ASSESSMENT OF PRODUCTION PERFORMANCES AND EGG QUALITIES OF HOUSEHOLD POULTRY IN HIDABU ABOTE DISTRICT OF NORTH SHOA, ETHIOPIA

MSc. THESIS

BY

ABI TOLOSSA SEGNI

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ASSESSMENT OF PRODUCTION PERFORMANCES AND EGG QUALITIES OF HOUSEHOLD POULTRY IN HIDABU ABOTE DISTRICT OF NORTH SHOA, ETHIOPIA

By: Abi Tolossa Segni

A thesis submitted to the Department of Animal Science, Jimma University, College of Agriculture and Veterinary Medicine, School of Graduate Studies, in partial fulfillment of the requirements for the Degree of Master of Science in Animal Sciences (Specialization: Animal Production)

Major Advisor: Mrs. Eyerus Muleta (MSc.)

Co-Advisor: Solomon Demeke (Prof.)

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Thesis Submission Request Form (F-08)

Name of student: **Abi Tolossa Segni** ID. No.**RM 1415/09**

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Major Advisor: **Eyerus Muleta (MSc.)** _____ _____

Name Signature Date

Co-Advisor: **Solomon Demeke (Prof.)** _____ _____

Name Signature Date

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DEDICATION

This thesis work is firstly dedicated to the Almighty GOD, who gave me all the strength and courage. Secondly, this work is dedicated to my mother, Mrs.FurnoTaddese and my father Mr.Tolossa Segni who had nursed me with love and advise and committed to my success with strong prayer for the betterment and in general success of my life.

BIOGRAPHICAL SKETCH

The author Abi Tolossa was born in June 1990 G.C. at Hidabu Abote Woreda North Shoa Zone of Oromia Regional State. He attended and completed grade 1 to 8 at Amara Aftin Elementary School, 9 to 10 at Ejere General Tadesse Biru High School and Preparatory at Gebre Guracha Senior Secondary School. Then he joined Gambella University in September, 2012 G.C. and graduated with the Degree of Bachelor of Science (BSc.) in Agriculture (Animal Science) in July 2015 G.C. After graduation, he was employed by Gambella University, where he served for one year as Graduate assistant. Starting from September, 2017 G.C., he joined Jimma University, College of Agriculture and Veterinary Medicine,School of Graduate Studies to pursue study leading to the Degree of Master of Science in Animal Production.

STATEMENT OF AUTHOR

I declare that this thesis hereby submitted for the M.Sc. degree to Jimma University, College of Agriculture and Veterinary Medicine. It is my own work and has not been previously submitted to others at another University or institution for the award of any academic degree, diploma, or certificate. I concede copyright of the thesis in favor of the Jimma University, Collage of Agriculture and Veterinary Medicine.

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Signature:…….

Place: Jimma University, Collage of Agriculture and Veterinary Medicine

Date of Submission: ……

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LIST OF ACRONYMS AND ABBREVIATIONS

AACMC	Australian Agricultural Consulting and Management Company
ANOVA	Analysis of Variance
CACC	Central Agricultural Census Commission
CSA	Central Statistical Agency
DZARC	Debrezeit Agricultural Research Center
EARO	Ethiopian Agricultural Research Organization
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
IB	Isa Brown
IBD	Infectious Bursal Disease (Gumboro)
ILCA	International Livestock Center for Africa
HPAI	Highly Pathogenic Avian Influenza
HU	Haugh Unit
IAR	Institute of Agricultural Research
JUCAVM	Jimma University College of Agriculture and Veterinary Medicine
M.a.s.l	Meter above sea level
MoARD	Ministry of Agriculture and Rural Development
MoFED	Ministry of Finance and Economic Development
NABC	Netherland African Bussiness Council
NGO	None Governmental Organizations
RIR	Rhode Island Red
RK	Rural Kebeles
RSBA	Regional State Bureaus of Agriculture
SE	Standard Error
SNNP	Southern Nation and Nationality People
SPSS	Statistical Package for Social Science
TSS	Technical Services and Supplies
UK	United Kingdom
USAID	United States Agency for International Development
WLH	White Leghorn

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ASSESSMENT OF PRODUCTION PERFORMANCES AND EGG QUALITIES OF HOUSEHOLD POULTRY IN HIDABU ABOTE DISTRICT OF NORTH SHOA, ETHIOPIA

Author: Abi Tolossa

Major Advisor: Eyerus Muleta (MSc.)

Co-advisor: Solomon Demeke (Prof.)

ABSTRACT

This study was conducted to assess the production performances and egg qualities of household poultry in Hidabu Abote district. A total of 180 randomly selected households from three different agro-ecologies were used to collect primary data with the use of questionnaires. A total of 180 eggs of indigenous, cross and exotic breeds (like brown leghorn) were also used for the determination of egg quality parameters. The results obtained showed that mean flock size of the study area was 6.8 chickens/household of which 78, 13 and 9% of the total local poultry population were indigenous, crossbred and exotic chickens respectively. About 51.4 and 24.8% of the respondents reported to have kept chicken for the purpose of income generation and household consumption in all the agro ecologies studied respectively. The dominant chicken production system was reported to be an extensive type/free ranges (82.3%). New castle disease (67.8%) and Kitchen waste born disease (32.2%) including, Fowl pox, Coccidiosis, Fowl typhoid and Salmonella were found to be the major poultry diseases with relatively high prevalence. About 42.8 and 38% of the farmers reported that wild cats and eagle as major predators respectively. About 46% of the respondents used different perching materials in all the agro-ecologies studied. The mean age at first egg was reported to be 5.7, 5.1 and 4.8 months for indigenous, cross breed and exotic pullets respectively. The mean egg number/ clutch / hen were calculated to be 22, 22.7 and 23.95 for the highland, mid highland and lowland respectively. About 45 and 36% of the respondent's use urban and local market to sale live birds and eggs respectively. There was significant difference ($P<0.05$) between the agro-ecologies in egg quality parameters except albumen height, yolk weight, egg shape index and Haugh unit. Exotic chickens had higher mean values than that of the crossbred and indigenous chickens in most of the egg quality parameters. Awareness creation and orientation of the farming community in the area of factors affecting productivity and egg quality seems to be appealing in the study area.

Key Words: Poultry, Agro Ecology, Egg Quality, Production Performance, Marketing Systems and Hidabu Abote Woreda

1. INTRODUCTION

In Ethiopia, the agricultural sector is a corner stone of the economic and social life of the people. The sector contributes about 40% of the GDP (MoFED, 2014), 90% of export earnings and 83% of employment opportunities (Davis *et al*., 2010; USAID, 2010). Livestock plays significant role in the country's economy through the provision of food, foreign exchange, draught power, transportation, manure, family income and social security in time of crop failure (NABC, 2010). Poultry is the largest group of domestic animal species (FAO, 2000) contributing about 30% of all animal protein consumed at the global level. Poultry is suitable for large scale commercialization than any other livestock industry. Local chickens contribute significantly to the worlds' meat and eggs production and represents about 80% of the total world poultry population (Moula, 2012).

In Ethiopia the word poultry is synonymous with chickens and the country owns the largest poultry population in Africa. The total chicken population of the country was estimated at about 60.04 million of which 88.5, 6.25 and 5.25 % is indigenous, hybrid and exotic breeds of chicken, respectively (CSA, 2018).

In Ethiopia, the traditional household poultry is rarely the sole means of livelihood for the household but is one of a number of integrated and complementary farming activities contributing to the overall well-being of the household. The indigenous chicken based household poultry is characterized by small flock sizes, low input and output and periodic devastation of the flock by disease (Solomon, 2007), but plays significant role as source of food and family income both in rural and urban areas. Household poultry is a source of self-reliance for women since, poultry and egg sales are decided by women (Aklilu *et al*., 2007) both of which provide women with an immediate income to meet household expenses. Moreover, rural poultry production system, dominated by indigenous chickens makes significant contribution to poverty alleviation in many developing countries including Ethiopia (Alders and Pym, 2009) and well adapted to harsh environmental conditions (Ajayi, 2010).

The contribution of the Ethiopian household poultry to human nutrition and export earnings are disproportionally small attributed to the low productivity of the indigenous chickens, characterized by slow growth, late maturity and low production performance. With the aim of improving poultry productivity, different breeds of exotic chickens were imported to Ethiopia since the 1950's. According to CSA (2004-2005), there has been an increase in the number of exotic breeds of chickens and at present the share of exotic chickens in the total annual egg and poultry meat production has been increased. The productivity of local scavenging hens is low, not only because of low egg production potential, but also due to high chick mortality. The low productivity of indigenous stock could also partially be attributed to the low management standard of the traditional production system. However, the exact negative effect attributed either by genetic or management need to be studied and Hidabu Abote Woreda of Northern Shoa is not exception to this situation.

Northern Shoa Zone accounts for about 3.64% of the total Oromia Regional chicken population and Hidabu Abote Woreda owns about 43,814 chickens (Woreda Agricultural Office). Different exotic breeds of chickens were distributed within the rural farming population of the Woreda by Ministry of Agriculture and different None Governmental Organizations, aimed at promoting household poultry of exotic breeds and up-grading of the indigenous chickens by crossing with exotic breeds. Some of the small scale modern poultry producers, along with Bureaus of Agriculture, Higher Educational Institutions, Cooperatives and Agricultural Research Center also distributed exotic breeds of chickens and improved management and feeding technologies within the farming population of the Woreda. This being the cases, the major objective of this research was to study the production performance and egg qualities of household poultry in Hidabu Abote Woreda of Northern Shoa with the following specific objectives

- To assess the production and reproduction performance of household poultry in Hidabu Abote Woreda of Northern Shoa
- To investigate the marketing systems of household poultry in Hidabu Abote District
- To study the egg quality of household poultry in Hidabu Abote District
- To identify constraints and suggest possible interventions of household poultry in Hidabu Abote Woreda of Northern Shoa
- To study the effect of agro-ecology and breed of household Poultry in the study area

2. LITERATURE REVIEW

2.1. Ethiopian Poultry Population and Distribution

Poultry include all domestic birds kept for the purpose of human food production (meat and eggs) such as chickens, turkeys, ducks, geese, ostrich, guinea fowl, doves and Pigeons. In Ethiopia ostrich, ducks, guinea fowls, doves and pigeons are found in their natural habitat (wild) whereas, geese and turkey are exceptionally not common in the country. Thus the word poultry is synonymous with chicken's production under the current Ethiopian condition. There is no recorded evidence indicating the exact time and locations of introduction of the first batch of exotic breeds of chickens into Ethiopia. It is widely believed that the importation of the first batch of exotic poultry was probably done by missionaries. Four breeds of exotic chicken (Rhode Island Red, Australia, New Hampshire and White Leghorns) were imported to Jimma and Alemaya in 1953 and 1956, respectively under USAID project (Solomon, 2007).The total chicken population in the country was estimated at about 56 million (CSA, 2015). However the contribution of the sub-sector to improve the household income and nutritional status is not proportional to the huge chicken population. The Ethiopian rural poultry production system is dominated by indigenous chickens and makes significant contribution to poverty alleviation and household food security in many developing countries including Ethiopia (Alders and Pym, 2009).

The four major Regional States (Oromiya, Amhara, SNNP, and Tigray) collectively account for about 96% of the total national poultry population. The other Regional States own 3.24% of the total national chicken population of which 2.2 % is owned by Banishing-Gumuze Regional State (Solomon, 2007). Oromiya region habitat about 34.4% of the total national chicken population and contribute 36% of the total annual national egg and poultry meat production. Almost all the available commercial poultry farms of the country are located in Oromiya region specifically in and in the vicinity of Debre Ziet. The Amhara, Southern Nation and Nationality People (SNNP) and Tigray Regional State habitat about 31.3, 18.8 and 11.65% of the total national poultry population of the country respectively. The SNNP Regional State Bureaus of Agriculture operates 4 poultry breeding and multiplication centers. The Amhara Regional State has one exotic poultry breeding and multiplication center (Solomon, 2007).

2.2. Productivity of the Ethiopian Household Poultry

2.2.1. Exotic breeds

According to Alamargot (1987), about 99% of the Ethiopian poultry population consists of indigenous chickens, while the remaining 1% consists of imported exotic breeds of chickens during the 1970s and 1980s. There has been an increase in the number of exotic breeds of chickens and at present it is estimated that exotic chickens make up about 4.14% of the national poultry population (CSA, 2015), indicating that the share of exotic chickens in the total annual egg and poultry meat production showed gradual increase over the last 20 years. Unfortunately however, the proportion of exotic chickens within the Ethiopian poultry is significantly lower than that of other African countries as shown in (Table 1).

The importation of exotic breeds of chicken into Ethiopia goes back to the early 1950s, followed by adaptability and management experimental trails. A comparative study conducted on the egg production performance of six different exotic breeds introduced (Brown Leghorn, White Leghorn, Rhode Island Red, New Hampshire, Light Sussex, and Barred Rock) was carried out at Debre Zeit Agricultural Research Centre. Egg production, hatchability and mortality data collected over several years, indicated that White Leghorn rated the best in terms of egg production, adaptability, disease resistance and production efficiency (DZARC, 1984). According to the results of an experiment conducted to compare the adaptability and productivity of exotic breeds at Alemaya in the 1950's, all the imported breeds of chickens performed well, but Leghorns had the best egg production record with less feed per dozen of eggs. It was reported that Leghorn pullets kept under good management condition could be expected to lay approximately 200 eggs/ year (Lee, 1960). All the available evidence indicated that all the imported breeds of chickens performed well under the intensive management system in Ethiopia (Alemu and Tadelle, 1997).

Table 1: The proportion of exotic breeds of chicken in selected African countries.

Country	Contribution (%)
Cameroon	35.0
Ethiopia	2.0
Gambia	10.0
Kenya	20.0
Malawi	10.0
Nigeria	9.0
Zimbabwe	70.0

Source: Alemu and Tadelle, 1997

2.2.2. Indigenous chicken

The Ethiopian Indigenous chickens are comparatively hardy, adaptive to their environments; survive on little or no inputs, adjustable to fluctuations in feed availability, thermo tolerant and resistant to disease. They have good egg and meat flavor, hard eggshells, high fertility and hatchability as well as high dressing percentage (Tadelle, 2003; Halima *et al*., 2007; FAO, 2007). Their use is largely limited to home consumption and generation of small cash income at the household level, but play significant role in the cultural and religious life of rural communities. There are no distinctive breed and variety characteristics of indigenous village chickens, but there is considerable information on some indigenous populations of different regions and localities. Based on feather color and other easily measurable features like body weight (Sonaiya and Swan, 2004). Duguma (2006) and Halima (2007) reported names of the indigenous chicken groups associated with chicken-ecotypes.

On the other hand, various reports showed that certain names of the indigenous chicken were designated on the bases of their phenotypic variations in terms of plumage color, shank length, comb type and growth performances (Fisseha and Moges,2009). Most village chicken were characterized based on their phenotypic variations in terms of plumage color, shank length, comb type and growth performances and named as: Tikur, Gebsat, Red, Black, White, Nech Wosera, Nech Gebsat, Wesera, White Necked neck, Teterima, Nech Gebsat, Sinde melek, Nigussie

(2013).There are large variations in morphological appearances, conformation and body weights of the Ethiopian indigenous chicken. Morphological variations of indigenous chicken ecotypes (between and within) are described in terms of comb types, shank types, earlobe types, plumage colors and other qualitative traits (Meseret, 2008).

2.3. Production Performance of Household Chicken

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 basic 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). Unfortunately, the productivity of village chicken production systems is low (Kondombo 2005), attributed to low egg production and high mortality (Nigussie *et al*., 2003). Teketel (1986) and Aberra Melesse (2000) characterized the low productivity of local chicken to be due to low egg production performance, production of small sized eggs, slow growth rate, late maturity, small clutch size, broodiness and high mortality of chicks. The production performance of indigenous or local scavenging chickens of Ethiopia is estimated to be about 36-60 small sized eggs produced per bird on an annual basis, high chick mortality and longer reproductive cycle or the low genetic potential (Tadelle *et al.,* 2000; FAO, 2004; Negesse Dana , 2011).

To estimate egg production, the average number of egg laying periods per hen per annum, length of a single egg-laying period per hen, and average number of eggs laid per hen per egg-laying period are required. In Ethiopia, a hen lays about 36 eggs in three clutches of 16 days each with 12 to 13 eggs per clutch. Accordingly, the estimated total number of eggs produced during the year is about 46.7 million. Average egg-laying period per hen and average number of eggs laid per hen during the reference period was also estimated for local, cross and exotic breeds. The average number of egg-laying period per hen per year was estimated to be about 4, 6 and 1 for the local, hybrid and exotic breeds, respectively. The average length of a single egg-laying period per hen is estimated to be about 21, 32, and 69 days for local, cross, and exotic breeds respectively. The average number of eggs laid per hen per egg laying period in Ethiopia was estimated at 12, 26 and 65 eggs, for local, cross, and exotic breeds respectively (CSA, 2011).

The average annual egg production of native chicken was reported to be 30-60 egg under village condition and this could be improved to 80-100 eggs under on station condition. A comprehensive study conducted at the Assela Livestock Farm revealed that the average egg production of local birds kept around Arsi was 34 eggs /hen/year, with an average egg weight of 38 g and the total yearly egg mass production was calculated to be about 1.3 kg, but local birds had high mortality when kept in confinement at the farm level. Results of the study conducted at Jimma University indicated that indigenous chicken kept under good housing, feeding and management conditions showed an increase in the productive performance with improvement in environment and management. Comparison of the production potential under improved management condition of local strains from southern Ethiopia with that of White Leghorns showed that the rate of egg production of local eco-types was poor, but had the capacity of sustained egg production at times of increased environmental temperatures. In a similar study conducted at Haramaya on local chicken of eastern Ethiopia, it was found that both hen-day and hen-housed egg production of local stock was about 70% for that of White Leghorn stock (Alemu and Tadelle, 2000).

The average weight of eggs from local birds was found to be about 40 to 46 gram. Predictably, in view of their lower rate of egg production performance, local stocks produce eggs with thicker shells than that of Leghorns, while fertility of eggs from local stocks was found to be higher than that from Leghorns. It was also reported that under improved management condition, local stocks with their current genotypes could not compete successfully with White Leghorns in terms of egg production (Alemu and Tadelle, 2000). Indigenous chickens barely produce 40-60 thick shelled eggs in two cycles from which about 10-15 are incubated and the rest are sold or consumed as table eggs. The native hens exhibit signs of broodiness and sit on their eggs for hatching. Egg production ceases during the period of broodiness. (Sonaiya and Swan, 2004) reported that there are three production systems for family poultry-free range, backyard and small scale intensive with productivity of 20-60, 30-100 and 80-150 eggs/hen/year, respectively. The meat production ability of local stocks is limited. Local males may reach 1.5 kg live weight at 6 months of age and females at about 30% less than that of the males. The carcass weight of local stocks at 6 month of age was 550 gram which was significantly lower than that of White Leghorn (875 gm). However, local stock has a higher dressing percentage (Alemu and Tadelle, 1997). Solomon *et al*. (2003) showed that there was no significant difference between White

Leghorn and local chickens raised under scavenging condition in mean daily body weight gain at an age of 2 months. According to Tadelle (1996), local chickens are sold at 6-8 months of age for meat purpose when they weigh around 0.7-1.4kg. The average age of pullets at first egg was 195 ± 28 days. Mean body weight of females at the start of lay was 1035 ± 34g. Body weights of 1.2 and 0.8 kg was obtained at an age of 32 weeks from normal size and dwarf breeds of local chicken kept under free range system respectively.

2.4. Characterization of Household Poultry Production Systems

There are four poultry production systems practiced in Africa. These are traditional free-range system, backyard or subsistence system; semi intensive system and small-scale intensive system (Kitalyi, 1998; Branckaert and Gueye, 2000 and Gueye, 2000a). The most common production system found in Africa are the free-range and backyard production systems (Sonaiya, 1990a; Gueye, 2003) and approximately 80% of chicken populations in Africa are reared under these two production systems (Gueye, 1998). Some of the important characteristics of these production systems are summarized in (Table 2).

Table 2: The major characteristics of the chicken production system in Africa

Characteristics	Traditional free range	Backyard or Subsistence	Semi-intensive	Small scale intensive
Flock size	1-10	10-50	50-200	50-500
Ownership	Women & children	Women & family	Middlemen	Business men
Breeds	Indigenous	Indig.& crossbreds	Cross breeds	Layers or broilers
Feed Source	Scavenging	Scavenging & supp.	Commercial/local	Balanced diets
Health Status	No vaccination	Vaccination &	Vaccination	Full vaccination
	No medication	Little medication	Little medication	Full medication
Housing	No specific housing	Simple and small houses	Medium & improved	Big and improved
Egg production	30-50 eggs/yr/hen	50-150 eggs/yr/hen	80-160eggs/yr/hen	250-300eggs/yr/hen
Use patterns	Home consumption	H.consump.& sale	Family income	Bussiness income

Source: Sonaiya, E.B.1990; Kitalyi, 1998; Sonaiya *et al*., 1999; Gueye, 2003

2.5. Major Constraints of Village Chicken production

2.5.1. Feeding and feed resources

Family poultry production in Africa survives on scavenging with or without supplementations. The supplementary feeds occasionally provided comprise of household waste and cereal grains (Dwinger *et al.,* 2003). In Ethiopia the smallholder chicken production system is characterized by keeping entirely under free range system and the major scavenging feed sources comprises of insect worms, seed and plant materials (Solomon, 2004). Poultry production in tropical countries is based on the traditional scavenging system and characterized by low output per bird (Aichi and Kitaly, 1998). In a study conducted by Mapiye and Sibanda (2005) in Rushinga district of Zimbabwe, about 6.2% of the households practice zero supplementation; 93.6% partial supplementation; and 0.2% always provides supplementary feed to their chickens. According to Tadelle Dessie (1996), in village chicken production systems, the major proportion of the feed is obtained through scavenging. As indicated by Tadelle and Ogle (2000) the amount of feed available for scavenging in relation to the carrying capacity of the land area and flock dynamics across the different seasons and agro-ecology is still not adequately quantified.

The results of the studies conducted in three villages of the Central Highlands of Ethiopia involving different altitudes and seasons revealed that the materials present in the crops of slaughtered birds were seeds, plant materials, worms, insects and unidentified materials. Sonaiya *et al*. (1998) indicated that scavenging birds not certainly found all its nutrient requirements for optimal production all the year round. During the dry season, chickens quickly suffer from vitamin deficiencies because of the scarcity of succulent vegetables on the range. During the short rainy season (March-May) the percentage of seeds in the crop contents is higher, probably because of the increased availability of cereal grains which had just been harvested and are given to the birds in larger amounts than during the big rainy season and dry season of the year. The average percentage of plant materials in the crop contents is highest during the rainy season (June-September) as a result of the increased availability of plant materials, and the relatively scarce seeds which might have increased intake of plant materials. The largest proportions of worms in the crop contents were found during October to February in higher altitude which might be attributed to the relatively high and extended rainfall. A larger proportion of insects were also found during the short rainy season (Tadelle and Ogle, 2000).

Insects and their larvae are identified as protein sources for scavenging poultry. Atech and Ologbenla (1993) reported that maggots could make up to 3% of the diets of chicken without compromising performance. Crop analysis studies conducted earlier by Tadelle and Ogle (1996) and Alemu and Tadelle (1997) indicated that the physical proportion of seeds was higher in the short rainy season. However the concentration of crude protein, Calcium and Phosphorus were below the recommended requirements for egg production. Mbugua (1990) suggested that both egg production and egg size vary with season, as the quality and availability of scavenging feed resource varies.

2.5.2. Disease and predators

Under village poultry production, prevailing diseases and predators were reported as the major constraint (Moges *et al.,* 2010a), Dinka *et al., (*2010), and Mammo Mengesha *et al.,*(2011). The high chick mortality encountered under village production system in Ethiopia is largely attributed to diseases, parasites and predation (Tadelle, 2001). Among the infectious diseases, Newcastle disease, Salmonellosis, coccidiosis and fowl pox are considered as the most important causes of mortality in local chicken while predators are an additional causes of loss (Eshetu yimer *et al.,* 2001). Newcastle disease is highly infectious, causes more losses than any other diseases in the tropics and spread rapidly through the flock. Mortality from Newcastle disease could reach up to 100% (Nigussie *et al*., 2003).Disease and predators are known to be the major causes of mortality in the developing countries (Negussie, 1999). According to Negussie and Ogle (1997), Newcastle disease accounts for the largest proportion of flock mortality (57.3%), followed by fowl pox (31.6%), coccidiosis (9.4%) and predator (1.7%).

Study conducted by Aberra Melesse (2007) in Southern Ethiopia indicated that the major health problems of poultry production in the study areas were Fowl cholera (28.8%), followed by Newcastle Disease (26%), Coccidiosis (21.6%), Fowl influenza or Infectious Bronchitis (15.4%), Fowl pox (3.4%), Fowl typhoid (3.4%) and Salmonella (1.4%). The prevalence of fowl cholera was considerably higher in the mid-altitude (53.3%) while fowl typhoid was the major problem in low altitudes accounting for about 57% of the overall mortality. Predators such as snakes, rats, dogs, cats and foxes are reported to be the main causes of losses especially in young birds. Thefts are another important cause for the loss of adult birds. According to Aberra Mellese (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.

2.5.3. Poultry housing

There is no separate poultry housing in rural villages of Ethiopia. In most cases (88.5 %) the birds roost inside the family dwelling at night. A few households (11.5%) were reported to have constructed a separate poultry houses (Tadelle, 1996). Mapiye and Sibanda (2005) reported that in Rushinga district of Zimbabwe all farmers provide housing to their chicken. Proper house provide an environment that moderates environmental impact and adequate ventilation for birds to lay eggs as well as to feed and sleep in comfort and security (Katie, 1990). 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 occurs due to nocturnal predators because of lack of proper housing (Dwinger, *et al*., 2003). Some research works 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%) compared to that observed in Ethiopia (66%) and Tanzania (33%), where no housing improvements were made (Kitalyi, 1998).

2.5.4. Marketing and socio-economic importance

In Ethiopia, live chickens and eggs are sold directly to consumers. The market prices of chickens are influenced by phenotypic natures of chickens, seasons and holidays. In the usual market the owners get better prices from mature chickens (Addis Getu *et al*., 2014). In the case of disease outbreak there is drop of market price owing to the high supply of birds. Farmers' sale birds when they need to meet their cash requirements. Eggs are stored inside grain storage container, with the intension of increasing the shelf life of the eggs until the time of sale or consumption (Tadelle and ogle, 2001; Solomon, 2008). Market price is highly dependent on market access. With increasing market access, the marketing chain between producer and consumer are shortened and associated with higher prices for the producers for both live birds and eggs. Income generated from the sale of birds and eggs is meant for general purpose household use (Tadelle and Ogle, 2001). The birds brought to the market need to be sold because re-introducing them to the flock owes high risk of disease transmission. It is clear that increased involvements of intermediaries lead to reduced prices for the producer (Solomon, 2008).

The current poultry and poultry product market is characterized by lack of information which favors relatively high profit for the intermidiataries. The share of the intermidiataries could be reduced through improving access to information. Better infrastructure and organization of the poultry producers. However, cost of transportation, credit and market risk should be carefully assessed (Akililu, 2007). Small scale household poultry are widely dispersed, resulting in serious problems of marketing (Solomon, 2008). According to Gueye (2005) rural households place high value on the possibility of cash income from poultry keeping and believe that village poultry act as a "starter" that enables people to raise themselves and their families from degrading poverty to better livelihood. It is also considered the only capital that households have left when declining into poverty because of varies reasons such as drought. An important function of poultry is their bartering value. Layers and cocks are exchanged for farm implements in remote areas where there is no circulation of currency. Birds are normally managed by house wives or family elders and sold in local markets. They are occasionally sold to middle man from the larger town and cities. There is no formal poultry and poultry product marketing channel and informal marketing of live birds and eggs involving open markets are common (Meseret, 2010).

2.6. Reproductive Performances of Household Poultry

2.6.1. Hatchability and chick mortality

Hatchability and rate of chick survival are the major determinant factors of reproduction and productivity in poultry. As reported by Geleta *et al*. (2013) egg produced from Fayoumi chickens at Oromia Agricultural Research Institute had about 63.5% compared to hatchability reported by Abraham and Yayneshet (2010), who reported percent hatchability of 67.9, 76.1 and 39.3% for Fayoumi, White Leghorn and Rhode Island Red in northern Ethiopia respectively. Kebede *et al*. (2014) reported hatchability of 78-81% from eggs of White Leghorn kept under intensive management. Mortality rate of exotic day-old chicks distributed in three agro-climatic zones of Amhara Regional State was reported to be 45% (Mazengia *et al*., 2012). Total mortality of 68 and 48.5% was recorded from chicks of Fayoumi and White Leghorn in Northern Ethiopia respectively (Abraham and Yayneshet, 2010). Alamargot (1987) indicated that the mortality of commercial chickens (from hatching to maturity) in Ethiopia range between 20 and 50%. However, Geleta *et al*. (2013) and Kebede *et al*. (2014) reported mortality of 7.2 and 7.1% from Fayoumi chicken kept under Adami Tulu Research center and Leghorn kept under intensive

management condition. Average mortality of exotic chickens was reported to be 7.8 and 6.1 chickens/year in the lowland and midland agro ecology, respectively (Alem, 2014).

Chicken mortality up to 8 weeks of age ranged from 4.3-5.3% for RIR and from 4.3-5.7% for Fayoumi kept in central Oromia (Reta *et al*., 2012). Similarly, to age 8 weeks was reported to be 29.9% for exotic chick (Mazengia and Eshetie, 2008). Moreover, Mazengia *et al*. (2012) reported mortality rate of exotic chicks distributed in low altitude districts (52.98%) was higher than that distributed in the high altitude (48.88%) and mid-altitude (43.25%) districts. The higher mortality obtained from the exotic chicks distributed in the low land and high altitude might be associated with extreme cold and hot temperature for newly distributed day-old chicks in these areas. The mortality rates of 47.4, 47.5,44.9 and 43.7% was recorded from exotic chicks distributed during dry, rainy, before rainy and after rainy seasons respectively (Mazengia *et al*., 2012).Mazengia and Eshetie (2008) reported higher mortality rate in wet season than dry season in parent stock flocks of RIR.

2.7. Household Egg Quality Measurement

Egg quality traits are of immense importance to poultry breeding industries (Bain, 2005). Embryonic development of hen's egg is dependent on traits like egg weight, yolk and albumen weights, genetic line and age of the hen (Onagbesan *et al*., 2007). Strains of Leghorn that lay brown eggs in addition to strains that lay white eggs were developed. The brown strains were developed because there was an apparent demand for consumption of brown eggs. Thus, there was interest to use strains of laying hens that lay better quality eggs. The different strains vary in the different criteria of egg production and quality (Bell and Weaver, 2002).Egg weight influences the weight of components of eggs especially egg albumen and yolk (Zhang *et al*., 2005; Aygun and Yetisir, 2010). 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. Thus, egg weight is 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 white and brown egg strains and reported that egg weight from brown hens (61.1g) was heavier than that of white hens (58.3g). Tixier-Boichard *et al*. (2006) recorded egg weight of 42.8 g for Fayoumi eggs and 58.8 g for IB eggs. Higher weight of egg from commercial strains is not a surprise since such strains were subjected to intensive breeding pressure for egg weight improvement (Hocking *et al*., 2003). Under smallholder farmers condition in northern Ethiopia, egg weight of 52.5, 52.1 and 43g was recorded for Rohde Island Red, White Leghorn and Fayoumi, respectively (Lemlem and Tesfaye, 2010). Hen age has been shown to increase yolk weight (Van den Brand *et al*., 2004) and albumen weight (Suk and Park, 2001).Yolk color is a key factor in any consumer survey relating to egg quality (Okeudo *et al*., 2003). Consumer preference for yolk color is highly subjective and varies widely from country to country. The determinant of yolk color is the xanthophyll (plant pigment) content of the laying diet (Silverside *et al*., 2006). High intake of green grass during scavenging might be responsible for carotenoid deposits in the yolk, which improves the yolk color. Supplementary yellow maize contributes to improvement in color intensity of the yolk. Thus, if a hen has access to green grass or supplemented with feed ingredients containing carotenoids (xanthophyll), it will be enough to give the yolk color preferred by consumer (Zaman *et al*., 2004).

The Ethiopian consumers have a strong preference for eggs with deep yellow yolk color. Very small sized eggs from the scavenging local chicken with deep yellow yolk color fetch much higher prices compared to larger eggs of improved strains with pale yolk (Tadelle *et al*., 2003a) .The Haugh Unit (HU) proposed by Haugh (1937), is calculated from the height of the inner thick albumen and the weight of an egg and it is considered to be a typical measure of albumen quality. It is generally accepted that the higher the Haugh unit value, the better the quality of the egg. Age of the hen and season of the year can also affect Haugh unit values. Rajkumar *et al*. (2009) reported that brown color egg layers produced eggs with higher HU. Research has shown in UK that there is consumer resistant to purchase eggs which have HU's below 60, the actual HU figure where resistance to the product determined later by market researchers. The eggshell thickness is an important trait for hatchability. For best result of hatchability egg shell thickness should be between 0.33 and 0.35 mm and few eggs with a shell thickness less than 0.27mm will hatch (Khan *et al*., 2004).

One of the main concerns in terms of egg quality is a decrease in eggshell strength as the hen ages increase 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).The egg shell quality is given throw the weight and the percentage of shell thickness and strength. The differences in eggshell quality depend on the environmental conditions and feed quality and strain of layers (Zita *et al*., 2009). On the other hand, Khan *et al*. (2004) reported no significant effect of breed on eggshell thickness of chickens kept under semi scavenging condition. Silversides and Scott (2001) reported that eggs from IB hens had better percentage of shell than those form Isa-White hens. Several authors reported variable results about the influence of the rearing systems on shell thickness. Leyendecker *et al*. (2001, 2005) reported thicker shells from free scavenging layers when compared to layers kept under conventional cage system

3. MATERIALS AND METHODS

3.1. Description of the study Area

This study was conducted in Hidabu Abote district of North Shoa Administrative Zone of Oromia Regional State. The study Woreda is located at 147 kms North East of Addis Ababa and at 42 kms North of Fiche, the administrative center of North Shoa Zone. The altitude of the Hidabu Abote Woreda ranges between 1160 and 3000m a.s.l. The average annual rain fall is estimated to be 1000 mm and the average annual daily temperature is 20°C. The study Woreda lies between $9^0$46'-$10^0$6' North latitudes and $38^0$40' East longitude. Agro-ecologically, Hidabu Abote Woreda was classified as 30% Dega (Highland), 35% Weina Dega (midland) and 35% kolla (lowland) (Woreda Agricultural office, 2017).

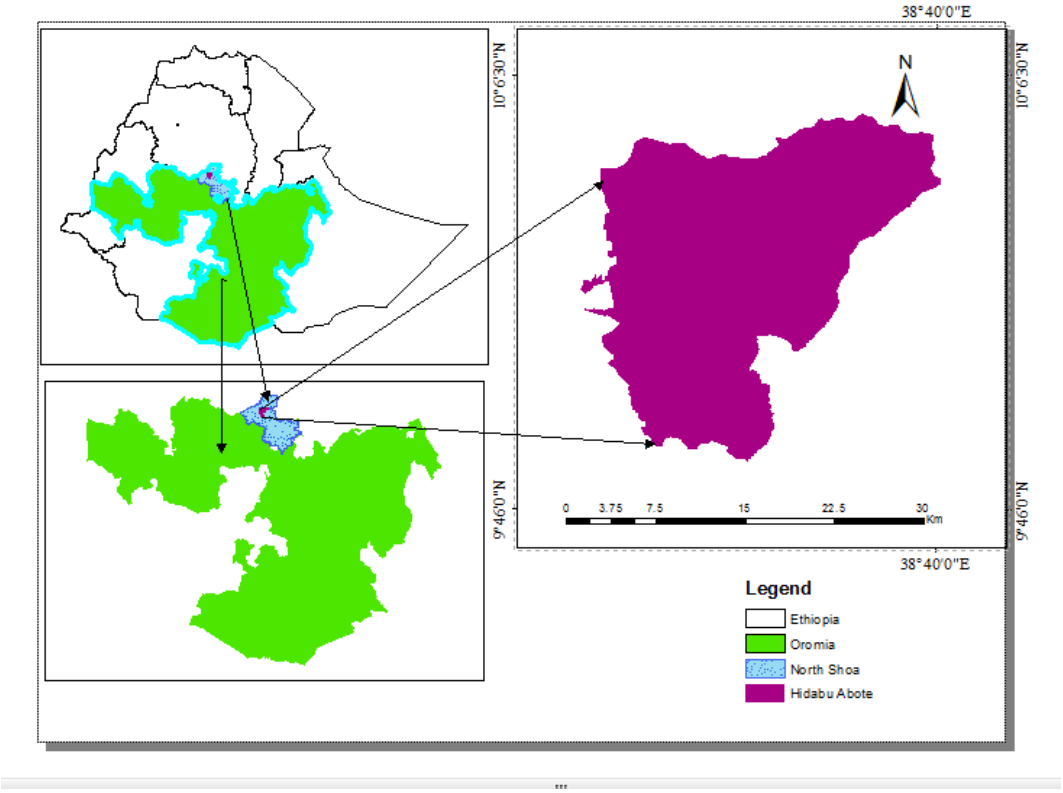

Figure 1: Map of the Study District

The total human population of the Woreda was reported to be 97,951of which 49% is male and 83.47% is rural community. The study Woreda has a total of 20 Kebeles (Peasant Association) (Hidabu Abote Woreda Agricultural Office, 2017). The major crops grown in the district (in order of importance) include teff, sorghum, pea, bean and maize respectively. The study Woreda has a total livestock population of 79,636 cattle, 23,899 sheep, 47,596 goats, 12,528 donkeys,

173 mules, 439 horses, and 43,814 chickens with (93%) local and (7%) exotic breeds. About 28.67, 36.76 and 34.5% of the chickens are found in the highland, midland and lowland respectively (Hidabu Abote Woreda Agricultural Office, 2017).

3.2. Sample size determination

The total number of the households included in the study was determined according to the following formula suggested by Arsham (2002).

$N= 0.25/SE^2$

Where, N= Sample size, SE= Standard error.

Thus, using the standard error of 0.038 with 95% confidence level, a total of 180 randomly selected households were used in the present study.

3.3. Selection of Participating Households

Three agro ecologies i.e. Lowlands ($\leq$ 1600m), Midlands (1600-2500m) and Highlands ($\geq$ 2500m) were purposively selected. Two Kebeles (Peasant Association) from each of the midland (Welu Mojo and Derro Amuma Wajju), highland (Sire Morose and Yaya Badda) and lowland (Alkochi Qarre and Gidabo Giyorgisi) were also purposively selected based on poultry population and accessibility. Thirty households were randomly selected from each of the six Kebeles and a total of 180 households and 18 Key informants (3 from each Kebele) were used to conduct the study.

3.4. Data collection

Semi-structured and pre-tested questionnaire was used to collect data from primary source which mainly comprised of the participating households. Reliability and consistency of the collected data was checked on time and on the site. The interviews were conducted at the farmer's residence with the assistance of local extension officers. The data enumerators were trained for two days on the implementation of the questionnaire and techniques of data collection. The data collected included management, marketing, production and reproduction performance of the household poultry in the study Woreda. The secondary data were collected with the use of internet, and through a comprehensive review of the available literature and documents.

3.5. Egg Quality Measurement

3.5.1. External and internal egg quality traits

A total of 270 eggs (45 from each Kebele) and equal eggs from each breed were purchased from the interviewed households of the three agro ecologies, and transported to JUCAVM animal nutrition laboratory. Soon after arrival, egg weight and internal and external egg qualities were individually measured. Egg weight was measured using digital sensitive balance. Each egg was carefully opened (broken) onto a flat plate and yolk, albumen and egg shell were carefully separated and weighed using sensitive balance. Egg shell thickness was measured at the middle, large and small end of an egg with calibrated micrometer screw gauge and the average value was taken. Yolk and Albumen height were measured by tripod micrometer. Yolk color was determined using the Roche Color Fan ranging 1-15. Haugh unit was calculated using the following formula adopted from (Haugh, 1937).

$HU=100XLog (AH-1.7EW^{0.37} +7.6)$

Where;

HU = Haugh unit,

AH= Albumen Height in millimeters and

EW = Egg Weight (g)

Yolk index was also computed using the following formula:

$$\text{Yolk Index} = \frac{\text{Yolk Height}}{\text{Yolk Diameter}} \times 100$$

3.6. Statistical Analysis

Descriptive statistic (mean, percentage and frequency) for numerical survey data the mean difference in different parameters (agro ecology, breed, etc) and data collected from laboratory work for both internal and external egg quality parameters were subjected to two-way ANOVA by taking agro-ecology and breed as fixed factors and use Tukey tests to differentiate mean and using statistical package for social sciences (SPSS version 20).

Model I: Survey for production and reproduction performances of Poultry

$Yij = \mu + Ai + Gj + AGij + Єij$

Where;

Yij = the value of the respective variable mentioned above

μ = overall mean of the respective variable

Ai = the effect of ith agro-ecology (i=3)

Gj= Effect of jth breed group (j=1, 2, 3. i,e indigenous (local), exotic (Brown leghorn, Red island Rode) and hybrid.

AGij = interaction of ith agro-ecology & jth breed group

Єij = random error term

Model II: Model for Measurement of egg quality parameters

$Yij = \mu + \alpha i + \beta j + (\alpha\beta)ij + \varepsilon ij$

Where;

Y *ij*= the value of the respective variable mentioned above

μ = overall mean of the respective variable

αi = the effect of i^{th}*Kebele* (i= 1---6, Yaya Dhaka Bora,Sire Morose, Welu Mojo,Daro Amuma Wajju,Gidabo Giyorgisi and Alkochi Qare) on the respective variable

β_j = the effect of j^{th} breed (indigenous, cross and exotic) breed

(αβ)ij = the interaction effect of i^{th}*Kebele* and j^{th} breed

εij = random error term

4. RESULTS AND DISCUSSION

4.1. Household Characteristics

The household characteristics of the respondents (Table 3) revealed that the proportion of female (54%) respondents were higher than that of the males (46%) in the study district. The females were mainly occupied in the household activities, whereas the males were reported to have been responsible for the farming activities in all the studied agro-ecologies. The result of this study was in agreement with that of Worku (2017) who reported that female family members (60%) are responsible for management of chickens in Tegede District; North West Ethiopia. The average family sizes of the respondents were 5.7 persons/household, the value of which was larger than the national average of 5.2 persons/households (CSA, 2003).

However, the result of the present study was smaller than that of Fisseha *et al*.(2007) and Asefa, (2007), who reported 6.2 and 7 persons/household for the Burie district of Amhara Region and Awassa Zuria Woreda of the SNNPR, respectively. The majority of the respondents (46.1%) belong to the age group of 15-30 years, followed by age group of 30-50 years (31.67%) both groups of which are considered to be within economically productive ages. There was no significant difference between agro-ecologies in age group and mean family size ($P>0.05$). The majority of the respondents (89%) were Orthodox Christians in religion and the remaining 7.7 and 3.3% were Protestant Christians and Waqeffata respectively (Table 3).

Table 3: Characteristics of the respondents in Hidabu Abote districts

Parameters	Agro ecology							
	Highland		Midland		Lowland		Overall	
	n	%	n	%	n	%	N	%
Sex of the respondents								
Female	32	53.3	29	48.3	36	60	97	54
Male	28	46.7	31	51.7	24	40	83	46
Total	60	100	60	100	60	100	180	100
Mean family size (persons/hh)	5.3		5.7		6.1		5.7	
Age group of the respondent's (%)								
≤ 15 years of age	5	8.3	2	3.3	4	6.7	11	6.1
15-30 years of age	18	40	20	46.7	19	51.7	57	46.1
30-50 years of age	20	30	28	33.3	31	31.7	79	31.7
>50 years of age	17	21.7	10	16.7	6	10	33	16.1
Total	60	100	60	100	60	100	180	100
Religion of the respondents (%)								
Orthodox Christians	54	90	55	91.7	51	85	160	89
Protestant Christians	1	1.7	3	3.3	3	5	6	3.3
Waqeffata	5	8.3	2	5	6	10	14	7.7
Total	60	100	60	100	60	100	180	100
P-Value				0.948				

n-represent the number of respondents.

About 83.3% and 60% of the respondents were married (Fig.2 and Table 4) and illiterates respectively. About 12.8% of the respondents reported to have been involved in formal education including elementary school, high school and College/University in all the studied agro-ecologies. The relatively low educational status of the respondents (60% illiterates) might be due to the fact that the majority of the respondents (54%) of the study area were females who get married at early age rather than joining to school. This circumstance resulted in considerably higher number of illiterates, which might influence the adoption of village poultry technology

negatively. The results of this study was in agreement with that of Hana (2016) who reported that larger proportion of illiterate respondents are females who get married at early age. The number of illiterates observed in this study was higher than that reported (39.3%) for Bure woreda of Northwest Amhara (Fisseha *et al.,* 2010a). However the result of this study was lower than 82.1% reported for North West Ethiopia (Halima, 2007). The result of the current study also indicated that the majority (53.3%) of the respondent practiced mixed crop-livestock production system.

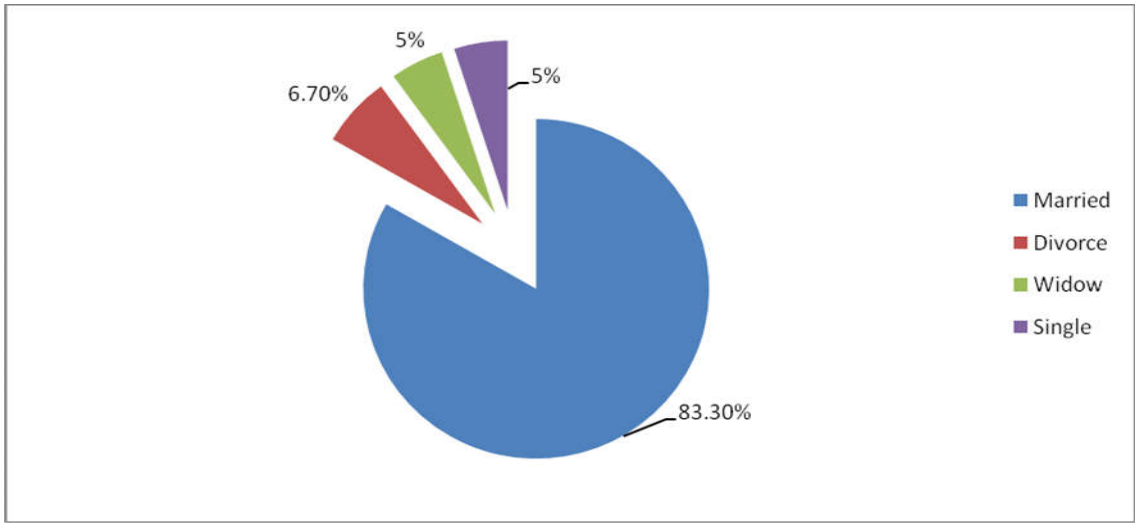

Figure 2: Marital Status of the respondents in the study district

Table 4: Educational Levels of the respondents in the Hidabu Abote district

Parameters	Highland		Midland		Lowland		Overall	
	n	**%**	**n**	**%**	**n**	**%**	**N**	**%**
Educational Levels of the respondents (%)								
Illiterate	35	58.3	36	60	37	61.7	108	60
Read and write	9	15	8	13.3	6	10	23	12.7
1-6 grades	9	15	10	16.7	5	8.3	24	13.3
7-12 grades	4	6.7	5	8.3	10	16.7	19	10.6
>12 grades	3	5	1	1.7	2	3.3	6	3.3
Total	60	100	60	100	60	100	180	100
P-Value				0.989				
Occupation of the Respondents (%)								
Livestock Production Only	29	48.3	4	6.7	5	8.3	38	21
Crop production only	2	3.3	0	0	4	6.7	6	3.3
Livestock and Crop production	17	28.3	43	71.7	36	60	96	53.3
Livestock, Crop production and trading	7	11.7	9	15	9	15	25	14
Livestock, Crop production and Crafting	1	1.7	3	5	6	10	10	5.56
Others	4	6.7	1	1.7	0	0	5	2.8
Total	60	100	60	100	60	100	180	100
P-value					0.872			

n-represent the number of respondents. There is no significant difference between the rows of all ago ecologies (P>0.05)

4.2. Socio-Economic Characteristics of the Respondents

4.2.1. Land and livestock holding

The mean landholding/household of the study district was 2.67 ha. About 7% of the respondents were landless. Respondents of the highland prefer livestock rearing over crop production due to lack of lands and high population density as compared to the respondents of midlands and low land agro-ecologies. About 26.3 and 21.1% of the respondents reported to have reared livestock especially poultry and cattle's respectively followed by small ruminants and equines (Fig. 3). In agreement with the results of the current study, Hana (2016) reported that the majority of the

respondents (88%) of North Gonder Zone were fully involved in crop-livestock production systems and used chickens as source of income for immediate expenses such as purchasing salt, coffee, cloth and chicken medicaments or drugs. According to Halima (2007) and Meseret (2010) the respondents of both of North Western Ethiopia and Gomma district reported to have used chicken as means of immediate household expenses respectively. .

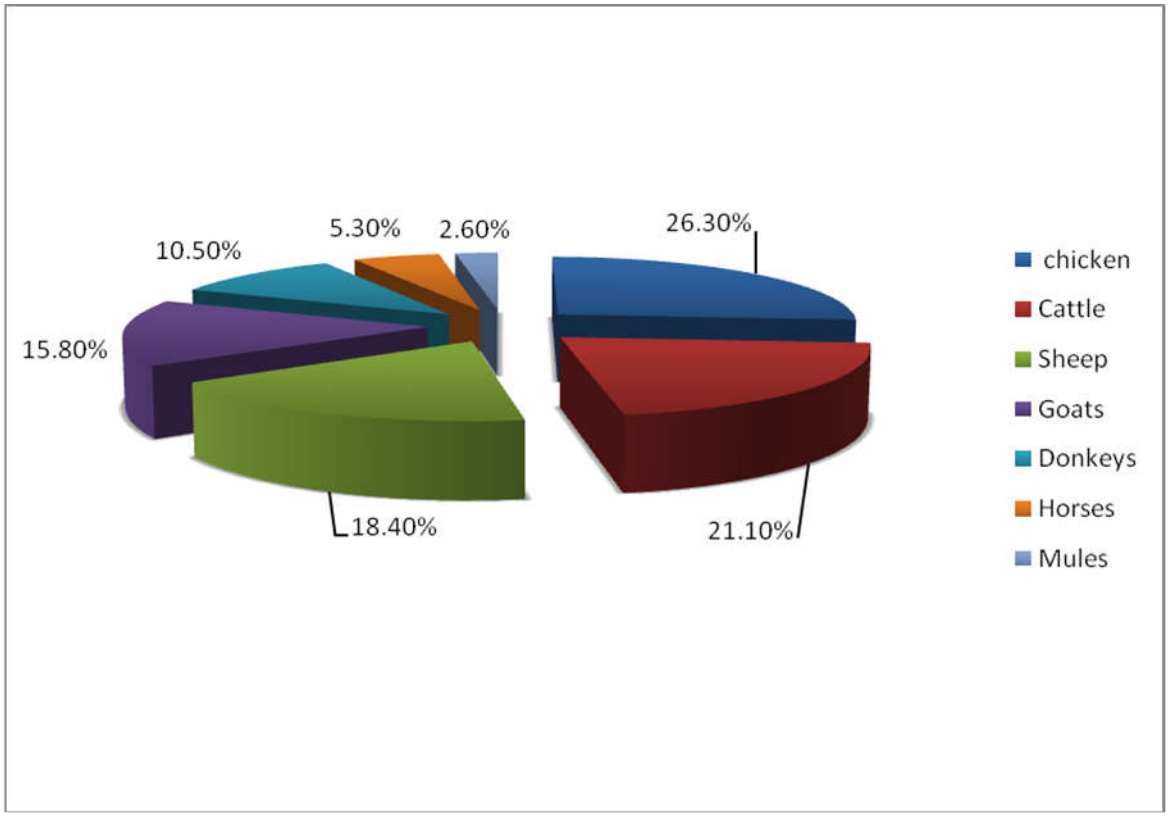

Figure 3: Livestock holding by respondents in Hidabu Abote district

4.2.2. Flock Size and Breed composition

The chicken flock size and structure of the study area were given in Table 5. There was no significantly (P>0.05) difference between agro-ecologies in chicken flock size/household. The results of this study showed that the mean flock size/household was 6.8 chickens. The respondents reported that chicken flock size varies from season to season mainly based on availability of feed, occurrence of diseases, presence of predators as well as the economic status of the households. The mean chicken flock size obtained from this study was comparable to that of Gueye, (1997) who reported flock size ranging between 5 and 20 chickens/household in the African villages. But, the result of the present study was lower than the mean flock size of 17.7

chickens/household reported from Gorogutu district of Eastern Hararghe Zone (Ahmedin, 2014). Mean flock size of 22 and 24.2 chickens /household was reported from Sudan and Tanzania by Khalafalla (2000) and Maphosa *et al.,* (2004) respectively. On the contrary, the results of this study was higher than that of Meseret (2010) who reported mean flock size of 6.24 chickens/household from Gomma district of Jimma Zone.

The result of this study indicated that 38.4, 28.5 and 15.3% of the chickens of the study area were hens (≥20 weeks of age), chicks (0-8 weeks of age) and pullets (9-19 weeks of age) respectively. The higher proportion of hens in the flocks of all the agro-ecologies studied was an indication of strong desire for egg production and chick hatching. The result of the current study was in agreement with that of Mekonnen (2007), who reported that 33, 27 and 17% of the chicken population of Dale Woreda of SNNP were hens, pullets and cockerels respectively.

Table 5: Average flock size of chickens in the Hidabu Abote districts

Parameters	Highland		Midland		Lowland		Overall Mean	
Classes of chicken's	**n**	**%**	**n**	**%**	**n**	**%**	**N**	**%**
Chicks (0-8 weeks of age)	2	30	1.9	28.2	1.94	27.2	4.84	28.5
Hens (≥ 20 weeks of age)	2.85	42.7	2.54	36.4	2.58	36.2	7.97	38.4
Pullets (9-19 weeks of age)	1	15	1.1	15.8	1.08	15.2	3	15.3
Cocks (≥20 weeks of age)	0.42	6.3	0.85	12.2	1.01	14.2	2.28	11
Cockerels(9-19)weeks of age)	0.4	6	0.52	7.4	0.51	7.2	1.43	6.9
Total	6.67	100	6.9	100	7.0	100	6.8	100
P- Value				0.469				

n-represent the number of chickens per household. There is no significant difference between the Columns of all ago-ecologies (P>0.05)

4.2.3. Composition of chicken breeds

Mean chicken breed composition of the study area was shown in Fig.4. There was no significant (P>0.05) difference between all the agro-ecologies studied in breed composition. About 78, 13 and 9% of the chicken population of the study area were local, crossbred and exotic breeds of chickens respectively. The high proportion of the indigenous chicken were attributed to the fact that indigenous chicken are widely available and known to possess desirable characteristics such

as thermo-tolerance, and resistance to diseases. The high proportion of the indigenous chickens might also be due to poor status of distribution of improved breeds and their susceptibility to disease and predators when kept under village conditions.

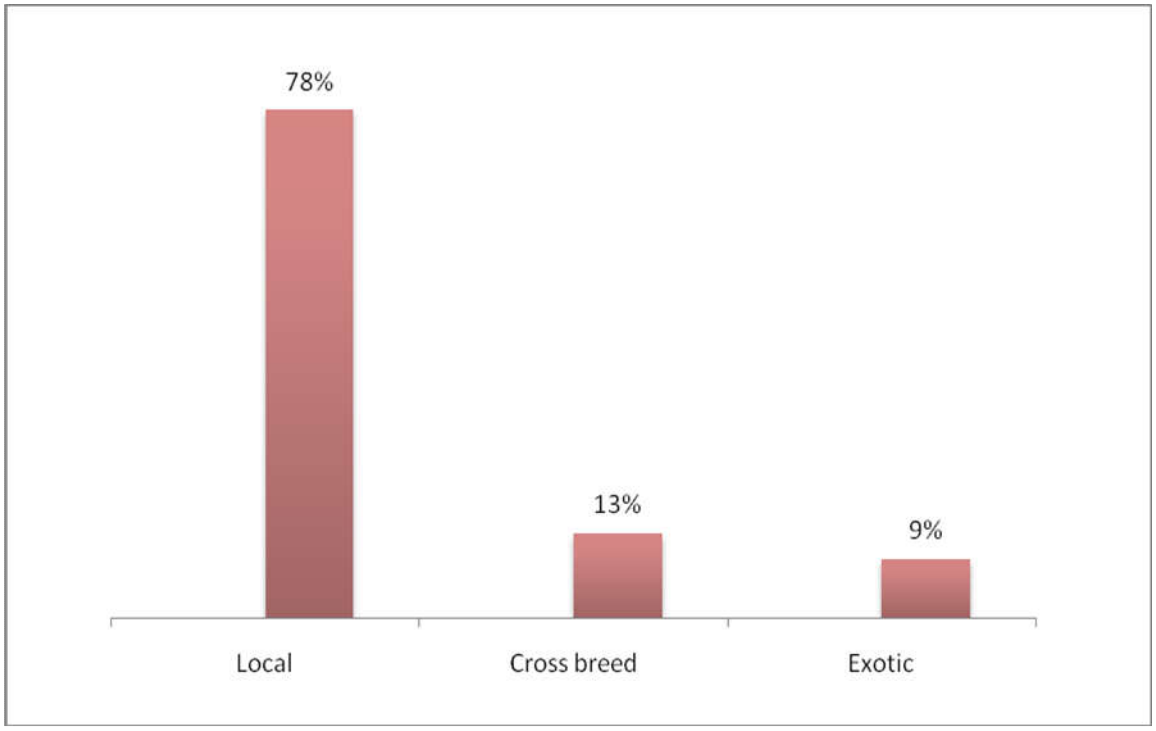

Figure 4: Composition of chicken breeds of respondents in the study area

4.2.4. Purpose of poultry keeping

The result of this study indicated that chicken keeping is widely practiced in the study area and every family keep indigenous chicken of various flock sizes. About 51.4 and 24.8% of the respondents reported to have kept poultry as means of family income and source of household food respectively in all the agro-ecologies studied. Less priority was given for religious purpose (8.9%) or traditional spiritual thinking in all the agro-ecologies studied. About 5.9% of the respondents reported to keep poultry for the purpose of using their dropping as fertilizers. In agreement with the results of the current study, Worku (2017) reported that more than half of family keep chicken in varying number of flock size for the purpose of income generation (51.3%), provision of household food (46.7%) and egg incubation or hatching of chicks for replacement of the flock (2%) in Tegede District of North Gondar Zone. The result of the present study was also in line with Halima (2007) who, reported that income generation was the primary objectives of chicken rearing in Southern and North-Western Ethiopia.

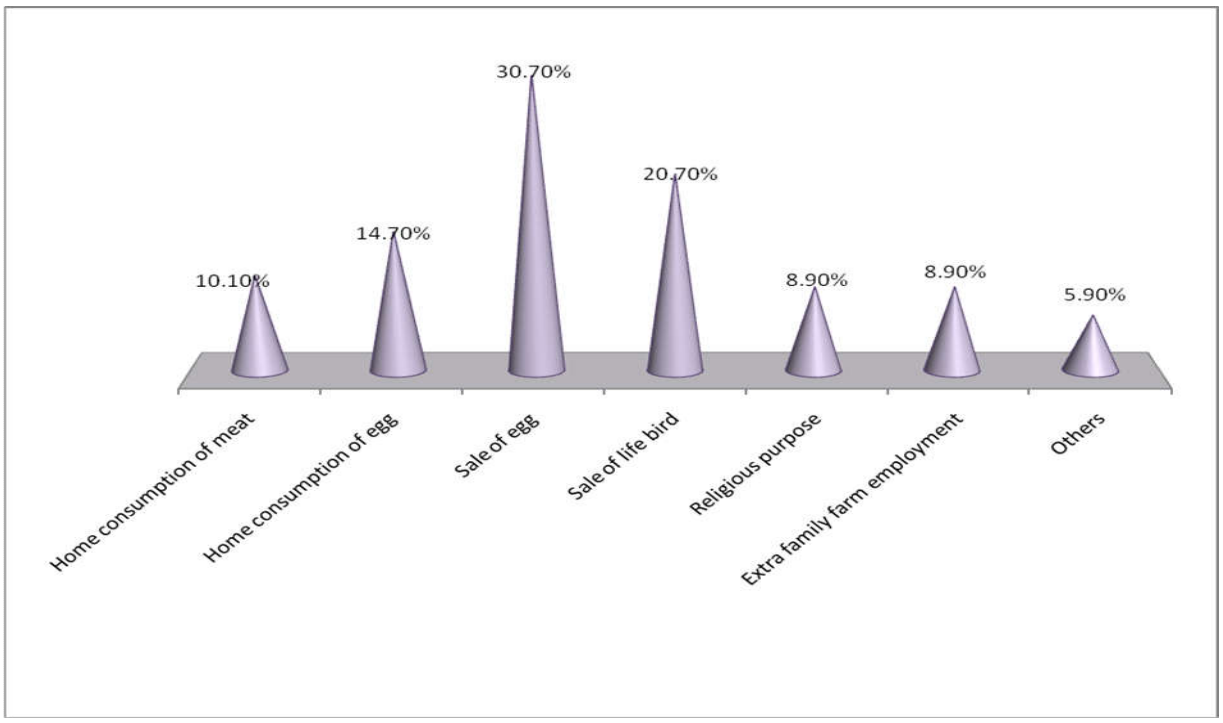

Figure 5: Purpose of poultry keeping in Hidabu Abote district

4.2.5. Consumption pattern of poultry and poultry products

The consumption pattern of poultry and poultry products in the study area was shown in Figure 6. According to the respondents, priority of consuming poultry products is given to lactating mother (33.3%) followed by adult (26.7%) family members with the assumption that chicken meat and egg are essential food for lactating mothers. Priority of consumption of poultry and poultry products is usually given to adults during invitation of guests and festivals during which chicken meat and eggs are considered to be very important dish in the Hidabu Abote district. This result was contrary with that of Bogale (2008) and Ahmedin (2014) who reported that children gets the priority of consumption of poultry products followed by lactating mother and pregnant women in Fogera Woreda of Amhara Region and in Gorogutu district of Eastern Hararghe respectively.

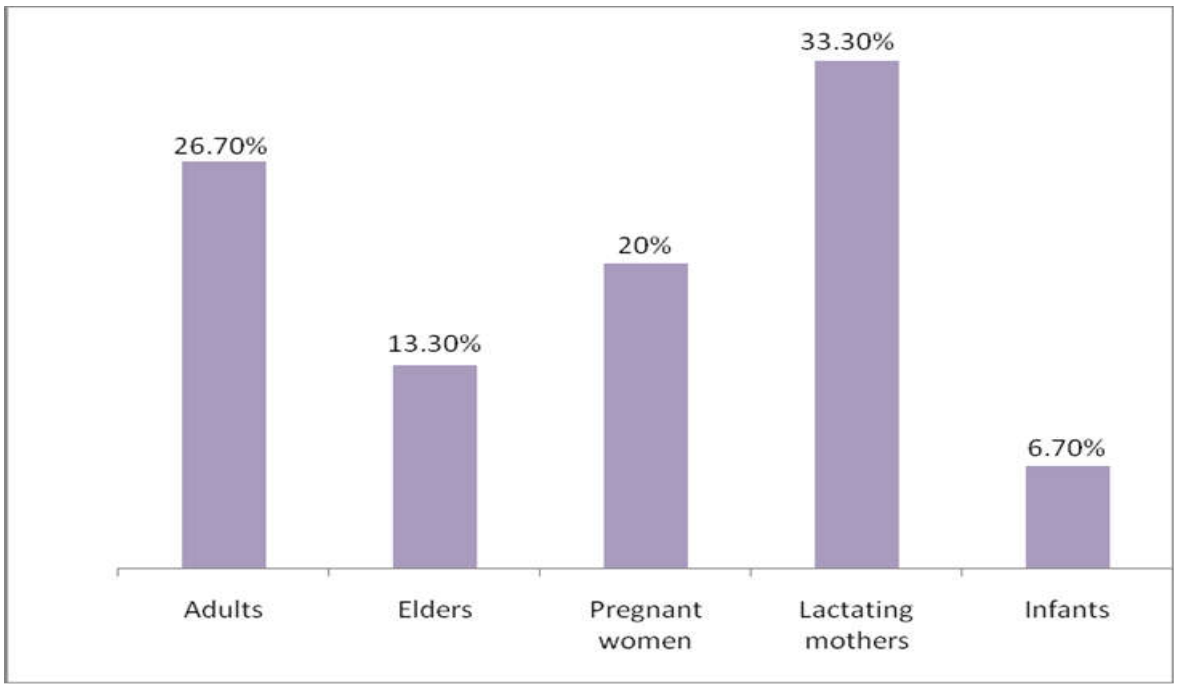

Figure 6: Chicken product consumption in the family of Hidabu Abote district

4.2.6. Problems of chicken product consumption

The major problems associated with the consumption of chicken and chicken product in the study area were summarized in Table 6. The results of this study revealed that there were various problems affecting chicken product consumption across all the three agro-ecologies studied. About 61.7, 56.7 and 65% of highland, lowland and midland respondents indicated that priority was given for the generation of family income than the use as source of food respectively. Major constraint to the consumption of poultry and poultry products were attributed to giving priority to family income, indicating that one of the most important reasons of keeping chickens in the study area is to generate family income. The result of the present study was in agreement with that of Ahmedin (2014) who reported that the need for family income negatively affected household consumption of poultry products in Gorogutu district of Eastern Hararghe.

Table 6: Impediments/limitation to consumption poultry product in the study area

Parameters	Highland		Midland		Lowland		Overall	
Impediment/limitation	**n**	**%**	**n**	**%**	**n**	**%**	**N**	**%**
High cost of preparation of Doro watt	3	5	3	5	6	10	12	6.7
High market price of eggs and chickens	17	28.3	9	15	9	15	35	19.4
Unavailability of eggs and chickens	3	5	7	11.7	8	13.3	18	10
High priority given to family income	37	61.7	39	65	34	56.7	110	61
Others	0	0	2	3.3	3	5	5	2.7
Total	60	100	60	100	60	100	180	100
	P-Value			0.831				

N-represent the number of respondents. There is no significant difference between the rows of all ago-ecologies (P>0.05)

4.3. Management of Poultry

4.3.1. Chicken breeding

About 98% of the respondents reported to have used natural incubation with the use of broody hens (Table 7) while the remaining 2% of the respondents reported to buy chicken from the market instead of hatching. However, there was no significant difference between the three agro-ecologies (P>0.05) in breeding practices. In all the three agro-ecologies studied the traditional poultry production system practiced was characterized by lack of systematic breeding program. The respondents prioritized egg production, feather color, body weight, body conformation and others like breeds as 1st, 2nd, 3rd, 4th and 5th selection parameter of breeding stock, respectively (Fig.7). Moreover, the respondents reported that broody-hen with large body size and good sitting-habit is preferably selected to attain good hatchability. The result of this study was in agreement with that of Sonaiya and Swan (2004) and Ahmedin (2014) who suggested the use of large sized broody hen for natural incubation.

Table 7: Locally hatching practices in the study area

Variables	Highland		Midland		lowland		Overall	
	n	**%**	**n**	**%**	**n**	**%**	**N**	**%**
Yes	59	98.3	60	100	57	95	176	98
No	1	1.7	0	0	3	5	4	2
Total	60	100	60	100	60	100	180	100
	P-Value			0.0001				

N-represent the numbers of respondents. There is significant difference between the rows of all ago-ecologies ($P<0.05$)

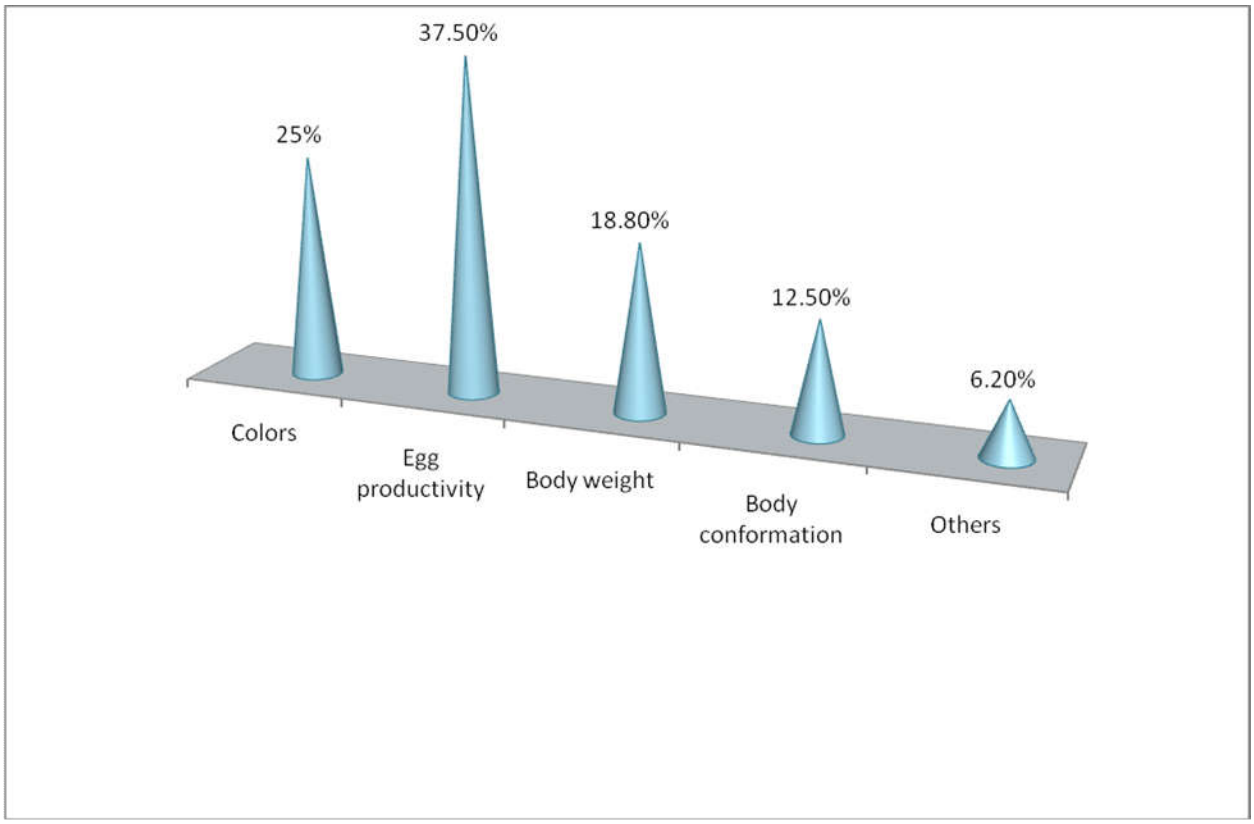

Figure 7: Criteria of selecting breeding stock in the study area

4.3.2. Sources of information on improved poultry production practices

The major sources of information on improved poultry production in Hidabu Abote district were shown in Table 8. The results obtained revealed that about 37% of the respondents obtained information on improved poultry production practices from their neighbors and about 18.9% reported to obtain, information on improved poultry production practices from extension agents. There was no significant (P>0.05) difference in the sources of information in all agro ecologies studied.

Table 8: Major sources of information on improved poultry production practices in the study area

Parameters	Highland		Midland		Lowland		Overall	
	n	**%**	**n**	**%**	**n**	**%**	**N**	**%**
Extension agents	11	16.7	9	15	15	25	35	18.9
Neighbors	22	36.7	25	41.7	20	33.3	67	37
Market place	5	8.3	8	13.3	5	8.3	18	10
Other farmer	15	25	11	16	9	18	35	19.7
Relatives	5	8.3	3	5	8	13.3	16	8.8
Co-operative leaders	2	5	4	6.7	3	5	9	5.6
Total	60	100	60	100	60	100	180	100
	P-Value			0.945				

N-represent the numbers of respondents. There is no significant difference between the rows of all ago-ecologies (P>0.05)

4.3.3. Culling of chickens

The determinant factors of culling chicken in the study district was shown in Table 9. About 35 and 26% of the respondents reported to have used rate of productivity and sickness as the major factors of culling chickens from the flock in Hidabu Abote district. The result of this study was in line with that of Meseret (2010) who reported that sickness and frequency of broodiness are the two major factors of culling chickens from the flock in Gomma Woreda of Jimma Zone. Ahmedin (2014) reported that poor productivity and frequency of broodiness are the two major factors of culling chickens from the flock in Gorogutu district of East Hararghe Zone. (Halima, 2007) also reported that farmers cull their chickens because of poor productivity and old age in

North Western Ethiopia. The result of the current study also indicated that selling and home consumption is the most common methods of chicken culling in the study area.

About 51.1% of the respondents in the study area placed breeding objectives on the selection of female. The remaining 37.2 and 11.7% of the respondents placed breeding objectives on the selection of both sexes and on the male respectively. Farmers usually place breeding objectives on female considering that female chicken provides both eggs, incubate or hatch chicks and used as means of income generation aimed at purchasing of food or related materials required at household level. There was significant difference between the agro-ecologies ($P<0.05$) in chicken selection and placing breeding objective on particular sex, in Hidabu Abote district. The majority of the respondents select moderately broody hens because of both egg laying and hatching chicks are equally important. Consequently, all the respondents reported to place special emphasis on egg production and good mothering ability rather than large body size, body plumage color and comb type. Egg production was reported to be the most preferable selection trait in the study area. This result was in agreement with that of Bogale (2008) who indicated that most of the respondents (66.7%) select breeding hens based on egg production in Fogera. Nigussie *et al.* (2010a) also reported that egg production is the most important selection criterion in different parts of Ethiopia.

Table 9: The determinant factors for culling chickens in the Hidabu Abote district

Variables	Highland		Midland		Lowland		Overall	
	n	**%**	**n**	**%**	**n**	**%**	**N**	**%**
Poor productivity	19	31.7	18	30	24	42.1	61	35
Old age	4	6.7	16	26.7	10	17.5	30	17
Sickness	17	28.3	15	25	14	24.6	46	26
Market price	12	20	5	8.3	5	8.8	22	12.4
Home consumption	3	5	3	5	4	7	10	5.7
Frequency of broodiness	5	8.3	3	5	3	3.5	11	4.2
Total	60	100	60	100	60	100	180	100
P-Value				0.977				
Chicken Sexes Selected								
Male	4	6.7	12	20	6	8.3	22	11.7
Female	18	43.3	30	50	36	60	84	51.1
Both	38	50	18	30	18	31.7	74	37.2
Total	60	100	60	100	60	100	180	100
P-Value				0.006				
Broody character preferred								
Frequent broody	14	23.3	10	16.7	11	18.3	35	18.2
Moderately broody	29	46.7	36	60	21	35	86	48.2
None broody	17	30	14	23.3	28	46.7	59	33.5
Total	60	100	60	100	60	100	180	100
P-Value				0.358				

N numbers of respondents .There is no significant difference across agro ecologies ($p>0.05$), except type of chicken sexes selected ($p<0.05$)

4.3.4. Local chicken production system

The results of the poultry production system practiced in the study area were shown in Table 10. The results obtained showed that about 90% of the respondents practiced an extensive traditional free range production system. The chickens are reported to depend on scavenging with occasional supplementation. About 10% of the respondents reported to practice semi intensive type of chicken management system respectively including the use of fences around their home stead in all the three agro-ecologies studied. This result was in agreement with various research results reported from different parts of Ethiopia. Tadelle *et al*.(2003b) and Solomon (2004) reported that the Ethiopian small holder chicken production system is characterized by scavenging on free range to collect insects, worms, seed and plant materials.

Table 10: Village chicken production system in Hidabu Abote district

Variables	Highland		Midland		Lowland		Overall	
	n	%	n	%	n	%	N	%
Type's of poultry Production system								
Traditional (scavenging only)	20	33.3	18	30	29	48.3	67	37.2
Scavenging +seasonal supplementation	34	56.7	40	66.7	21	35	95	52.8
Semi-intensive	6	10	2	3.3	10	16.7	18	10
Total	60	100	60	100	60	100	180	100
	P-value				0.996			

N numbers of respondents .There is no significant difference across agro ecologies ($p>0.05$), except type of chicken sexes selected ($p<0.05$)

4.3.5. Feeds and feeding practices of local Chicken

The locally available feeds and poultry feeding practice in the study area were shown in Table 11. About 70% of the respondents reported that scavenging with occasional supplementation was the major feeding system encountered in all the three agro-ecologies of the study district. The feed materials used as supplementation comprises of home grown crops such as maize, wheat, sorghum, spoiled grains and household leftovers. Wheat, maize and sorghum are the top three cereal grains provided as supplementary feed in all the three agro-ecologies of the study district (Table 11). There was significant difference between the three agro-ecologies in feed resource based on season and the degree of scavenging and supplementations ($P<0.05$). The highland altitude was reported to be highly dependent on scavenging rather than midland and lowland.

The result of this study was in agreement with that of Zemene *et al.,* (2012) who reported that all the chicken owners (100% of the respondents) in West Amhara region provide supplementary feed to their chickens. The results of this study was also in agreement with the results of Halima (2007) who reported that 96.8% of the farmers provide partial supplementation of feeds produced locally in Northern Ethiopia. Fisseha (2009) also reported that 97.5% of chicken owners in Bure Woreda of North-West Amhara provided supplementary feeds to village birds. Spreading of grain on the floor was the common (60%) way of providing supplementary feeds. Similarly, Mapiye and Sibanda (2005) who reported that only 11.4% of village chicken keepers in Rushinga district of Zimbabwe use feeding trough for village chicken.

Table 11: Supplementation practice of scavenging chickens in Hidabu Abote district

Parameters	Highland		Midland		Lowland		Overall	
	n	%	n	%	n	%	N	%
Feeding system								
Scavenging alone	21	35	18	30	15	25	54	30
Scavenging with supplement	39	65	42	70	45	75	126	70
Total	60	100	60	100	60	100	180	100
P-value				0.0001				
Sources of supplementation								
Wheat grain	11	15.3	16	25.7	11	19.2	38	20.1
Foods left over	3	6.7	6	12.7	4	4.7	13	8
Kitchen wastes	4	7	1	1.7	1	1.7	6	3.46
Spoiled grains	3	5	1	1.7	3	3	7	3.23
Maize and sorghum grain	17	27.3	11	16.2	7	15.7	35	19.73
All	4	8.7	7	12	16	25.7	27	15.46
Total	42	70	42	70	42	70	126	70
P-Value				0.286				
Ways of supplementation								
Feeding trough	8	10	8	10	7	5	23	8.33
Spreading on the floor	32	56.7	34	60	35	63.3	101	60
Others	2	3.3	0	0	0	1.7	2	1.67
Total	42	70	42	70	42	70	126	70
P-Value				0.916				

n-represent the number of chickens per household. There is no significant difference between the rows of all ago-ecologies (P>0.05)

About 28.34% of the respondents in the study area provide supplementary feeds for their chickens every 3 days/week and about 22% of the respondents provide supplementary feed every day depending on the seasons and period of feed shortage. The months of July, August and September were reported as periods of feed shortage, during which the chickens do not get enough feed from scavenging and require the provision of supplement feeds. Cereal grains and household leftovers were reported to be the major supplementary feed offered. The result of the present study was in agreement with that of Fisseha (2009) who reported that the chicken owners in Bure Woreda of North-West Amhara Region provide supplementary feeds to their chickens. About 30.8% of the respondents provide supplements for their flocks in the morning. Unfortunately, About 48.9% of the respondents provide supplementary feed collectively to the whole flock at the same time rather than feeding in separate groups. There were significant different between agro ecologies ($P<0.05$) in the methods used to give supplementary feeds for their flocks.

Table 12: Frequency and methods of providing supplementary feeds in the study area

Parameters	Highland		Midland		Lowland		Overall	
	n	%	n	%	n	%	N	%
Frequency of supplementation								
Every day	13	21.7	15	28.3	7	10	33	22
Every two day	10	16.7	17	25	12	23.3	41	19.66
Every 3 day	19	31.7	10	16.7	23	36.7	52	28.34
Total	42	70	42	70	42	70	126	70
P-value				0.359				
Time of supplementation								
Morning	18	33.3	20	36	14	23	52	30.76
At noon	3	14.3	2	2.3	4	8	9	8.2
After noon	4	7.3	4	5.7	3	5.7	11	6.27
At all time	17	15	16	26	21	33.3	54	24.76
Total	42	70	42	70	42	70	126	70
P-value				0.518				

n= represents numbers of respondents. There is no significant difference between the rows of all agro-ecologies ($P>0.05$)

Parameters	Highland		Midland		Lowland		Overall	
	n	%	n	%	n	%	N	%
Methods of supplementation								
Separately for different classes	10	16.7	12	21.7	13	25	35	21.13
Together to whole groups	32	53.3	30	48.3	29	45	91	48.86
Total	42	70	42	70	42	70	126	70
	P value				0.0001			

n=number of respondents. There is significant difference in methods of give extra feeds in all agro ecologies (P<0.001).

4.3.5.2. Priority in supplementary feeding

About 42.63% of the respondents reported to have provided supplementary feeding to their chickens for the purpose of increasing egg and meat production followed by improving percent hatchability during natural incubation (Table 13). Similarly, Bogale (2008) reported that the main reason of feed supplementation in Fogera district was to increase egg and meat production. About 31.23% of the respondents reported to have given priority of supplementary feeds to layers followed by chicks (25.66%), indicating that layers got the highest priority and attention in feeding because farmers believe that supplemented hens lay more eggs. Young chicks were also reported to receive attention in terms of supplementary feeding because they could not scavenge sufficiently.

Table 13: Reasons and priority of supplementing chickens in the study district

Parameters	Highland		Midland		Lowland		Overall	
	n	%	n	%	n	%	N	%
Reasons of supplementation								
To increase egg yield	21	33.3	27	45	31	49.6	79	42.63
To improve meat yield	8	11.7	5	10	4	7	17	9.56
For broodiness	12	23.3	8	11.7	5	8.7	25	7.9
All	1	1.7	2	3.3	2	4.7	5	3.23
Total	42	70	42	70	42	70	126	70
	P-Value			0.839				
Priority of supplementation								
Chicks	17	26.7	10	20	17	30.3	44	25.66
Layers	20	31.7	26	40	14	22	60	31.23
Pullets	3	6.7	4	6.7	7	12	14	8.46
Cocks/cockerels	2	5	2	3.3	4	5.7	8	4.66
Total	42	70	42	70	42	70	126	70
	P-value			0.639				

n= represents numbers of respondents. There is no significant difference between the rows of all agro-ecologies (P>0.05)

4.3.6. Family labour dynamics in chicken management

The intra-household dynamics refers to the way in which household members behave and react to each other in the production process. About 56.7 and 24.5% of the respondents indicated that women and children's were responsible for chicken management at household level respectively (Table 14). The result of the current study showed that most of the chicken management activities are covered by women including the control of the cash generated from the sale of birds and eggs. The proportion of women that shared poultry ownership in this study was similar with that of Mammo (2006) who reported 57% ownership by women from the study conducted in Jamma woreda and that of Tadelle *et al.* (2003) who reported from the central highlands of Ethiopia that women own and manage birds and control the cash generated from the sale of birds. However, the results of this study was lower than that of Kitayi (1998) who reported that 80 and 82% of the chicken management is performed by women in Gambia and Tanzania, respectively.

On the contrary, the results of the current study (56.7% women ownership) was higher than that of Hoyle (1992) who reported elder men and women accounted for 30 and 47% of poultry ownership in Welaita Soddo vicinity respectively. The ownership of village chickens in most African societies is a product of social and cultural aspects of the community (Sonaiya, 1990a). The ownership pattern is usually related to decision making in selling and consumption of chickens and eggs. About 90% of the respondents reported that chicken house construction in the study area was performed by men. According to Fisseha (2009), about 97.5% of the respondents reported that chicken house construction was done by men in Bure Woreda of North-west Amhara Region. The general indication is that women are more responsible for many chicken management activities like provision of water and supplementary feeding including the selling of chicken and eggs.

Table 14: Responsibility of chicken feeding and watering in the study area

Parameters	Highland		Midland		Lowland		Overall	
	n	%	n	%	n	%	N	%
Women	40	66.7	33	55	29	48.3	102	56.7
Children	13	21.7	12	20	19	31.7	44	24.5
Elders	3	5	5	8.3	7	11.7	15	8.33
Adults	4	6.7	10	16.7	5	8.3	19	10.6
Total	60	100	60	100	60	100	180	100
P-Values				0.732				

n= represents numbers of respondents. There is no significant difference between the rows of all agro-ecologies (P>0.05)

4.3.7. Watering practice of chickens

All the respondents (100%) reported to have provided water for their chicken. About 58.3% of the respondents make water available all the times. According to Halima (2007) about 99.5% of chicken owners in North West Amhara Region provide water to their chickens. There was difference between agro-ecologies (P<0.05) in frequency of watering their chickens. Larger number of respondents of the lowland agro-ecology reported to have provided water all the times as compared to the respondents of highland and midland agro ecologies (Table 15) which might be attributed to the higher ambient temperature in the lowland.

Table 15: Frequency of watering chickens in the study area

Parameters	Highland		Midland		Lowland		Overall	
	n	%	n	%	n	%	N	%
Every other day	8	13.3	5	8.3	2	3.3	42	8.3
Once/day	13	21.7	10	16.7	4	6.7	29	15
Twice/day	14	23.3	13	21.7	6	10	40	18.3
Adlib	25	41.7	32	53.3	48	80	69	58.3
Total	60	100	60	100	60	100	180	100
P-value				0.681				

n= represents numbers of respondents. There is no significant difference between the rows of all agro-ecologies (P>0.05)

The results of the current study revealed that the major sources of water for village chicken in the study area included spring water, rain water, river water and tap water. About 42.77% of the respondents use tap water in watering their chickens. Spring water was better used in the highland than in the midland and lowland agro-ecologies. Broken home utensils (clay, plastic and wooden materials) are the most widely used watering troughs in the study area (Table 16). All the respondents using watering trough reported that they never cleaned watering trough, which indicates poor sanitation. The results of this study agrees with that of Tesfau (2007) who reported that there was no practice of washing the watering container at the household levels.

Table 16: Sources of water and ways of watering chickens in the study area

Parameters	Highland		Midland		Lowland		Overall	
	n	%	n	%	n	%	N	%
Rain water	5	8.3	6	10	5	8.3	16	8.86
River water	15	25	6	10	8	13.3	29	16
Tap water	22	36.7	38	63.3	17	28.3	77	42.77
Spring water	18	30	10	16.7	30	50	58	32.23
Total	60	100	60	100	60	100	180	100
	P-value			0.362				
Ways of watering								
Wooden trough	12	20	11	18.3	7	11.7	30	16.67
Clay materials	17	28.3	16	26.7	17	28.3	50	27.77
Plastic materials	6	10	13	21.7	6	10	25	14
Broken equipment	25	41.7	20	33.3	30	50	75	41.67
Total	60	100	60	100	60	100	180	100
	P-value			0.361				

n= number of respondents. There is no significant difference between the rows of all ago-ecologies ($P>0.05$)

4.3.8. Diseases and health status

According to the respondents disease and predators were known to be the major causes of mortality in the Hidabu Abote district. Diarrhea, colored dropping, respiratory disease, molting or loss of feather, Ecto-parasites, sudden death and discharge through beak and eye were the major symptoms of disease frequently observed in the study area (Fig.8). Based on the symptoms encountered and consultation with the Woreda Animal Health Experts (Veterinarian) about 67.8 and 32.2% of the respondents reported high prevalence of New castle disease and feed borne diseases including Fowl pox, coccidiosis, Fowl typhoid and Salmonella respectively (Table 17). There were significant difference among agro ecologies ($P<0.01$) in the prevalence of major poultry disease in the study area. Based on the symptoms encountered, the respondents reported that New castle disease was widely distributed in the study area followed by fowl pox, coccidiosis and ecto-parasites. In agreement with the results of the current study, Negussie and Ogle (1997) reported that Newcastle disease accounted for the largest proportion of flock

mortality in Ethiopia. About 57.3, 31.6, 9.4 and 1.7% of the mortality were occurred to New castle disease, fowl pox, coccidiosis and predators respectively.

The results of the research work conducted in Benin (Chrysostome *et al.,* 1995), Burkina Faso (Bourzat and Saunders, 1990), Mauritania (Bell *et al.,* 1990) and Tanzania (Yongolo, 1996) identified Newcastle as the most devastating disease of local chickens. The result of the current study was in line with the result of study conducted in different regional states of Ethiopia. Aberra Melesse (2007) indicated that about 28.8, 26, 21.6, 15.4,3.4, 3.4 and 1.4% of the annual chicken mortality could be attributed to Fowl cholera, New Castle Disease, Coccidiosis, Fowl influenza (Infectious Bronchitis), Fowl pox, Fowl typhoid and Salmonella in Southern Ethiopia respectively. In the result of the current study, animal health services (treatment and vaccination) were given for other animals, but not for chickens, except that exotic breed of chickens was immunized against Newcastle disease before distribution within the farming population. According to the discussion made with animal health technicians of the study areas, farmers are responsible for the negligence in reporting the outbreak of poultry disease on time. This was mainly due to lack of awareness about the animal health extension services delivered in the area.

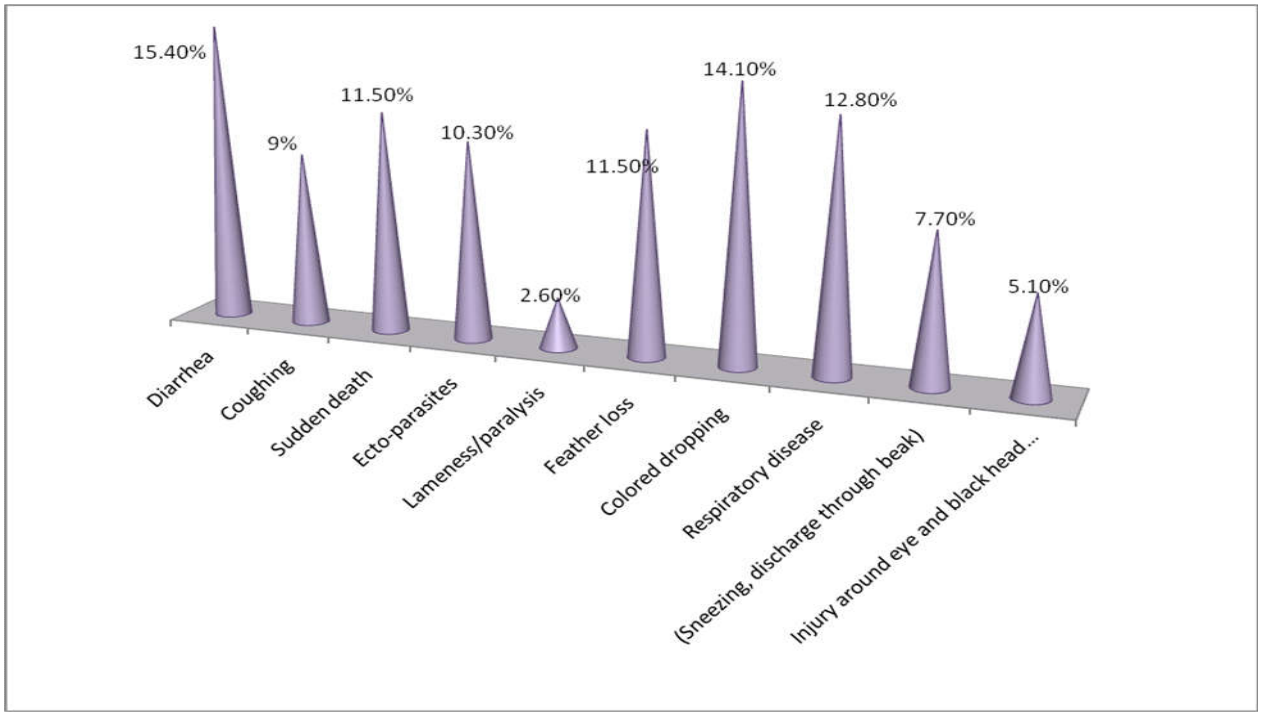

Figure 8: Priorities of disease symptoms in terms of frequencies of occurrence in the Hidabu Abote district

Table 17: Major poultry disease prevailing in the study area

Parameters	Highland		Midland		Lowland		Overall	
	n	%	n	%	n	%	N	%
New castle disease	38	63.3	41	68.3	43	71.7	122	67.8
Feed born diseases	22	36.7	19	31.7	17	28.3	58	32.2
Total	60	100	60	100	60	100	180	100
P-value				0.0001				

n= represents numbers of respondents. There is significant difference between the rows of all agro-ecologies (P>0.05)

Local chicken owners of the study area had no tradition of vaccinating their chickens. The level of awareness about availability of local chicken vaccines was low in all the three agro-ecologies studied. About 96.6% of the respondents in Hidabu Abote did not have experience of getting their chicken vaccinated against diseases (Table 18). About 44.4, 16.7 and 38.9% of the respondents' lack of the awareness about the availability of vaccines, lacks attention to village chicken, and lack of accessibility to vaccines respectively. This result was in agreement with that of Fisseha (2010), who reported that 96.4 % of the respondents in Bure Woreda do not have any experience of getting their chicken vaccinated.

Table 18: Tradition of vaccination and treatment of chickens in the study area

Parameters	Highland		Midland		Lowland		Overall	
	n	%	n	%	n	%	N	%
Chicken vaccination								
Yes	5	8.3	3	5	2	3.3	10	3.3
No	55	91.7	57	95	58	96.7	170	96.6
Total	60	100	60	100	60	100	180	100
P-value				0.0001				
Reason for not vaccinating and treating								
Lack of awareness about the-availability of vaccine	26	43.3	29	48.3	25	41.7	80	44.4
Lack of attention to village chicken	14	23.3	6	10	10	16.7	30	16.7
Inaccessibility and shortage of vaccines	10	33.3	25	41.7	25	41.7	70	38.9
Total	60	100	60	100	60	100	180	100
P-value					0.282			

n= represents numbers of respondents. There is no significant difference between the rows of all agro-ecologies (P>0.05) in the reason of not vaccinating and treatment but there is significant (p<0.05) in response of chicken vaccinate

Access to veterinary services is limited in all the three agro ecologies studied. About 96.7% of the respondents use traditional (ethno-veterinary) treatment against Newcastle and other killer diseases (Table 19). About 27.2% of the respondents use mixture of different traditional drugs mixed with traditional food materials and alcoholic drinks. About 11, 17.8, 24.5, and 19.4% of the respondents reported to use oil, Chill powder, plant materials (Garlic, Fexo, Ebicha), antibiotics (tetracycline) and bleeding around the wing to remove' infected' blood in treating their chickens in the study area respectively. Upon observing disease symptoms, 40.5% the respondents, use isolation method to control the transmission of diseases to the healthy chickens. The poor coverage of veterinary services observed in the study district negatively impacted poultry production and deserves special attention from all the concerned bodies. This result was in agreement with that of Sonaiya and Swan (2004) who reported that the use of traditional treatment to control poultry disease is important as most developing countries like Ethiopia cannot afford the importation of veterinary medicine and vaccines.

Table 19: Types of traditional drugs used to treat disease in Hidabu Abote Woreda

Parameters	Highland		Midland		Lowland		Overall	
	n	%	n	%	n	%	N	%
Treatment of Sick Chicken								
Yes	57	95	58	96.7	59	98.3	174	96.7
No	3	5	2	3.3	1.7	1	6	3.3
Total	60	100	60	100	60	100	180	100
	P-value			0.0001				
Traditional Treatment								
Oil and Alcohol	9	15	8	13.3	3	5	20	11
Tetracycline (mata-xiyyiti)	14	23.3	9	15	12	20	35	19.4
Chill powder (berbere)	10	16.7	12	20	10	16.6	32	17.8
Plant product (Garlic,Fexo,Ebicha)	16	26.7	13	21.7	15	25	44	24.5
All	11	18.3	18	30	20	33.3	49	27.2
Total	60	100	60	100	60	100	180	100
	p-value			0.492				
Handling of sick birds								
Isolation	28	46.7	27	45	18	30	73	40.5
Immediate slaughter	6	10	3	5	4	6.7	13	7.2
Leaving with the flock	10	16.7	13	21.7	14	23.3	37	20.6
Treatment with different drugs	16	26.7	17	28.3	24	40	57	31.7
Total	60	100	60	100	60	100	180	100
	P value			0.952				

n= represents numbers of respondents. There is no significant difference between the rows of all agro-ecologies (P>0.05)

4.3.9. Local poultry housing and predations

The results of the Local poultry housing and status of predation were shown in Table 20. About 46 and 20.6% of all the respondents of the three agro-ecologies studied used different perching structure and share family dwellings with chickens respectively. On the other hand, about 18.3% of the respondents keep their chickens in the different shelter other than family dwellings (Table 20). The lowland households use more of perching materials than the highland and midland households, which might be attributed to difference in ambient temperature. The practice of sharing family dwellings might be associated with the protection of the chickens from predators,

the act of which is very severe during night time than daytime. This result was in agreement with that of Kitalyi (1998) who reported that there is no separate housing for rural chickens in Ethiopia and Kenya and chickens are housed in family dwelling or in the kitchen during night times.

According to the result of the current study, about 85% of the respondents reported to have no separate poultry house for which the farmers had various reasons including risk of predators and lack of constructional materials (availability and cost) as shown in Table 20. The result of the current study was in agreement with that of Ahmedin (2014) who reported that about 79.05% of the households have no separate house for poultry in Gorogutu district. On the contrary the results of the current study was lower than that reported by Meseret (2010) and Eskinder (2013) who suggested 94.4 and 92.06% of Gomma woreda and Horro and Jarso chicken farmers have no separate poultry house, respectively. However, Halima (2007) and Bogale (2008) reported that about 51 and 59.7% of the chicken's owners of Northwest Ethiopia and of Fogera woreda had separate shades for their chickens, respectively.

Table 20: Types of chicken Houses in the Hidabu Abote district

Parameters	Highland		Midland		Lowland		Overall	
	n	%	n	%	n	%	N	%
Poultry Houses								
Share family dwellings	16	26.7	9	15	12	20	37	20.6
Have different shelter in the same roof	14	23.3	11	18.3	8	13.3	33	18.3
Separate home constructed entirely for poultry	11	18.3	12	20	4	6.7	27	15
Using perching materials in the same roof	19	31.7	28	46.7	36	60	83	46
Total	60	100	60	100	60	100	180	100
P-Value					0.152			

n= represents numbers of respondents. There is no significant difference between the rows of all agro-ecologies (P>0.05)

In Hidabu Abote woreda predators (associated with lack of housing) such as eagle, dogs, wildcats and foxes were the main causes of losses mostly in young birds (Table 21). The results of the present study revealed that about 42.8 and, 38% of the chickens mortality was attributed to wildcat (locally known as Adala) and eagle especially during the rainy season and during the dry season respectively. Thefts are another important cause for the loss of adult birds. According to

Aberra Mellese (2007), about 46% of the respondents in Southern Ethiopia reported, that wild birds (an eagle, hawk, etc.) were the most common predators during the dry season, while wild cat (locally known as Shelemetmat) was the most dangerous predator during the rainy season.

Table 21: Common predator prevailing in the study area

Parameters	Highland		Midland		Lowland		Overall	
	n	%	n	%	n	%	N	%
Major predators								
Wild cat	30	50	28	48.3	20	30	78	42.8
Fox	4	6.7	6	10.3	10	16.7	20	11.2
An eagle	20	33.3	19	32.3	29	48.3	68	38
Dogs	6	10	5	8.6	3	5	14	7.9
Total	60	100	60	100	60	100	180	100
P-value				0.890				

n= represents numbers of respondents. There is no significant difference between the rows of all agro-ecologies (P>0.05)

4.4. Poultry Production and Reproduction Performances

The production performance of indigenous, crosses and exotics chicken in Hidabu Abote district were shown in Table 22. The average ages of indigenous, cross breed and exotic pullets at first egg laying were 5.7, 5.1 and 4.8 months respectively. There was no statistically significant difference (P>0.05) between the three agro-ecologies studied in sexual maturity of the chickens. The results of the current findings show that local chicken reach sexual maturity late as compared to the improved exotic breeds (Table 22). One of the expressions of the low productivity of indigenous chicken is their late sexual maturity. Similarly, Halima (2007) reported that 77.4% of local cockerels in northwest Ethiopia reach sexual maturity at 20–24 weeks of age, but present result is lower than the result of Tadelle *et al.,* (2003) who reported 6.8 months of mean age at first lay.

The results of the present study revealed that the numbers of eggs produced/clutch/hen was higher for the exotic (35.2±2.457) as compared to that of cross breeds (21.7±1.201) and indigenous chickens (12±0.916) eggs. There was statistically significant differences (P<0.05) between all the three agro-ecologies studied in mean number of eggs per clutch. Mean eggs/ clutch/ hen of about 22, 22.7 and 23.95 were calculated for highland, midland and lowland

respectively. The result of the present study was in agreement with that of Habte *et al.* (2013) who reported production level of 31.66, 26.14 and 11.23 eggs/clutch for exotic, cross, and indigenous chickens from Nole Kobba Woreda respectively. The mean annual production of 51±2.017 eggs/individual indigenous hens obtained in the present study was comparable with the mean annual indigenous hen production of 59.51 eggs obtained from Metekel Zone of Northwest Ethiopia as reported by Zewdu *et al.,* (2013). Moges *et al*. (2010) reported total egg production/hen/year of 60 from Bure district. But the results obtained from the current study (51eggs/year/hen) was higher than that reported from Asela (34 eggs/hen/year) as reported by Brannang and Persson (1990).

The mean annual production of 184 eggs/hen of exotic breed obtained in the present study was lower than that of Desalew (2012) who reported 276.1eggs/hen/year from East Shoa. The low productivity of the exotic hens obtained in this study might be due to poor management practice and difference in breed of the exotic chickens. On the other side, the result of the current study (184eggs/hen/year) was higher than the result of Ahmedin (2014) who reported 150.2 eggs/hen/year from East Hararghe Gorogutu district. Bolton and Blair (1974) observed that egg production in poultry is a function of good feeding with balanced diet. According to the results of the current study the average number of eggs set per hen in the study area was 13.7 of which 9.5 chicks hatched. This result was in agreement with that of Fisseha *et al.* (2010b), who reported that average number of eggs set per hen is 13 of which 9.5 chicks hatched in Fogera. According to Asefa (2007) the mean number of eggs incubated was 12.97 of which 10.23chicks hatched in Dale W*oreda*. The mean number of eggs set for natural incubation was 9.8 eggs in Awassa Zuria W*oreda* of southern Ethiopia. The average clutch size of local chickens in the study area was 8 clutches/hen/year. The reproductive performances obtained from the present study had larger clutch size than that of Addis Getu *et al. (*2014) who reported average clutch size of 3.53 clutches/hen/year for of local chickens.

Table 22: Comparative production performance of exotic, cross breed and local chickens kept under local management condition of Hidabu Abote district (mean±SE)

Parameters		Highland	Midland	Lowland	Overall Mean±SE
Mean sexual maturity (months)					
Indigenous	Age at1st egg laying	5.8±0.066	5.8±0.066	5.6±0.066	5.7±0.066
Cross breed	Age at1st egg laying	5.2±0.088	5.1±0.088	4.9±0.088	5.1±0.088
Exotic	Age at1st egg laying	4.9±0.057	4.8±0.057	4.7±0.057	4.8±0.057
P-value			0.482		
Productivity of Indigenous chickens					
Mean number of eggs/hen/clutch		11.6±0.916	14±0.916	11±0.916	12±0.916
Mean number of eggs/bird/year		48.9±2.017	55±2.017	49±2.017	51±2.017
Mean length of productive life		6.4±0.260	6.9±0.260	6±0.260	6.4±0.260
Mean number of eggs /hen/set		12±1.235	13.4±1.235	13.7±1.235	13±1.235
Mean number of chick's hatch/hen/set		9.4±0.872	10±0.872	9±0.872	9.5±0.872
Productivity of cross breed chickens					
Mean number of eggs/hen/clutch		24±1.201	20±1.201	21±1.201	21.7±1.201
Mean number of eggs/bird/year		100±7.637	120±7.637	125±7.637	115±7.637
Mean length of productive life		6±0.577	5±0.577	4±0.577	5±0.577
Productivity of exotic chickens					
Mean number of eggs/hen/clutch		30.6±2.457	36±2.457	39±2.457	35.2±2.457
Mean number of eggs/bird/year		179.2±3.195	190±3.195	183±3.195	184±3.195
Mean length of productive life		4.1±0.240	4.9±0.240	4.3±0.240	4.4±0.240
P-Value			0.021		

There is no significant difference between columns of all agro-ecologies (P>0.05) for sexual maturity, However**,** There is significant difference (P<0.05) for other productive performances, SE=Standard error of mean

4.4.1. Incubation and hatching of eggs

The results of hatching and brooding performance of local chicken were showed in Table 23**.** According to the discussion made with key informant group of the study area, time and seasons of incubation depends on the risk of predators and availability of supplementary feeds and scavenging feed resources. According to the results of the current study, about 97.2% of the respondents incubate/hatch their chicks with the use of broody hen. In the traditional backyard

poultry production system, broody hens are responsible for the newly hatched chick and it is common to see hens with their hatched chicks, indicating that natural incubation is the most commonly used method of replacing and increasing flock sizes in the study area. About 54% of the respondents use clay pot with straw bedding placed in dark and quite location during natural incubation. About 33.7, 9.5, and 2.8% of the respondents use cartoons with straw bedding, clay pot without straw bedding and locally made nest box during natural incubation respectively indicating that farmers in the study area were concerned in the preparation of appropriate place for incubation of eggs under broody hen.

About 77.2% of the respondents incubate eggs during the Ethiopian "Bega seasons" characterized by dry environments, availability of feed resource and low risk of predators. About 16% of the respondents do not have any specific choice of season in incubation. Few respondents reported to hatch and brood chicks during wet season. The result of this study was in agreement with that of Mekonnen (2007) who reported that about 89.4 % of the respondents hatch and brood chicks during the dry seasons in Southern Ethiopia. But the result of the current study was contrary to that of Ahmedin (2014) who reported that the majority of the respondents hatch and brood chicks during the wet seasons in Gorogutu district of East Hararghe Zone.

Table 23: Season of hatching and brooding of chicks in Hidabu Abote district

Parameters	Highland		Midland		Lowland		Overall	
	n	%	n	%	n	%	N	%
Season did rear more birds								
Bega (December, January, February)	40	66.7	50	83.3	49	81.7	139	77.2
Kerimt (June, July, August)	7	11.7	3	5	2	3.3	12	6.7
Both (Kerimt and Bega)	13	21.7	7	11.7	9	15	29	16
Total	60	100	60	100	60	100	180	100
P-value				0.581				
Nesting materials for incubation								
Clay pot with straw bedding	32	55.2	36	60	28	46.7	96	54
Clay without bedding	3	5.2	10	16.7	4	6.7	17	9.5
Cartoon with straw bedding	21	36.2	14	23.3	25	41.7	60	33.7
Others	2	3.4	0	0	3	5	5	2.8
Total	60	100	60	100	60	100	180	100
P-Value				0.936				

n= represents numbers of respondents. There is no significant difference between the rows of all agro-ecologies (P>0.05)

The broody character of a given breed of chickens is genetically inherited. It is reported that thoroughly broody hen is used for hatching and brooding chicks in the study area. About 86.13% of the respondents reported to have selected laying hens in favor of strong broodiness for the purpose of hatching and brooding of chicks. There was significant difference ($p<0.05$) in the select broody hens. About 67.5, 21.7 and 10.8% of the respondents select large, medium and small body sized broody hen for hatching and brooding of chicks respectively (Table 24). Because they assume that large hens hatchs large chicks.

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Table 24: Selection and size of hens for incubation in Hidabu Abote district

Parameters	Highland		Midland		Lowland		Overall	
	n	%	n	%	n	%	N	%
Select broody hens								
Yes	42	70	55	91.7	58	96.7	155	86.13
No	18	30	5	8.3	2	3.3	25	13.87
Total	60	100	60	100	60	100	180	100
	P-value			0.0001				
Size of hen preferred For incubation								
Large	36	60	33	82.5	36	60	105	67.5
Small	10	16.7	3	7.5	5	8.3	18	10.8
Medium	14	23.3	24	10	19	31.7	57	21.7
Total	60	100	60	100	60	100	180	100
	P-value			0.991				

n= represents numbers of respondents. There is no significant difference between the rows of all agro-ecologies ($P>0.05$) but there was significant ($p<0.05$) in the select broody hens.

The majority of the respondents (54.5%) select larger eggs for incubation because they perceive that larger egg produce bigger chick. About 73.3% of the respondents use eggs laid at home for incubation. Significantly larger ($P<0.05$) number of the respondents of the midland and lowland areas use eggs laid at home for incubation as compared to the respondents of the highland. About 26.3% of the respondents use purchased eggs from the markets for incubation (Table 25). They were purchasing it first by examining whether it is fertile or not by visualization and asking the owner of the eggs. The results of this study was in agreement with that of Ahmedin (2014) who reported that nearly all farmers (91.1%) use eggs laid at home as the source of eggs for incubation from East Hararghe Zone.

Table 25: Selection of eggs for incubation in Hidabu Abote district

Parameters	Highland		Midland		Lowland		Overall	
	n	%	n	%	n	%	N	%
Selected eggs for Incubation								
Medium	36	60	15	25	20	33.3	71	39.4
Large	22	36.7	40	66.7	36	60	98	54.5
Small	2	3.3	5	8.3	4	6.7	11	6
Total	60	100	60	100	60	100	180	100
	P-value			0.931				
Sources of incubating eggs								
Purchase from markets	22	36.7	15	25	11	18.3	48	26.7
Laid at home	38	63.3	45	75	49	81.7	132	73.3
Total	60	100	60	100	60	100	180	100
	P-value			0.0001				

n= represents numbers of respondents. There is no significant difference between the rows of all agro-ecologies ($P>0.05$) but there was significant ($p<0.05$) in the sources of incubating eggs

4.5. Chickens and Eggs Marketing System

The results of marketing characteristics of village chickens and eggs in the study area were shown in Table 26**.** The sale of live birds and eggs takes place in various places including rural/local and urban markets. The results of this study clearly showed that both eggs and chickens pass through different individuals/actors before reaching consumers. The number of selling surplus males (cocks), old and nonproductive hens and sick birds is high. At all the market places of Hidabu Abote district, the sale and purchase of live chickens and eggs is decided by women, indicating that household poultry is a source of self-reliance for women, both of which provide women with an immediate income to meet household expenses. According to 11% of the respondents, children were also involved in marketing of live birds.

According to 45% of the respondents of all the studied three agro-ecologies, urban areas or woreda's capital city wich called Ejere was the first priority market place for the sale of live birds and eggs. About 36% of the respondents indicated that rural local markets were the first priority market place of local chickens and eggs in the study area. According to Hana (2016) about 56.7% of the respondents indicated that urban areas was the first priority market place for

the sale of live birds and eggs in North Gondar Zone of the Amhara Regional State. The results of the current study were in agreement with that of Ahmedin (2014) and Meseret (2010) both of whom reported live birds and eggs are sold either at the farm gate, primary market (small village market) or at secondary market (at large woreda town) in East Hararghe and Gomma Woreda of Jimma zone respectively.

Table 26: Marketing outlets of chickens and eggs in Hidabu Abote district

Parameters	Highland		Midland		Lowland		Overall	
	n	%	n	%	n	%	N	%
Places to selling Chicken-and eggs								
To urban markets	26	43.3	22	36.7	33	55	81	45
To local markets	19	31.7	28	46.7	18	30	65	36
To retailers	13	21.7	9	15	6	10	28	15.6
To home consumers	2	3.3	1	1.7	3	5	6	3.3
Total	60	100	60	100	60	100	180	100
	P-value			0.701				

n= represents numbers of respondents. There is no significant difference between the rows of all agro ecologies (P>0.05).

According to 76% of the respondents, chickens were transported to the market place by hands. About 14.4% of the respondents either carry the birds in baskets or use public bus during transportation to urban market, the latter of which is a common method of transportation of chicken by traders. The result of the current study revealed that about 75 and 23.3 % of the respondents use hand carrying (using piece of cloths with grains/straw) and basket in the transportation and egg marketing respectively. The purpose of using beds of grain/straw in the storage and transportation of eggs is to protect the eggs from breakage. According to the results of the group discussions held with key informants, egg collectors/traders use larger cartoons and bamboo-made containers (basket) to collect and transport eggs to its final destination.

The result of this study indicated that there was no significant difference in the marketing constraints among the agro-ecological zones of the study area (Table 27). About 40.6, 22.2, 17.8 and 19.5% of the respondents indicated that low market price, poor sales (demand seasonality), lack of local market/retailers and poor infrastructure was the major live chickens and eggs marketing problems in the study area. Comparable results were obtained from a study conducted in North Wollo Zone of Amhara Regional State as reported by Addisu *et al*., (2013). Meseret (2010) also reported that 42.3 and 41.7, 19.4 and 24.4 and 38.3 and 33.9% of the respondents indicated that demand seasonality, unstable prices, and unstable prices and demand seasonality were the major problems of live chickens and eggs marketing in Gomma woreda of Jimma Zone respectively.

Table 27: Means of transportation and market Constraints of live birds and eggs in Hidabu Abote district

Parameters	Highland		Midland		Lowland		Overall	
	n	%	n	%	n	%	N	%
Means of transportation Of chickens								
By hands	48	80	40	66.7	49	81.7	137	76
By public bus	2	3.3	0	0	7	11.7	9	5
By baskets	8	13.3	14	23.3	4	6.7	26	14.4
Others	2	3.3	6	10	0	0	8	4.4
Total	60	100	60	100	60	100	180	100
P-value				0.824				
Means of transportation of eggs								
By hands with pieces of- Clothes with grains /straw	40	66.7	45	75	50	83.3	135	75
By public bus	2	3.3	0	0	1	1.7	3	1.7
By baskets	18	30	15	25	9	15	42	23.3
Total	60	100	60	100	60	100	180	100
P-value				0.948				

Constraints of chicken and egg marketing								
Unstable market prices	28	46.7	25	41.7	20	33.3	73	40.6
Poor sales (demand seasonality)	10	16.7	17	28.3	13	21.8	40	22.2
Lack of local market/retailer	9	15	8	13.3	15	25	32	17.8
Poor infrastructure	13	21.7	10	16.7	12	20	35	19.5
Total	60	100	60	100	60	100	180	100
P-value				0.269				

n= represents numbers of respondents. There is no significant difference between the rows of all agro-ecologies (P>0.05

4.5.1. Determinants of market price of chickens and eggs

The results of this study indicated that there were different market prices for live chicken and eggs in the study area. According to 46.2, 30.8, 15.4 and 7.7% of the respondents the price of chicken is primarily determined based on breeds, plumage color, body weights, and comp types respectively. About 48.9, 18.3, 18.3 and 14.4% of the respondents attributed causes of variation in market prices in the study area to religious holidays/fasting, lack of retailers, lack of consumers and seasonal outbreak of diseases respectively. Since the majority of the peoples of Hidabu Abote district are Orthodox Christian in religion, there were many fasting period/year including every Wednesday and Friday all of which causes variation in both chicken and eggs prices in all the three agro-ecologies studied. In agreement with the results of the current study, Halima (2007) reported that seasonal demand (holidays and fasting seasons), lack of infrastructure, plumage color, size, age, sex, market sites and health status of the chickens had great effect on live chicken market prices in North West Ethiopia. Hunduma *et al.* (2010) also reported that religious festivals (mainly Christian festivals), market day (holiday versus ordinary market days) together with plumage color, physical stand and shank length, comb type and parents' performance (pedigree) were the major price determinant factors of chickens and chicken products in the Rift Valley of Oromia Regional State. According to Mengesha *et al.* (2008) about 34.2, 33.3, 32.4%, 33.4,,33.2 and 32.5% of the respondents indicated that body weight, plumage color, comb type, purchasing power of consumers, fasting, and availability of products were the major causes of the market price fluctuations of village chicken and chicken products in Jamma district of South Wollo Zone of the Amhara Regional State respectively.

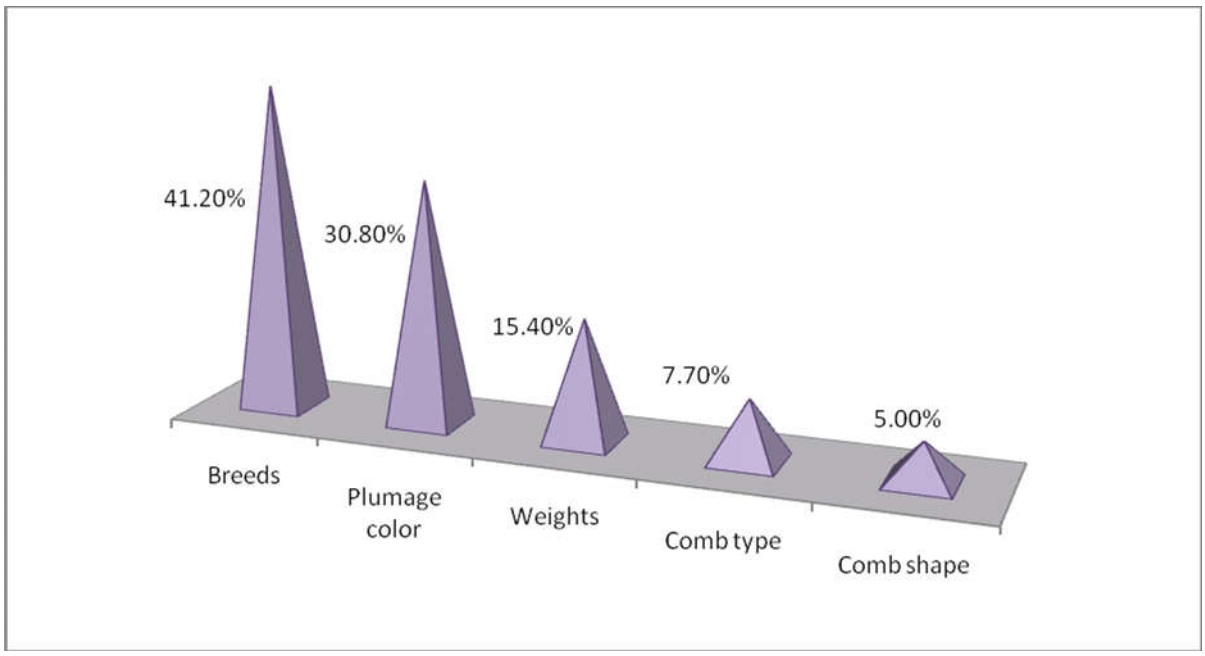

Figure 9: The criteria used to purchasing chickens

Table 28: Determinant of market prices of birds and eggs in the study Area

Parameters	Highland		Midland		Lowland		Overall	
	n	%	n	%	n	%	N	%
Religious fasting	23	38.3	29	48.3	36	60	88	48.9
Lack of retailers	15	25	14	23.3	4	6.7	33	18.3
Lack of consumers	10	16.7	5	8.3	18	30	33	18.3
Seasonal distribution of diseases	12	20	12	20	2	3.3	26	14.4
Total	60	100	60	100	60	100	180	100
P-value				0.204				

n= represents numbers of respondents. There is no significant difference between the rows of all agro-ecologies (P>0.05

4.6. Challenges of Local Chicken Production System

According to 26 and 21.9% of the respondents, disease outbreak and predators were the first and second major constraints to chicken production in the study areas (figure 10). Moreover 14, 13.3, 9.8, 8.5 and 6.4% of the respondents indicated that , shortage of supplementary feed, improper veterinary service, lack of knowledge about scientific chicken management, poor attention for poultry, and lack of local market were the major constraints to chicken

production in the study areas. The results of the current study was comparable to that of Worku (2017), who reported that disease outbreak and predators were the first and second major constraints to chicken productivity in the study areas.

Likewise, Solomon *et al.* (2003), reported that seasonal disease outbreak (mainly Newcastle disease), predators, lack of credit services, limited skill of management practices (improved feeding and housing) and low productivity of local chickens were the major identified constraints to village chicken production in Metekel Zone of Northwest Ethiopia. The results of the current study was also in agreement with that of Tadelle and Ogle (2001) who reported that disease is the major constraint to poultry production in the Central Highlands of Ethiopia. Halima (2007) also reported that predators are the major constraints to village chicken production in North West Ethiopia. Scavenging chickens are vulnerable to predation as they need to leave the family dwelling to scavenge for feed (FAO 2008). However, Worku *et al.* (2012) reported that 97.6 and 2.4% of the respondents of West Amhara Region of Ethiopia indicated that predators and diseases are the first and second major constraints to village chicken production.

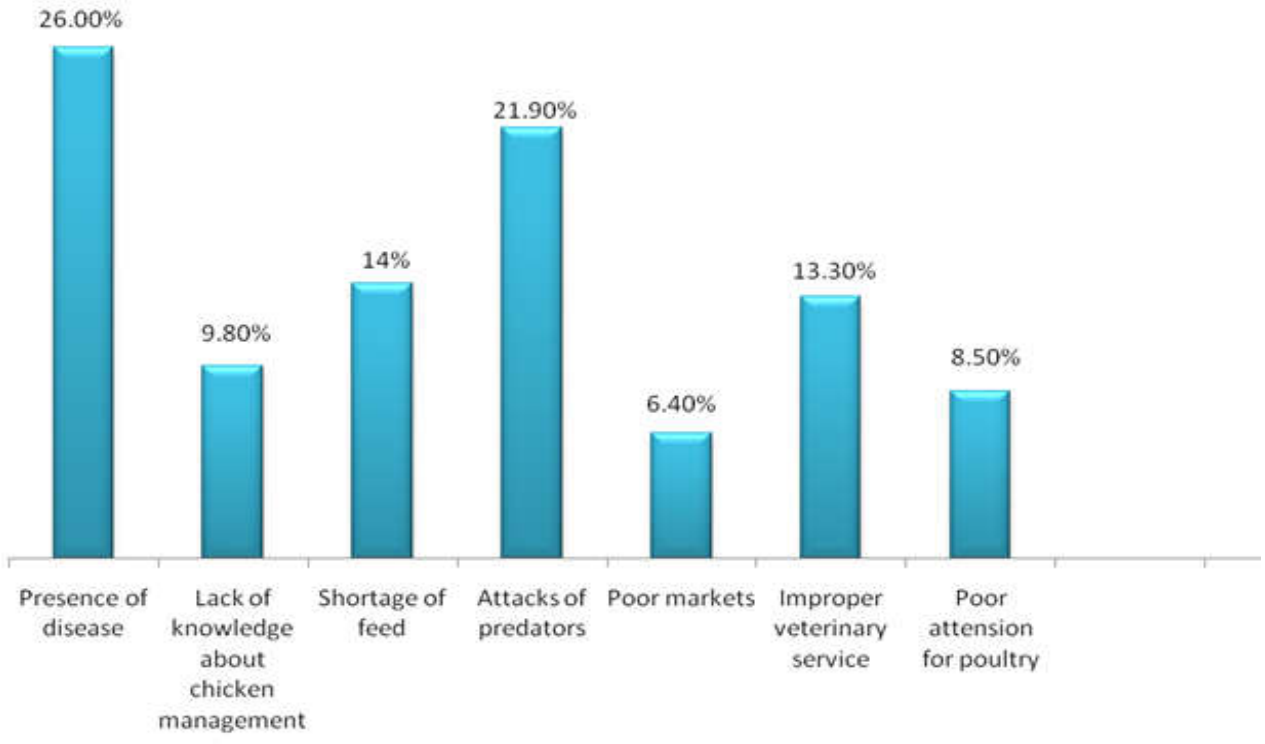

Figure 10: Major constraints of chicken rearing in the Hidabu Abote district

4.7. Egg Qualities

4.7.1. External egg quality

As shown in Table 29, there was significant difference in mean egg weight among agro ecologies. In the present study the mean egg weight was 45.2g. However, mean egg weights of 47, 44.9 and 43.9 g/egg were recorded from the eggs collected from the highland, midland and lowland respectively. This result indicating that the quality deterioration was a result of water lose through storage time, temperature, availability of feed or provision of supplementary feed, etc. Similarly, Samli *et al*. (2005) suggested that egg weight was the parameter greatly influenced by egg storage period and temperature. Since lowland and midland ambient temperature is higher than that of highland, the mean egg weight of the former two agro-ecologies might be less in egg weight. The result of the current study was in agreement with that of Hallima (2007), who reported mean egg weight of 45.95±0.97g for eggs collected from seven chicken ecotypes of North-West Amhara. The result of mean egg weight obtained from the current study was also in agreement with that of Ahmedin (2014) who reported that an average egg weight of 45.75±1.98g for eggs collected from East Hararghe Gorogutu district but lower than that of Getachew (2016) who reported mean egg weight of 51.17+1.03g from Chelliya district of Western Shoa. Such differences were because of the distribution of different breeds of chickens and management system.

Egg breaking strength was significantly ($P<0.05$) higher in midland than in highland and lowland agro ecologies. Additionally, there was significant difference in average shell weight of eggs collected from different agro-ecologies studied. The mean of shell weight, egg shape index, shell thickness, and egg breaking strength obtained in this study were 5.44g, 75.56, 0.31mm and 3.5 respectively (Table 29). There was significant difference between indigenous, crossbred and exotic chickens egg in mean egg weight. Mean egg weight of 51.53, 47.11 and 39.21g were recorded from eggs of exotic, crossbred and indigenous chickens respectively. The mean egg weight of exotic egg obtained in the current study was comparable with that of Halima (2007) who reported mean egg weight of 53.4g for RIR breed of chicken but lower than that of Getachew (2016) who reported mean egg weight of 57.92g from exotic breed of chicken in Western Shoa.

The exotic breeds studied in the current study district were White leghorn and Issa Brown. On the other side there was no statistically significant difference (P>0.05) among indigenous, crossbred and exotic breeds of chickens studied in mean egg breaking strength, egg shape index and shell thickness. The average eggshell thickness of 0.30mm, 0.31mm and 0.31mm were recorded for indigenous, crossbred and exotic breeds of chickens, respectively. This result was higher than that of Ahmedin (2014) who reported that the average eggshell thickness recorded for indigenous, crossbred and exotic breeds of chickens was 0.29, 0.27 and 0.29 mm, from eggs collected from east Hararghe Zone respectively but lower than that of Halima (2007) who reported 0.71 and 0.69 mm for eggs collected from intensively managed local chicken ecotypes of North-West Amhara and RIR breeds of chickens respectively. Teketel (1986) reported an average egg shell thickness of 0.35 mm for Ethiopian local breed of chicken. Asuquo *et al.* (1992) also reported an average egg shell thickness of 0.30 mm and 0.35 mm for Nigerian local breeds and Isa Brown breed chicken respectively**.**

4.7.2. Internal egg quality

There was no statistically significant (P>0.05) difference between eggs collected from different agro ecologies in mean albumin height, yolk weight and Haugh Unit (Table 29). Similarly, there was no statistically significant difference (P>0.05) among indigenous, crossbred and exotic breeds in mean albumen height, yolk height, yolk diameter and yolk index. However, there was significant difference among agro ecologies in yolk height, yolk diameter and yolk index. This significant difference was due to variation of management system and breeds in all agro ecologies studied. Ahmedin (2014) reported that the eggshell weight of indigenous was significantly lower than that of crossbred and exotic breed of chickens (p<0.05). There was statistically significant (p<0.05) difference between the eggs of indigenous, crossbred and exotic breed of chickens in mean albumen weights. The mean yolk heights of eggs collected from highland, midland and lowland agro ecologies showed significant difference between each other's (P<0.05). The results of the current study was in agreement with that of Niranjan *et al.* (2008) who reported significant difference in mean yolk height for chicken under backyard management.

In the same way Desalew (2013) reported that the average yolk weight of the three chicken groups was not significantly different. The mean yolk color fan score of 8.60±0.33 recorded from chickens of studied in the current study was higher than that of Halima (2007) who reported mean yolk color fan score of 3.48 for eggs collected from intensively managed local hens in North-West Amhara Region and 4.0 reported for RIR breed of chicken respectively. Pavlovski *et al.* (1981) also reported that the yolk color score of free scavenging local hens was higher as compared to eggs collected from hens managed under intensive management condition. The general indications are that, there was significant difference between highland, midland and lowland eggs in mean of Yolk Color. This difference is due to chicken feeding rather than their breed. Similarly yolk colour values were recorded by Fisseha Moges *et al.* (2010b) for eggs of local chicken collected from Bure and Fogera districts, indicating that yolk colour is a function of feed not breeds (Solomon,2004). However, in the present study, the highest yolk colour value might indicate good scavenging ability of village chicken that could get enough green grass required to bring the higher yolk colour value.

The average Haugh unit value obtained in this study (73.3) was higher than that of Halima (2007) who reported the value of 61.1 for eggs collected from local chicken ecotypes of North-West Amhara but lower than that of Asuquo *et al.* (1992) who reported 81 for eggs collected from intensively managed RIR breeds chicken. In the same way mean Haugh unit values of 79.8 and 89.9 was recorded for eggs collected from Nigerian indigenous chickens and Isa-Brown breed of chicken respectively. In the present result Haugh unit values (73.6) were within normal value due to the value 72 or more was expresses high quality and the freshness of the eggs. There was significant difference across agro ecologies in the average Haugh unit ($P<0.05$).This difference was due to the effect of storage time, Temperature and humidity on internal egg quality.

Table 29: Effect of agro-ecology and breed on external and internal egg quality (mean±SE) respectively

	Agro Ecology				Breed				ANOVA Values		
Parameters	Highland	Midland	Lowland	Overall Mean	Indigenous	Cross Breed	Exotic	Overall Mean	Agro ecology (A)	Breed (B)	A*B
EWT(g)	47.0	44	43	44.7	39	47	51	45.7	0.0001	0.0001	***
EBST(kg/cm^2)	3.17±0.11	3.73±0.11	3.57±0.11	3.49±0.11	3.29±0.11	3.63±0.11	3.55±0.11	3.49±0.11	0.001	0.800	*
SHWT(g)	5.26±0.08	5.28±0.08	5.78±0.08	5.44±0.08	4.98±0.08^c	5.33±0.08^b	6.02±0.08^a	5.44±0.08	0.0001	0.0001	***
ESHI (%)	75.59±0.56	75.75±0.56	75.34±0.56	75.56±0.56	75.09±0.56^b	76.05±0.56^a	75.33±0.56^b	75.5±0.56	0.870	0.480	NS
SHT(mm)	0.31±0.01^a	0.31±0.01^a	0.29±0.01^b	0.30±0.01	0.30±0.004^b	0.31±0.004^a	0.31± 0.004^a	0.3±0.004	0.033	0.389	NS
AWT(g)	26.04±0.42^a	23.34±0.42^c	25.64±0.42^b	25.0±0.42	20.52±0.42	25.73±0.42	28.77±0.42	25.0±0.42	0.0006	0.0001	***
AHT(mm)	3.49±0.13	3.4±0.13	3.54±0.13	3.47±0.13	3.55±0.13	3.12±0.13	3.69 ±0.13	3.45±0.13	0.764	0.025	NS
YHT(mm)	15.73±0.19^a	14.85±0.19^b	13.8±0.19^c	14.8±0.19	14.47±0.19	14.93±0.19	14.97±0.19	14.8±0.19	0.0001	0.140	***
YD(mm)	39.9±0.03	38.9±0.03	37.5±0.03	38.76±0.03	38.6±0.03	38.9±0.03	38.7±0.03	38.7±0.03	0.0001	0.762	NS
YI (%)	39.42±3.86	38.14±3.86	36.77±3.86	38.1±3.86	37.45±3.86	38.27±3.86	38.61±3.86	38.1±3.86	0.0001	0.097	*
YWT(g)	15.67±0.24	15.33±0.24	15.49±0.24	15.5±0.24	13.71±0.24^b	16.02±0.24^a	16.76±0.24^a	15.5±0.24	0.593	0.0001	***
YC(1-15)	8.16±0.19^b	8.53±0.19^b	9.1±0.19^a	8.6±0.19	8.2±0.19^b	8.43±0.19^b	9.16±0.19^a	8.6±0.19	0.003	0.001	NS
HU	79.6±1.46^b	70.4±1.5^a	68.8±1.46^c	73.0±1.46	77.1 ±1.46	75.5±1.46	68.3±1.46	73.6±1.46	0.748	0.0001	NS

a-c Means within a row under the same heading with different superscript differ significantly between the two agro ecologies and breeds($P<0.05$);EWT=Egg Weight; EBST=Egg breaking strength; SHWT =Shell Weight; AWT=Albumen Weight; AHT=Albumen Height; YHT=Yolk Height; YD=Yolk Diameter; YI= Yolk Index; YWT= Yolk Weight; YC=Yolk Color; ESHI=Egg Shape Index; SHT=Shell Thickness;HU=Haugh unit; SE =Standard Error; mm= millimeters; g=gram; %=percent; NS=No Significant,***,* highly and least significant respectively at $p<0.001$.

In general there was significant difference between highland, midland and lowland eggs collected from the farmers in all egg quality parameters except albumen height, yolk weight, egg shape index and Haugh unit but there was no significant($p>0.05$) difference between breeds in egg breaking strength, Yolk height, yolk index, yolk diameter, egg shape index and shell thickness. In most of parameters, exotic breeds had higher mean values than that of the cross and indigenous breeds' eggs collected.

5. CONCLUSIONS AND RECOMMENDATION

5.1. Conclusion

The results of this study indicated that the mean flock size/household in the study area was 6.8 chickens. The flocks are consistently dominated by laying hens regardless of agro-ecology. The majorities of the local poultry comprises of indigenous chickens known to be thermo-tolerance and resistance to diseases under scavenging conditions, but are late in sexual maturity as compared to the crossbred and exotic breeds kept under similar management conditions of the study area. There was no separate poultry house and chickens are mostly kept in family dwellings with provision of perching materials. The large segment of poultry management practices were reported to be performed by women and chickens are kept for the purpose of income generation, while most of the respondents reported to use chicken product for household consumption only during religious/cultural festivals.

Disease and predators are reported to be the major causes of mortality in the study area. Exotic chickens had higher mean values in major egg quality parameters than that of the cross and indigenous breeds. Egg quality was affected by storage period of time, Temperature and by management system. The generally tendency is that good management practice with respect to bird husbandry, careful egg collection and handling could contribute to the productivity and egg quality of household poultry in the study area.

5.2. Recommendation

The following recommendations were suggested based on the result of this study:

- The majority of the village poultry comprises of indigenous chickens. The low performance of local chickens is due to low management standard, long reproductive cycle and high mortality. Awareness creation, improvement of health measures & the use of appropriate brooding and rearing technologies seems to be appealing.
- Control of the major poultry diseases, could be achieved through improvement in veterinary based extension service and provision of proper training for the farming community. There is a need to improve the awareness of household poultry users specially that of women.
- Exotic and crossbred chickens are reported to be doing well but characterized by shortage of improved genetic & feed materials and health care. The setup of input supply system (day old chicks, feed packages, vaccines etc.) seems to be appealing.
- The households should be advised to provide adequate quality and quantity of feeds in regular manner for better production performance of chickens. Thus the livestock resource and development office and producers should work in collaborating way in the area of diseases and predators control and prevention, feed and breed improvement and other management aspects.
- The future breeding programme development should incorporate the breeding objectives of farmers'.

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7. APPENDICES

Appendix A: ANOVA Tables in the appendix

Table 1: ANOVA table for average flock size of chickens in the Hidabu Abote districts

		DF	Sum of Squares	Mean Square	F	Sig.
Classes * agro ecology	Between Groups	2	0.023	0.011	0.014	0.986
	Within Groups	12	10.064	0.839		
	Total	14	10.087			

Table 2: ANOVA Table for Livestock and landholding characteristics in Hidabu Abote district

		DF	Sum of Squares	Mean Square	F	Sig.
Characteristics	Between Groups	2	0.076	0.038	0.006	0.994
	Within Groups	21	123.460	5.879		
	Total	23	123.536			

Table 3: Effect of agro ecology, breed and their interaction on egg weight in Hidabu Abote district**.**

Source of variation	DF	Sum of Square	Mean square	F Value	Pr > F
Agro ecology	2	365.304	182.652	9.686	0.000
Breed	2	4675.229	2337.614	123.967	0.000
Agro ecology*breed	4	679.594	169.899	9.010	0.000
Error	172	3224.502	18.857		
Total	180	388960.320			

Table 4: Effect of agro ecology, breed and their interaction on egg breaking strength in Hidabu Abote district

Source of variation	DF	Sum of Square	Mean square	F Value	Pr > F
Agro ecology	2	9.889	4.945	6.888	0.001
Breed	2	3.681	1.841	2.564	0.80
Agro ecology*breed	4	12.359	3.090	4.304	0.002
Error	172	122	0.718		
Total	180	2342.501			

Table 5: Effect of agro ecology, breed and their interaction on shell weight in Hidabu Abote district

Source of variation	DF	Sum of Square	Mean square	F Value	Pr > F
Agro ecology	2	10.407	5.203	12.618	0.000
Breed	2	33.466	16.733	40.576	0.000
Agro ecology*breed	4	28.665	7.166	17.377	0.000
Error	172	70.520	0.412		
Total	180	5473.170			

Table 6: Effect of agro ecology, breed and their interaction on Albumen weight in Hidabu Abote district

Source of variation	DF	Sum of Square	Mean square	F Value	Pr > F
Agro ecology	2	254.547	127.274	11.758	0.000
Breed	2	2090.151	1045.076	96.551	0.000
Agro ecology*breed	4	341.366	85.341	7.884	0.000
Error	172	1850.917	10.824		
Total	180	117101.990			

Table 7: Effect of agro ecology, breed and their interaction on Albumen height in Hidabu Abote district

Source of variation	DF	Sum of Square	Mean square	F Value	Pr > F
Agro ecology	2	0.574	0.287	0.270	0.764
Breed	2	8.070	4.035	3.791	0.025
Agro ecology*breed	4	0.919	0.230	0.216	0.929
Error	172	182.025	1.064		
Total	180	2366.5900			

Table 8: Effect of agro ecology, breed and their interaction on Yolk height in Hidabu Abote district

Source of variation	DF	Sum of Square	Mean square	F Value	Pr > F
Agro ecology	2	111.300	55.650	24.440	0.000
Breed	2	9.073	4.536	1.992	0.140
Agro ecology*breed	4	35.629	8.907	3.912	0.005
Error	172	389.364	2.277		
Total	180	39945.930			

Table 9: Effect of agro ecology, breed and their interaction on Yolk diameter in Hidabu Abote district

Source of variation	DF	Sum of Square	Mean square	F Value	Pr > F
Agro ecology	2	1.850	0.925	13.484	0.000
Breed	2	0.037	0.019	0.272	0.762
Agro ecology*breed	4	0.285	0.071	1.040	0.388
Error	172	11.732	0.069		
Total	180	2721.370			

Table 10: Effect of agro ecology, breed and their interaction on Yolk index in Hidabu Abote district

Source of variation	DF	Sum of Square	Mean square	F Value	Pr > F
Agro ecology	2	21041.975	10520.987	11.782	0.000
Breed	2	4215.601	2107.801	2.360	0.097
Agro ecology*breed	4	12359.0.38	3089.759	3.460	0.010
Error	172	152699.332	892.979		
Total	180	26340.000000			

Table 11: Effect of agro ecology, breed and their interaction on Yolk weight in Hidabu Abote district

Source of variation	DF	Sum of Square	Mean square	F Value	Pr > F
Agro ecology	2	3.572	1.786	0.523	0.593
Breed	2	303.977	151.988	44.548	0.0005
Agro ecology*breed	4	134.251	33.563	9.837	0.000
Error	172	583.420	3.412		
Total	180	44264.020			

Table 12: Effect of agro ecology, breed and their interaction on Yolk color in Hidabu Abote district

Source of variation	DF	Sum of Square	Mean square	F Value	Pr > F
Agro ecology	2	26.533	13.267	5.926	0.003
Breed	2	30.533	15.267	6.820	0.001
Agro ecology*breed	4	3.333	0.833	0.372	0.828
Error	172	382.800	2.239		
Total	180	13756.000			

Table 13: Effect of agro ecology, breed and their interaction on egg shape index in Hidabu Abote district

Source of variation	DF	Sum of Square	Mean square	F Value	Pr > F
Agro ecology	2	5.183	2.591	0.139	0.870
Breed	2	27.477	13.739	0.738	0.482
Agro ecology*breed	4	75.675	18.919	1.016	0.400
Error	172	3183.063	18.614		
Total	180	1030927.045			

Table 14: Effect of agro ecology, breed and their interaction on egg shell thickness in Hidabu Abote district

Source of variation	DF	Sum of Square	Mean square	F Value	Pr > F
Agro ecology	2	0.006	0.003	3.490	0.033
Breed	2	0.002	0.001	0.949	0.389
Agro ecology*breed	4	0.004	0.001	1.110	0.354
Error	172	0.153	0.001		
Total	180	17.057			

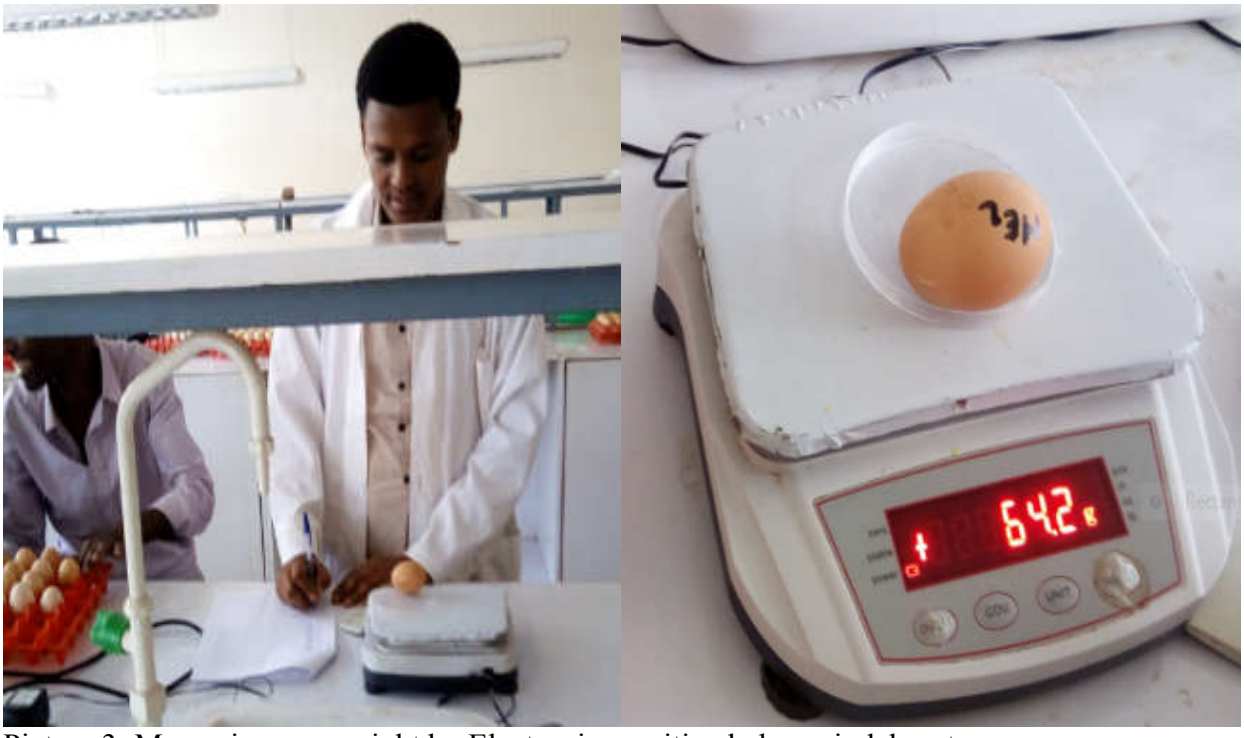
Table 15: Effect of agro ecology, breed and their interaction on egg Haugh unit in Hidabu Abote district

Source of variation	DF	Sum of Square	Mean square	F Value	Pr > F
Agro ecology	2	74.922	37.461	0.291	0.748
Breed	2	2895.575	1447.788	11.258	0.000
Agro ecology*breed	4	340.217	85.054	0.661	0.620
Error	172	21990.300	128.598		
Total	180	664696.132			

Appendix B: Important pictures

Picture 1: Providing supplement feeds by spreading on the floor and broody hens for chickens in the study area

Picture 2: Local Chickens types of housing system in the Hidabu Abote district



Picture 3: Measuring egg weight by Electronic sensitive balance in laboratory

Picture 4: Equipment used to measure egg breaking strength and Measuring egg diameters and egg length (by micrometer screw gauge)


Picture 5: Measuring yolk weight, height, diameters(by Tripod micrometer) and Yolk colors (by Roche color fan) in JUCAVM laboratory.

Appendix C : Sample Questionnaires

A. Rules to Enumerators

I. Make brief introduction to each farmer before starting any question, get introduced to the farmers (greet them the local way) get his name, tell him yours, the institution you are working for, and make clear the purpose and objectives of your question.

II. Please ask each question so clearly and patiently until the farmer understands.

III. Please fill up the questionnaire according to the farmers replay (do not put your opinion).

IV. Please try not to use technical terms while discussing with farmers and do not forget the local unit.

I. Demographic Characteristics of the Households in the Study Area

1. Region----------zone----------woreda----------Kebeles----------
2. Agro-ecology: A/ highland B/ midland C/ lowland.
3. Name of the respondent ---------- sex: A/ Female B/ Male
4. Total family size,_____ : Female_____Male_____
5. Name of interviewer----------Date of interview---------- signature-----
6. Age group A. child age (0–15) B.young adult age (15–30),
   C. middle adult age (31–50) D.Senior adult age (>50)
7. Educational status
   A. Illiterate B.Read and Write C.1st –4th grade
   D. 5^{th} –8^{th} grade E. 9^{th}-10^{th} grade F.College/University

II. General information

Types and number of livestock's kept

Species	**Breeds**		**number of live stocks**
poultry	Ind.	pullet	
		hen	
		Cockerels	
	Exo.	pullet	
		Cocks	
		hen	
Cattle	Cow		
	males calves		
	female calves		
	Heifers		
	Oxes		
sheep			
goats			
donkeys			
horses			
Mule			

III. Socio-economic aspects

1. What is the purpose of keeping poultry (**Rank (1-9) in the order of importance**)

Purpose of keeping poultry	**Rank**
home consumption of meat	
home consumption of egg	
sale of egg	
sale of life bird	
for religious purpose	
cultural prestige	
family employment	
extra farm employment	
Others (mention if any)……	

Note: *consumption of egg and meat stands for 'improving family nutrition' and sale for 'income generations'.*

2. Do you consume eggs and meats of your poultry? A/ yes B/ No

3. If you yes give prioritize (give rank 1 to 5) the consumption pattern of poultry products in your family

Consumption of poultry products in the family	Time of consume the poultry product	
	Egg	Meat
to infants		
to pregnant women		
Adults		
to lactating mothers		
to older people		

4. What are the constraints against poultry product consumption at home?
   A. expensiveness to prepare the dish
   B. eggs and chicken are expensive
   C. no availability
   D. giving priority to cash in come
   E. Others (mention)……..
5. Do you sell egg or birds? A. yes b. no
6. If you sell, what are the criteria used to judge the price of chicken while purchasing or sale in local market; prioritize them (1 to 6).

Criteria used during purchasing	Ranks	Suggestion
Feather color		
comb type		
comb shape		
Breeds		
Weight		
others----		

7. Where do you sale the chickens?
   A/ local markets B/ retailers C/ others
8. Distance from market----------hour's trips
9. Means of transportation of the chickens. (A) in baskets (B) by hand (C) other means (mention)……
10. Average market prices in Birr/head.

Type of product	**Average market prices in Birr/head**
Eggs	
Pullets	
Hens	
Cocks	
cockerels	

Iv. Breed/Breeding

1. Did you hatch a chicken by your own? A. yes B. no
2. If so, For which character(s) do you select chicken to be used as a future parent (stock)(Rank the)?

Characters to select chicken to be used as future parents	Ranks
Colors	
egg productivity	
Weight	
Body conformation	
Others (mention--------	

3. Do you have exotic breed? A. yes B. no
4. If you say no, are you interested to have exotic birds? 1/Yes, 2/ no,
5. How many chickens can you manage under your conditions? ----------
6. Why not more than these?

7. If you compare the performance of exotic versus local chickens in terms of eggs and growth under your management, which one is better?

(A) Exotics (B) locals;

Parameters		Number of egg / week	Age at slaughter in months
Egg	exotic		
	Indigenous		
meat	exotic		
	Indigenous		

V. Feed and feeding system

1. Do you provide supplementary feed for your scavenging chicken? 1. Yes 2. No
2. If yes, what are the supplements?
   (A) Wheat grain (B) foods leftover
   (C) Kitchens wastes (D) spoiled grains
   (E) Others (mention)…….
3. How do you provide the feed?
   A. By feeder B. Spreading on the floor C. Other feed (specify) _____
4 .Which breed of chicken gets supplementary feeding most frequent
   A. Local breed B. Cross breed
   C. Exotic breeds D. All breeds
5. What is the frequency of providing supplemental feed during the above season listed

Frequency of time providing supplementary feed	Breeds	
	Indigenous	Exotic
Every day		
Every two day		
Every 3 days		
Unknown		

6. At what time you are supplementing extra feeds
   (A) Morning (B) at noon (C) after noon

7. How do you give extra feeds?

   (a) Separately to different classes (b) together to the Whole Groups?

8. What is the basis of offering supplement?

   (A) To increase egg yield (B) To improve meat Yield

   (C) Broodiness (during incubations) (D) Others

9. Priority of supplementations

   (A) chicks---- (B) layers ---

   (C) pullets--- (D) cocks/cockerels---

10. Do you perceive improvements due to extra supplements? A/yes B/No

11. Do you provide water for your birds regularly? A/Yes, B/no

12. If you give water for your chickens, how frequent do you provide?

(A) Every other day (B) Once/day

(C) Twice/day (D) Adlib

13. Who is more responsible to give feed and water for poultry in your family?

A/women B/children C/Elders D/Adults E/others

14. If you give water for the chickens, where do you get the water from?

(a) Rain water (b) River

(c) Tap water (d) others, specify---------

15. If you give water for the chickens, what type of container do you use to supply water?

a/ Drinker b/Clay materials c/ Broken equipment

16. How frequent do you wash the drinker?

VI. Diseases and health

1. Is there any poultry disease in your area? 1. Yes 2. No

2. If yes, what is the most prevalent diseases and their symptoms in your area?

A. Newcastle disease (Fengil), symptoms----------

B. Coughing, symptoms----------

C. Other disease, specify _____

3. What type of traditional control measures (Indigenous knowledge) you used to prevent the risk of these diseases?

A. ----------

B. ----------

C. _____

4. Have you ever vaccinated your chicken? 1. Yes 2. No

5. If Yes, What type of vaccine (for what type of disease)?

A/Newcastle b/coccissidosis c/Ecto-parasite d/others

6. If yes, to which breed you give vaccine?

A/ Local B/ Cross

C/ Exotic D/All breed

7. If not, what is the reason? _____

8. Have you ever treated your sick birds? 1. Yes 2. No

9. If yes, to which breed you gave treatment?

A/ Local B/Cross

C/ Exotic D/All breed;

What type of treatment you used? .....

10. If not, what is the reason? _____

11. What is your immediate measure when you observe sick birds in the flock?

A/ isolation B/ Immediate slaughter

C/leaving with the flock D/treat with different medicines

E/others (mention) ------

12. What type of disease(s) frequently occurs in your flock? (Rank)

Types of disease frequently occurs in your flocks	Ranks
diarrhea -	
Coughing	
sudden death	
ecto-parasites	
lameness---	
respiratory disease(sneezing, discharge through beak)	

13. Do you know the sources of medicines?

A/ from governmental organizations B/ private

C/non -governmental organizations D/others

14. What are the traditional medications used to treat sick birds?

Mention them----------

If you used plants, from where do you gets? ----------

Name the name of plants (parts used), ----------

How they are used and for what at they are used----------

Vii. Housing

1. How do you house chickens?

(A) Share the same room with family

(B) Have a different shelter for night enclosure in the same roof

(C) Separate house constructed entirely for poultry (D) perches E/ others

2. What type of management system do you practice for your poultry rearing?

a) Free range (scavenging) b) Intensive c) Semi-intensive d) Others

3. Is there any predator problem in your locality? 1. Yes 2. No

4. If yes what is the major predator (wild and domestic animal attacking chicken)?

A/wild cat B/ fox C/ An eagle D/ Others/specify

5. Which breed groups of chicken are attacked (affected) more?

A. Local chicken B. Cross breeds

C. Pure exotic chicken breed D. All breeds are affected

6. How do you control the problem?

A/----------

B/ ----------

C/----------

VIII. Culling

1. Do you purposely cull your birds at any time? A/Yes B/ No

2. For what purpose do you cull the poultry?

(a) Consumption (b) For sale

(c) For sacrifice (d) other specify

3. What factors determine which bird you will cull?

Factors to determine birds you cull	Ranks
Poor productivity	
Sickness	
Lack of broodiness	
Old age	
Frequent broodiness	
other, specify------	

4. If you culled old age birds, at what age of the bird do you decide to cull it? ----

5. If you culled poor productive birds, what is their level of productivity?

a) Number of eggs/clutch b) number of clutch/year

c) Number of eggs/year

IX.Productivity

1. Where do you get your chicken first?

A. Market B. Family E/ From Governments

C. Gift D. From NGOs F/Other (specify) _____

2. When did you start rearing chicken? Since _____years

3. What is the major chicken feather color types found in your area?

A/brown b/red c/grey d/others

4. Which color do you prefer more?

1st._____2nd. _____3rd. _____

Why? 1. _____

5. How do you start chicken rearing (Source of knowledge for chicken rearing)?

A. Learning from my parents B. From my own interest

C. From colleagues and neighbors D. Training E. Others (Specify) _____

6. What type of poultry production system do you practice?

A. Traditional (Scavenging only)

B. Scavenging + Seasonal/conditional supplementation

C. Semi scavenging (Scavenging + Regular supplementation) D. Intensive system

7. Why do you keep (rear) birds?

Purpose keeping chickens	Ranks
For home consumption	
For sale live birds	
For sale eggs	
For cultural benefits	

8. For what purpose do you use Eggs?

Purpose of eggs	Ranks
For home consumption	
For sales	
For others /specify	

9. When do you consume (eat) eggs mostly?

A. Every time (when available) B. During religious/cultural holidays

C. When being broken. D/Others (Specify) _____

10. When do you consume Chicken meat mostly?

A. Every time (when available) B. During religious/cultural holidays

C. When being sick D. Others (Specify) _____

11. What do you think the advantages and disadvantages of poultry rearing?

Advantages	Dis-advantages

12. When (which season) do you rear more birds? Why?

A. Bega (December, January, February)
(Why) 1. _____
2. _____
B. Kerimt (June, July, August)
(Why) 1. _____
2. _____
C. Both Bega & Kerimt (Why) 1. _____
2. _____

13. How frequent hens lay eggs until the end of the clutch period

During of feed surplus		**Breeds**		
		Indigenous	**Cross-breed**	**Exotic**
A.During feed sufficient season	Daily			
	Every other day			
	Every 3 days			
	No egg (Stop laying			
B. During feed Shortage season	Daily			
	Every other day			
	Every 3 days			
	No egg (Stop laying			

X. Hatchery

1. Do you practice hatching of eggs? A/Yes, B/ no

2. At what seasons you are practicing hatching of chicks? (1) Wet (2) dry,

Why? ----------

3. Nesting materials for brooding

(A) Clay pot and straw bedding (B) clay without bedding

(C) Others specify-----

4. Do you select eggs for incubation? 1/Yes, 2/ no

5. If you select, which one is selected? (A) Medium (B) large (C) small;

why?.....

6. Do you make special treatment before incubation of external dirt eggs? A/Yes, B/ no

7. What are the materials used while cleaning dirt on external parts of eggs?

(A) By water (B) Clean by dry materials C/soft materials D/Others/Specify------

8. Do you select sizes of hen for incubation? A/Yes B/ no

9. If yes for Q_8 above, which size preferred? A/large B/ small C/ medium

10. What is the age of egg (after laying) used for incubation?

A/ <one week B/ two weeks C/ three weeks

11. Sources of incubating eggs A/ purchase from markets B/ laid at home

12. How can you identify normal egg from spoiled? A/visual examination

B/using floating techniques C/ other methods----------

13. Put in ascending order according to the proportion of egg utilization for the following purpose

Purpose of egg utilization	Ascending order
A. eggs consumed	
B. eggs sold	
C.eggs used for incubation	
D. eggs for gift	
E. for other purposes	

XI.Chicken and Egg Marketing

1. Do you sale chicken? 1. Yes 2. No

2. If yes, Where do you sale your chicken?

A/ to retailers B/ to the local market

C/ to neighbor consumers D/ to others /specify

3. How do you transport chicken to local and urban markets

A/ by hands B/ by cars C/by baskets D/by others /specify

4. Have you ever faced death of birds during transportation to markets?

A. Yes B. No

5. Do you sale eggs? 1. Yes 2. No

6. If yes, Where do you sale your Eggs

A/to retailers B/to the local market

C/to home consumers D/to others /specify

7. How do you transport eggs to local and urban markets (circle accordingly)

A/ by hands B/ by cars C/by donkey D/by others /specify

8 .What are the major Chicken and Egg Marketing Constraints in your area?

Chicken & egg marketing constraints	Ranks
Lack of transportation	
Low price	
Lack of local market/retailer	
Long distance from urban market	

9. What is the current market price of eggs? ----------

10. Which of the followings is the major determinant of market price of egg in your locality?

A. Shell color B. Size of egg C. Yolk color

11. Is there variation of market price of eggs in your locality? A/Yes B/ No

12. If your answer is yes please write down the causes of variations in market price of eggs in terms of importance.

1st ---------- 2nd----------

3rd ---------- 4th ----------

13. If you sale your eggs at local market how long do you transport to reach the market point

14. How long do ---------- (m or km)

15. How do you transport the eggs? –

A/ by hands B/ by cars C/by baskets D/by others /specify

How long you store your egg before sale? ---------- (days or weeks)

16. Where do you store market eggs? ----------

17. Who is your regular client (buyer) of eggs?

A/Retailers B. Village collectors/neighbors

C/ Collector in the market D/ Sell to consumers E. Others

18. Who is responsible for the sale of eggs within the family?

1st ---------- 2nd ---------- 3rd ----------

19. What is the current market price of pullets? ----------

20. What is the current market price of laying hen? ----------

21. What is the current market price of cocks? ----------

22. Is there variation of market price of live bird in your locality? A/ Yes------ B/ No-----

XI. Chicken Reproduction performances

1. Wich breed have large growth rate in your area?

A. cross breed B.Exotic C.Indigenous\

2. Is there factor affect early maturity in your flock? A/ yes B/No

If you say yes, what are they list them, ----------

3. List factor affect sizes of eggs? ----------

4. Is there high mortality rates in your flocks? A/ yes B/ No

5. In w/c breeds the inter clutch is more extended?

A/Exotic B/Cross breeds c/ Indigenous

6. Productive/Reproductive characteristics

(A) Approximate age of sexual maturity for exotic pullet-----, cockerels----.

For indigenous pullet……, cockerels……Months

(B) No of eggs in one clutch/bird----, exotic……., indigenous……..

(C) No of clutches per bird per year ---exotic……, indigenous……

XIII. Chicken Production Constraints

1. State and rank major poultry production constraints in your area
2. No of. Constraint type Rank Preventive mechanisms

Opportunities	Constraints	Ranks	Suggested solution
Rearing by owns	1.Presence of disease 2.Lack of knowledge about scientific poultry management practices		
Distributed by Gov.t	3.Shortage of feed from surrounding		
Distributed by NGOs	4.Attacks of predators (which age group is affected)		
Reared by Cooperative	5.Thieves		
Others	6.Lack of market 7.Lack of time due to farm work activities 8. Improper service of veterinary doctors at village level		

3. What are the major causes of chicken losses?

a/----------

b/ ----------

4. What do you suggest to improve your poultry business?

a/----------

b/----------

c/----------