# Assessment on Management Practices and Comparative Study on Egg Production and Egg Quality Parameters of Sasso and Local Chicken Breeds in Aleta Chuko Woreda, Sidama Zone, Southern Ethiopia

BY

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A THESIS SUBMITTED TO THE

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## APPROVAL SHEET I

SCHOOL OF GRADUATE STUDIES, HAWASSA UNIVERSITY

This is to certify that the thesis entitled as: **'Assessment on Management Practices and Comparative Study on Egg Production and Egg Quality Parameters of Sasso and Local Chicken Breeds in Aleta Chuko Woreda, Sidama Zone, Southern Ethiopia'** is submitted in partial fulfilment of the requirements for the degree of Master of Science in Animal and Range sciences with a Specialization of **Animal Production** of the Graduate Program of the School of Animal and Range sciences, Hawassa College of Agriculture, and is a record of original research carriedout by **Ayele Rodamo Bacho** ID. No PGAPr/005/10 under our supervision, and no part of the thesis has been submitted for any other degree or diploma.

The assistance and the help received during the course of this investigation have been duly acknowledged. Therefore we recommend that it will be accepted as fulfilling these requirements.

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| Co-Advisor: | Dr Sandip Banerjee | _____ | _____ |
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**APPROVAL SHEET II**

SCHOOL OF GRADUATE STUDIES, HAWASSA UNIVERSITY

We, the undersigned, members of the board of examiners of the final open defense by Ayele Rodamo have read and evaluate his thesis entitled, 'Assessment on Management Practices and Comparative Study on Egg Production and Egg Quality Parameters of Sasso and Local Chicken Breeds in Aleta Chuko Woreda, Sidama Zone, Southern Ethiopia' and have examined the candidate. This is, therefore, to certify that the thesis has been accepted in partial fulfillment of the requirements for the degree of Master of Science in Animal and Range Sciences (specialization Animal Production).

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## DEDICATION

I dedicate this piece of manuscript to my beloved mother Dambowe Burako (Dararo) for nursing me with affection, love and prayers in the success of my life, who passed away on April, 2019 without seeing any of my achievements.

## DECLERATION/ STATEMENT OF THE AUTHOR

I declare that this thesis is my original work and that all sources of material that are used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for an MSc degree at Hawassa University and is deposited at the university library to be made available to borrowers under rules of the library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the awards of any academic degree, diploma or certificate.

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School: Animal and Range Sciences, School of Graduate Studies

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## Abbreviations and Acronyms

| | |
|---|---|
| ANOVA | Analysis of variance |
| CSA | Central Statistics Agency |
| DAs | Development Agents |
| EL | Egg Length |
| ESI | Egg Shape Index |
| EST | Egg Shell Thickness |
| EW | Egg Weight |
| FGD | Focus Group Discussions |
| GDP | Gross Domestic Product |
| HU | Haugh Unit |
| NCD | Newcastle Disease |
| ND | Newcastle Disease |
| SD | Standard Deviation |
| SI | Shape index |
| SPSS | Statistical Package for the Social Sciences |
| YC | Yolk Color |

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**Assessment on Management Practices and Comparative Study on Egg Production and Egg Quality Parameters of Sasso and Local Chicken breeds in Aleta Chuko Woreda, Sidama Zone, Southern Ethiopia**

By

Ayele Rodamo

Major Advisor: Aberra Melesse (Prof.)

Co- advisor: Sandip Banerjee (Dr)

## *ABSTRACT*

*The study was conducted in midland and lowland agroecologies of Aleta Chuko Woreda with the aim of assessing chicken management practices and compares egg production and egg quality parameters of the newly introduced Sasso chicken breed and that of local chicken. A total of 174 households rearing indigenous and Sasso chicken for at least three years were selected for the survey work based on systematic random sampling method. Three hundred eggs from the two agroecologies, (150 eggs from each agroecology, 75 eggs each from Sasso and local chicken from one agroecology) were collected from 6 Kebeles (3 Kebeles in one agroecology) and tested in Hawassa University poultry laboratory for its external and internal quality traits. Two-way ANOVA was used to evaluate the effects of the two breeds and the two agroecologies using SPSS version 20. From the respondents, 21.8% of the sampled households were female headed. The average number of chickens per households was 4.3. The current chicken breed composition in the study woreda was 62%, and 38% of local and Sasso respectively. The average age of local and Sasso chicken at first egg laying was* 7.18*and* 5.14*months of age, respectively. The average number of clutches per hen per year for local and Sasso chickens were 4.06 and* 7.8*, respectively. About 86.2% of the respondents from Sasso chicken rearers and 77% from local chicken rearers had experience of culling non-productive chicken from their flock, with 79.3% of the culling Sasso chicken was caused due to sickness and 65.5% of the culling local chicken was caused by poor productivity. The overall means for egg production per hen per year for local and Sasso chicken was* 52.74*and* 161.4*, respectively. From this work, it is recommended that regular training must be given on management practices of the chicken and government should support on disease treatment mechanisms and vaccination of chickens.*

**Keywords:** *Sasso chicken, Local chicken, egg quality, Agroecology*

# 1. INTRODUCTION

## 1.1. Background

Poultry production has an important economic, social and cultural benefit and plays a significant role in family nutrition in the developing countries (FAO, 2013). In many of the tropical countries, poultry farming is primordially based on the scavenging production systems where the chickens are allowed to fend for themselves at the backyard of the rearers. In this system they are rarely provided with supplementary feeds and medicaments, and yet under such adverse circumstances they produce a few eggs and gain some weight (Solomon, 2007). In spite of all these adversities in chicken husbandry practices, they still contribute significantly to the household income for their rearers (Salam, 2005). The products from chicken husbandry also contribute significantly to the overall nutrition of the rearers and create direct and indirect employment to several people across the value chain (Alemu *et al*.2009). In Ethiopia, the total population of the chickens was estimated to be 60 million, with about 94% of them being native ecotypes (CSA (2016/17).

Exotic chicken breeds were introduced in the country in the mid 1950's by the missionaries and over the years the government organizations established several poultry multiplication centers across different parts of the country with an aim of distributing the improved genotypes in the rural areas and thereby improving the livelihood of the rearers (Tadelle, 2011). However, their overall contribution was far below the expectation, which may be grossly ascribed to the mismatch with the prevailing husbandry practices and also that many of the breeds could not adapt to the prevailing agroclimate (Permin, 2008, Hailu et al, 2012). This may further be ascribed to the fact that all the package and practices associated with the husbandry of the introduced breeds were rarely followed and this was mostly based on the top

down approach without any assessment of their adaptation to the environment where they are expected to perform (Hailu et al, 2012). Traditional or backyard system of poultry management are prevalent in the country. However exotic birds require specialized management which is rarely affordable and provided by the beneficiaries (Hailu et al, 2012). The quality and quantity of the feed available too vary across the country, and also across the seasons in a particular location (Dessie et al., 2013; Mazengia et al., 2012). Poor and unbalanced nutrition grossly affects the growth of the chickens and consecutively compromises the production and reproduction parameters (Karcher, 2009). Lack of feed also glaringly influences the immunological status of the birds and this further leads to lowering their productivity and also leads to increase in mortality (Kidd *et al.*, 2001).

Thus, it becomes imperative to understand the pros and cons prior to introduction of an exotic breed under a particular production system (FAO, 2010, Teklewold *et al*., 2006). However, such studies are rarely carried out especially under on farm management conditions. Therefore the study was carried out with the following objectives.

## 1.2. Objectives of the study

### 1.2.1. General objective

- To assess the chicken husbandry practices and egg production of Sasso and local chicken in some selected kebeles of Aleta Chuko Woreda, Sidama zone.

### 1.2.2. Specific objectives

- To compare egg production performances and egg quality of Sasso and native chicken under village production system
- To compare some external and internal egg quality parameters from Sasso with those of native chickens under on-farm conditions

## 1.3. Significance of the Study

Rearing of chickens provide direct or indirect employment to many people of the country. It is also the most widely reared avian species globally (Sluis, 2007). This can be ascribed to their adaptability in various environment and more people are directly involved in chicken production throughout the world than in any other single agricultural enterprise and the impact of village chicken in the national economy of developing countries and its role in improving the nutritional status, income, food security and livelihood of many farmers and smallholders are significant owing to its low cost of production (Gondwe, 2004; Abdelqader *et al*, 2007; Abubakar *et al*., 2007).

According to Moreki *et al*. (2001), family chicken help in supplementing the livelihood for the family. Chicken serve as a source of protein during the cultural festivities and religious ceremonies (Gueye, 2003). Village chicken also play a role of converting household leftovers, wastes and insects into valuable and high quality protein (Doviet, 2005).

Chicken have several advantages over ruminant as they have relatively short generation interval, require less spare and have easier husbandry practices. This is besides the fact that the income can be relatively regular (in form of eggs) and are easier to sell (Muchenje *et al*., 2000). However, in spite of many benefits the potential of the chickens in the country are rarely achieved, this is basically due to suboptimal management, lack of supplementary feed, traditionally the selection objectives were aimed towards adaptation and production came through the numbers reared. The chickens also suffer from lack of nutrients thereby compromising with their immunity, this leads to large scale deaths among the chickens and this too from many vaccine preventable diseases (Aberra and Tegene, 2009). Traditional chicken production system is part of a balanced farming system, plays an important role in the supply of high quality protein to the family food balance, and provides small disposable cash income in addition to the socio-religious functions important in the rural people's lives.

# 2. LITERATURE REVIEW

## 2.1. Poultry Production System in Ethiopia

Animal production in general and chicken production in particular play an important roles in the socioeconomic and at many places the cultural structure of the respondents rearing them (Fisseha, 2009). The term poultry encompasses several species of domesticated avines while in the Ethiopian context, it is solely correlated with the term “chickens" (Tadelle *et al*., 2001). Most of the chickens reared in the country are raised under traditional backyard management with small numbers of chickens per households (Tadelle and Ogle, 2001). However, over the years several small scale poultry farms have sprung up in the urban and per urban areas as small scale business ventures (Alemu *et al*., (2009). These business ventures help in easing the unemployment problems to a certain extent but also help in better accessibility of eggs and meat for the consumers (Alganesh et al., (2003), Bogale (2008). Chicken farming requires relatively less inputs (when compared to those of other farm animals) and at least few chickens can be reared in a small farm with only the basic inputs (Tadelle et al. 2003a). However, the inputs can be quite expensive based on the finance available to the rearers (Sonaiya, 2000). The small scale chicken farms hardly require any expensive inputs and are gender friendly (Gueye, 2003).

Traditionally, the feed resources for the native chickens raised under the scavenging management are seeds and insects besides food leftovers from the homestead (Tadelle and Ogle, 1996; Solomon, 2004, Aklilu *et al.*, 2007). The native chickens are good at scavenging and evading the predators when compared to those of exotic (introduced) chickens (Doviet, 2005, Sonaiya, 1997). The scavenged feed at times may be just enough to keep the native

chickens alive, however the quantity is in most of the times not enough for the exotic chickens to stay alive let alone to exhibit their genetic potential (Haftu, 2016).

This along with poor veterinary care and lack of regular vaccinations make the chickens vulnerable to various diseases which can either be acute or chronic and thereby leading to mass deaths and those which survive require long time to recapitulate back their health (Aberra, 2007). This may be the reason why in spite of large numbers of chickens, their contribution is far below their numbers (Gausi *et al. (*2004)

## 2.2. Production and reproduction performances of village chicken in Africa

The productivity of village chicken production systems in general and the free range system in particular is far below expectation (Moges et al., 2010a). Average egg production in different parts of Ethiopia and Africa on local scavenging hen is presented in Table 1 below.

According to Sonaiya et al. (1998), Aini (1990) and Gueye (2000), the annual egg production/hen of local hens in village conditions ranged from 20 to 100 eggs; with an average egg weight range of 30 to 50 gm. According to Gueye (2000), the adult male and female weight of African village chicken ranges from 1.2 to 3.2 kg and from 0.7 to 2.1 kg, respectively.

**Table 1: Egg production of local hens in different locations of Africa**

| SNo | Trait | Genotype | Location | Range | Mean±SD | Reference |
|---|---|---|---|---|---|---|
| 1 | No of eggs laid/hen/year | Local | Ethiopia | 36-40 | 38±2 | Tadelle *et al*. 2000; FAO 2004 |
| 2 | Ave egg wt. | Local | Arsi, Ethiopia | | 38gm | Brannang and Persson 1990 |
| 3 | Ave no of eggs/hen/clutch | Local | Burkina Faso | | 12 | Kondombo 2005 |
| | | Local | Guinea | 12-18 | 15±3 | Gueye (1998) |
| | | Local | Guinea | | 10 | Mourad et al. (1997) |
| | | Local | Mali | | 9 | Kuit et al. (1986) |
| | | Local | Sudan | | 12 | Khalafalla et al (2001) |
| | | Local | North-West Ethiopia | 9-19 | 14±5 | Halima (2007) |
| 4 | Ave no of clutches/hen/yr. | | Sudan | 2-3 | 2.5±0.5 | Halima (2007) |
| 5 | Annual egg production/hen | Local | Ethiopia | 20-100 | 60±40 | Sonaiya et al (1998),Gueye(2000) |
| 6 | Average egg wt | Local | Ethiopia | 30-50 | 40±10 | |
| 7 | Adult male and female weight, respectively(kg) | Local | Ethiopia | | 1.2 to 3.2 and 0.7 to 2.1 | Gueye,2000 |

## 2.3. Indigenous Chicken Production in Ethiopia

In many developing countries, chicken production is based mainly on traditional extensive production systems with local chicken ecotypes and low purchased-inputs (Gueye, 1998, 2000 and Garcia, 2007). The extensive chicken production system in Africa, where birds are kept on free range, is different from the more recent extensive free range system coming up in developed countries, due to the hot chicken welfare issues (Fisseha *et al*., 2010a). In most part of Ethiopia, village chicken represents a significant component of the rural household livelihood as a source of cash income and nutrition. The birds scavenge in the vicinity of the homestead during daytime where they may be given cereal grains, cereal bran, broken grains and other house waste products as supplementary feed (Aklilu et al., 2007). The number of chicken flocks per household of most Ethiopian rural community is small in number and containing birds from each age group with an average of 7-10 mature birds, consisting of 2-4 adult hens, a male bird (cock) and a number of growers of various ages (Tadelle and Ogle, 1996).

The importance of village poultry production in the national economy of developing countries and its role in improving the nutritional status and incomes of many small farmers and landless communities has been recognized by various scholars and rural development agencies for the last few decades (Abera and Tegene, 2009; Fisseha *et al*., 2010a). Gueye (1998) indicated some advantages of village chicken production such as the special meat and egg quality/flavor, hard egg shells and especially low cost with little special care required for production. The indigenous chicken always fetches better price than exotics because of its taste and flavor. Ethiopia has a wealth of indigenous chicken genetic resources with unique meat and/or egg qualities, a low susceptibility to stress and other useful characteristics. Considerable variation

in genetic and morphology of indigenous chickens in Ethiopia is potential resource for improvements (Mammo and Tsega, 2011). Village based chicken production requires less space and investment and can therefore play an important role in improving the livelihood of the poor village family (Samson and Endalew, 2010).

Poultry production is affected by factors such as breed and strain of chicken used, environmental conditions in poultry house, management practices and feed and feeding management (Bell and Weaver, 2002). The low productivity of the local scavenging hens is not only because they are low producers of small sized eggs and slow growers but also the system is characterized by high chick mortality before they reach around 8 weeks of age. Moreover, the local chickens are the results of uncontrolled breeding between various local chicken ecotypes, which have not been selected by systematic breeding methods.

Comparatively little research and development work has been carried out on village chickens, despite the fact that they are more numerous than commercial chickens. Even though, some research has been done in the area of breed evaluation and supplementary feeding (Aberra, 2000; Negussie 2003; Tadelle and Ogle, 2001), these studies are not tangible enough to show the relative effect of genetic and non-genetic factors on the performance of the local chickens (Halima, 2007). Improving the poultry productivity would improve protein nutrition and could increase the income levels of the rural population. In addition, consumers prefer meat from indigenous chickens, because of its leanness. They also like the multi colored plumage of these birds. The productivity of indigenous chickens can be improved by providing appropriate housing, disease control and good nutrition (Ndegwa and Kimani, 1997).

## 2.4 Introduction of Exotic Chicken Breeds in Ethiopia

The most important thing is the introduction of exotic breed of chicken (Tamirat D. 2015). Even if there is no record or evidence indicating the exact time and locations of introduction of the first batch of exotic breeds of chickens into the country for genetic improvement, it is widely believed that the importation of exotic breeds of chicken goes back to the early 1950s (Avery A. 2004). It has been reported that many exotic breeds of chicken (White and brown Leghorns, Rhode Island Red, Bovans, New Hampshire, Cornish, Australorp and Light Sussex) were introduced over the past years. The most important inputs have been the introduction of improved (exotic) breed, improved feed, vaccine and medicaments and credit aiming at increased productivity (Tamir S. *et al* (2015).

Most of the urban and Peri-urban community keeps indigenous breeds because they are well adapted to the current environmental condition. The egg laying period and number of eggs laid per period are to some extent higher in urban than in rural areas. The carcass weight of local chickens at 6 months of age was 559g which was significantly lower than that of the 875g found for Leghorn but higher in dressing percentage than exotic chickens (Fessiha M. *et al* ,2010). Though productivity of the local chicken breed was reported to be low these chickens can survive well with low input and the taste of their eggs and meats is flavorful (USAID , 2012) Therefore, breed improvement and subsequent proper utilization of these local chicken genotypes strongly demands comprehensive characterization including, production system and breeding practice.

### 2.3.2.1. Productive performance of improved chickens

Poultry production is affected by factors such as breed and strain of chicken used, environmental conditions in poultry house, management practices and feed and feeding

management (Bell and Weaver, 2002). The knowledge of performance of economic traits in chicken is important for the formulation of breeding plans for further improvement in production traits. Growth and production traits of a bird indicate its genetic constitution and adaptation with respect to the specific environment (Ahmed and Singh, 2007).

The laying cycle of a chicken flock usually covers a span of about 12 months. Egg production begins when the birds reach about 18-22 weeks of age, depending on the breed and season. Flock production rises sharply and reaches a peak of about 90%, 6-8 weeks later of production then gradually declines to about 65% after 12 months of lay. There are many factors that can adversely affect egg production. Unraveling the cause of a sudden drop in egg production requires a thorough investigation into the history of the flock. Egg production can be affected by feed consumption (quality and quantity), water intake, intensity and duration of light received, parasite infestation, diseases, management and environmental factors (http://edis.ifas.ufl.edu, 2017)

## 2.4. Origin, characteristics, strains and performance of Sasso chicken

Sasso is a commercial breed originated from France. It is also a dual-purpose chicken. One of the most popular chickens used for local chicken in Africa, T451 strain of Sasso (female SA51 and male T44) is producing more than 240 eggs per year with average growth rate of 2.2 kg in 84 days. There are also other Sasso strains among these colored rooster T44 and T55. T44 is characterized by a slow growing colored rooster, red feathers, yellow shanks and feet. T55 is also characterized by red plumage and white skin, shanks and feet. Both breeds were ideal for traditional breeding, adapted for outdoor production, excellent viability, easy to manage, very hardy and superior quality meat. It weighs 2516 g in males and 2030 g in female at 12 weeks

of age (http://www.sasso.fr/sasso-village-chicken-africa-broilers-dual-purposebreeders.html, 2018).

According to Aman *et al*. (2017) research conducted in Wolaita zone and Kembata Tembaro zone, it was shown that the average number of eggs laid/year/bird of Sasso chickens was 229 and average age at first laying was 4.8 months. Body weight of male Sasso chicken at sexual maturity was 2.9kg and the weight of female chicken of the same breed at the age of greater than 20 weeks was 2.7kg. Mortality recorded at farmers level from 45 days to age of production was 25%. The mortality could be attributed to predators and poor management conditions (feeding, housing and sanitation).

According to Serkalem *et al*. (2018), the annual egg production performance, age at first egg laying, number of eggs/clutch and length of clutch of Sasso chicken were 137 eggs, 162 days, 26 eggs and 30 days, respectively, in midland agroecology at Sidama zone of southern Ethiopia.

## 2.5. Flock Composition

Flock structure is described in terms of proportion of the different sex and age groups in the flock. According to Meseret (2010), the mean flock size per household was 6.23 chickens, the mean number obtained in this study was comparable to the reported mean flock size of 7-10 and 5-10 chickens/household from the central highlands of Ethiopia and Africa (Tadelle and Ogle (1996) and Sonaiya (1990), respectively). In contrast, the mean flock size recorded in this study was lower than the mean flock size of 8.8 and 9.2 chickens per household reported by Asefa (2007) for Hawassa Zuria and by Mekonnen (2007) for Dale district in Ethiopia, respectively.

Findings of several studies indicated that the average of flock size per household was 7.13 chicken and flock size varies between seasons mainly due to availability of feed, the occurrences of diseases, the presence of predators as well as the economic status of the owners in Northwestern Ethiopia (Halima, 2007); 6.2 chicken in Gomma Woreda of Jimma zone (Meseret, 2010) and 13.1, 12.4 and 9.22 in Burie, Fogera and Dale district, respectively (Fesseha *et al*., 2010). The indigenous, Exotic and crossbreed chicken flock size per house hold were 22.83, 0.96 and 1.57, respectively in the Western zone of Tigray region (Shishay, 2014). The general indication is that the national average flock size reported from Ethiopia (4.1) is significantly lower than that reported from other developing countries such as Philippines (19), Uganda (18) and Sudan (22) (Eugene, 2004; Khalafalla *et al.*, 2000 and Sewannyana *et al*., 2004), respectively. The flock size variation and lower flock size in rural areas has been attributing to the farming systems practiced and prevalence of local factors such as diseases and predators (Kuit *et al.*, 1986).

**Table 2: Average flock size in different locations**

| SNo | Ave. flock size/HH | Genotype | Locations | References |
|---|---|---|---|---|
| 1 | 7.13 | | Northwest, Ethiopia | Halima,2007 |
| 2 | 6.2 | | Gomma woreda, | Meseret,2010 |
| 3 | 13.1, 12.4, 9.22, respectively | | Burie, Fogera, Dale woredas, Ethiopia | Fisseha et al 2010 |
| 4 | 22.83, 0.96, 1.57, respectively | Indigenous, exotic, cross | Western Tigray | Shishay, 2014 |
| 5 | 4.1, 19, 18, 22, respectively | | Ethiopia, Philippines, Uganda, Sudan | Eugene,2004, Khalafalla *et al.*, 2000,and Sewannyana *et al*., 2004 |

## 2.6. Feeding and Feed Resources

Family poultry production in Africa survives by scavenging and generally, no supplements provided except that sometimes, household wastes fed to the birds and other circumstances the diet supplemented with grain (Dwinger *et al.*, 2003). Similarly, in Ethiopia the smallholder chicken production system is characterized by keeping under free range system and the major feed sources are believed to be insect worms, seed and plant materials (Tadelle and Ogle, 1996; Solomon, 2004).

There is no purposeful feeding of rural household chickens in Ethiopia and the scavenging feed resource is almost the only source of feed. Asefa (2007) and Mekonnen (2007) reported 95 -98% of the small scale household poultry producers in Hawassa Zuria and Dale offer supplementary feeding to their chickens. The scavenging feed resource in Gomma woreda consists of insect, grass, enset (*Ensete ventricosum*), kitchen wastes, and harvest leftovers indicating that the village chicken production system is friendly with the environment (Meseret,2010).

## 2.7. Housing

Lack of housing is one of the constraints of the smallholder poultry production systems. In some African countries, a large proportion of village poultry mortality accounted due to night-time predators because of lack of proper housing (Dwinger *et al*., 2003). Some research works also indicated that the mortality of scavenging birds reduced by improved housing. For instance, in the Gambia livestock improvement program, which included improved poultry housing resulted in lower chick mortality (19%) relative to that observed in Ethiopia (66%) and Tanzania (33%), where no housing improvements were made (Kitalyi, 1998).

The finding of the survey carried out in village of Bangladesh by Billah *et al*, (2013) indicate that poultry rearing and management practices were not satisfactory. Approximately 30% of farmers kept poultry in their village house, 46% in the earthen houses, 10% wooden house/shed, 8% wooden house or bamboo house and 6% concrete house. According to Nyoni and Mssika (2012), different forms of housing structure were provided for the chickens (96.7%) but 3% of chicken were roosted overnight in open space in Amatola Basin in Eastern Cape province of South Africa. Chicken house were constructed using wide range of materials. All structure was roofed with iron sheets. 8.6% of the structure had solid walls, 14.8% had been wire mesh and 76.5% had a combination of iron sheet and wire mesh (Nyoni and Mssika (2012).

## 2.8. Egg production

Average annual egg production of indigenous chicken ecotype under extensive management condition was 30-60 eggs, this could be improved to 80-100 eggs on station with improved management (feeding, housing and health care) (Nigussie & Ogle, 2000). The annual egg production performance of local hen under farmers' management conditions was found to be 60egg/hen ranging from 24-112egg in Bure district North West Ethiopia (Fisseha, 2009). Meseret (2010) also reported that the mean annual egg production of the indigenous local hens of Gomma district was 43.8 egg/year/hen, which is comparable result to the reported ranges of 18-57 eggs in North West Ethiopia by Halima (2007) and 27-45 egg/year/hen in Changni town, Awi administrative zones of Amhara region by Ayalew & Adane (2013) but are lesser than the means of 60 eggs, 53 eggs and 55 eggs reported by Fesseha *et al*. (2010) in Bure, Fogera and Dale district of Ethiopia, respectively. The finding of another study revealed that average annual eggs/year/hen is 62.95, 54.9 and 51.44 in Wonsho, Loka and Dale Woreda of

Southern Ethiopia respectively (Mekonnen, 2007). Another recent study's result revealed that the average eggs laid per year per hen under farmers' management condition was 65 eggs in Enebsei Sar Midir Woreda of Eastern Gojjam (Yitbarek & Zewudu, 2013). These are summarized in Table 4 below.

**Table 3: Average annual egg production of indigenous chicken**

| SNo | Average egg production | Management type | Location/Ethiopia | References |
|---|---|---|---|---|
| 1 | 30-40 eggs | Extensive | Ethiopia | Nigussie and Ogle,2000 |
| 2 | 80-100 eggs | Improved | | |
| 3 | 60eggs | Extensive | Bure district | Fisseha, 2009 |
| 4 | 43.8 eggs | Extensive | Gomma district | Meseret,2010 |
| 5 | 18-57 eggs | Extensive | North West | Halima,2007 |
| 6 | 27-45 egg | Extensive | Changni town, | Ayalew&Adane,2013 |
| 7 | 60,53&55,respectively | Extensive | Bure, Fogera, Dale | Fesseha *et al*, 2010 |
| 8 | 62.95,54.9,51.44,resp. | Extensive | Wonsho, Loka, Dale | Mekonnen,2007 |
| 9 | 65 eggs | Extensive | Enebsei Sar Midir | Yitbarek&Zewudu,2013 |

## 2.9. Egg quality

It is generally agreed that all characteristics of egg quality have a genetic basis. Egg quality is the most important price contributing factor in table and hatching eggs. Quality of chicken eggs may vary due to several factors like rearing, temperature, relative humidity and season. Therefore, the economic success of a laying flock solely depends on the total number of quality eggs produced. Egg is one of the most essential cheap sources of protein in human diet all across the globe. Egg quality is composed of those characteristics of an egg that affect its

acceptability to consumers such as cleanliness, freshness, egg weight, shell quality, yolk index, albumen index, Haugh unit and chemical composition (Song *et al.,* 2000). Quality of an egg ascertains the success of a poultry business because it is associated with the acceptability among the consumers (Rajkumar *et al.,* 2009).

### 2.9.1. External Egg quality

The external quality of the egg is determined by features such as the size and shape of the egg as well as the structure, thickness and strength of the shell (Bain, 2005). External factors including cleanliness, freshness, egg weight and shell weight are important in consumer's acceptability of shell eggs (Adeogun and Amole, 2004; Dudusola, 2010).

**Egg Weight (EW)** is a very simple measurement to collect and therefore is frequently analyzed simply by placing an unbroken egg on a scale and recording the value (Zeidler, 2002). Genetics and environment greatly influence egg weight (Scott and Silversides, 2001). Egg weight is also one of the important phenotypic traits that influence egg quality and reproductive fitness of the chicken parents (Islam *et al.,* 2001; Farooq *et al.,* 2001). Anderson, (2002) provided detailed information on the differences in egg production and quality between different white and brown egg strains and reported the egg weight from brown hens (61.1g) was more than that of white hens (58.3g). (Tixier Boichard *et al.,* 2006) recorded weight of 42.8 g for Fayoumi eggs.

Higher weight of egg from commercial strains is not a surprise since such strains submitted to important breeding pressure for egg weight improvement (Hocking et al., 2003). Further, under smallholder farmers condition in northern Ethiopia, egg weight was recorded as 52.5g,

52.1g and 43 g for Rhode Island Red, White Leghorn and Fayoumi, respectively (Lemlem and Tesfaye, 2010).

**Table 4: Average egg weight in different breeds**

| SNo | Average weight | Breed | Location | References |
|---|---|---|---|---|
| 1 | 61.1g | Brown strains | | Anderson,2002 |
| 2 | 58.3g | White strains | | |
| 3 | 42.8g | Fayoumi | | Tixier Boichard *et al.*,2006 |
| 4 | 52.5, 52.1 and 43g respectively, | Rhode Island Red, White Leghorn and Fayoumi | Northern Ethiopia | Lemlem& Tesfaye,2010 |

**Eggshell color** has always received more attention from the consumer than it deserves. Eggshell color does give an indication of the breeding history of the hen. White eggs are produced commercially by lines derived principally from the White Leghorn breed, whereas brown eggs are produced by hens derived from a number of dual-purpose breeds (Silversides, 2000).

**Egg Shape Index (ESI)** is a measurement of the overall shape of an egg. The 3 shapes most prevalent in production are classified as sharp (SI of < 72), normal (SI of 72-76), and round (SI >76). Egg shape is important in commercial systems, as shapes outside the normal range do not fit well into pre-made packaging. Also, sharp eggs are not as resistant to the shipping and handling processes, as are their normal counterparts (Altuntas and Sekeroglu, 2007). To calculate shape index, the egg width and egg length of the egg are measured in mm using

calipers. The egg width is then divided by the egg length and that ratio multiplied by 100 (van den Brand *et al.,* 2004).

Since SI is important for commercial industry, when considering pre-made packaging, normal shaped eggs are ideal for fitting into containers. Normal shaped eggs also provide more strength to the eggshell, compared to sharp eggs, making them more resistant to breakage during shipping and handling (Altuntas and Sekeroglu, 2007). Additionally, uniformity in egg shape is important, as the market for further processed eggs continues to grow. The efficiency of this market is based on the use of automatic breakers, and conformity in egg shape to the characteristics of this machinery is essential.

**Eggshell Thickness and Color (EST):** The egg shell quality is given through the weight and the percentage of shell thickness and the strength. The differences in eggshell quality depend on the environmental conditions and the feed quality and also of strain of layers (Zita *et al.,* 2009). On the other hand, (Khan *et al.,* 2004) reported no significant effect of breed on eggshell thickness under semi-scavenging condition.

Eggshell thickness is also an important external quality trait for hatchability. And it should be between 0.33 and 0.35 mm and few eggs with a shell thickness less than 0.27mm will hatch. Thickness measurements are typically taken along the midline of the egg and done using a micrometer and can only be evaluated after an egg has been broken (Khan *et al.,* 2004). An eggshell thickness of at least 0.33 mm has been estimated to be necessary for the egg to have at least a 50% chance of withstanding normal handling conditions without breaking (Stadelman, 1995).

### 2.9.2 Internal Egg quality

The internal quality is measured on the basis of the quality of the albumen as indicated by the Haugh Units (HU), the relative size of the various internal components and the integrity of the shell membrane. Of the internal egg quality characteristics, thick albumen is quite an important measure for the freshness of an egg. The longer an egg is stored, the more the height of the thick albumen decreases (Toussant and Latshow, 1999). Internal quality of the egg begins to decline as soon as the egg is laid. The management and nutrition of the hen do play a role in internal egg quality (Gerber, 2012).

**Yolk color** (**YC**) is a quality measure in eggs that is quite variable and easily changed (Zeidler, 2002). The diet of the hen has the greatest influence on YC (Galobart *et al.,* 2004). The YC can be easily manipulated by using synthetic additives, and this is frequently done in many countries (Zeidler, 2002). To achieve the basic yellow color of a typical egg yolk, yellow xanthophylls are needed. Because YC is influenced so heavily by the diet, the age and breed of the hen has little influence (Galobart *et al.,* 2004). Yolk color is subjectively determined by the use of the Roche color fan (Vuilleumier, 1968; Stadelman, 1995).

Yolk color is a key factor in any consumer survey relating to egg quality (Okeudo *et al.,* 2003). Yolk quality is determined by the color, texture, firmness and smell of the yolk (Jacob *et al.,* 2000). The determinant of yolk color is the xanthophyll (plant pigment) content of the diet consumed (Silverside *et al.,* 2006). Among feed ingredients, only supplemented maize contributes to improved color intensity of the yolk.

Thus, if a hen has access to green grass or supplemented feed ingredients containing carotenoids/xanthophylls, it will be enough to give the yolk the color preferred by consumer

(Zaman *et al.*, 2004). The yolk of a freshly laid egg is round and firm (Jacob *et al.*, 2000). However, as the egg ages and the vitelline membrane degenerates, water from the albumen moves into the yolk and gives green grass during scavenging might be responsible for carotenoid deposits in the yolk, which improves the yolk color (Zaman *et al.*,2004).

**Albumin quality** is related to the consistency, appearance and the functional properties. It is measured in terms of Haugh Units (HU) proposed by Haugh (1937) calculated from the height of the albumin and the weight of the egg. However, most eggs leaving the farm should be between 75 and 85 HU (Coutts and Wilson, 1990). (Rajkumar *et al.*, 2009) reported that age of the hen and season of the year can also affect Haugh unit values brown egg layers produced eggs with higher HU. It is generally accepted that the higher the Haugh unit value, the better the quality of the egg. It is also important that all eggs being evaluated at the same internal temperature.

**Albumen Height (AH)** Albumen refers to the "white" of an egg and consists of a thick and thin portion. The thick albumen is the portion immediately surrounding the egg yolk, whereas the thin albumen comprises the rest of the white portion. The height of the albumen indicates the freshness of the egg and can be measured using a tripod micro meter. Once the egg is broken onto a flat surface, a tripod micrometer is placed over the thick albumen. The center pin is lowered until it "kisses" the albumen and the height, typically in mm, can be observed. The thicker the albumen, the better the quality of the egg, with heights of 8 to 10 mm being considered superior interior quality (Zeidler, 2002). While AH can be measured directly, an additional measure of AH, HU, which accounts for egg weight, can be calculated (Haugh, 1937; Williams, 1992). The calculation for HU is as follows:

$$HU = 100 \log (AH - 1.7EW)^{0.37} + 7.57$$

Where, AH is the height of the albumen in mm and EW is the weight of the egg in g. Since the relationship between EW and AH is not constant across breeds of birds, the HU is not appropriate for comparing eggs across breeds (Silversides, 1994).

### 2.9.3 Effect of breed on egg quality traits

Egg traits are influenced by a variety of factors including genetics, hen age and body weight, diet and length of holding period (Silversides, 1994; Silversides and Budgell, 2004; van den Brand et al., 2004). Genotype has direct influence on egg weight and eggshell characteristics. Many studies showed that hens with colored feathers lay bigger eggs than hens with white feathers (Halaj and Grofík, 1994; Vits et al., 2005; Halaj and Golian, 2011)**.** The color of an egg shell is determined primarily by the genetics of the hen, with white feathered hens laying white eggs and brown feathered hens laying brown eggs (Jacob *et al.,* 2000).

Genetic differences in eggshell quality characteristics exist between species, and between breeds, strains and families within the lines (Buss and Guyer, 1982). Egg weight is very different between various lines and eggshell thickness is under great influence of line (Pandey *et al.,* 1986). Egg shell thickness measurement typically has little variation across similar breeds (Potts *et al.,* 1974; Anderson *et al.,* 2004). The yolk % is affected by breed or strain within a breed, age of hen and egg size (Campo, 1995; Suk and Park, 2001).The egg shell quality is given through the weight and the percentage of shell thickness and the strength. The differences in eggshell quality depend on the environmental conditions and the feed quality and also of strain of layers (Zita *et al.,* 2009). On the other hand, (Khan *et al.,* 2004) reported no significant effect of breed on eggshell thickness under semi scavenging condition.

### 2.9.4 Effect of age on egg quality traits

Almost all egg quality traits decline as hen's age, with the exception of egg weight, which increases (Ledur *et al.,* 2002; Altunas and Sekeroglu, 2007). The findings of (van den Brand *et al.,* 2004) lead us to anticipate a decrease in shape index, from sharp to normal, as hen's age. One of the main concerns is a decrease in eggshell quality as the hen ages, due to an increase in egg weight without an increase in the amount of calcium carbonate deposited in the shells. For this reason, the incidence of cracked eggs could even exceed 20% at the end of the laying period (Nys, 2001). Egg shell weights have been shown to both increase and decrease as the hen ages, following no specific pattern (Silversides, 1994; Silversides and Budgell, 2004; Popova-Ralcheva *et al.,* 2009).

The egg size and its component are influenced by a number of genetic and non-genetic factors (Washburn, 1990). The yolk % is affected by breed or strain within a breed, age of hen and egg size (Campo, 1995; Suk and Park, 2001). Hen age has been shown to increase yolk weight (Van den Brand *et al.,* 2004) and albumen weight (Suk and Park, 2001).

Age, feed, protein levels and temperature are some of the factors that affect egg size in chickens (Banerjee, 1992). Economically important egg quality traits such as weight, size, yolk and albumen contents are quantitative traits with continuous variability (Das 1994). The relationship between weight, length and width of eggs has been reported by (Danilov, 2000) who also noted the proportion of yolk, albumen and shell that contribute to the egg weight increases with hen's age, reaching a plateau by the end of the laying cycle.

Egg weight influences the weight of components of eggs especially egg albumen and yolk (Zhang *et al.,* 2005; Aygun and Yetisir, 2010). Thus egg weight is one of the important

phenotypic traits which influence egg quality and reproductive fitness of the chicken parents (Islam *et al.,* 2001; Farooq *et al.,* 2001). Eggshell strength is highly dependent on egg shell thickness. It can either decrease (Anderson *et al.,* 2004) or remain constant as hens age (van den Brand *et al.,* 2004). The thickness of an eggshell can be compromised in a variety of ways, including temperature over $32^0$C, hen age, and dietary calcium levels below 3% (Zeidler, 2002).

The length of time a hen has been in continuous production, or has continuously produced eggs without going through a molt, will impact the height of the albumen. Furthermore, AH will decrease as a hen ages (Ledur *et al.,* 2002; van den Brand *et al.,* 2004). As a laid egg ages, the AH also will decrease (Silversides, 1994; Silversides and Budgell, 2004). Besides SI and WT, (van den Brand *et al.,* 2004) evaluated AH. In the youngest hens, the average AH was 7.27 ± 0.18 mm, while the average AH in the oldest hens decreased by 1.78 ± 0.18 mm ($P < 0.05$).

## 2.10. Ownership Pattern and Gender Role

Chicken are reared by any member of a given family in both urban and rural areas of Ethiopia because they require less input (space, labour, capital and others). A study conducted in Fogera Woreda of Amhara regional state (Bogale, 2008) revealed that women had higher responsibility of providing feed and water (59.72%) cleaning chicken house (62.5%), selling chicken (56.95%) while men had the responsibility of shelter construction (63.89%). Halima (2007) also reported that rural women in North-West Ethiopia are more responsible for chicken rearing in both male and female headed households, while men are responsible for crop cultivation and other off-farm activities.

## 2.11. Challenges in village chicken production systems

According to Getu and Birhan (2014), under farmer management poultry production, prevailing disease, predators and veterinary services were reported as the major constraint. Several studies have indicated that the chickens in the country face several life threatening diseases, Newcastle disease (NCD) being one of the highly infectious (Besbes, 2009, Halima H.,2007). However, the prevalence of diseases varies across locations and also seasons within a location. Studies by (Aberra, 2007) have indicated that fowl cholera, fowl pox, upper respiratory tract infections and coccidiosis too are prevalent in many parts of Ethiopia. It has also been reported that mycotoxiosis too have been reported among many flocks and can impair the productivity of the chickens (Aberra, 2007). This is besides the incidences of parasites (endo and ecto) which adversely affects the flock productivity and at times the mortality can be very high indeed (Tadelle and Ogle, 2001).

Lack of sanitation, poor housing and nesting facilities besides several tangible and intangible factors too are detrimental to the overall productivity of this sector (Dwinger et al (2003).

Predators such as snakes, rats, dogs, cats and foxes are the main causes of losses especially in young birds. Thefts are also another important cause for the loss of adult birds. According to (Aberra, 2007), about 46% of the respondents in Southern Ethiopia reported that wild birds (eagle, hawk, etc.) are the most common predators during the dry season, while wild cat (locally known as "*Shelemetmat*") is the most dangerous predator during the rainy season

## 2.12. Extension interventions to improve village chicken production

As poultry farming has a potential for poverty alleviation, gender friendly and also requires relatively less infrastructure (when compared to other livestock species), there has been a

spearhead impedes by various governmental and non-governmental agencies to distribute chickens to the rural communities especially who are landless and marginal farmers (Alemu *et al.* 2009). Several such programs were initiated over decades while most of such programs did not meet the desired goals, there were success stories too (Tadelle, 2011). The aim of distributing the chickens was to improve the livelihood of the beneficiaries; however, in most of the cases the package and practices associated with rearing of the improved genotypes were rarely followed (Misba *et al*., 2011). This is besides the fact that the selection of genotypes to be distributed were also not scientifically carried out, this led to the poor adaptability of the distributed chickens to a given agro climate (Teklewold *et al*, 2006, Reta, 2009). In the recent times the development agencies have been distributing KoecKock, Bovans Brown and Sasso replacing the Rhode Island Red and White Leghorn breeds (Tamir et al, 2015). However, the adaptability of the newly introduced strains has not been accessed especially in the rural areas of SNNPRS. There have been some studies in the past which indicate that Sasso chickens have a better performance when compared to the other introduced genotypes. However, there have also been several studies which indicate that the genotype requires some management package and practices which are difficult for the beneficiaries to follow. Thus, under such circumstances it is necessary to understand the lacunas of the prevailing management practices and how to overcome the same, in doing so it can help in holistic improvement of the sector and also achieve the desired goals (Serkalem *et al*, 2018).

# 3. MATERIALS AND METHODS

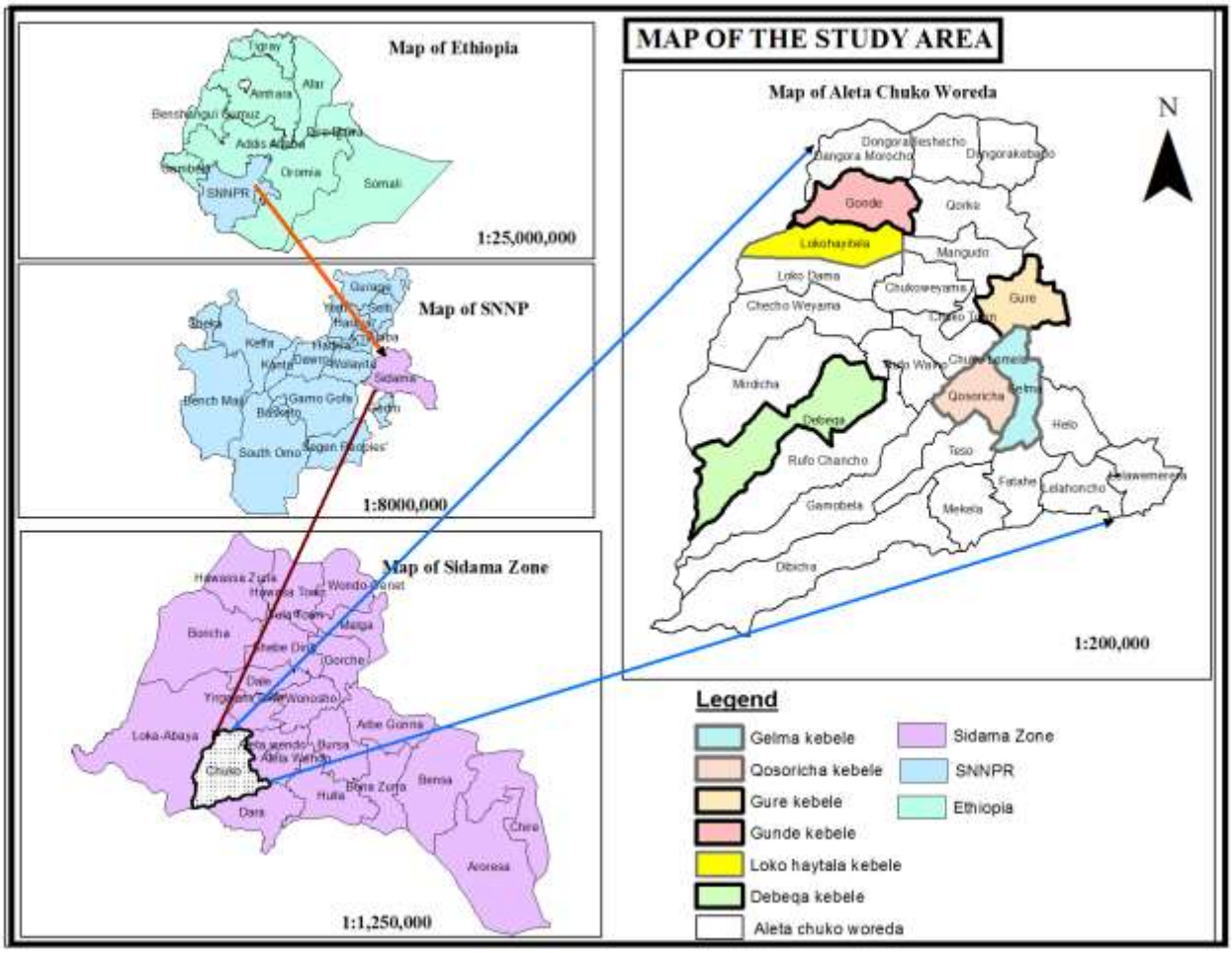
## 3.1. Description of the Study Area

The survey study was conducted in Aleta Chuko woreda which is located in Sidama Zone, SNNPRS. Its geographical location extends from $6^0$46'N to $7^0$01'N and $38^0$04'E to $38^0$24'E. Aleta Chuko woreda is administratively bordered with Dalle woreda on its northern direction, on the south Dara woreda, on the East Aleta Wondo woreda and on the west Loka Abaya woreda. It has an altitude of 1400-2300 masl and average annual rainfall of about 1200-1400mm. The temperature of the area ranges between minimum $18^0$C and maximum $28^0$C (CSA, 2014/2015). Administratively the woreda is divided into 26 rural and 5 urban kebeles. According to CSA (2016/2017), the total population of Aleta Chuko woreda is 209,886 heads, of which 102,215(48.7%) was male and 107,671(51.3%) was female. The Woreda has an estimated land area of 32.2 $KM^2$. The area is characterized by midland and lowland agroecological zones.

Rainfall is bimodal in nature occurring in two growing seasons, namely the ''belg'' (extending from March to May) and the ''meher'' (extending from June to August). "Belg" is major growing season and a period of land preparation and planting of crops like coffee (*Coffea arabica*), maize (*Zea mays*), enset (*Ensete ventricosum*), khat (*Catha edulis*) and potato (*Solanum tuberosum*). During "meher" season crops such as haricot bean (*Phaseolus vulgaris*), teff (*Eragrostis tef),* tomato *(Solanum lycopersicum),* potato (*Solanum tuberosum*) and sweet potato (*Ipomoea batatas*) are grown. Coffee, (*Coffea cherries*) enset (Ensete ventricosum), haricot bean (*Phaseolus vulgaris*), khat(*Catha edulis*), maize (*Zea mays*) and pineapple(*Ananas comosum*) are the main potential crops in the area(CSA,2014/2015.

Livestock were reared by many people living in the rural and urban kebeles and the dominated production system is extensive.

**Figure 1: Map of Aleta Chuko Woreda**



## 3.2 Study Birds

The animals used in this study were Sasso chicken which are exotic dual purpose type and native chicken.

## 3.3. Design of the Study

The research design for this particular research was both cross-sectional survey (with households using semi-structured questionnaires), FGDs (Focus group discussions), and key informant interviews for egg production of Sasso and local chicken. Laboratory experiment was also used for external and internal egg quality tests as well as to compare the qualitative parameters of the two chicken eggs.

## 3.4. Sampling Technique and Sample Size Determination

Multi-stage sampling methods using stratified random sampling (SRS) was employed. In the first stage, the woreda was purposely selected mainly with the considerations of the potential of Sasso chicken distribution so that to have sufficient population to compare with the local chicken. In the second stage, potential Sasso chicken distributed and potential local chicken rearing kebeles from both agro ecologies were identified. In the third stage, six kebeles (three kebeles from one agro ecology) were selected purposely based on the distribution of Sasso chicken, potential native chicken rearing areas, accessibility to all weather roads and assumed the beneficiaries were willing to participate in the work. Then, from the identified total chicken rearing households in the kebele, 10% was selected for the study in each kebele. Information was also sought from the authorities of the Livestock and Fisheries Resources Development Office of the woreda and kebele experts for the identification of the beneficiaries of the distribution scheme. Then, the beneficiaries who had received Sasso chickens and had been

rearing them for at least 3-4 years and the respondents who have been rearing local chicken for at least 3-4 years were identified and randomly selected for the study.

**Table 5: Sample Size and Selected Kebeles**

| Sample kebeles | Agroecology | Total Households | HHs possessed Chicken | Sample size (10%) |
|---|---|---|---|---|
| Gure | Midland | 376 | 266 | 27 |
| Kosoricha | Midland | 341 | 242 | 24 |
| Gelma | Midland | 322 | 228 | 23 |
| Loko Haytala | Lowland | 453 | 337 | 34 |
| Gunde | Lowland | 438 | 321 | 32 |
| Debeka | Lowland | 485 | 345 | 34 |
| Total | | 2415 | 1739 | 174 |

### 3.5. Data Types and Data Sources

Both primary and secondary data were collected. Primary data were collected from households, FGDs and key informants. Secondary data were collected from written documents, meaning that; from woreda offices, published and unpublished documents. The primary data were collected based on interviews from semi structured questionnaires. Direct observation was also made to assess available chicken feed resources, chicken feeding & housing practices, traditional egg incubation & brooding procedures and egg handling & storage practices. The questionnaire had been pretested prior to being administered and therefore necessary corrections were made based on the results of pretesting. The questionnaire was translated to the native language. All suitable data such as; type of chicken production systems, flock characteristics and performances, housing systems, disease

treatment methods and constraints of the prevailing chicken productions were gathered from individual chicken owner farmers, extension officers and key informants.

### 3.5.1. Focus group discussions

Regarding the focus group discussion, based on the following parameters such as, age groups, sex and socio economic status in the village, the focus group discussions were performed. The focus group discussions were held with various stakeholders associated with chicken husbandry, viz. farmers with native and exotic chickens, traders and also extension agents. This helped us to identify the advantages and disadvantages of each type of chickens.

Two focus group discussions were held at each kebele, the respondents of the focus group discussion were those who had been rearing Sasso chickens and local chickens. In each kebele, 8-10 individuals were participated per round.

### 3.5.2. Key informants

This was employed, to gather in-depth information which related with the study objectives. Those key informants were the various stakeholders in the chicken business from the rearers, development agents, veterinarians, traders, etc. The interviews were held separately for each group followed by a common discussion with participants from all the sectors taken together, so that the information could be obtained across various crosscutting issues.

## 3.6 Data collection and Egg Quality Traits

Thereafter, from the Sasso and native chickens prevalent in the area, 50 fresh eggs were collected from each kebele (150 eggs each from one agroecology which were 75 eggs each from the two species). The households were identified and the date of egg lay and the type of the chicken (native or Sasso) had been written on the egg prior to being transported. Then

totaling to 300 eggs from the two different agro ecologies were collected and brought to Hawassa University poultry section for assessment of the external and internal egg quality parameters. These parameters which included; egg weight, egg length, egg width, yolk height, albumen height, yolk width, yolk color and egg shell thickness were determined in the laboratory.

**Egg weight** (EW): measured with an electronic balance in grams.

**Egg width and egg length**: were measured using digital caliper

**Yolk height (mm):** measured by tripod micrometer at the highest point of egg yolk in a flat dish**.**

**Yolk Width (mm):** measured as the maximum cross sectional diameter of the yolk using a pair of automated vernier caliper.

**Yolk Index** (%): This was calculated using the following formula as given by Reddy *et al* (1979) and Anderson *et al* (2004)

$$YI = \frac{YH * 100}{YW}$$

Where: YI = Yolk index

YH = Yolk height

YW = Yolk width

**Shape Index (%):** was calculated using the following formula: (Reddy *et al* (1979) and Anderson *et al* (2004))

$$SI = W/L * 100$$

Where: W = Width of egg

L = Length of egg

**Yolk color**: was measured using roach color fun that contains a series of fifteen colored plastic strips

**Albumen Height (mm):** was measured by tripod micrometer at the highest point of the albumen and taken as the average of the readings at 3 locations in a flat dish.

**Egg shell thickness (mm):** was measured using digital caliper after dried 24hours and it was measured at three places; at the broad end, narrow end and middle parts of the egg shell and then averaged.

**Haugh Unit (HU):** The Haugh unit indicates egg quality as conceived by Dr. Raymond Haugh in 1937. The height of the thick albumen surrounding the yolk, combined with the egg weight, determines the Haugh unit score. The higher the score, the better the egg quality. The Haugh unit (HU) determines the freshness of the albumen quality and thus, the higher the HU the better would be the albumen quality (Aberra, 2007). It was calculated from the albumen height and egg weight using the formula as given by Haugh (1937);

$$HU = 100\log (H+7.57-1.7W^{0.37})$$

Where;

HU: Haugh unit

H= Observed albumen height in (mm).

W= Observed egg weight in grams.

## 3.7. Method of Data Analysis

The data were coded, classified and tabulated in Microsoft excel and SPSS (Statistical Package for the Social Sciences) for analysis. The data were classified into qualitative and quantitative traits in which the qualitative data were analyzed using non parametric tests ($X^2$) and the quantitative traits were analyzed using two-way ANOVA by fitting agro-ecology (lowland and

midland) and breed (Sasso and local) as fixed effects. When ANOVA (F-test) declares significant, means were compared using Duncan multiple range test.

**Model of statistical analysis: Model 1 used to analyze chicken husbandry practices**

$Y_{ij}= \mu+a_i+e_{ij}$

$Y_{ij}$= Observation on husbandry practices

$\mu$= Overall mean

$a_i$= Effect due to agro ecologies (i= midlands and lowlands)

$e_{ij}$= random error

**Model 2 used to analyze egg quality traits**

$Y_{ij} = \mu + a_i + b_j + (a*b)_{ij} + e_{ij}$

$Y_{ij}$ = Observation of egg quality traits

$\mu$= Overall mean

$a_i$= Effect due to agro ecologies (i= midlands and lowlands)

bj= Effect due to breed (j = native chicken and Sasso chicken)

(a*b)ij = Effect due to interaction between agroecology and breed

eij= residual error

# 4. RESULTS AND DISCUSSIONS

## 4.1. Socio-economic Characteristics of the Households

The socio-economic characteristics of the respondents (chicken owners) in the study area are indicated in Table 7. In this study, majority of the respondents were male headed (78.2%) and minority (21.8%) were female headed households. This shows that local poultry rearing was mainly managed by male and any intervention to improve poultry production and productivity should include male households in the study area. The result of this study agreed with that of Getachew *et al*. (2016) who reported that high proportion of male respondents participated in chicken production in Benchi Maji Zone south western Ethiopia. In Cameroon also, majority of the chickens were owned by men (55.6%) followed by women (38.9%) and children (11.1%) (Abubakar, *et al*., 2007).

Regarding educational level, 17.2% of the respondents were illiterate while 28.7% of them were found to be capable of reading and writing. About 25.9% were under the level of $1^{st}$ - $4^{th}$ and 15.5% of the respondents were under the level of $5^{th}$ - $8^{th}$. From the rests, 8% and 4.6% of the respondents were the level of $9^{th}$ - $12^{th}$ and diploma and degree holders respectively. The proportions of education status of the respondent were no variation across the agro-ecologies. The proportions of illiterate were (8% & 9.2%) in the midland and lowland agro-ecologies respectively. The proportion of secondary education in the two agro-ecologies for the level 9th - $12^{th}$ respectively was 2.9 and 5.2. Diploma and degree was respectively 1.7%, and 2.9%. This indicates that the households had equal access to education services in the two agro-ecologies. Generally, the highest populations of the respondents were educated primary education in each agro-ecology but the lowest population of the respondents' educational status was college/university graduate. The higher presence of educated people in the two agro-ecologies

might help them to advance their chicken production systems like feeding, housing, breeding, etc. if they have access for improvements. Educational status (regarding illiterate people) was better than the study reported from South-West Showa, Gurage zone of Ethiopia (Emebet, 2015) (illiterate (41.5%) and Western zone of Tigray, Northern Ethiopia (Shishay, 2014), (illiterate 41.3 %,) respectively. However it was more or less approached to the study reported from Dale, Wonsho and Loka Abaya woredas of Southern Nation Nationalities and People's Regional State (Mekonnen, 2007) (illiterate, 6.9%).

The average age and family size per household were 40.54 years and 5.03, respectively. The higher average age of the respondents in this study indicated that the active working age groups did not participate in poultry husbandry and this may hinder the development of the sector. This result approached to the result of Halima, (2007; and Melaku, (2016) who reported that the average age of the respondents 37.5 and 42.7 in North West Amhara and south Wollo zone, respectively.

**Table 6: Characteristics of chicken owners in Aleta Chuko woreda**

| Variables | Agroecologies | | | |
|---|---|---|---|---|
| | Midland (N=72) | Lowland (N=102) | Overall mean | $X^2$ |
| Sex of household heads (%) | | | | |
| Male | 80.6[a] | 76.5[a] | 78.2 | 0.521 |
| Female | 19.4[a] | 23.5[a] | 21.8 | |
| Edu. Status of HH heads (%) | | | | |
| Illiterate | 19.4[a] | 15.7[a] | 17.2 | 0.987 |
| Read and write and above | 80.6[a] | 84.3[a] | 82.8 | |
| Ave. age of HHs in years (Mean±SD) | 40.3±6.709[a] | 40.7±7.609[a] | 40.5±7.232 | 0.818 |
| Average family size/HH (Mean±SD) | 5.22±0.953[a] | 4.89±0.964[a] | 5.03±0.97 | 0.129 |

[a], Means between agroecologies with the same superscript letters are not significantly different, SD=Standard Deviation, $X^2$=Chi-Square

### 4.1.1. Livestock holding

Among the large livestock species, cattle were dominant in the study areas and the majorities of the farmers used them as sources of income followed by consuming milk and milk products. According to the result of the current study the average livestock holding per household of the study woreda was; 3.18 for cattle, 0.27 for sheep, 0.56 for goats, 0.16 for donkeys, 0.01 for mules, 0.02 for horses and 4.30 for chicken (Table 8). The number of cattle, sheep, donkey and chicken holding per household found in this study was in line with the findings of Adugna and Said (1992), in mixed production system of Wolyita Zone, which estimated; 3.6 cattle, 0.1 donkeys and 2.1 chickens.

**Table 7: Number of livestock in the households of the two agroecologies (Mean±SD)**

| Type of livestock | Midland | Lowland | Overall mean | $X^2$ |
|---|---|---|---|---|
| Cattle | 2.17±1.815[a] | 3.9±2.173[b] | 3.18±2.201 | 0.001 |
| Sheep | 0.49±0.48[a] | 0.12±0.115[b] | 0.27±0.098 | 0.003 |
| Goat | 0.15±0.064[a] | 0.85±0.72[b] | 0.56±0.281 | 0.008 |
| Horse | 0.03±0.065[a] | 0.02±0.039[a] | 0.02±0.01 | 0.723 |
| Donkey | 0.14±0.034[a] | 0.17±0.04[a] | 0.16±0.075 | 0.69 |
| Mule | 0.03±0.065[a] | 0.0±0.0[a] | 0.01±0.007 | 0.09 |
| Chicken | 4.36±2.266[a] | 4.25±2.105[a] | 4.3±2.167 | 0.371 |

[a,b] , means between agroecologies with different superscript letters are significantly different, $X^2$= Chi-Square, SD=Standard Deviation

The result of the current study revealed that sale of animals and animal products was an important source of household cash income. In addition, livestock were identified to be vital sources of food (animal protein), prestige (determination of wealth status of households) and organic manure for soil fertility. Equines (mainly donkey) were used for the purpose of carrying materials and to pull carts.

According to the interviewed chicken owner farmers, goats were more owned by lowland area farmers than in the midland, people own more cattle and holding of sheep was little, hence the population of goat was found higher than that of sheep's population. Though the proportion of the midland from the total area of the study sites was low, the majority of sheep population was found in this agroecology. The proportion of donkeys in the study area was higher among the total equine population. The result of the study revealed that very few farmers owned mules and hence the proportion of mules followed by horse in the herd was very small.

### 4.1.2. Chicken flock structure

Flock structure is described in terms of the number of the different age groups and sex in a flock. The mean values of chickens in different age category of the flock owned as different size of chickens are shown on Table 9. The overall mean flock size per household was 4.3 and ranged from 2-10(regardless of the two breeds). The value reported in this work is lower than 7-10 chickens per household reported by Tadelle and Ogle (1996a) for the central high lands of Ethiopia and 8.8 chickens per household reported by Asefa (2007) for Hawassa Zuria. But it is in line with the result reported by Sonaiya (1990) (5-10 birds per household) reported for Africa. Flock size variation in rural areas has been attributing to the farming systems practiced and local factors such as diseases and predators (Kuit *et al.,* 1986). However, the relatively lower mean flock size and range in the study area compared to other similar research conducted in the country is perhaps due to purposive selection of sampled farmers raising two and above chickens.

The number of chickens in the households in different age category varies considerably (Table 9). Relatively highest mean number of local chicks per household (1.40 with standard deviation 1.92) was observed followed by local pullets (1.38 with standard deviation 0.669). Here respondents who owned Sasso chicken did not have any chick hatched from Sasso hen. According to Asefa (2007) a report from Hawassa Zuria woreda, the corresponding figures for chicks and hen were 3.8 and 2.5, respectively.

**Table 8: Chicken Flock Size per Household in Aleta Chuko Woreda (Mean±SD)**

| Chicken | Local | | Sasso | | Overall | |
|---|---|---|---|---|---|---|
| classes | Midland | Lowland | Midland | Lowland | Local | Sasso |
| Chicks | 1.39±1.25 | 1.41±1.32 | 0.0±0.0 | 0.0±0.0 | 1.40±1.25 | 0.0±0.0 |
| Pullets | 1.42±0.73 | 1.35±0.63 | 0.19±0.15 | 0.29±0.26 | 1.38±0.70 | 0.25±0.23 |
| Cockerels | 1.33±0.72 | 1.24±0.71 | 0.25±0.23 | 0.37±0.25 | 1.28±0.71 | 0.32±0.30 |
| Cocks | 0.81±0.60 | 0.82±0.60 | 0.69±0.50 | 0.73±0.45 | 0.82±0.56 | 0.71±0.46 |
| Hen/layers | 1.28±0.50 | 1.04±0.20 | 1.22±0.42 | 1.18±0.40 | 1.14±0.35 | 1.2±0.40 |
| Total/Mean | 1.246±0.90 | 1.17±0.80 | 0.47±0.37 | 0.52±0.36 | 1.21±0.84 | 0.51±0.36 |

### 4.2. Farming system

In the studied villages, farmers follow extensive mixed farming system rearing of livestock and crop production. The major crops grown in the surveyed area include enset (*Ensete ventricosum*), maize (*Zea mays*), coffee (C*offea arabica*), cabbage (*Brassica oleraceava*) and haricot bean (*Phaseolus vulgaris*). However, there is considerable variation in abundance and importance of crops across the two agroecologies. Enset and coffee were relatively more important crops in midland than lowland agroecology. While maize, haricot bean and khat were rated as important and major crops in lowland agroecology.

There are two cropping seasons in the area which are the short rainy season (Belg) (from March to April) and long rainy season (Meher) (from June to September). The Belg rains are mainly used for land preparation and planting long cycle crops such as maize and seedbed preparation for Meher crops. The Meher rain is used for planting cereal crops like barley, teff, wheat, haricot bean and vegetable crops. There about 78.7% of the respondent were owners of

both crop and livestock and 21.3% of the respondent were owners of crop and only chicken rearers. As the farmers' response, there were no only livestock rearers or pastoralists.

### 4.3. Chicken production systems

The most dominant chicken production system in the study area was the back yard or subsistence extensive systems which were based on the husbandry system of local indigenous chickens and scavenging with occasional and seasonal supplementary feeding of homegrown grains and household food refusals. About 72% of the farmers in the surveyed area owned both indigenous chicken (local chicken eco types) and Sasso chicken (exotic commercial breed). From this about 62% of the respondents owned local chicken and 38% of the respondent farmers owned Sasso chickens. From local chicken rearers, about 50.6% of the respondent obtained the initial stocks from the local market, 6.9% inherit the stock from their family and 42.5% hatch their chicks at home. The majority of the replacement stocks from Sasso chicken rearers (90.8%) were obtained from agricultural extension agents (which were mainly pullets and cockerels) and 9.2% of the replacement stock bought from the local market.

The most important reasons for keeping local chickens and producing eggs were primarily as source of income and for hatching. However, farmers owned Sasso chicken mainly for income from eggs and some farmers use the eggs for consuming for children and for themselves and sometimes consume their meat at home. Men took the major ownership and decision on the chickens in the house. However, the major management activities pertinent to poultry production are the responsibility of women.

The back yard chicken production system in the study area was also characterized by chick mortality caused by predators and diseases. The birds find their feed by scavenging among the

houses in the village, and in addition, they might get leftovers from the harvest and from the kitchen with some supplements of homegrown grains.

The free-range feeding practice in the study area also attributed to indiscriminate mating of cocks and hens. None of the farmers followed regular vaccination and treating for their chicken. Very often, there was probability in which birds might not get enough water (regular watering activity), or they might get dirty water, which may transfer diseases as some farmers informed there was high probability in which they forget providing water.

Except for the little effort made to distribute some exotic breeds as part of the extension package under gone in the woreda, there was no regular extension support attached to management, veterinary and marketing extension services. Traditionally, households make use of their own local/indigenous poultry rearing knowledge acquired over a long period. Almost none of the respondents had formal and timely training on poultry husbandry.

### 4.4. Husbandry related findings

#### 4.4.1. Chicken housing practices

The survey indicated that greater than 50% of the households did not provide separate house for their chicken (Table 10). There were no specific separate poultry houses in the area; overnight shelter with simple chicken nest made of cartoon or local basket and perch confined within the main house were the most commonly used housing facilities. Overall, 75.9% of the respondent did not construct separate house for their chicken while the rest only 24.1% provide separate house for their chicken. From the households that construct separate house for their chicken, 5.7% provide house of wooden made with grass roof, 14.4% use house of

wooden made with mud and grass roof, 4.0% use house of wooden made with mud and mesh wire with grass roof.

**Table 9: Chicken Housing Practices in Aleta Chuko Woreda**

| **Variables** | Midland (%) | | Lowland (%) | | Cumulative (%) | |
|---|---|---|---|---|---|---|
| No of HHs who | No | % | No | % | Total | % |
| Have separate chicken house | 21 | 29.2 | 21 | 20.6 | 42 | 24.1 |
| Have no separate chicken house | 51 | 70.8 | 81 | 79.4 | 132 | 75.9 |
| **House constructing material** | | | | | | |
| No separate house | 51 | 70.8 | 81 | 79.4 | 132 | 75.9 |
| wooden made with grass roof | 6 | 8.3 | 4 | 3.9 | 10 | 5.7 |
| wooden made with mud and grass roof | 11 | 15.3 | 14 | 13.7 | 25 | 14.4 |
| wooden made with mud and mesh wire with grass roof | 4 | 5.6 | 3 | 2.9 | 7 | 4 |

### 4.4.2. Feed resources and feeding strategies

Lack of feed supplementation is one of the characteristics of a free-ranging or backyard poultry production system (Gueye, 2003). As the farmers' response, about 55.7% of them did not control free movement of the chicken (allow the chicken scavenge around the area) and about 32.2% of the farmers replied that they sometimes, especially at crop sowing seasons, control the free movement of their chicken. 12.1% of them responded that they practiced controlling free movement of their chicken (Table 10). About 86.2% of the respondents offered additional feed supplements for their scavenging birds. A study in Hawassa Zuria by Asefa (2007) indicated that 95% of the households offer supplementary feed for their chicken. According to the farmers' responses, scavenging feed source consists of insect, grass, enset

(*Ensete ventricosum*) and harvest leftovers. Similarly, Tadelle *et al*. (2003) reported that insect, grass and harvest leftovers as source of scavenging for village chicken in Ethiopia. Thus, the smallholder chicken production goes eco-friendly because they convert insects and household leftovers to valuable cheap and quality animal protein to the family. However, some farmers in the study area complained that chickens, especially Sasso chicken, damage crops like Enset (*Ensete ventricosum),* cabbage (*Brassica oleraceava*) and haricot bean (*Phaseolus vulgaris*) by eating them without farmers' willing. Similar research conducted at Hawassa Zuria by Girma *et al.* (2004) also reported that in the dry season the chicken ate different parts of the Enset (*Ensete ventricosum*) including the corm. Enset (*Ensete ventricosum*) and cabbage were among the major food crops grown in the surveyed area leading chickens to compete for the same food source with the family. However, certainly one can say this could not be a threat for future development of the sector; it is only a matter of management as it is easily protected by keeping chickens in improved housing facilities.

The major feed and feeding practices of the two agroecologies are summarized in Table 11. The major supplementary feed in the surveyed area includes maize, wheat, ''furishika'' (leftover of grains bought from milling houses) and feed leftovers in the house including ''kocho'', ''enjera'', bread, etc. In most cases, provision of feeds to chicken was seasonal. It also depended on the quantity and availability of the resources in the house. They supply little or nothing by the end of dry season when the feed resource is becoming scarce in the house.

**Table 10: Poultry Feeds and Feeding Practices in Aleta Chuko Woreda**

| Variables | Midland (N=72) | | Lowland (N=102) | | Cumulative (N=174) | |
|---|---|---|---|---|---|---|
| Number of HHs who | No | % | No | % | No To | % (cumul) |
| Controlled free movement | 10 | 13.9 | 11 | 10.8 | 21 | 12.1 |
| Did not control free movt | 46 | 63.9 | 51 | 50 | 97 | 55.7 |
| Sometimes controlled | 16 | 22.2 | 40 | 39.2 | 56 | 32.2 |
| Allowonly scavenging feeding | 6 | 8.3 | 6 | 5.9 | 12 | 6.9 |
| Supplemented with additional feeds | 61 | 84.7 | 89 | 87.3 | 150 | 86.2 |
| Purchased feed only | 5 | 6.9 | 7 | 6.9 | 12 | 6.9 |
| **Additional feed type** | | | | | | |
| No additional feed | 6 | 8.3 | 6 | 5.9 | 12 | 6.9 |
| Wheat and maize | 5 | 6.9 | 4 | 3.9 | 9 | 5.2 |
| Food leftovers | 16 | 22.2 | 19 | 18.6 | 35 | 20.1 |
| ‘‘Furishka’’ | 45 | 62.5 | 73 | 71.6 | 118 | 67.8 |
| **Frequency of feeding perday** | | | | | | |
| No additional feed | 6 | 8.3 | 6 | 5.9 | 12 | 6.9 |
| Once | 2 | 2.8 | 3 | 2.9 | 5 | 2.9 |
| Twice | 50 | 69.4 | 73 | 71.6 | 123 | 70.7 |
| Thrice | 14 | 19.4 | 20 | 19.6 | 34 | 19.5 |

All the respondents provided kitchen waste as supplement in both agroecologies. ‘Furishka’ (grains’ leftover bought from milling houses) covers more percent (67.8%) from the respondents who provide supplementary feed for their chicken. Provision of food leftovers and wheat and maize takes the second place in both agroecologies respectively. Regarding frequency of feeding, 70.7% feed their chicken twice a day and 19.5% and 2.9% feed their chicken three times and once per day respectively. While the rests of the respondents (6.9%) do not provide additional supplements for their chicken.

### 4.4.3. Source of water and watering practices

Water plays an important part in the digestion and metabolism of the fowl and in addition it serves as a media to administer some important vaccines (FAO, 2018). Despite variations in source of water and frequency of watering, almost all of the respondents informed that they provided water for their chickens. This is a promising and good experience and could be considered as one aspects of their concern to their chickens. Concerning the source of water, in both agroecologies, the water given to chickens was drawn from tap water (82.8%), spring water (13.2%) and bore well (4%). About 61.5% of the respondents freely provided water for their chicken (make the water available to drink for their chicken as they thought water is needed for them), and 17.2% of the respondents provide twice a day usually in the morning and evening and 21.3% of the respondents provide once a day especially to morning time. They usually provided water when the chickens show sign of thirsty. Concerning the drinking materials, 46% and 12.6% usually used broken utensils or clay dish and plastic containers, respectively. The remaining 41.4% did not have permanent drinking materials. However, only 32.8% of the respondents wash the container regularly and the remaining 67.2% of the respondents did not wash the container. This was because either the respondent did not provide

water regularly as they did not have permanent drinking material or did not wash the container at all (Table 12)

**Table 11: Sources and Frequency of Watering**

| Source and frequency of watering | | Midland (N=72) | | Lowland (N=102) | | Cumulative (N=174) | |
|---|---|---|---|---|---|---|---|
| | | Freq. | % | Freq. | % | Freq. (Total) | % (cum.) |
| Freq. of watering | Free access | 45 | 62.5 | 62 | 60.8 | 107 | 61.5 |
| | Morning | 15 | 20.8 | 22 | 21.6 | 37 | 21.3 |
| | Morning and evening | 12 | 16.7 | 18 | 17.6 | 30 | 17.2 |
| Water sources | Tap water | 60 | 83.3 | 84 | 82.4 | 144 | 82.8 |
| | Bore well water | 7 | 9.7 | 0 | 0 | 7 | 4.0 |
| | Spring water | 5 | 6.9 | 18 | 17.6 | 23 | 13.2 |
| Type of container used to provide water | No permanent drinking material | 29 | 40.3 | 43 | 42.2 | 72 | 41.4 |
| | Plastic containers | 9 | 12.5 | 13 | 12.7 | 22 | 12.6 |
| | Broken utensils/clay dish | 34 | 47.2 | 46 | 45.1 | 80 | 46 |
| Wash the container | As frequent as water provided | 15 | 20.8 | 21 | 20.6 | 36 | 20.7 |
| | Once in a day | 12 | 16.7 | 9 | 8.8 | 21 | 12.1 |
| | Do not wash | 45 | 62.5 | 72 | 70.6 | 117 | 67.2 |

### 4.4.4. Culling practices of chickens

Culling practices and reasons for culling are shown in Table 13. Culling of non-productive chickens is an important management in commercial chicken production. Likewise, most of the respondents, both Sasso and local chicken rearers, had experience of culling non-

productive and low performing chicken from the population whereas the remaining of the respondents did not practice culling. According to the farmers' response, the reason to cull was due to the fact that farmers who reared Sasso chicken usually practiced culling when their chicken had been sick and become old in age. From the local chicken rearers, more than 50% farmers also practiced culling. The reasons for culling local chicken were poor productivity, sickness, old age, frequent broodiness and slow growth even if variations observed between those reasons. Totally in both rearers, 81.6% of the respondents practiced culling and 18.4% of the respondents did not practice culling. This result coincides with Mearg (2015) who reported 78.9% of households culled and the rest 21.1% of the household did not cull their chicken. The farmers culled when the age of chickens reached at 38.2 weeks (either slaughter or sell) as the condition happened and as Mammo (2006) reported culling of unproductive chickens through consumption and sale was experienced.

This result was in line with Halima, (2007) and Mearg, (2015), who reported the first criteria of culling, is poor productivity that was 74.7% and 78.5% in North West Amhara Region and Central Zone of Tigray respectively.

**Table 12: Culling Practices of Chicken in Aleta Chuko Woreda**

| Items | Midland | | Lowland | | Cumulative | |
|---|---|---|---|---|---|---|
| **No of Sasso chicken rearers who** | No | % | No | % | No Total | %(cum) |
| Practiced culling | 31 | 86.1 | 44 | 86.3 | 75 | 86.2 |
| Did not practice culling | 5 | 13.9 | 7 | 13.7 | 12 | 13.8 |
| **Reason for culling** | | | | | | |
| Sickness | 26 | 72.2 | 43 | 84.3 | 69 | 79.3 |
| Old age | 10 | 27.8 | 8 | 15.7 | 18 | 20.7 |
| **No of local chicken rearers who** | | | | | | |
| Practiced culling | 26 | 72.2 | 41 | 80.4 | 67 | 77 |
| Did not practice culling | 10 | 27.8 | 10 | 19.6 | 20 | 23 |
| **Reason for culling** | | | | | | |
| Poor productivity | 26 | 72.2 | 31 | 60.8 | 57 | 65.5 |
| Sickness | 4 | 11.1 | 8 | 15.7 | 12 | 13.8 |
| Old age | 3 | 8.3 | 8 | 15.7 | 11 | 12.6 |
| Frequent broodiness | 1 | 2.8 | 1 | 2 | 2 | 2.3 |
| Slow growth | 2 | 5.6 | 3 | 5.9 | 5 | 5.7 |

No *and % indicated in the table above is the number of responses/HHs in each agroecology*

### 4.5. Chicken productivity in the study area

Productivity of birds mainly depends on the production and management system followed in managing the birds. Productivity of birds can be compared in relation to the production system the birds are kept. Current study revealed that there is a significant difference ($p<0.05$) in productivity between Sasso and local chickens.

The present study revealed that the overall average age at first egg for local chicken was 7.18 months and ranged from 7-8monthes with no significant difference between the two agro-ecologies (Table 14). And for Sasso chicken was 5.14 months and ranged from 5-7monthes with no significant difference between the two agroecologies. Serkalem *et al* (2019) reported 238days (7.9months) with standard deviation of 36.8days (1.23months) for local and 155days (5.16 months) with standard deviation of 24.6 days (0.82months) for Sasso chicken age at first egg. The findings showed that the local birds in the study area reached sexual maturity about 1 up to 2 months lately.

**Table 13: Reproductive performance of hen in Aleta Chuko woreda (Mean±SD)**

| Parameter (number) | Breed | Midland | Lowland | Overall | Range |
|---|---|---|---|---|---|
| Age at first egg (month) | Local | 7.26±0.4 | 7.13±0.26 | 7.18±0.32 | 7-8 |
| | Sasso | 5.22±0.48 | 5.078±0.27 | 5.14±0.4 | 5-7 |
| Clutches per hen per year | Local | 4.25±1.0 | 3.92±1.0 | 4.06±1.0 | 3-6 |
| | Sasso | 7.9±0.64 | 7.78±0.66 | 7.8±0.65 | 6-9 |
| Eggs per hen per clutch | Local | 11.36±3.4 | 14.2±4.45 | 13.02±4.3 | 7-23 |
| | Sasso | 21.11±3.5 | 20.25±3.64 | 20.61±0.4 | 12-28 |
| Eggs per hen per year | Local | 48.11±17.5 | 56.0±23.95 | 52.74±21.76 | 21-115 |
| | Sasso | 166.5±28.65 | 157.82±31.78 | 161.4±30.65 | 96-230 |

### 4.5.1 Hatchability and Survivability of chicks

**Hatchability** is the state of being able to produce hatchable eggs and commonly used to evaluate hatchery performance. Simply said, percentage of hatchability = (number of chicks/number of hatching eggs) * 100 (King'ori, A.M. 2011).

Hatchability and survivability condition of chickens in the study area is presented in the table below (Table 15).

**Table 14: Hatchability and Survivability of Local Chicks in Aleta Chuko Woreda**

| Hatchability (%) (for local chicks) | Midland (N=72) | | Lowland (N=102) | | Cumulative (N=174) | |
|---|---|---|---|---|---|---|
| | Freq. | % | Freq. | % | Freq. | % |
| 100% | 6 | 17.1 | 6 | 11.8 | 12 | 14.0 |
| ≥75% | 18 | 51.4 | 42 | 82.4 | 60 | 69.8 |
| ≥50% | 9 | 25.7 | 3 | 5.9 | 12 | 14.0 |
| ≤50% | 2 | 5.7 | 0 | 0.0 | 2 | 2.3 |
| Survivability (%) (for local chicks) | | | | | | |
| 100% | 3 | 8.8 | 6 | 11.8 | 9 | 10.6 |
| ≥75% | 20 | 58.8 | 38 | 74.5 | 58 | 68.2 |
| ≥50% | 8 | 23.5 | 7 | 13.7 | 15 | 17.6 |
| ≤50% | 2 | 5.9 | 0 | 0.0 | 2 | 2.4 |
| ≤25% | 1 | 2.9 | 0 | 0.0 | 1 | 1.2 |

All the respondents from Sasso chicken rearers said that they never used their Sasso chicken for egg setting, hatchability and mothering purposes as they had believed that exotic chicken are not used for these purposes including Sasso.

### 4.5.2 Egg production

#### 4.5.2.1 Egg production of local chicken

The average annual egg production of local chicken in study area was 52.74 with standard deviation of 21.76 and ranging from 21 up to 115 (Table 14). The result of the current study is comparable with the result of (Nigussie & Ogle, 2000) who reported that average annual egg production of indigenous chicken ecotype under extensive management condition was 30-60 eggs, this could be improved to 80-100 eggs on station with improved management (feeding, housing and health care) and related with the result of Fisseha et, al (2010) who reported the average of 60 eggs, 53 eggs and 55 eggs in Bure, Fogera and Dale district of Ethiopia, respectively. The finding of another study revealed that average annual eggs/hen/year is 62.95, 54.9 and 51.44 in Wonsho, Loka and Dale Woreda of Sidama zone, Southern Ethiopia (Mekonnen, 2007), (Yitbarek & Zewudu, 2013).

#### 4.5.2.2 Egg production of Sasso chicken

The average annual egg production of Sasso chicken in study area was 161.4 with standard deviation of 30.65 and ranged from 96 up to 230 eggs. This result is higher than Serkalem et al. (2018), who reported that egg production of Sasso, Koeckock and Bovans brown were 137, 148 and 144 eggs/hen/year respectively in midland agro-ecology of Sidama zone of southern, Ethiopia. However, Dirsha (2009) and Aman et al (2017) reported 226 and 229 eggs per hen per year under village production systems for RIR and Sasso in Cheha Woreda and SNNPR, Ethiopia respectively.

#### 4.5.2.3 Clutches per year for local chicken

The average number of clutches per year in this study for local chicken was 4.06 with standard deviation of 1.0 and ranged from 3 to 6. The average number of clutches per year in the

present study was related with the result of Addisu (2013), who reported with mean of 3.62 number of clutches per year for indigenous chicken in North Wollo Zone.

However, the number of average egg production of local chicken per hen per clutch was 13.02 ranged from 7-23, which was related with the result of Serkalem *et al* (2019) in which average eggs/hen/clutch was 13.3. Melaku, (2016) reported 12.8 average eggs/clutch of local chickens in three districts of south Wollo zone, and Meseret(2010), Addisu *et al*., (2013) and Wondu *et al*.,2013 reported that the mean egg number laid per clutch per hen of local chickens in Gomma Woreda, North Wollo Zone and North Gondar Amhara region were 12.9, 12.6, 11.5, respectively.

#### 4.5.2.4 Clutches per year for Sasso chicken

The average number of clutches per year in the study area for Sasso chicken was 7.8 with standard deviation of 0.65 ranged from 6 to 9; and the number of average egg production of Sasso chicken per hen per clutch was 20.61 with standard deviation of 0.4 ranged from 12-28.

### 4.6. Predators and Diseases

Poultry disease is widely distributed in Ethiopia and Newcastle disease (ND) is the most important cause of economic loss in poultry production in the country (Nasser *et al*., 2000). Diseases are the major limiting factor to rural household poultry production system (Aini, 1990) to which the results of this study agreed.

The results of this study is in agreement with that of Solomon (2007) who reported that the bio-security of the backyard poultry production system is very poor and risky, since scavenging birds live together with people and other species of livestock.

It is apparent that predation by birds, pet animals and wildcat is responsible for high mortality of chicks in the study area contribute to substantial losses of the flock.

According to Solomon (2007), full day scavenging chickens are vulnerable to predation and diseases. The need to leave the family dwelling to scavenge for feed makes them more vulnerable to predation. The further they go, the greater the danger. Scavenging for food away from the family dwelling also results in birds coming into contact with larger number of birds from other flocks than would otherwise be so, facilitating the spread of infection.

In the free-range and backyard poultry production system, diseases are the major limiting factor to the production of indigenous chickens (Aini, 1990). In the study area, mortality of chicken by the case of diseases and losing by predators was observed. However, the farmers responded that, this was varied in different rates and the condition had its favorable season (Table 16).

67.8% of the respondents confirmed that mortality of chicken including predation in the area was high. Some of the respondents, 23%, responded that mortality of chicken including predation was low and occurs in specific seasons only. However, 9.2% of the respondent confirmed that mortality of chicken including predation did not suffering or not commonly experiencing case for them.

The major diseases reported in the study area, in the order of their importance, were Newcastle disease, coccidiosis and fowl typhoid. Research work in some African countries such as Benin (Chrysostom *et al.*, 1995), Burkina Faso (Bourzat and Saunders, 1990), Mauritania (Bell *et al.*, 1990) and Tanzania (Yongolo, 1996) reported that Newcastle is the most devastating disease in village productions.

However, Newcastle became the major reason for the loss caused by disease; this mainly because farmers in the area have no proper prevention mechanism and do not have proper vaccination program to their chicken. There is also a favorable condition for the transmission of the diseases, which is likely associated with the nature of the rearing practice. This is because local keepers in the surveyed area rear scavenging poultry with, relatively no separate housing, no veterinary services and high degree of contact with the neighbor chicken.

According to the discussions made with the woreda veterinary experts, the Newcastle disease was found to be an important limiting factor in expanding the productivity of poultry in the study area by causing high chick and matured bird mortality (see Table 16 and 17).

### 4.7. Traditional medicines used for chicken treatment

The farmers had experienced using traditional medicines to treat when their chicken were suddenly fallen to diseases. However they responded that they also practiced treating their chicken by veterinarian experts when their chicken sick and disease outbreaks happened (Table 16). The respondents told that they first used development agents of their kebele instead of directly contacting the veterinarian, as they said development agents could help them what to do and how to treat their chicken more regularly than the veterinarian. After they had become familiar with the veterinarian experts, they could directly call them. Some of the respondents also told that they sometimes used traditional medicines to treat them by themselves and they used locally familiarized herbs like ‘‘lome’’ (*Citrus limon)*, ‘’argisa’’ *Aloe vera*, ‘‘charicho’’ *Euphorbia spp*, ‘’masincho’’ *Croton macrostachyus* and ‘’araddo’’ *Nicotiana* tabacum. (Table 16).

**Table 15: Diseases and Season of the Disease in Aleta Chuko Woreda**

| Parameters | Midland | | Lowland | | Cumulative | |
|---|---|---|---|---|---|---|
| Experience serious disease outbreaks? | Freq. | % | Freq. | % | Freq. To | %(cum) |
| Yes | 46 | 63.9 | 68 | 66.7 | 114 | 65.5 |
| No | 26 | 43.3 | 34 | 33.3 | 60 | 34.5 |
| Diseases commonly experienced | | | | | | |
| New Castle | 57 | 79.2 | 77 | 75.5 | 134 | 77 |
| Coccidiosis | 6 | 8.3 | 12 | 11.8 | 18 | 10.3 |
| Fowl typhoid | 9 | 12.5 | 13 | 12.7 | 22 | 12.6 |
| Season of the disease | | | | | | |
| Short rainy (February- March) | 6 | 8.3 | 5 | 4.9 | 11 | 6.3 |
| Short dry (April- May) | 7 | 9.7 | 8 | 7.8 | 15 | 8.6 |
| Long rainy (June- September) | 54 | 75 | 83 | 81.4 | 137 | 78.7 |
| Long dry (October- January) | 5 | 6.9 | 6 | 5.9 | 11 | 6.3 |

**Table 16: Mortality of Chickens by Diseases including Predation**

| Status of the occurrence | Midland | | Lowland | | Cumulative | |
|---|---|---|---|---|---|---|
| | Freq. | % | Freq. | % | Freq. To | %(cum) |
| High | 46 | 63.9 | 72 | 70.6 | 118 | 67.8 |
| Low | 19 | 26.4 | 21 | 20.6 | 40 | 23 |
| No | 7 | 9.7 | 9 | 8.8 | 16 | 9.2 |
| Season of predation | | | | | | |
| Short rainy (February- March) | 9 | 12.5 | 11 | 10.8 | 20 | 11.5 |
| Short dry (April- May) | 12 | 16.7 | 34 | 33.3 | 46 | 26.4 |
| Long rainy (June- September) | 36 | 50 | 43 | 42.2 | 79 | 45.4 |
| Long dry (October- January) | 15 | 20.8 | 14 | 13.7 | 29 | 16.7 |

**Table 17: Disease Treatment Meanses and Traditional Medicines**

| Parameters | Midland | | Lowland | | Cumulative | |
|---|---|---|---|---|---|---|
| | Freq. | % | Freq. | % | Freq. | % (cum) |
| Farmers did when birds were sick | | | | | | |
| Treat them myself | 8 | 11.1 | 8 | 7.8 | 16 | 9.2 |
| Call in veterinarian | 26 | 36.1 | 52 | 51 | 78 | 44.8 |
| Call in development agent (DA) | 31 | 43.1 | 30 | 29.4 | 61 | 35.1 |
| Take them to veterinary clinic | 7 | 9.7 | 12 | 11.8 | 19 | 10.9 |
| Traditional medicinal plants used to treat | | | | | | |
| 'Lome' ('Lomi') (*Citrus limon)* | 40 | 55.6 | 59 | 57.8 | 99 | 56.9 |
| 'Argisa'('Iret') ( *Aloe vera)* | 13 | 18.1 | 20 | 19.6 | 33 | 19 |
| 'Charicho'(Kulkual') (*Euphorbia spp)* | 8 | 11.1 | 10 | 9.8 | 18 | 10.3 |
| 'Masincho'('Bisana')(*Croton macrostachyus)* | 5 | 6.9 | 6 | 5.9 | 11 | 6.3 |
| 'Araddo'('Timbaho') (*Nicotiana* tabacum) | 6 | 8.3 | 7 | 6.9 | 13 | 7.5 |

### 4.8. Purpose of Keeping Chicken in the Study Area

As the respondents explained, they kept their chicken for different purposes. About 12.1% of the respondents replied that their main purpose to keep chicken was home consumption. They told that they had experienced consuming egg and meat of the chicken in home. As their response, they usually fed their infants from chicken eggs and when celebration times they ate chicken meat. About 42% of the respondents kept their chicken mainly to get incomes and money for their home requirements. 46% of them kept their chicken for the purpose of both home consumption and selling egg and chicken (Table 19).

**Table 18: Purpose of Keeping Chicken in Aleta Chuko Woreda**

| Purposes | Midland | | Lowland | | Cumulative | |
|---|---|---|---|---|---|---|
| | Freq. | % | Freq. | % | Freq.Total | %(cum) |
| Home consumption | 11 | 15.3 | 10 | 9.8 | 21 | 12.1 |
| Income from selling egg & chicken | 31 | 43.1 | 42 | 41.2 | 73 | 42 |
| Both home consumption and selling | 30 | 41.7 | 50 | 49 | 80 | 46 |

### 4.9. Season of Good Productivity

The respondents in the study area informed that long dry season (ranged from October up to January) was the best productive season for chicken rearers even if small number of the people included other seasons). The reason, as the respondents' idea, long dry season was good for the chicken to scavenge feeds from surrounding area, additional feeds from home foods was more available, predators also had not suffered them at this season and the climate also more favorable for chickens than other seasons (Table 20).

**Table 19: Season of Good Productivity of Chicken in Aleta Chuko Woreda**

| Season of good productivity | Midland | | Lowland | | Cumulative | |
|---|---|---|---|---|---|---|
| | Freq. | % | Freq. | % | Freq.Total | %(cum) |
| Short rainy (Feb-March) | 6 | 8.3 | 2 | 2 | 8 | 4.6 |
| Short dry (April-May) | 2 | 2.8 | 2 | 2 | 4 | 2.3 |
| Long rainy (June-Sept) | 5 | 6.9 | 7 | 6.9 | 12 | 6.9 |
| Long dry (Oct.- Janua) | 56 | 77.8 | 87 | 85.3 | 143 | 82.2 |
| All seasons | 1 | 1.4 | 3 | 2.9 | 4 | 2.3 |
| No seasonal effect | 2 | 2.8 | 1 | 1 | 3 | 1.7 |

### 4.10. Major Challenges of Chicken Production in the Study Area

In the study areas, the farmers' focus group discussions put that the major constraints of chicken production was outbreaks of diseases, (specially New Castle disease) at known seasons and by this case farmers could not be enforced to expand their chicken production systems. Mearg, (2015) also reported that majority of households confirmed that presence of disease outbreaks were challenging for chicken production. Next to this, the farmers raised as a challenge to the production was feedings and housings of chicken as they could not have sufficient income (as they told) to purchase supplementary feeds and predators also challenged them not to have secured environment. They also informed that if they increase their flock size, the predators like wild fox (*Vulpesvulpes*) and wild birds like hawk (*Buteogallus anthrusinus*) would be threat on their chicken. The farmers generally raised that full

management practices like improved housing, and feeding were mandatory criteria to proceed improved chicken production.

### 4.11. Options Suggested by Farmers to Improve Poultry Productivity

In order to improve the existing state of poultry productivity, farmers suggested that government should support them to have seasonal training on how they could produce their chicken in improved way, how to keep chicken in houses, and support on feeds and seasonal vaccines and treatments on diseases. Additionally the farmers also needed getting exotic breeds of chicken at affordable price from government with full package of production.

### 4.12. Determination of Egg Quality Parameters

#### 4.12.1. External Egg Quality Traits

As shown in Table 21, there was significant ($p<0.05$) effect of agroecologies and breeds on all of external egg quality traits except for egg shape index. The interaction of agroecology by breed was also significant for all parameters. The Sasso chickens reared in the lowland were significantly superior in all observed external egg qualities.

Egg shape index values of native chicken were higher in midland agroecologies than lowlands but those of the Sasso chicken were higher in lowland agroecologies.

This result is related with the result of Serkalem *et al* (2019) in which egg weight was recorded as 41.2g in lowland and 39.5g in midland agroecologies in local breeds. 53.8g in lowland and 51.0g in midland was recorded for Sasso egg weight in the same report.

**Table 20: Effect of Agroecology, Breed, and their Interactions on External Egg Quality Traits (Mean±SD)**

| Agroecol | Breed | Egg wt. | Egg width | Egg length | Shape ind | Shell thick |
|---|---|---|---|---|---|---|
| Midland | Local | 41.1±4.0 | 38.0±1.7 | 49.3±3.0 | 77.23±2.5 | 0.302±0.3 |
| | Sasso | 47.9±3.1 | 39.5±1.8 | 51.7±2.3 | 74.2±3.4 | 0.325±0.04 |
| Lowland | Local | 41.6±4.1 | 37.7±2.28 | 49.7±2.2 | 76.8±4.0 | 0.326±0.03 |
| | Sasso | 52.3±6.0 | 41.4±1.7 | 54.5±2.7 | 76.6±4.5 | 0.293±0.02 |
| Sources of variation | | | | | | |
| Agroecology (AE) | | <.0001 | 0.0005 | <.0001 | 0.0607 | <.0001 |
| Breed (B) | | <.0001 | <.0001 | <.0001 | 0.0001 | <.0001 |
| AE*B | | 0.0002 | <0.0001 | <.0001 | 0.0002 | <.0003 |

SD=Standard Deviation

The findings indicated that the egg weight, egg width and egg length of Sasso hens varied across the agroecologies with higher values recorded among the eggs laid in the lowlands (Table 21). The study indicated that eggs of Sasso hens reared in the lowlands as well as in midlands were heavier than those of local hens. The eggs of Sasso chickens reared in the lowlands were heavier ($p<0.05$) when compared to those from the midlands. Local chickens were less in all external egg qualities except for shell thickness.

### 4.12.2. Internal Egg Quality Traits

As shown in Table 22, the effect of agroecology was significant for all internal egg quality traits except for yolk color. Similarly, the effect of breed was significant for all internal egg quality traits except for Haugh unit. The interaction effect of agroecology by breed was also significant for all traits. In the lowland, yolk index was relatively higher ($p<0.05$) in eggs from Sasso than local chickens. Conversely, local chickens reared in the midland produced eggs

with higher yolk index than Sasso chickens. Yolk color was significantly higher in Sasso chickens than local chickens. Haugh unit values of the eggs laid by Sasso hens reared in the lowlands were higher ($p<0.05$) when compared to midlands. No significant difference was observed between the breeds in Haugh unit values.

**Table 21:Effect of Agroecology, Breed, and Their Interactions on Internal Egg Quality Traits (Mean±SD)**

| Agroecol | Breed | Albumen ht | Yolk ht | Yolk width | Yolk color | Yolk index | HU |
|---|---|---|---|---|---|---|---|
| Midland | Local | 3.42±0.7 | 14.4±1.0 | 39.0±2.0 | 7.64±1.7 | 41.3±2.0 | 62.27±8.5 |
| | Sasso | 3.54±0.87 | 14.4±0.9 | 41.9±2.8 | 8.73±2 | 38.4±3.7 | 60.1±9.96 |
| Lowland | Local | 3.48±0.7 | 14.4±1.1 | 39.3±3.8 | 8.45±1.8 | 38.9±5.3 | 62.8±7.0 |
| | Sasso | 4.27±0.9 | 15.5±0.8 | 41.1±1.8 | 8.67±1.5 | 40.2±3.4 | 64.6±8.0 |
| Sources of varia | | | | | | | |
| Agroecology (AE) | | <.0001 | <.0001 | 0.0212 | 0.0690 | <.0001 | 0.0026 |
| Breed (B) | | <.0001 | <.0001 | <.0001 | 0.0016 | <.0001 | 0.4714 |
| AE*B | | 0.0004 | <.0001 | 0.0003 | 0.0323 | <.0001 | 0.0130 |

SD=Standard Deviation

Egg's internal quality could be influenced by factors like genetic factors, environmental factors (such as temperature and relative humidity), hen age, nutrition status, egg storage condition and storage time (Juliet, 2004). Halima (2007) reported the color of the egg yolk is mainly dependent on the type of ration and the management systems of the chickens.

# 5. CONCLUSION AND RECOMMENDATION

## 5.1 Conclusion

The performance of Sasso chicken under village production system was better than local chicken via the traits like egg production per hen per year, number of clutches per year, etc. Farmers were aware that Sasso chicken layers can produce more eggs if they are fed and looked after carefully. But the management practices of the farmers for both local and Sasso chickens were not in proper condition. This limited them not to be satisfied by the rearing of chicken. The chickens were exposed to several diseases which were preventable with vaccines but the farmers were not regularly following improved mechanisms to keep their chicken in right way. However, regarding diseases and predation, local chicken were better to resist diseases and to fight or flight behaviors against predators and exotic chicken (Sasso) were more exposed..

Regarding the external and internal egg quality traits, most of the results indicated that exotic chicken (Sasso) were better performing. However, in some egg quality parameters, such as agroecology effect on shape index and yolk color; and breed effect on HU traits, the variation was non-significant.

Sasso chicken could not be used for egg setting, hatchability and chick nurturing traits in all farmers in the study area. This would inhibit them not to replace themselves in the households.

Somewhere farmers could not give exact information on their chicken production conditions and chicken’s productivity. This was perceived as farmers did not practice recording system for their chicken rearing concerns.

## 5.2 Recommendation

With the view of the above outcomes, the following recommendations are suggested:

- Supporting farmers to rear exotic and/or improved chicken rather than local chicken may advance their economy as well as income and nutrition.
- Supporting the farmers by improved housing systems to keep their chicken in secured environment may improve their husbandry system and also to keep them from predators.
- Farmers should have veterinary service nearby their areas; as the site of the clinic farer from their homes, the chance to contact the agent become difficult as they indicated.

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# 7. APPENDICES

## 7.1 Appendix I : Survey Questionnaire

1. Questionnaire that was used to collect information from Sasso and local chicken rearers/farmers.

This questionnaire was completed by farmers; the respondents were kindly requested to complete this questionnaire.

Name of the enumerator _____Date of Interview _____ Name of the respondent _____ Phone Number _____

Kebele _____ Agro ecology _____

Socio-economic characteristics: Type of house: Male headed/Female headed, position of the respondent: household head/not household head

1. Sex of the respondent: 1.Male ----------. 2. Female --------

2. Age of the respondent -------

3. Major occupation: ----------

4. Educational level of the respondent:

1. Illiterate 2. Read & write 3.1st –4th 4. 5th –8th 5.9th-12$^{th}$ 6.University/college graduate

5. Religion: 1/ Protestant 2/ Orthodox 3/ Muslim 4/ Traditional 5. No religion 6/ Other (specify)

6. Marital status: 1/ Single 2/ Married. 3/ Divorced 4/ Widow 5/ Other (specify) ……

7. Total land size (ha): ----------

8. Total Family size : Male --------- Female--------- Total ----------

1) Age below 7 years Male --------- Female--------- Total ----------

2) Ages between 8 to 15 years: Male --------- Female--------- Total ----------

3) Ages between 16 to 30 years : Male --------- Female--------- Total ----------

4) Ages between 31 to 60 years: Male --------- Female--------- Total ----------

5) Ages above 60 : Male --------- Female--------- Total ----------

6) Total number: Male --------- Female--------- Total ----------

9. Household size and Educational level

| Sex | Age group in years | | | | | Educational level | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | <7 | 7-15 | 16-30 | 31-60 | >60 | Illiterate | 1-4 | 5-8 | 9-12 | >12 |
| Male | | | | | | | | | | |
| Female | | | | | | | | | | |
| Total | | | | | | | | | | |

10. Type and number of livestock you rear

a/ Cattle : Native ……., Crossbred ……. Total …… .

b/ Small ruminants : Sheep ……. Goats …… Total …….

c/ Equines : Donkeys …… Horses ……. Mules…….. Total ……

d/ Chicken: Native : roosters…… hens….. pullets….. cockerels……chicks… Total……, Sasso : roosters…… hens……. pullets……cockerels……chicks……. Total……...

11. Total farm land size of the household

| Purpose | Land holdings (ha) | | |
|---|---|---|---|
| | Own(ha) | Rented (ha) | Communal (ha) |
| Grazing land | | | |
| Crop land (both annual and perennial) | | | |
| Improved forage land | | | |
| Woodland (forest) | | | |
| Fallow land | | | |
| Others | | | |
| Total land holding | | | |

12. Which crops do you produce? 1. Maize —— (ha) 2. Teff ——— (ha) 3.Wheat———(ha) 4.Barley ——— (ha) 5. Enset ——— (ha) 6. Haricot bean ——— (ha) 7. Banana….8.Mango 9.Coffee 10.Sugar cane 11.Other

**B. Production system/Husbandry practices**

**Direction1:** For the following all questions, the respondent was identified whether he had either Sasso or native chicken. One was selected (Marked this √) on the blank below.

**The farmer was 1.Sasso chicken rearer …… 2.Native chicken rearer ……**

1. How long have chicken been kept in the household? ……..

2. What chicken categories/classes and number do you raise and where do you get it from?

| | Male | Female | Total | Source (Purchased, Inherited, hatched, other |
|---|---|---|---|---|
| 1/ Starter (0-8wks) | ……. | …… | ……. | ……. |
| 2/ Grower (8-20wks) | ……. | …… | ……. | ……. |
| 3/ Layer/hen | ……. | …… | ……. | ……. |
| 4/ Breeder/cock | ……. | …… | ……. | ……. |
| Total | ……. | …… | ……. | |

3. Do you feel there is need to improve your poultry production related activities in your area?

1. Yes 2.No

If Yes, why? (Prioritize what is to be improved-- Rank them))

1st ……

2nd …….

3rd ……..

4th……..

If No, why? (Rank the problems based on the most important)

1st ……

2nd …….

3rd ……

4th……

**C. Husbandry related findings**

**I. Housing**

1. What type of management system do you practice for your poultry rising?

a) Extensive b) Intensive c) Semi-intensive d) Others

2. Do you have separate poultry house, other than family dwellings? 1. Yes 2.No

3. If your answer to question 2 is No, what is the problem in the construction of separate poultry house (Prioritize them in ascending order)

1st ……..

2nd …….

3rd ……

4th ……...

4. If your answer to question 2 is No, where do your birds stay at night? (a) In the kitchen (b) Family dwellings (c) Perch on trees (d) Under basket (e) In cages (f) In the house purposely made for the chickens (g) Others, specify …….

5. If your answer to question 2 is No, where do your birds stay during the day times?

6. Do you believe it is advantageous to construct separate poultry house? 1. Yes 2.No

7. If your answer to question 6 is Yes, state the advantages of separate poultry house.

a.

b.

c.

d.

e.

10. If your answer to question 2 is Yes, what is the chicken house made up of?

1) Mud blocks 2) Galvanized iron sheet roof & wood 3) Cement blocks and concrete roof 4) Thatched roof 5) Galvanized iron sheet

11. Specify any special care given/associated with birds in the area regarding housing managements

1. Ventilation of the house ……. 2. Presence of rodents in and around the house…….3.Floor of the house (cemented, mud) 4.Design of the house (rain, wind, sunlight,,,,) 5.Other …….……

**II. Feed Resources and Feeding Strategy**

1. Do you practice purposeful feeding of your chicken in confinement? 1.Ye 2.N

2. If your answer for Q1 is Yes, what do you feed for your chicken (ingredients you use for poultry feeding)?

1/ Grains 2/ Vegetables (which can be either tuber/root crops, leafy vegetables, etc.) 3/ Oil seeds 4/ Concentrate (can be either home prepared or purchased) 5/ Minerals

6 Other, specify …….

3. If your answer to question 1 is Yes, how frequent do you feed your birds daily?

1. Once a day 2. Twice a day 3. Thrice a day 4.Adlib

4. If you provide concentrates/industrial by-products, where do you buy these feeds?

1. Factories 2. Retailers 3. Commercial farms 4. Feed mills 5.Both factories and Retailers 6. Both retailers and feed mills 7. Other (Specify) …….

5. The supplementary/purposive feed is provided for the purpose of?

1. Egg production 2.Meat yield 3.Broodiness (during incubation) 4.Growth 5.Maintaining body condition 6. Disease tolerance 7.Other, specify (more than one option can be answered from the above choices)……..

6. If your answer to Q1&5 is Yes, how do you feed your birds?

1. In a feeder 2. on the floor 3.Both 4.Other, specify……

7. How do you give the extra feeds?

1. Separate the birds into different classes 2.Together for the whole groups (for group feeding)

8. If your answer to question 1 is No, what is the reason?

1. Lack of awareness about providing feed 2.Unavailability of feed and feed ingredients

3. High cost of feed and feed ingredients 4.Shortage of time

5. Lack or shortage of money 6.Erratic supply of feeds 7.Others, specify……

9. Indicate the season when the extra feed is provided to the chicken using the following table. (At which season(s) do you offer more extra feed to your birds?) (More than one season can be answered) (Use√)

| Class | Short rainy (Feb-March) | Short dry (April-May) | Long rainy (June-Sep) | Long-dry (Oct-Jan) |
|---|---|---|---|---|
| Layers | | | | |
| Brooding hens | | | | |
| Cockerels | | | | |
| Pullets | | | | |
| Cocks | | | | |
| Chicks | | | | |

10. Indicate priority of supplementation (Management and care) of the different classes (Rank 1 to 4) using the following table)

| Class | Short-rainy (Feb-March) | Short-dry (Apr-May) | Long-rainy (June-Sep) | Long-dry (Oct-Jan) |
|---|---|---|---|---|
| Layers | | | | |
| Brooding hen | | | | |
| Cockerels | | | | |
| Pullets | | | | |
| Cocks | | | | |
| Chicks | | | | |

11. Do you allow the chicken to scavenge? 1. Yes…2.No…

12. If Yes, which class of your chicken do scavenge? (Use the following table)

| SNO | Class | Scavenging | Season |
|---|---|---|---|
| 1 | Mother hen with her chicks | | |
| 2 | Pullets and cockerels | | |
| 3 | Laying hen and cocks/rooster | | |
| 4 | Brooding hen | | |

13. Do you provide water to your chicken? 1. Yes 2. No

14. If Yes, fill the following table

| SNO | Class | Provide water | If Yes, howoften |
|---|---|---|---|
| 1 | Chicks | | |
| 2 | Pullets and cockerels | | |
| 3 | Laying hen | | |
| 4 | Brooding hen | | |
| 5 | Rooster | | |
| 6 | Mothering hen | | |

15. If you provide water for the chickens, where do you get the water from?

1. Rain water 2.Borewell 3.Tap water 4.Spring water 5. Conserved water

16. If you provide water for the chickens, what type of container do you use to provide the water? 1. Plastic containers 2. Broken utensils 3. Glasses 4. Other

17. If you provide water for the chickens, how frequent do you wash the container?

1. As frequent as I provide water 2.Once in a day 3. Don't wash 4. Other

**IV. Productivity**

1.State the productivity of your chicken in the following table.

| Chicken types | Age at sexual Maturity | No. of times the hen hatches per year | Average No of Eggs per clutch | Average No of days for a clutch | Average No of eggs per set | Number of chicks Hatched per set | No. of chicks Surviving to adult hood | Season of good productivity |
|---|---|---|---|---|---|---|---|---|
| Sasso | | | | | | | | |
| Local | | | | | | | | |

2. What is market and/or slaughter age of cock?

3. What is market and/or slaughter age of hen (female)?

4. Current total flock size? ----------

5. Frequency of egg consumption at household level?

6. Frequency of poultry meat consumption at household level? ----------

7. Mortality of chicken including predation? 1. High 2. low (Indicate this using the following table

| SNO | Class | Mortality season | Predation season |
|---|---|---|---|
| 1 | Chicks | | |
| 2 | Pullets and cockerels | | |
| 3 | Laying hen | | |
| 4 | Brooding hen | | |
| 5 | Rooster | | |
| 6 | Mothering hen | | |

**8. Egg characteristics**

8.1 Dominant color of the shell (indicate genotype using the following table

| SNO | Genotype | Dominant color of the egg shell (white, pale white, pale brown, dark brown, other) | Dominant size of the egg (small, medium, big) | Dominant yolk color (light yellow, yellow, deep yellow) |
|---|---|---|---|---|
| 1 | Sasso | | | |
| 2 | Local | | | |

9. State the major potential threat/ production constraints to chicken production and productivity in order of economic importance (Indicate genotype here ……..)

1st ----------

2nd ----------

3rd ----------

4th ----------

5th ----------

6th ---------- (Indicate season which you usually experience potential threat) …….

10. How often do your chicken lay egg

1. Daily 2.Once in two days 3.Once in three days 4.Daily but sometimes twice in a day

**V. Culling**

1. Do you purposely cull your chicken at any time?

1.Yes 2.No

2. If your answer to Q1 is Yes, what factors influence you to cull the bird?

1.Poor productivity 2.Sickness 3.Lack of broodiness 4.Old age

5. Frequent broodiness 6. Slow growth 7.Canibalism 7.Other, specify------

3. If your answer for Q1 is Yes, for what purpose do you use the culled birds?

1. Consumption 2. For sale 3. For sacrifice 4.Other, specify …….

4. What is the season in which culling usually occurs.

**VI. Health and disease control**

1. Do you experience serious disease outbreaks? 1.Yes 2.No

2. If Yes, then during which season are the diseases mostly seen? 1. June to August 2. September to November 3. December to February 4. March to May

3. If Yes, describe the common diseases you have experienced in your flock

4. What is the season the above disease mostly seen ? ……..

5. How do you recognize sick birds?----------

6. What do you do when birds are sick?

1. Treat them myself 2. Call in veterinarian 3. Call in development agents 4. Take them to veterinary clinic 5. Ask neighbors and friends

6.Cull/kill them all immediately 7.Slaughter them all immediately for home consumption 8.Sell them all immediately 9.Others. Specify ------

7. Do you control the free movement of chickens all the times? 1. Yes 2. No

8. If Yes, what is the season you control the movement? …….

9. If Yes, would you mention the reason?

1. To protect from predators attack 2. To avoid risk of contagious diseases

3. To protect from mixing with the village flock

4. To protect birds from picking and destroying crops/ vegetables

10. Do you control the free movement of chickens at a time of disease outbreak? 1.Yes 2.No

11. Do your chickens scavenge mixed with that of your neighbors? 1.Yes 2.No

12. What do you do with dead birds? ----------

13. Do you segregate the sick chickens

1. Yes 2. No, 3. Sometimes

14. Do you practice quarantine among your flocks

1. Yes 2. No 3. Sometimes

15.If Yes, then what do you do

1. Segregate the chickens prior to introducing them in the flock

2. Segregate the sick chickens from the main flock

3. Segregate own flock in case there are outbreak of diseases

4.Others

16.If your answer is "No" then why

1. Unaware of the importance of quarantine 2. Do not have separate space

3. Do not have time to maintain the same 4. Do not have separate provision for the same

Major diseases and parasites in the area : Name the diseases in the box

| | Long rainy | Short rainy | Dry | Irrespective of the season |
|---|---|---|---|---|
| Roosters | | | | |
| Hens | | | | |
| Pullets | | | | |
| Cockerels | | | | |
| Chicks | | | | |

**Ethno veterinary practices**

1. Do you use traditional medicines to treat your flock? 1. Yes 2. No

3. Which categories of chickens do you treat using traditional medicines

1. Chicks 2. Pullets 3. Cockerels 4. Roosters 5. Hens 6. All

Name the diseases you treat using traditional medicines

| Name of disease ( local name) | English name | Plant name | Part of the plant used | Method of usages (with water, milk, feed,othermedium | If in combination then with which plant and part used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

4.Do you vaccinate your chickens 1. Yes 2. No

5. If Yes, who provides the vaccination?

1. Local veterinarian 2. Development agent 3. NGO's 4. Others

6. If "Yes" for which diseases do you vaccinate the chickens and when

1.

2.

3.

4.

7.If "No" why

1. Do not know what vaccinations are 2. Not aware of the importance

3. They are expensive 4. They do not provide the intended results 4. Others

8.Do you provide anthelminthic to the chickens? 1. Yes 2. No

9. If "Yes" how frequent do you provide the vaccinations

1. Once in a lifetime 2. Once every six months 3. Once every three months

10.If your answer is Yes to question 8, then which anthelminthic do you use?

1. Do not know the name 2. Piperazine 3. Albendazole 4. Others

11. If your answer is "No" then why

1. Not aware of the existence 2. Not aware of the importance 3. Expensive 4. Others

12. What are the major predators in your area

1.

2

3

4

13. Which category of birds are most likely to be attacked by the predators

| | Local | Sasso |
|---|---|---|
| Roosters | | |
| Hens | | |
| Pullets | | |
| Cockerels | | |
| Chicks | | |

14.Disposal of dead birds is carried out by

1, Throwing 2. Burying 3, Deep burying 4. Burning

**D. Extension services**

1.How often do you meet the extension agents of your area

1**.** Daily 2. Once a week 3. Once a monthly 4 On call 5. Never

2.If you meet him/her then

1. Have you ever discussed your poultry production & related problems with the extension agents? 1. Yes---------- 2.No----------

3. If No, state the reasons for not contacting the extension agent in terms of importance

1. Have no idea about the extension in poultry 2. Could not easily reach them

3. There is no need to contact the agent 4. Not friendly

5. Demand payment for consultation 6. All the above 7. None of the above

4. Have you ever heard about improved poultry production practices?

1. Yes 2.No

5. If Yes, what is your major source of information on improved poultry production practices?

1. Extension agents 2.Relatives 3.Other farmers 4.Newspaper 5. Traders 6. Radio 7. Neighbors 8. Television 9. Co-operative leader 10. NGO's 11. Other specify ……

6. If Yes, then how often are training programs on poultry production held in your kebele

1. Once a month 2. Once in two months 3. Once in six months 4. As and when required 5. No training at all 6. Others

7. If " Yes" then the training programs are on

1. General (Housing, feeding, hygiene watering etc.) management 2. Breeding management 3. Feed preparation using locally available feeds 4. Veterinary advise 5. All of the above 6. Others

7. If " No" then what are the extension agents limited to when it comes to poultry farming

1. Distribution of crossbred chicks/ hens/ pullets/ cockerels 2. Distribution of feed 3. Distribution of medicines 4. Vaccinations 5. None of the above 6. All of the above

8. Are NGO's active in poultry husbandry practices in your area 1. Yes 2. No 3. Sometimes

9. If Yes which NGO'S are active in your area (name of the NGO's)

1.

2.

3.

10. If the answer is "Yes" then what are the major activities they carry out

1. Distribution of crossbred chicks/ hens/ pullets/ cockerels 2. Distribution of feeds 3. Distribution of medicines 4. Vaccinations 5. None of the above 6. All of the above

11. What are the major drawbacks in the extension services in the area?

1.

2.

3.

4. Everything is fine and no problems exist

E. **Breed/Breeding**

1. Do you select the chickens for breeding? 1.Yes 2.No

2. If Yes, on which sex do you practice selection? 1.Roosters 2.Hens 3.Both

3. Is there any seasonal variation for breeding? 1.Yes 2.No

4. If Yes, which season is good for breeding …….and which is bad…….

5. Are you interested to have exotic/ crossbred chickens? 1.Yes 2.No

6.If you have exotic breeds of chickens, would you compare the performance/merits of exotic versus local chickens?(like egg production, growth, income development ……..) Describe as

1. Higher (**), 2. Lower (*), 3. No difference (-)

7. Do you limit the number of Roosters running with pullets/ hens? 1.Yes 2.No

8. If Yes, would you mention the ratio of male: female you normally have in your homestead? ----------Male to ---------- Female.

9. Do the roosters from the neighboring houses come to your yard? 1. Yes 2. No. 3. Sometimes

10. Do your roosters visit the neighboring yards 1. Yes 2. No. 3. Sometimes

11.. How many chickens can you afford to manage under your condition?

12. Which season is good to manage chicken? ……..

13. State the major factors limiting the number of chickens to be kept in order of importance (why not more?)

1st ---------- 2nd ---------- 3rd ---------- 4th ---------- 5th ---------- 6th ----------

F. **Incubation, brooding and rearing**

**Direction 2:** Some of the following questions may concern either Sasso or local chicken rearers and some of them may be for only local chicken. You can skip/jump the questions that don't concern you.

1. Do you have your own rooster for breeding? 1. Yes 2.No

2. If your answer to question 2 is No, how do you mate (breed) your laying hens----------

3. If your answer to question 2 is Yes:

4. Indicate the age of sexual maturity for the use of cock for breeding purpose?

5. How long do you use the cock for breeding purpose? ----------

6. Do you assign the number of layers per breeding cock?

7. How many layers do you assign /breeding cock? ----------

8. How many times do you incubate eggs per year? ----------

9. What do you use as nesting material?

1. clay pot & straw bedding 2. clay pot only/without bedding

3. Teff straw 4. wheat straw 5 other (Specify)_____

10. How long do you store eggs before incubation? ----------

11. Where do you store eggs before incubation? ----------

12. What do you use as bedding for the broody hens? ----------

13. Do you select eggs at a time or before incubation? 1.Yes 2.No

14. If Yes to question 13, state the criterion of selecting eggs for incubation

i. ---------- ii. ---------- iii. ---------- iv. ----------

15. Do you select any specific color of eggs for incubation? 1.Yes 2.No

16. If Yes, which color do you prefer and why? 1.Brown 2.White 3.Others --------

(Why ?.....

17. Do you practice any treatments of eggs before incubation? 1.Yes 2.No

18. If Yes, how do you treat?

1. Wash with cold water 2. Wash with warm water 3. Test fertility by looking at the growing embryo against the sunlight or lump

4. Clean the eggs using cloths or other materials 5. Other_____

19. Do you select size of hens for brooding? 1. Yes 2. No 3.Do not consider the size since any hen that manifested broody behavior is allowed

20. If Yes, which one do you prefer? 1. Bigger 2. Medium size 3. Smaller

If " No" Why

1.

2.

21. Do you select the laying hen incubating the eggs? 1.Yes 2.No

If Yes then what are the criteria used

1.

2.

3.

22. How many eggs do you incubate under a single hen at a time in average?

23. How many live chicks do you collect from that single incubation? ----------

24. State the major causes for failure of hatching in order of importance

1st ---------- 2nd ---------- 3rd---------- 4th----------

25. Is there any seasonal variation for incubation, hatchability and chick's growth? 1. Yes 2. No 3. Sometimes

26. If Yes, what is the season that is good for incubation, hatchability and chick's growth …….. and which is the bad one ……

27. How do you manage broody hen at a time of incubation? ----------

28. Sources of eggs for incubation

i. Purchased from market ii. Purchased from neighbor

iii. Laid at home iv. Bartered v Other

29. Do you incubate eggs purchased from market? 1.Yes 2.No

30. If Yes, which genotype …….. and when(season)…….

31. Do you test eggs for fertility? 1.Yes 2.No

32. If Yes to question 31, how do you test? ----------

33 If Yes to question 31, when do you test? ----------

1. Before incubation 2. after incubation (after how many days----------)

34. Where do you set/place the broody hens?

1. In dark and protected corner 2. In light and protected corner 3.Anywhere in the house

35. Do you practice avoiding broody behavior? 1.Yes 2.No

36. If Yes, what technique do you practice?

1. Hanging the bird upside down 2. Depriving the birds from feed & water

3. Disturbing in the nest 4. Moving to neighbors 5. Others_____

37. If Yes to question 35, is there any seasonal consideration to avoid broody behavior ? 1. Yes 2. No 3. Sometimes

38. If Yes, in which season to avoid and why ?.....

39.. How do you store eggs to improve their shelf lives?

1. In cold room 2. Inside cold container 3. Any place 4. Other practices----------

40. If there is seasonal variation how to store eggs, where do you store in which season? ……

41. How many eggs do you incubate per clutch in average? ----------

42. How many chicks are hatched from them in average? ----------

43. How many chicks survive to an age of 2 months from them? ----------

44. How many chicks survive to an age of sexual maturity (5 months?)----------

45. How long the hen spends nurturing the chicks (in weeks)? _____

46. What do you feed the chicks? ----------

47. Is there any seasonal variation for what to feed chicks? 1. Yes 2. No

48. If Yes, what to feed when? ……

49. When the highest chick mortality does occur after hatching? During:

1.1st- 2nd week 2. 3rd – 4th week 3. 5th - 6th week 4. 7th- 8th week

50. State the cause of the highest chick mortality in order of importance

1st. ---------- 2nd. ---------- 3rd. ---------- 4th.----------

51. State the cause of the highest adult bird mortality in order of importance

1st. ---------- 2nd. ---------- 3rd. ---------- 4th.----------

52. What are your selection criteria of eggs before incubating? (Indicate genotype ……..)

| **Criterion** | **Selected** | **Why? Rejected** |
|---|---|---|
| Egg size | 1. Big 2. Medium 3. Small | |
| Egg shape | 1. oval 2. circular (Kib) | |
| Age of egg | 1. 1 week 2. 2weeks 3. 3weeks | |
| Type of eggs | 1.From local pullet 2. From mature local hen 3.From Sasso 4. Other…… | |

53. How do you test and prepare eggs before incubation?

1. Visual examination through the sun light 3. Eggs will be cleaned before incubation
2. Floating eggs in a bucketed filled with water 4. Other (Specify)

I. **Other General Issues**

1. Do you intend to expand poultry production as a business? 1.Yes 2.No

2. If Yes, indicate flock size of your interest ----------

3. What are your barriers to future expansion of poultry production?

1st ----------

2nd ----------

3rd ----------

4th ----------

5th ----------

6th ----------

4. What do you think introducing new breeds of chickens every time?

1. Important 2.Not important 3. I don't have any idea

5. Why if? Important Not important

---------- ----------

---------- ----------

---------- ----------

---------- ----------

6. What do you think the government should do to improve poultry keeping, particularly in rural areas? ----------

II. **Other information**

1. Type of farming 1. Crop-livestock 2. Only livestock 3. Only Crop

2. Measurement System 1. Intensive (confined) 2.Semi intensive (partially confined)

3. Extensive (kept outdoor & confined)

3. Purpose of keeping poultry

1. Home consumption 2. Sale 3. Religious 4. Sacrifice 5. other

4. Is there any institution providing credit services in your area? 1.Yes 2.No

5. If the answer is " Yes" is it a "formal" or "informal" credit

6. If it's a " formal" credit institution then what is its name _____

7. How much amount in ETB is provided at one time _____

8. Is the money provided in cash or kind _____

9.If it's in cash then what is the collateral required to avail the credit facilities ( irrespective of both formal and informal agencies) _____

10.In both the cases what is the rate of interest for the credit obtained : informal ( %), formal ( bank %, micro finance %)

11. Do these financial institutions provide any sort of extension services for facilitating chicken production? 1. Yes 2. No 3, Sometimes

12.If Yes and "Sometimes", then indicate the type of extension services provided

1.

2

3

4.

13. If the credit is in kind then what types of items are supplied by the credit institutions?

1.

2

3

4

14. In the case of the loan taken for the poultry farming could not be repaid, then what happens

1. Repay from other allied activities 2. Carryover to the next loan 3.Others: _____

15. Is there any development/ research project on poultry serving in your area?

Yes---------- No----------

16. If Yes, name of the Institution. Types of service support

_____ _____

_____ _____

17. Do you have any access to extension services (other than those of poultry)? 1.Yes 2.No

18. If Yes, in what aspects?

1. Crop production 2. Dairy production 3. Sheep/goat production

4. Value addition 5. Others, specify---

19. If you are receiving extension services in what form?

1. Advice only 2. Provision of improved breeds

3. Provision of feed and veterinary service 4. Complete national package

5. Others, specify ……..

20. What is your estimated annual income from the sale of egg? ------

21. For what purpose or how do you use the money from sell of egg

1. Purchase of agricultural inputs 2. Payment of school fee for children

3. To cover household expense 4. To cover medical expense 5.Others, specify ……

22. General comments and suggestions of the respondent for improved poultry production systems and productivity

_____

_____

_____

_____

_____

_____

_____

## 8. BIOGRAPHICAL SKETCH

The author Ayele Rodamo Bacho was born from his father Rodamo Bacho and his mother Dambowe Burako (Dararo) in July 11/1984E.C in Aleta Chuko woreda, Chicho Woyama kebele, Sidama zone, Southern Ethiopia. He attended his primary education at Miridicha Primary First Level School (from 1990-1995E.C), elementary at Mangudo Elementary School(1996-1997E.C), secondary at Chuko High School(1998-1999E.C) and preparatory school at Aleta Wondo Secondary and Preparatory School(2000-2001E.C). After completion of his preparatory school education, he joined Hawassa University at 2002E.C and stayed for three consecutive years and awarded with Bachelor of Science degree in Animal and Range Sciences on July 2004E.C. Soon after graduation, he was employed at Aleta Chuko woreda Agriculture Office as Poultry Production Expert from 2005- 2009E.C and from where he joined School of Graduate Studies of Hawassa University, Hawassa College of Agriculture at September 2010E.C by the sponsorship of the woreda to pursue his MSc degree in Animal Production. The author had five years' work experience and not married.