due to education is important to food security not only because it is usually correlated with income, but also because it may have a positive impact on how the resources in the household are managed. In contrary to this studies done by Fekadu and Meqanent (2010) and Garrett and Ruel (1999) were found negatively influence on the food security status of household and educational level of a household head with statistically significant association.

Moreover, Age of household head was found to be statistically significant at 1% level ($p = 0.004$) and positively correlated with the household food insecurity status, which is similar to what was expected, with a beta coefficient (β) = -0.0336428 and an odds ratio (Exp(β)) = 0.9660715. The model predicts that Age of livestock producer households head would increase the odds of a households to be food secure is more likely while holding all other independent factors constant. Similar result was obtained by scholars for example Arene and Anyaeji (2010) and von Fintel and Pienaar (2016) were found that older farmers tend to be more food secure. This is may be experienced livestock producer household has more likely to have adequate knowledge. Moreover, older persons are more risk averters and mostly they intensify and diversify their production activities. As a result, the chance for such household to be food secure is high. Contrary to this, study done by Otilia *et al*., (2020) the age of the head of the household had a negative effect and was statistically significant in OLM models. Other scholars such as Mannaf and Uddin (2012) and Adenike (2016) results found contrast to this study.

Household size (total number of individuals in a household) was found to be statistically significant ($p \leq 0.05$) and positively correlated with food insecurity status of household, with a beta coefficient (β) = 0.1460022 and an odds ratio (Exp (β)) = 1.157199. Similar result recorded by Abafita and Kim, (2018) stated that larger household sizes increase the probability of food insecurity compared to smaller household size by exerting more pressure on consumption than contribution of labor to production. In contrast to this result study done by Maitra and Rao, (2015) in India revealed that a larger household size had less likelihood to be found in a food-insecure category.

Improved breed was found to be statistically significant ($p = 0.031$) and was positively influenced the livestock producer households food insecurity status, with a beta coefficient (β) = 0.6802294

and an odds ratio (Exp (β)) = 1.880643. The model predicts that using improved breed on livestock producer households, the odds of a household less likely to be food secure while holding all other independent factors constant. Unavailability and high prices of better-performing, genetically improved heifers and chickens is the key bottleneck (Yisehak, 2008). Improved bulls are unavailable and artificial insemination (AI) service is insufficient and inefficient, despite high demand for it (Tegegne *et al*., 2013; Yami, 2012).

The variable access to credit was found to be statistically significant (p = 0.042) and was positively correlated with the livestock producer households food insecurity status of households, this is in contrast to what was expected, with a beta coefficient (β) = .5932097 and an odds ratio (Exp(β)) = 1.871411. The model predicts that when a livestock producer households had access to credit, the odds of a households to be food secure is less likely while holding all other independent factors constant. Surprisingly, the variable of access to credit was found negatively influence the status of livestock producer household food security in the study area. Similar result was recorded by Primrose *et al.,* (2018), this could be attributed to the fact that either formal credit facilities are not well exploited and/or probably that most households were not receiving any formal credit support. Therefore, it could be due to the fact that the loan from the informal creditors was not enough in the first place to guarantee the intended investment. In contrast to this study different scholar throughout the literature noted that access to credit is a crucial aspect for promoting the food security status of households, as revealed in Iftikhar, *et al*., (2017) and Matchaya and Chilonda (2012). In addition recent study done by Ayele, *et al.,* (2020) revealed that households that do not take a credit from any financial institution were more likely (AOR = 2.83, 95% CI: 1.36, 5.89, P = 0.006) to be food insecure compared to households that take a credit from financial institutions

The findings of this study on the variable veterinary service revealed that a livestock producer households headed was using veterinary service found to be statistically significant (p = 0.000) and positive effect on food insecurity status with a beta coefficient (β) = 1.01056 and an odds ratio (Exp(β)) = 2.684523. The model predicts that with a veterinary service, the odds of a livestock producer household to be food secure is less likely while holding all other independent factors constant. In contrast to this study, recent research done by Kedija and Jema (2020) and Hussein and Janekarnkij (2013) in Somali region indicated that access to veterinary service was

found to have positive influence on food security condition of the household. Other study conducted in Southern Ethiopia by Samuel (2014) using chi-squared test and the result obtained revealed that access and demand to veterinary service (X^2=12.258, p<0.001) and (X^2=17.799, p<0.001) were positively related to food security.

The finding of this study on the TLU variable was found to be a negative statistically significant associated factor for food insecure livestock producer household. With the odds of ratio (AOR = 0.9837372 95% CI: .9722306, .9953801, P < 0.006). The model predicts that when a livestock producer households had one unit increase in TLU, the odds of a livestock producer household to be food secure is more likely while holding all other independent factors constant. Similar result was observed by scholar such as Ayele *et al* (2020); Abdulla (2015); Asmelash (2014) and Abafita and Kim (2013) conducted in Ethiopia and revealed that TLU was positive significant associated factor for food secure household. This finding supported the idea large herd size household certainly contributes to food security through food supply, source of income, as a hedge against risks and as a means of capital accumulation that can be exchanged for food in times of deficit (Doti, 2010). In other way Scholars like Veronica *et al.*, (2020) and Silvestri *et al.*, (2015) result showed that no significant difference in livestock asset ownership on food security status.

The total income obtained from livestock was found to be a negatively statistically significant associated factor for household food security. With odds of ratio (AOR = 0.9999% CI: -.1.35e-06, -.-7.44e-07, P < 0.000). The model predicts that when a livestock producer households had one unit increase in income obtained by livestock, the odds of a livestock producer household to be food secure is more likely while holding all other independent factors constant.

Table 4. 7 Result of ordinary logistic and odd ratio showing the determinants of food security status

Variables	Food security status				
	Coefficient	Odds ratio	p- value	95% Cl for O.R	
				Lower	Upper
Age	-.0336428	.9660715	0.007***	.9422056	.9905419
TLU	-.0154852	.9837372	0.006**	.9722306	.9953801
Total livestock income	-1.23e-06	.9999988	0.000***	.9999984	.9999992
Household size	.1460022	1.157199	0.005	1.045795	1.280469
Sex	.2689957	1.620308	0.239	.7256657	3.617916
Marital status	.2500331	1.206625	0.345	.8167745	1.782554
Educational status	-.4746391	.6368648	0.000***	.5398183	.751358
Occupation	.3379417	1.259511	0.336	.7636281	2.077409
Improved feed	-.5304888	.6325758	0.071*	.3848876	1.03966
Access to credit	.5932097	1.871411	0.042*	1.023349	3.422272
Veterinary service	1.01056	2.684523	0.000***	1.666411	4.324662
Extension service	-.1147908	.9810247	0.945	.5667968	1.69798
Improved breed	.6802294	1.880643	0.024**	1.08664	3.254818

Log likelihood = -347.0829
Number of obs = 344
LR chi2(13) = 220.88
Prob > chi2 = 0.0000
Pseudo R2 = 0.2414
Significance levels: * p < 0.10, ** p < 0.05, ***p < 0.01.

Source: Authors' own explanation from surveys, 2020

4.3.3 Ordered logit model estimation

In terms of variable Age of livestock producer households head in this study as showed in table 4.8 had positive marginal effects for food secure households was 0.4% percentage points more likely to be food secure with statistical difference p = 0.006 and in contrary the other two food insecure categorize had negative marginal effects on moderately and severely food insecure household with statistical significant difference. This result may suggest that, on average, as age of household head increases, the household head had got more experience in managing the resources in the household and developed more experience at work may represent higher disposable income, reducing the probability of the household to be food insecure.

The variable TLU of livestock producer households had positive marginal effect on food secure in terms of food security status categories was 0.2 percent points more likely to be food secure with statistical difference p = 0.005 and on the other hand the household TLU had negative marginal effect on moderately and severely food insecure household with statistical difference p- value = 0.01 and 0.008 respectively. Similarly study done by Demeke *et al*., (2011) examined the determinants of household food security in rural Ethiopia and found that households with more livestock ownership were less likely to be food-insecure. Livestock ownership is viewed as a potential approach to help minimize food insecurity.

Table 4.8 revealed that variable total livestock income had positive marginal effect on food secure and mildly food insecure livestock producer households. On the other hand total livestock income had negative marginal effect on moderately and severely food insecure household with statistical significance difference ($p \leq 0.05$). Similarly by Mango *et al.,* (2014) who applied linear regression to evaluate the factors that affect food security among smallholder farmers in Zimbabwe and found that livestock income contributed better to be household food secure.

Regarding variable of livestock producer households size on table 4.8 showed that had negative marginal effects on the size of household was 1.8 percent points less likely to be food secure with statistical difference. On the other hand the two categories of food insecurity had positive marginal effect with 0.9 and 1 .2 percent points more likely to be moderately food insecure and severely food insecure respectively. Similarly result was observed by De Cock *et al.*, (2013) in

South Africa using the multivariate regression analyses. The finding revealed that larger household size was higher food insecure than a smaller household size.

Table 4.8 revealed that in terms of variable educational status of livestock producers of households head had positive marginal effects on food secure and mildly food insecure categories of food security about 5.8 % and 0.8 % points more likely to be food secure and mildly food insecure than a household headed by a person with no formal education with statistical significant ($p \leq 0.05$) respectively. On the other hand, negative marginal effects were obtained for each of the two food insecurity categories of moderately and severely food insecurity of household with statistical significance difference ($p \leq 0.05$). Similarly study done by Magana, *et al.*, (2016) in Mexico who used the food consumption as an indicator of food security to determine the factors influencing food security and the result found that households featuring a household head with a higher education level had better food security status.

The result in this study on table 4.8 revealed that the variable veterinary service to livestock producers household had negative marginal effect is 12 and 1.8 percent points less likely to be food secure and mildly food insecure respectively with statistical significant ($p \leq 0.05$). Veterinary service variable had positive marginal effects are 6.3 and 8.3 percent points more likely to be moderately and severely food insecure with statistical significance difference. This may be happened due to high cost of inputs and use of irrational veterinary medicine. As one of government officials explained that veterinary services and facilities found in the sub city are very limited. There is only one government veterinary clinic and five private clinics found in Akaki Kality sub city. As a result transport livestock to veterinary clinic become difficult, plus to that lack of awareness about the consequence of irrationally using of veterinary drugs by itself mean that owner of animals administered or prescribes drugs to their animals. Supported by Dessie, (2013) pointed out that veterinary services in Ethiopia are limited and farmers are generally unsatisfied with those that exist due to cost, quality, and range of available services.

According to World Bank, (2016) stated that use of antimicrobials in animal body irrationally (without proper diagnosis, too short or too low-dosing, use for prevention instead of cure, use for growth promotion and herd treatment instead of individual treatment); it exacerbates the natural phenomenon for microbes to develop Anti-Microbial Resistance (AMR) and this led to poor efficiency of antimicrobials in fighting livestock diseases and reduced productivity; it required

repetitive treatment, further diagnosis and cause economic loss. Based on this emergency AMR trend estimates indicated that the livestock production in low-income countries will be reduced by 4 to 10% the coming decades.

The result in this study regarding variable improved breed revealed that to livestock producer households had negative marginal effect is 8 percent points less likely to be food secure with statistical significant ($p \leq 0.05$). A household who had access to improved breed had positive marginal effects were 4 and 5 percent points more likely to be moderately and severely food insecure respectively with statistically significant (Table 4.8). As one of Akaki kality farmers and pastoral urban agriculture (government) officials explained about improved breed. There was a problem on luck of trained Artificial Insemination (AI) technician in Akaki Kality farmers and agricultural development office. This led livestock producers to find private service and may be found uncertified or untrained technician due to this reason urban livestock producer exposed on repetitive insemination; they may spent their time and money unnecessary.

Concerning access to credit variable on table 4.8 showed that livestock producer household had negative marginal effect are 8 and 1.2 percent points less likely to be food secure and food insecure household respectively. On the other hand access to credit had positive marginal effects are 4 and 5 percent more likely to be moderately and severely food insecure with p-value=0.04 and 0.04 respectively. Scholar like Tirivayi *et al.,* (2016) stated that the presence of constraints related to credit access for smallholder farmers and to alleviate agricultural interventions of establishing microcredit and microfinance institutions is needed. Study done by Aidoo *et al*., (2013) in rural Ghana using logistic regression model analysis revealed that access to credit had a positive influence on a household's food security.

Table 4. 8 Ordered logit model estimation results

Variables	**Food secure**		**Mildly food insecure**		**Moderately food insecure**		**Severely food insecure**	
	dy/dx	**P>z**	**dy/dx**	**P>z**	**dy/dx**	**P>z**	**dy/dx**	**P>z**
Age	.0044586	0.006	.000664	0.057	-.0022203	0.010	-.0029022	0.006
TLU	.0021179	0.005	.0003154	0.097	-.0010547	0.010	-.0013786	0.008
Total Livestock income	1.56e-07	0.000	2.32e-08	0.023	-7.45e-08	0.000	-1.01e-07	0.000
Household size	-.018896	0.004	-.0026604	0.059	.0092711	0.005	.0122859	0.006
Educational status	.0582804	0.000	.0086798	0.011	-.0290233	0.000	-.0379369	0.000
Veterinary service	-.127554	0.000	-.0189968	0.014	.0635211	0.000	.0830297	0.000
Improved breed	-.081584	0.022	-.0121505	0.097	.0406285	0.026	.0531064	0.026
Access credit	-.080948	0.039	-.0120558	0.120	.040312	0.041	.0526926	0.046

Source: Authors' own explanation from surveys, 2020

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusion

The aims of this study were to examine the factors that affect the food security status among urban livestock producer household in Akaki Kality Sub-city, Addis Ababa, Ethiopia. The study covered demographic and socioeconomic characteristics of livestock producer household in the study area. In addition, this study identified the relationship of some institutions like credit, improved breed, veterinary service, extension service and livestock production training on the development of urban livestock production in Akaki Kality sub city. The food security status of livestock producer's household in Akaki Kality sub city were performed using HFIAS measurement scale and the results revealed that about 29.77 %, 33.68 %, 23.76 % and 12.79 % of households were food secure, mildly food insecure, moderately food insecure and severely food insecure respectively. Determinants of food security status were determined by using ordered logistic regression model, urban livestock producers in the study area were significantly affected by age of household head, education status of household head, TLU, total livestock income, improved breed, veterinary service and access to credit. Among selected determinants age, TLU, Total livestock income and educational status variables were negatively significant difference ($p \leq 0.05$) to livestock producer's household to be food insecure but other determinants such as access to credit, veterinary service, improved breed and household size were positively significant difference ($p \leq 0.05$) to livestock producers household to be food insecure.

In this study urban livestock productions included were cattle (dairy and beef), poultry, bee, pig and goats and sheep those animals considered as food producing in Ethiopian cultural context. Livestock can be used as a source of food and income. The food security status of urban livestock producers in the study area were categorized mostly under food secure and mildly food insecure. To enhance the current urban livestock farming on production and productivity the concerned body should focused on the identified urban livestock production determinants and should take appropriate measurement. Livestock contribute a lot benefits not only to the livestock owners themselves but also to the general population in greater employment opportunities and food security via a source food, income generation and as a reserve bank to the ever-increasing urban population. The increased demand for livestock products in urban also an opportunities for livestock producers to increase their return. Hence, livestock keeping in various forms in urban is

a way of ensuring household food security, income generation and generally a way out urban poor households from poverty.

5.2 Recommendations

Based on the findings of the study the following recommendations are forwarded in order to improve further smallholder livestock producer household food security in the study area.

- Development strategies and programs related with food security through urban agricultural production should think about the importance of livestock production. Hence, the governmental and non- governmental organization should expand access of urban small holder livestock production to households in poverty reduction and to improve their food security.
- The government and non-governmental organization ought to pursue policies that could lead to improve indigenous livestock breeds and quality veterinary service to enhance small scale urban production of livestock and among other interventions that will lead to the development of the livestock sub sector.
- The government and non-governmental organization should train AI professionals to provide quality, effective and efficient service for livestock producers.
- Government should also promote integration of crossbred livestock into the smallholder sector to enhance livestock performance linked with environmental adaptability and disease resistance.
- Micro finance and farmers and urban agriculture development office should work in coordination to improve production and productivity of urban livestock producer.
- Young generation who are participating in urban livestock production should integrated technology and knowledge of indigenous from experienced livestock producer to enhance productivity.
- Researchers should do their research on urban livestock producer education included more variables representing knowledge acquisition other than the level of household head education in the survey and analysis.
- Further studies needed about contribution of urban livestock production for job creation, nutrition security and availability to urban dwell.

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APPENDICES

Household Survey Questionnaire

Dear participant! My name is Tesfaye Bejiga. I'm working my Master's thesis in Addis Ababa University. I am conducting household survey to study the food security status of smallholder livestock producer to the selected sub city which is Akaki-kality sub city. Collect the required data is helped to accomplish the intended thesis. Due to this the following questionnaires provided so I would like to ask you questions about your household and I expect your respond will be genuine for each question with respect to your household activities. I guaranteed you all your response and the results obtained will be kept confidentially.

Are you willing to fill this questioner?

Yes_____ (continue) No _____ (Thank you and stop)

Name of the enumerator _____ Date _____

Sub-city _____ Woreda _____ Kebele _____

Survey HH No _____

Respondent: A. Head of the Household B. Other, (specify relation to HHH)_____

Part I Demographic and socio-economic characteristics of household

No	Questions		Code
1.	**Sex of household head:** 1. Male 2. Female		
2.	**Age of household head in years**		
3.	**Education status of household head**: 1. Illiterate 2. Read and write 3. Religious school 4. Basic/Adult education 5. Elementary school (1-4) 6. Secondary school (5-8) 7. High school (9-10) 8. Preparatory (11-12) 9. Other, specify		
4.	**Family size**		
4.1.	Number of family members in the household	1. Male	
		2. Female	
		3. Total	

4.2.	Number of adults with the age of greater than 15 years lived in household	1. Male	
		2. Female	
		3. Total	
4.3.	Number of children with age of less than 15 years with in household	1. Male	
		2. Female	
		3. Total	
4.	What type of house do you live? 1. Own House 2. Private rented 3. Kebele rented		
5.	Marital Status: 1. Single 2. Married 3. Divorced 4. Widowed		
6.	Main occupation of the household head: 1. Livestock production 2. Formal employment 3. Crop production 4. Private business 5. Retired		
7.	When did you start to participate on urban agriculture? (in yrs) ----------		
8.	Do you have access to credit? 1. Yes 2. No		

9. Do you have extension contact?

List of extension service		Please rank the prospects as per the following scale					
	Yes (1)/ No (2)	Daily (6)	Weekly (5)	Monthly (4)	Quarterly (3)	Six month (2)	Yearly (1)
Training on livestock production							
Veterinary service							
Improved breed/AI							

Part II: Livestock- production related information

1. Source of animal feed: 1. Grazing 2. Formulated feed from factory 3. Hay
2. Total number of livestock raring within the household.
   1. Less than and equal to two 2. Between three and five 3. Within range of five to ten
   4. Between eleven and fifty poultry 5. Between 51 and 100 6. More than 101
3. Type of animal production engaged with in livestock producer household

S.N	Type	Do you own? 1)Yes 0) No	If yes, tell us the number you owned.
1.	dairy production		
2.	poultry production		
3.	fattening (cattle or sheep)		
4.	Bee keeping		
5.	Pig-production.		

4. Reasons for Households Engagement in livestock production
    1. Low Income Earnings/Create income source
    2. Lack of Employment Opportunities/ Create job opportunities
    3. Low Food Supply/ Contribute to food security
    4. Interest
    5. Presence of suitable infrastructure
5. Livestock raring household`s total amount of productivity per day/week/month/year per product in litter/kg

S.N o	Type	Measurement	Amount Produced	Amount consumed at home	Amount sold to market		Total income obtained
					Unit Price	Total sold	
1.	Milk	lit					
2.	Butter (Kibe)	kg					
3.	Cottage Cheese(ayb)	kg					
4.	Sure Milk(Ergo)	kg					
5.	Three month chicken	Number					
6.	Meat chicken	Number					
7.	Egg	Number					
8.	45 day chicken	Number					
9.	Beef cattle	Number					
10.	Mutton/ sheep and goat	Number					
11.	Honey	Kg					
12.	Swine	Number					
13.	Cow dung /chicken urine	Quintal					

Part II. Food Security Measurement questions

Household Food Insecurity Access Scale (HFIAS) Measurement Tool

NO	QUESTION	RESPONSE OPTIONS	CODE
1.	In the past four weeks, did you worry that your household would not have enough food?	0 = No (skip to Q2) 1=Yes	
1.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
2.	In the past four weeks were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	0 = No (skip to Q3) 1=Yes	
2.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
3.	In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?	0 = No (skip to Q4) 1=Yes	
3.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
4.	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	0 = No (skip to Q5) 1=Yes	
4.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
5	In the past four weeks, did you or any household member have to eat a smaller	0 = No (skip to Q6) 1=Yes	

	meal than you felt you needed because there was not enough food?		
5.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
6	In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?	0 = No (skip to Q8) 1=Yes	
6.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
7	In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?	0 = No (skip to Q7) 1=Yes	
7.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
8	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?	0 = No (skip to Q9) 1=Yes	
8.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
9	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?	0 = No (questionnaire is finished) 1 = Yes	
9.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	

Checklist for Key informants

Checklist for interview with urban agricultural administrative office

1. How is the extent of urban farming particularly livestock production in this sub-city?
2. Is there any policy on urban agriculture? How do you see the policy towards encouraging small-scale farmers to participate in urban livestock production?
3. What type of livestock production are common and which livestock are commonly produced in this sub-city? Start with the most important.
4. What problems do the livestock producers face?
5. What are the possible opportunities of participating in livestock production for small-holder farmers?
6. What kind of support did you provided to household to enhance the profitability and sustainability of livestock production?

Checklist for interview with Government extension office

1. How is the extent of urban farming particularly livestock production in this sub-city?
2. What type of households is participating in urban livestock production? (Wealth status, education level, farming experience, etc.)
3. What type of livestock production are common and which livestock are commonly produced in this sub-city? Start with the most important.
4. What are the main uses of livestock in this sub-city? Start with the most important.
5. What problems do the livestock producers face?
6. What are the possible opportunities of participating in livestock production for small-holder farmers?
7. What kind of extension service are provided to smallholder livestock producers