BAHIR DAR UNIVERSITY

COLLEGE OF AGRICALTURE AND ENVIROMENTAL SCIENCES

GRADUATE PROGRAM

PHENOTYPIC CHARACTERIZATION AND BREEDING OBJECTIVES OF INDIGENOUS CHICKEN ECOTYPES IN THREE DISTRICTS OF NORTH GONDAR ZONE, ETHIOPIA

M.Sc. Thesis

By

Hana Asmamaw Kassie

SUBMITTED TO THE GRADUATE PROGRAM IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN ANIMAL GENETICS AND BREEDING

May, 2016

Bahir Dar, Ethiopia

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As member of the Board of Examiners of the Master of Sciences (MSc.) thesis open defense Examination, certifying that we have read and evaluated the thesis prepared by Hana Asmamaw Kassie entitled "**PHENOTYPIC CHARACTERIZATION AND BREEDING OBJECTIVES OF INDIGENOUS CHICKEN ECOTYPES IN THREE DISTRICTS OF NORTH GONDAR ZONE, ETHIOPIA"** We here by certify that the thesis be accepted for fulfilling the thesis requirement for the award of the degree of the MSc. in Animal Genetics and Breeding.

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This is to certify that this thesis entitled **"PHENOTYPIC CHARACTERIZATION AND BREEDING OBJECTIVES OF INDIGENOUS CHICKEN ECOTYPES IN THREE DISTRICTS OF NORTH GONDAR ZONE, ETHIOPIA"** Submitted in partial fulfillment of the requirements for the award of the degree of Master of Sciences in Animal Genetics and Breeding to the graduate program of College of Agriculture and Environmental Sciences, Bahir Dar University by Hana Asmamaw Kassie ID.No.Re/0602041/06 is a real work carried out by me under our guidance. The matter embodied in this thesis work has not been submitted earlier for award of any degree or diploma to the best of our knowledge and belief.

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ACKNOWLEDGMENTS

First of all, I would like to thank the Almighty God for his grace and immeasurable love, giving me strength and patience to bring me out humble piece of work in to light. Special thanks and heartfelt appreciation goes to my major devisor Dr. Kefyalew Alemayehu for his unreserved support and guidance during thesis proposal writing, research work and thesis write up. I am grateful to Dr. Solomon Gizaw and Dr. Hailu Mazengia, my co-advisors for all the effort they made to shape during thesis proposal writing research work and thesis write up.

I am also grateful to my place of work: Dembiya District Agricultural Development Office for giving me time off and allowing me to study leave. I would like also to express my sincere gratitude to LIVES-ILRI project for providing the funding tuition fee, research and other expenses.

I am indebted to the Department of Animal production and Technology, Graduate Studies of Bahirdar University for their contribution in the process of developing the research proposal and provision of various services and providing me a great opportunity to advance intellectually.

Finally, I am also grateful to the Gondar Zuria and Lay Armachiho district office of agricultural development and all staff members for providing necessary baseline data required for this study. I thank also all farmers, village chicken owners, district livestock agricultural office experts, development agents, key informants and other participants who helped me to carry out every activity on this research.

DEDICATION

I dedicate this manuscript to my father Mr. Asmamaw Kassie, who passed away without seeing any of my achievements. Let this also stand for a great welcome to my mother Ayaleneshi Shibabaw and my brother Tesfahun Asmamaw who gave me continuous appreciation and encouragement to this work.

ABBREVIATIONS

AnGR	Animal Genetic Resource
BC	Before Christ
Cp	Crude Protein
CSA	Central Statistical Agency
DA	Discriminate Analysis
DDAO	Dembiya district Agricultural office
DZARC	Debrezeit Agricultural Research Center
FAO	Food and Agricultural Organization
FGD	Farmer Group Discussion
FTC	Farmer Training Center
GLM	General Linear Model
GDAO	Gonder zuria district Agricultural office
ILRI	International Livestock Research Institute
LDAO	Lay armacheho district Agricultural office
MtDNA	Methichonderial Deoxyribo Nucleic Acid
NCD	Newcastle Disease
PA	Peasant Association
SAS	Statistical Analysis System
SFS	Scavenging Feed Source
SLM	Sustainable Land Management
SPSS	Statistical Package for Social Sciences
USAID	United States Agency for International Development
WADU	Wolaita Agricultural Development Unit
WB	World Bank

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PHENOTYPIC CHARACTERIZATION AND BREEDING OBJECTIVES OF INDIGENOUS CHICKEN ECOTYPES IN THREE AGRO-ECOLOGIES OF NORTH GONDAR ZONE, ETHIOPIA

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ABSTRACT

The study was conducted from November to August 2015/16 to characterize the indigenous chicken ecotypes and identify the breeding objectives of the farmers across different selected districts of Gondar Zuria, Dembia and Lay Armachiho. From the selected districts three peasant associations (PA) were selected randomly in each district and a total of 9 PA was used for the survey and characterization. About 20 household (HH/ (PA)) within the total respondents of 230 HH (180 rural and 50 urban HH) was used for primary data collection. whereas, measurable traits like body weight (Bwt), body length (BL), wing span (WS), shank length (SL) and circumference (SC), wattle length (WL) and width (WW), keel length (KL), super length (sl), beak length (bl), comp length (CL) and width (CW) were used. For the quantitative traits measurement 450 local chicken were measured. Comb type, feather color, shank color and body shape was the considered morphological characters chicken. The data was analyzed using GLM procedure of SPSS (version 20) and index methods for priority setup of the major constraints. The overall mean for body weight obtained for mature male chicken and female chicken were 1.57±0.27and 1.34±03 Kg, respectively which, showed a significant difference ($p<0.001$) across districts, sex and ecotype. To address the marketing system, and understand the poultry and egg marking value chain, semi structured questioner for producers and checklists and field observations for consumers and middlemen's was used. Reproductive performance study revealed that in male and female average age at first sexual maturity was 5.01±0.27 and 5.47±0.42, respectively for rural and 4.87±0.02 and 5.05±0.03, respectively for urban production system. Hatchability percentage was 87% and 77% for rural and urban production systems, respectively. The main breeding objectives of the study areas were for egg production to home consumption, as source of income and meat production for home consumption with their order of importance. The main preferable traits for poultry production were color, weight gain, comb and others with their order of importance. The marketing chain in poultry and its products incorporate the producer (the start of the chain), brokers (middlemen's), retailers/wholesalers, shops, supermarkets, hotel and restaurants (in the middle of the chain) and the consumers (the end user of the chain). The major constraints of poultry production in the study district were disease, predator and shortage of feed with respective index value of 0.38, 0.31 and 0.31. The identified chicken populations generally showed higher ($p< 0.001$) phenotypic variations with their adopted environments. Almost all of the differences in the populations could be explained by the genetic variability of individuals among the population. Therefore, the breeding program should be considered the district effects to improve the performance of local resources in the country and it further needs better conservation and improvement plan for breeding strategies so as to utilize in a sustainable way based on different districts and further breeding program development should incorporate the breeding objective of farmers'.

Key Words: *ecotype, breeding objectives, production system, rural, urban*

CHAPTER 1. INTRODUCTION

Local chicken contribute significantly to the worlds' meat and eggs production and represents about 80% of the total world poultry population (Moula, 2012). However, the majority of these breeds and their characteristics are not well recorded and studied (Besbes,2009). Likewise about 40% of poultry breeds have an unknown their risk status that needs a considerable effort to evaluate the resources (FAO, 2008).

Ethiopia, in general, is endowed with a huge livestock population in Sub-Saharan Africa. It has been estimated that livestock supports the livelihoods of about 80% of the 60 million rural population (FAO, 2004). The poultry production system is predominantly traditional and small scale with low-input/low-output indigenous chicken types representing close to 97% of the national poultry flock (CSA cited in Vernooij *et al*., 2012).The fact that almost all of the poultry in Ethiopia comprises indigenous birds reveals that the poultry subsector is strongly dominated by small-scale, household-level poultry (CSA. 2005; Alemu *et al*., 2008).

Though, the total chicken population in the country was estimated about 56.87 million of which 95.86%, 2.79% and 1.35 % indigenous, hybrid and exotic breeds, respectively (CSA, 2015). The same source indicated that chicken populations in Amhara region were about 18 million and about 5.58 million in North Gondar zone. Off which about 99% of these chicken populations are maintained under the traditional production systems. Rural poultry production system is dominated by indigenous chickens and made significant contribution to poverty alleviation in many developing countries (Alders and Pym, 2009) and well adapted to harsh environmental conditions (Ajayi, 2010).

These indigenous chickens show a large variation in body position, feather distribution, plumage color, comb type, shank color, poor production and productivity. According to Tadelle *et al*. (2003) and Halima *et al*. (2006) reported that these variations are due to their adaptive nature in different production environment like low inputs, harsh Scavenging conditions, poor nutrition, and parasite and disease challenges and possess high genetic diversity (Nigussie Dana *et al.,* 2010). However, their productive and reproductive performance is very poor than exotic chickens. Therefore, in Ethiopia many works were made at various times to improve village chicken production systems through introduction

of exotic chickens like fertile eggs, pullets and cocks (Alemu Yami and Tadelle, 1997). Despite, this hugely disseminated exotic chicken and its contribution to improve the chicken one in the current production system of the region is believed to be very low (Teklewold *et al.*, 2006). However, these local chicken genetic resources are poorly improved its performances, the contribution to the economy of the country, the region and the zone is significant having with the larger chicken populations (CSA, 2011).

Even though village chickens provide a valuable function in the livelihood of rural smallholders, little research and development work has been carried out to characterize, understand and improve the village chicken based on agro ecologies in the country (Mammo Mengesha *et al.,* 2008). Therefore, it is necessary to obtain baseline data on the characteristics of production systems and production performance of local chickens under scavenging system in the three districts of north Gondar zone. Having this in mind,for a nation to bring sustainable development for every citizen to be benefited, it is important to have improved indigenous chicken through identification, characterization of available genetic resource and documenting the effects of the agro ecology in a country (FAO, 2011).

As it expressed on many of livestock related sectors, chicken genetic resource characterization is launched to measure their performances and tried to improve the production system in different parts of the country. However, lack of information on farmers' breeding practices and marketing chain based on agro ecology is creating difficulty to design and implement poultry breeding programme. Developing appropriate village based breeding program is required through defining the production environments and identified production objectives based on agro ecologies. Therefore, identifying potential indigenous chicken and improve the livelihoods of poor society through investigating adapted local chicken genotypes for genetic improvement, market requirements and production circumstances should be inhaled, many researchers like Tadelle Dessie (2003); Halima Hassen (2007), Nigussie Dana *et al*., 2009 and (Addis Getu *et al*., 2013) have made phenotypic and genetic characterization of indigenous chicken in some parts of the country. Like ways, poultry production and marketing system by Mekonnen G/Egeziabeher (2007), characterization of poultry productivity and marketing system by Bogale Kiberet (2008) and genetic parameters on Horro chickens by Nigussie Dana, *et al.* (2010). However, the above researchers who conducted their work in the same

area were not considering the district effects on the performance of the identified chicken ecotypes. Therefore, the research was developed to address the following objectives.

General Objective

The general objective of the study was phenotypic characterization of the indigenous chicken ecotypes based on different districts of north Gondar zone, Ethiopia.

Specific Objectives

- ✓ To undertake phenotypic characterization of available indigenous chickens
- ✓ To identify the breeding objectives of indigenous chicken in North Gondar zone
- ✓ To assess the market value of chicken
- ✓ To identify chicken production related constraints

CHAPTER 2. LITERATURE REVIEW

2.1 Origin and Domestication of Chickens

From the total poultry species, chickens are the most socio economic important and largely constituent of the population (Gueye, 2003) and the indigenous chickens are the once which commonly distributed across every corner of the tropical countries of Africa. The domestic chicken (*Gallus gallus*) is believed to have descended from the wild Indian and Southeast Asian red jungle fowl. The domestication of fowl in the region of the Indus valley is believed to have occurred by 2000 BC (Zeuner, 1963), but more recent archaeological evidences showed that a much earlier domestication occurred in China 6000 BC (West and Zhou, 1989) cited by Addis Getu *et al*., 2014. Four species of *Gallus* have been considered as progenitors of the domesticated fowl: *Gallus gallus* (Red jungle fowl), *Gallus lafayettei* (Ceylon jungle fowl), *Gallus sonnerrati* (Grey jungle fowl) and *Gallus varius* (Green jungle fowl) and all found in regions of Southeast Asia (Stevens, 1991). The red jungle fowl is one of the oldest domesticated birds and its popularity quickly spread to Europe. Oddly enough, its original popularity till the beginning of the 19th century was not for meat but for game of cockfighting and use in religious rituals (Singh, 2000).

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 and 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 production is synonymous with chicken production under the present Ethiopian conditions (EARO, 1999). Indigenous poultry contribute almost99% of the national egg and poultry meat production (Tadelle Dessie *et al.*, 2003).

2.2 Chicken Population in Ethiopia

The total chicken population in the country was estimated at 56.8 million (CSA, 2015). However contribution of the sector to improve the income of each farm household in particular and the national income in general is not proportional to the huge chicken numbers.

According to Fisseha Moges (2007) the local chicken genetic resources in the Amhara region of are becoming seriously endangered owing to the high rate of genetic erosion and inbreeding resulting from chicken diseases, specifically Newcastle disease and predation. The rural poultry production system is dominated by indigenous chickens and has made significant contribution to poverty alleviation and household food security in many developing countries (Alders and Pym, 2009).

2.3. Poultry Production System in Ethiopia

The poultry sector in Ethiopia can be characterized into three major production systems based on some selected parameters such as breed, flock size, housing, feeding, health, technology and bio-security. These are large scale commercial poultry production system, small-scale commercial poultry production system and village or backyard poultry production system (Bush, 2006).

The large-scale commercial production system is highly intensive production system involves an average of greater or equal to 10,000 birds kept under indoor conditions with a medium to high bio-security level. This system heavily depends on imported exotic breeds that require intensive inputs such as feed, housing, health, and modern management systems. It is estimated that this sector accounts for nearly 2% of the national poultry population. This system is characterized by higher level of productivity where poultry production is entirely market oriented to meet the large poultry demand in major cities. The existence of somehow better bio security practices has reduced chick mortality rates to merely 5% (Bush, 2006).

Small-scale intensive production system is characterized by medium level of feed, water and veterinary service inputs and minimal to low bio-security. Most small-scale poultry farms obtain their feed and foundation stock from large-scale commercial farms (Nzietchueng, 2000). There are few studies about diseases affecting poultry in this production system. Kinung'hi *et al*. (2004) mentioned coccidioses as a cause of mortality, reduced weight gain and egg production and market value of affected birds.

Village/indigenous production system characterized by little or no inputs for housing, feeding (scavenging is the only source of diet) and health care with minimal level of bio-

security, high off take rates and high level of mortality. Mostly, indigenous chickens are kept although some hybrids and exotic breeds may be kept under this system (Dawit Alemu *et al*., 2008).

Table 1. Characteristics of Ethiopian poultry production systems

Characteristic	**Intensive commercial**	**Small scale market oriented**	**Scavenging**
Breed and flock size	Specialized breeds: 2,500–50, 000 (18 farms)	Specialized and dual-purpose breeds: 50–1000	Local indigenous type: <50
Housing	Modern housing, Generally with concrete walls and regulated internal environment	Varies from modern houses to simple housing made from locally available materials	Specific poultry houses are rare
Feed resource	Commercially compounded feeds	Commercially compounded, homemade mixtures and scavenging	Scavenging and occasional feeding with home grains and refuse
Health programme	Standard and regular animal health program	Disease control and health program at varying levels	No regular health program of disease control measures
Markets	Cold chain system for input-output distribution	Input and output distribution is based on existing trading Centers	No formal marketing channels

Source: (FOA, 2000)

2.4. Contribution of Chickens to Rural Households in Developing Countries

The local chicken sector constitutes a significant contribution to human livelihood and contributes significantly to food security of poor households and can be considered an initiative enterprise owing to its low cost (Gondwe, 2004; Abdelqader, 2007). Family chicken is rarely the sole means of livelihood for the family but is one of a number of integrated and complementary farming activities contributing to the overall well-being of the household. Village chickens were regarded as a walking bank by many families and were often sold to meet emergency cash needs (Moreki, 2001).

Scavenging chicken also serve in waste disposal system by converting leftover of grains and human foods and insects in to valuable protein foods-egg and meat (Doviet, 2005). Both chicken meat and eggs were affordable sources of protein and contribute to a well balanced diet to satisfy human needs. Village chicken could be particularly important in improving the diet of young children in Sub-Saharan Africa. Rising income and urbanization in many parts of the developing world caused a growing demand for alternative food resources like animal products. There are only few alternative animal protein sources available in the tropics including chicken and chicken products (Odunsi, 2003).

Village chickens make substantial contributions to household food security throughout the developing world. Indigenous chicken serve as an investment and source of security for households in addition to their use as sources of meat and eggs for consumption and of income (Muchadeyi *et al*., 2007). Chicken in general are a means of investment that is important to the welfare of women and children in traditional, low-input farming systems in the tropics. Besides rural households, these low-input, low-output poultry-husbandry systems are an integral component of the livelihoods of most of peri-urban, and some urban, households in most parts of the developing world. A review by Gueye (2000) indicated that an average family flock of five adult chickens (two males and three females) enables women in Central Tanzania to have an additional income equivalent to 10% of the average annual income. In the Niger Delta family poultry husbandry contributes 35% of the income of household women, which represents about 25% of Nigerian minimum wage and 50% of the per capita income (Alabi *et al*., 2006). Experiences in many other

developing countries have shown that village poultry can be used as an effective means of empowering women and as a tool for poverty alleviation (Kitalyi, 1998).

2.5. Village Chicken Breeds and their Characteristics

Indigenous chickens in Ethiopia are in general hardy, adaptive to rural environments, survive on little or no inputs, adjust to fluctuations in feed availability, thermo tolerant, resistant to some disease, good egg and meat flavor , hard eggshells, high fertility and hatchability as well as high dressing percentage (Tadelle Dessie, 2003; Halima Hassen *et al*., 2007; FAO, 2007). Their use is largely limited to home consumption and generation of small cash income to the household. However, they have a great value in the cultural and religious life of rural communities. There is no comprehensive list of the breeds and varieties of village chickens used by rural smallholders, but there is considerable information on some indigenous populations from various regions. Most of this is based on feather color and other easily measurable features like body weight (Sonaiya and Swan, 2004). Reta Duguma (2006) and Halima Hassen (2007) reported that the names of the indigenous chicken groups were being called as chicken-ecotypes and native-chickens, respectively. The indigenous chickens are studied so far in two approaches as criteria for their differentiation and identification. (1) Based on their ecological or main habitat, thus the chickens are named after their area of geographical origin. (2) Based on morphological characteristics for identification specially feather type and color.

Some of the characterized and designated chicken ecotypes (native chickens) of Ethiopia by the same authors were: Tilili, Horro, Jarso, Tepi, Gelila, Debre-Elias, Melo-Hamusit, Gassay/ Farta, Guangua , Mecha ,Dawo, Raya-azebo, Endamehoni and Ofla ,Seden Sodo, Mehale Amba and Mehurena Aklile (Tadelle Dessie, 2003, Halima Hassen, 2007, Nigussie Dana, 2011, Hailemichael Nigussie, 2013, Emebet Moreda, 2015).

On the other hand, Various report showed that the names of indigenous chicken designated based on their plumage colors such as Fissiha 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, Hailemichael Nigussie (2013) at southern zone of Tigray

(Raya-azebo, Endamehoni and Ofla district) has characterized local chicken on the basis of plumage color as, Ambesuma ,Brown, Black, Brownish black, Gebsima, *Libework*, Grey, *key Teterma*, Multicolor, Nech teteruma, Kuarichama, Red, Tikur gebsat , Tikur teteruma Wheaten, White and Zigirama .There are large variations in morphological appearances, conformation and body weights of indigenous chicken in Ethiopia. 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 Molla, 2008).

2.6. Production and Reproduction Traits of Ethiopian Indigenous Chickens

Indigenous chickens are kept in many parts of the world irrespective of the climate, traditions, life standards, and/or religious taboos relating to consumption of eggs and chicken meat like those for pig meat.

Results of several researchers Muchadeyi *et al*., (2007); and Halima Hassen *et al*., (2007) on biodiversity of indigenous chickens in many parts of Africa revealed the presence of high genetic variability between and within populations, thereby evincing the potential for genetic improvement of these chickens through selective breeding.

The production performance of indigenous or local scavenging chickens of Ethiopia is low in case of low egg production potential with only 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 Dessie *et al.,* 2000; FAO, 2004; Aberra Mellese and Tegene Negesse Dana , 2011).

Results of a study by FAO (2010) indicated no significant differences among the village chicken production system in five different zones in Ethiopia. The report by Gueye (2000) indicated that the adult weight of male and female African village chicken range from1.2 to 3.2 kg respectively. In Ethiopia the meat production ability of local stocks is limited.

Local male may reach 1.5 kg live weight at 6 month of age and female about 30% less. The carcass weight of local stocks at 6 month of age was 550 gram which was significantly lower than that of white leghorn (875gm). However, local stock has a higher dressing percentage (Alemu Yami and Tadelle Dessie, 1997).Solomon Demeke (2003) showed that there was no difference between white leghorn and local chicken raised under

scavenging condition in mean daily body weight gain at 2 months. The chick mortality is high in the scavenging system of management and is coupled with longer reproductive cycle. Solomon Demeke (2007), Meseret Molla (2010) and Fisseha Moges *etal*., (2010a)reported that about 40-60% of the chicks that hatch die by the first 8 weeks of age mainly attributed to many vaccine preventable disease and predators. Thus, as indicated by Fisseha Moges *etal*., (2010a) about half of the eggs have to be hatched to replace the mortality in which the brooding time of the laying hens is longer with many brooding cycles required to compensate for its unsuccessful brooding.

Halima Hassen *et al*., (2009) in their studies in Northern Ethiopia estimated that, under scavenging conditions, the reproductive cycle of indigenous hens consists of 20 days of laying phase, 21days of incubation phase and 56 days of brooding phase. This implies the fact that, the number of clutches per hen per year is probably 2-3. Assuming 3 clutches per hen per year, the hen would have to stay for about 168 days out of production every year. Even though village chickens do have low productivity they are well known to possess desirable characters/special features such as ideal mothers, good sitters, hatch their own eggs, thermo tolerant, excellent foragers and ability to utilize the limited and poor quality feed resources, immunities to resist common poultry diseases and the special meat and egg quality/flavor, hard eggs hells high fertility and hatchability as well as high dressing percentage provide them an important place.

Sonaiya and Swan (2004) reported that indigenous village chicken, in Ethiopia attains sexual maturity at an average of 7 months. The hen lays about 36 eggs per year in 3 clutches of 12 to 13 eggs in about 16 days. Each reproductive cycle lasts for 17 weeks. Three cycles then make one year. By using brooding coop or other means of controlling broody character of village chicken it is possible to shorten the period to switch the clutch to every 27 days and to increase the egg produce by bird in 81 days time to 30 eggs (Amsalu Asfaw, 2003).

2.7. Breeding Objectives and Selection Practices for Chicken

According Addisu Hailu **(**2014) only 17.3% of respondents had breeding experience in improving their chicken productivity either by cross breeding (20.0%) or by line breeding (80.0%).Meseret Molla (2010) also reported traditional chicken production system is

characterized by lack of systematic breeding practice in Gomma district. Similarly, another study in different part of Ethiopia revealed that village chicken breeding is completely uncontrolled and replacement stock produced through natural incubation using broody hens (Nigussie Dana, 2011). In another study, Fisseha Moges (2009) reports that, 92.2% of chicken owner farmers in Bure district have the tradition of selecting cock for breeding stock. Similarly, Okeno et al. (2011) in Kenya reports that farmers who are confining their flocks do selection of chicken for breeding. Combination of comb type and plumage colour (28.3%) and egg production and broodiness performance (32.1%) were the major selection criteria of farmers in genetic improvement for male and female chickens, respectively. About half of the respondents in mid agro-ecological zones considered comb type as selection criteria of male chicken while 29.2% respondents in high altitude and 31.6% respondents in low altitude considered plumage Colour and comb type as a selection criterion Fisseha Moges (2009) also plumage color (45.4%), physical stand and shank length (37.1%), comb type (8.6%) and pedigree history (1.1%) are some of selection criteria for breeding stock in Bure district. Another study conducted in mid Rift valley of Oromia revealed that 68.0% of the farmers selected productive hens by body size, 12.0% by finger accommodation between the pelvic bones and 20% by pedigree performance for replacement (Samson and Endalew, 2010).

Developing appropriate breeding programs for village conditions requires characterization of production circumstances and identification of breeding practices and trait of economic importance to farmers (Abdelqader *et al.*, 2007).

2.8. Constraints of Village Chicken Production

Under village poultry production, prevailing diseases, predators, lack of proper health care, poor feeding and poor marketing information were reported as constraint by (Fisseha Moges *et al.,* 2010a), Dinka *et al. (*2010), and Mammo Mengesha *et al.*(2011). The high mortality of chicks under village chicken production in Ethiopia is due to diseases, parasites, predation, lack of feed, poor housing and insufficient water supply (Tadelle Dessie, 2001). Among the infectious diseases, Newcastle disease, Salmonellosis, coccidioses and fowl pox are considered the most important causes of mortality in local chicken while predators are an additional causes of loss (Eshetu yimer *et al.,* 2001). Newcastle disease (NCD) is highly infectious and causes more losses than any other

diseases in the tropics which spread rapidly through the flock and mortality can reach up to 100% (Nigussie Dana *et al*., 2003 and Serkalem Tadesse *etal.*,2005).

2.9. Feeding and Feed Resources

Family poultry production in Africa survives by scavenging and generally, no supplements provided except that some times, household waste fed to the birds and other circumstances the diet supplemented with grain (Dwinger *et al.*, 2003). Similarly, in Ethiopia the smallholder chicken production system is characterized by keeping under free range system and the major feed sources are believed to be insect worms, seed and plant materials (Solomon Demeke, 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 Dessie 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. However, studies conducted in three villages of the Central Highlands of Ethiopia with different altitudes and in three different seasons revealed that the materials present in the crop, as visually observed, are seeds, plant materials, worms, insects and unidentified materials.

Sonaiya *et al*. (1998) indicated that scavenging birds not certainly found all nutrients it needs for optimal production all the year round. During the dry season, chickens quickly develop 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 increase availability of

plant materials, and the relative scarcity of seeds during this season 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 Dessie 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 three percent of the diets of chicken without compromising performance.

Crop analysis studies conducted earlier by Tadelle Dessie and Ogle (1996) and Alemu Yami and Tadelle Dessie (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) also suggested that both egg production and egg size vary with season, as the quality and availability of feed varies.

2.10. Housing

Usually, there is no special housing provided for birds in rural villages of Ethiopia. In most cases (88.5 %) they roost inside the family dwelling at night, the roost being made of two or three raised planks of wood placed in parallel. A few households (11.5%) have constructed a house wife, depending on her work load (Taddelle Dessie, 1996). Mapiye and Sibanda (2005) reported that in Rushinga district of Zimbabwe all farmers provide housing to their chicken. Brick and litter types were the most popular houses because farmers felt that they provide more warmth and security from both thieves and predators than other type of housing. Proper housing must not only provide an environment that moderates environmental impact but must provide adequate ventilation for birds to lay eggs in nest boxes, 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 accounted due to nocturnal predators because of lack of proper housing (Dwinger, *et al*., 2003). Some research works also indicated that the mortality of scavenging birds reduced by improved housing. For instance, in the Gambia livestock improvement program, which included improved poultry housing resulted in lower chick mortality (19%) relative to that observed

in Ethiopia (66%) and Tanzania (33%), where no housing improvements were made (Kitalyi, 1998).

2.11. Health and Mortality

Production of indigenous chickens under the scavenging production systems is wide-spread and well-established in the country villages, even where resource is poor (Hunduma *et al*., 2010). Reta Duguma (2006) also indicated that they are predominantly raised where a traditional family-based free range scavenging management system is practiced. Consequently, the problem of disease in village chickens is compounded by the interaction of different entities that are of significant importance to disease epidemiology. At village level, contacts between flocks of different households, exchange of birds as gifts or even entrusting sales and purchase are the main sources transmission of infection (Tadelle Dessie, 2003; Mapiye and Sibanda, 2005).

Attempts have been made from time to time at different times to raise indigenous chickens under confined management in different research institutions situated in various geographical areas of the country (Hunduma *et al*., 2010). However, all attempts have failed due to high morbidities and mortalities of the chickens. These repeated failures make some researchers to conclude that indigenous chickens of Ethiopia are unfit for confined management (Reta Duguma,2006).According to Hunduma *et al*., (2010), Newcastle disease (NCD), Infectious Bursal disease(*Gumboro*), Mareks disease, Fowl typhoid, Cholera, Mycoplasmosis and Coccidiosis are widely distributed in most African countries. The Ethiopian indigenous flocks are said to be tolerant towards various diseases and adapted to their environment. However, survival rate of chicks kept under natural brooding conditions is considered to be very low. As indicated by Tadelle Dessie and Ogle (2001) the mortality rates of chicks is as big as 60 to 69 percent. Similarly, Tadelle Dessie (2003) reported chick mortality rate of 49% in the first two months after hatching with expected increase when disease outbreaks in the area.

In Ethiopia disease and predators are known to be the major causes of mortality (Nigussie Dana, 2011). Robert (1992) reported that in Indonesia losses were due to a combination of poor nutrition, predators and various disease factors. Although predators were blamed for the majority of losses, other biological and environmental factors made significant

contribution. Mapiye and Sibanda (2005) also reported that in Rushinga district of Zimbabwe predation and disease attribute to 40.5 and 30.2 percent of the total death respectively. Kitaly (1998) in Africa, Sonaiya *et al*., (1998) in sub-Saharan Africa, Mallia (1999) in America, Mwalusanya *et al.* (2002) and Tadelle Dessie (2003) in Ethiopia reported that among the diseases of village chicken, Newcastle disease was ranked as the most important cause of economic loss since vaccination occurs only in response to an outbreak in the traditional chicken production system. According to Hunduma *et al*., (2010), losses attributed to Newcastle disease are estimated at about 57.3% of the overall annual chicken mortality whereas Fowl pox, Coccidiosis, and predation account for about 31.6%, 9.4% and 1.7% of the total annual flock mortality, respectively. Identified Fowl cholera, followed by Newcastle disease, Coccidiosis, Fowl influenza (Infectious Bronchitis), Fowl pox, Fowl typhoid and Salmonella to be the major poultry diseases, respectively

2.12 .Disease and Predators

Disease and predators are known to be the major causes of mortality in the country (Negussie Dana, 1999). According to Negussie Dana and Ogle (1997), New castle disease accounted for the largest proportion of overall flock mortality to be 57.3% followed by fowl pox 31.6%, coccidiosis 9.4% and predator loss 1.7%. Another study conducted in all zones found in Southern Ethiopia by Aberra Melesse (2007) indicated that the major problems of poultry production in the study areas were Fowl cholera (28.8%), followed by New Castle Disease (26%), Coccidiosis (21.6%), Fowl influenza [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 a major problem in low altitudes accounting for 57% of the overall mortality. Predators such as snakes, rats, dogs, cats and foxes are the main causes of losses especially in young birds. Thefts are also another important cause for the loss of adult birds. According to Aberra 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.

2.13. Marketing Systems and Practices

In Ethiopia live chickens and eggs are sold from the ordinary day. Whereas, the prices of chickens are influenced by phonotypic natures of chickens, seasons and holidays. In the usual market the owners get better prices from matured chickens from different districts for both live male and female chickens (Addis Getu *et al*., 2014). In Ethiopia many researchers reported that site if the market and road accessibility in particular, phenotypic nature of an animals, seasons and holydays in general play important role for the variations of chicken prices (Mekonnen G/Egeziabeher, 2007).Whereas no formal poultry and poultry product marketing channel and informal marketing of live birds and eggs involving open markets are common (Meseret Molla, 2010). The same work result revealed that farmers are directly sold their chicken to consumers and/or to small retail traders who take them to large urban centers.

Poultry products in most developing countries, especially in Africa, are still expensive. The marketing system is generally informal and poorly developed. Unlike eggs and meat from commercial hybrid birds (derived from imported stock), local consumers generally prefer those from indigenous stocks. The existence of a local market offering good sales opportunities and adequate transport facilities are obvious prerequisites for family poultry development. As most consumers with greater purchasing power live in and around cities, intensification of poultry production should be initiated in peri-urban areas or, at least, in areas having a good road network (Branckaert *et al.,* 2000). Many study results indicated that research in promoting of village chicken production has concentrated on improvements in management while ignoring the potential role of socioeconomic issues, such as marketing. According to Gausi *et al*. (2004), small holder village chicken producers tend to ignore new technology even when it appears to be better than their current practices due to market limitations. This implies that apart from meeting subsistence needs, engagement and level of investment of smallholder farmers in agricultural enterprises responds to existing market opportunities.

2.14. Phenotypic Characterization of Indigenous Chicken

Phenotypic character is affected by agro-climates, ethnic groups, socio- economic, religious and cultural influences in the nature of the qualitative and quantitative traits

variation (Halima Hassen, 2007). Ethiopia is gateways of domestic animals migration from Asia to Africa and it has further impact on the diversity of Ethiopian chickens (Hallima Hassen, 2007). According to FAO (2011) stated that diversified chicken characterization is identifying distinct Animal Genetic Resource /AnGR/ and describing their uniqueness in their environment within specific location and describes any measurable (quantitative trait), adaptable and observable (qualitative) nature of AnGR and evaluate effective population size and evaluates status their risks (FAO, 2011). Different report stated that indigenous chickens are characterized in different parts of Ethiopia; Bogale Kebret (2008) at Fogera District (based on plumage colors as, white, red, black, grayish, brown, white brownish, black brownish, and red brownish), Fissiha Moges (2009) at Bure (characterized based on their phenotypic variations in terms of plumage color, shank length, comb type and growth performances). Based on location Tadelle Dessie (2003) at Tilili, Horro, Chefe, Jarso and Tepi, Halima Hassen (2007) at Tilili, Gelila, Debre-Elias, Melo-Hamusit, Gassay/Farta, Guangua and Mecha and Nigussie Dana (2011) characterized at Farta, Konso, Mandura, Horro and Sheka. However, only 5 chickens are listed in DAD-IS (FAO, 2008) and 10 in DAGR-IS (DAGRIS, 2008) including those listed in DAD-IS. This small number represented in the databases indicates that locally adapted populations are still un documented (Nigussie Dana, 2011).

CHAPTER 3. MATERIALS AND METHODS

3.1. Description of the Study Area

3.1.1 Lay Armacheho District

Lay Armacheho district is one of the districts of North Gondar Administrative Zone,it covers an area of 129,272 ha. The altitude of the district ranges between 980 and 2820 meters above sea level and the average annual rainfall range between 1223mm-1700mm. The annual maximum and minimum temperature of the district is 38ºC and 10 ºC, respectively. The agro ecology of the district is highland 7%, midland 65% lowland 32% and the soil type is claylome 25%, vertisoli 8%, and red brown 45%. Lay Armacheho is bordered on the north by Tachi Armacheho, on the south by Gondar town, to the west by Chilga, to the east by Wogera districts. Major crops in the district are teff, wheat, finger millet and maize respectively. The livestock populations of the district was reported to be 172,438 cattle, 285,604 sheep and goat, 197,100 poultry, 197,100 equines and 18,522 bee colonies (LDAO, 2015).

3.1.2 Dembiya District

Dembiya district is one of the districts of North Gondar Administrative Zone , it covers an area of 148,968 ha. The altitude of the district ranges between 1750 and 2100 meters above sea level. Dembiya is bordered on the south by Lake Tana, on the southwest by Takusa, to the west by Chilga, to the north by Lay Armacheho, and to the east by Gondar Zuria district. Its administrative town Kolla Diba is 35 km from Gondar town. In the Woreda, there are four small urban centers including kolladiba, Aynba, Chuahet and Robet towns as well as rural Kebeles and peasant associations. The topography of the district is 87 % plain, 8 % mountain 2.8% plateau and 2.2% covered by water and the soil type is clay 65 clay lome 35%. The area has a summer rain fall with mean annual rain fall and mean annual temperature of 1600mm and 20°C respectively .The district has 64% is arable or cultivable (49118 ha) and another 25% under irrigation, 6% pasture, 4% forest or shrub land, and the remaining 1% is considered degraded or other. This district is adjacent about 287 square kilometers to Lake Tana which is subjected to regular and extensive flooding. Major crops in the district (in order of importance) are teff, sorghum, finger

millet and maize respectively. The livestock populations were accounted as 314,423 cattle, 58,601 sheep, 18,659 goat, 147,720 poultry, 20,205 donkey, 269 mule, 58 horses and 12,485 bee colonies (DDAO, 2015).

3.1.3 Gondar Zuria District

Gondar Zuria district is one of the districts of North Gondar Administrative Zone , it covers an area of 114,983ha .The altitude of the district is 1107-3022 meters above sea level and the average annual rainfall range between 950mm-1035mm. The annual temperature of the Woreda is 33^0c maximum and 27^0c minimum. Its administrative town Maksegnete is 42 km from Gondar town. In the district, there are four small urban centers including Maksegnete, Teda, Enfranze and Degoma towns as well as rural Kebeles and peasant associations. Regarding the economic activity, agriculture is the dominant source of income for the farmers in the area. The major crop produced includes, Teff, Maize, Sorghum and Barley. The livestock populations were accounted as 212,164 cattle (exotic, cross and local), 75,324 sheep, 345,640 goats, 987 horses, 636 mules, 26,722donkeys and 173,391 poultry and 5,909 bee colonies (GDAO, 2015).

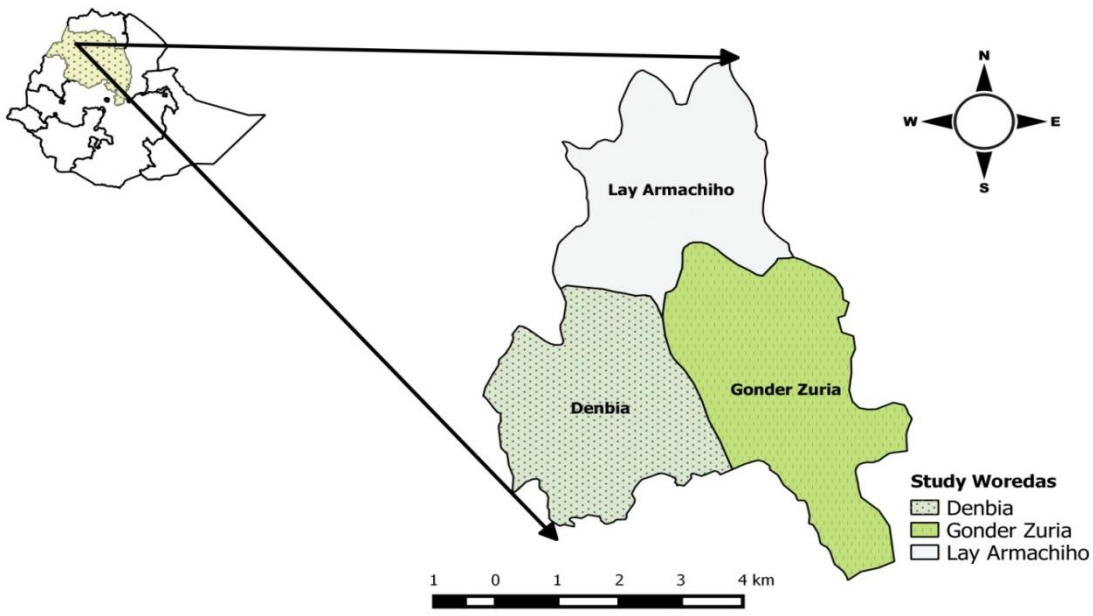

Figure 1: Map of the study area (using GIS version 9.2 software)

3.2 Sample Size and Sampling Techniques

The study was conducted in the three districts viz. Dembiya, Gondar Zuria and Lay Armacheho. The districts were purposively selected because of chicken production potential, socioeconomic significance and accessibility. From each district representative districts, three rural PAs per district were selected randomly. From each selected PA, 20 respondent farmers; 60 per district and 180 farmer respondents were used for the questioner survey. In addition, five chicken producers from each 10 urban centers, a total of 50 respondents were selected using Systematic simple random sampling technique and used for the interview. Systematic simple random sampling technique was applied to choose the respondents in each of the selected PAs. Based on the production system, 180 households for rural poultry production and 50 interviews from urban poultry producers were used.

To document the main chicken ecotypes, their production system and major production constraints, nine focus group discussions comprising of 8 to12 members selected from development agent of the kebele, kebele administratives, elders, female HH and youths were also conducted. For the phenotypic characterization, 210 male and 240 female adult live chicken were used; 12 quantitative traits like body weight (kg), body length (BL), wing span (WS), shank length (SL) and circumference (SC), wattle length (WL) and width (WW), keel length (KL), super length (sl), beak length (bl), comp length (CL) and width (CW) were measured based on agro ecologies separately for females and males using spring balance and centimeter (cm) in the nearest two digital techniques (FAO, 2011).

To address the marketing system, and understand the poultry and egg marking value chain, semi structured questioner for producers and checklists and field observations for consumers and middlemen's was used. Four poultry commodity and input suppliers were recorded in Gondar town; and all of them were used to capture major information on poultry input distribution path.

3.3. Data Management and Statistical Analysis

The qualitative and quantitative data were analyzed by using Statistical Package for Social Sciences SPSS (version 20). Analysis of variance was carried out for some of the parameters and Teky Test was used to locate treatment means that are significantly different. More specifically descriptive statistics and General Linear Model (GLM) was used for liner body measurements with the fixed effects of sex, ecotype and agro ecology. The following model was used to the measurement of data.

$$\mathbf{Y_{ijkl} = \mu + D_i + S_j + E_k + DE_{ik} + DES_{ijk} + e_{ijkl}}$$

Where: Y_{ijkl} = the observed body weight and linear body measurement of chickens

μ = overall mean

D_i = Fixed effect of i^{th} district (1= Dembia, 2= Gondar Zuria and 3= Lay Armachiho)

S_j = Effect of j^{th} sex (1= male and 2= female)

E_k= Ecotype k^{th} (1= Naked Neck (Angete Melata), 2 =Yetilku zere and 3= kechere)

$DE_{ik=}$ the intraction effects of district by ecotype

DES_{ijk} = the intraction effects of district, ecotype and sex of chicken

e_{ijkl}= Random residual error Model that was used for data analysis

The major poultry production constraints and breeding objective of the producers were analyzed and summarized by index method.

Index =Σ (n x number of HHs ranked 1^{st}) + (n-1) x number of HHs ranked HHs ranked 1st+ (n-1) x number of HHs ranked 2nd+…. +1x number of HHs ranked last) for all traits, and where n = number of traits under consideration. The variable with the highest index value is the highest economically important (Kosgey, I .S. 2004).

CHAPTER 4. RESULTS AND DISCUSSIONS

4.1 Farming System Characteristics

4.1.1 Household characteristics

The household characteristics of interviewed village chicken owners are presented in Table 2. About 90% of the respondents' village chicken owners were females, while the remaining proportion of the households was males. This is due to females are mainly occupied in the house for the sec of home management, whereas males are responsible for farm work. Majority of the respondents (88%) were fully involved in crop-livestock production systems and used chickens as source of income for immediate expenses such as purchasing salt, coffee, clothe and Chicken medicaments or drugs. Similarly Halima Hassen (2007) and Meseret Molla (2010) in north western Ethiopia and Gomma district reported that farmers were used chicken as means of livelihood and immediate household expenses, respectively. Most of the respondents were married (88.3%). Whereas, smaller result was reported by Mekonnen G/Egeziabeher (2007) who showed that only about 59% of the respondents were married. As we have seen from the result most of the information was generated from females which indicated that mainly women are traditionally responsible for rearing of chicken. Moreover, about 89.4% of the interviewed farmers were illiterate, which might be due to females were the major respondents and they got marriage during young age before getting to education. The educational status of the interviewed farmers in the recent study was slightly similar to southern Ethiopia of reported by (Mekonnen G/Egeziabeher, 2007).

Table 2. Household characteristics engaged in chicken rearing activities in Dembiya, Gondar Zuria and Lay Armachiho and districts

Characters	District						Overall	
	Dembiya		Gondar Zuria		Lay Armachiho			
	N	%	N	%	N	%		
Sex								
Male	7	11.7	5	8.3	6	10.0	18	10.0
Female	53	88.3	55	91.7	54	90.0	162	90.0
Educational level								
Illiterate	48	80.0	57	95.0	56	93.3	161	89.4
Read and write	9	15.0	2	3.3	4	6.7	15	8.3

1-4 grade	1	1.7	1	1.7			2	1.1
5-8 grade	2	3.3					2	1.1
Marital status								
Married	52	86.7	51	85.0	56	93.3	159	88.3
Widowed	8	13.3	3	5.0	3	5.0	14	7.8
Widower			6	10.0	1	1.7	7	3.9

4.1.2 Flock and family size of the respondents

Average family size of Dembiya, Gondar Zuria and lay Armachiho districts were 3.88±0.958, 4.17±1.011 and 3.88±1.059 persons, respectively with overall mean of 3.98±1.014 (Table 3). These results were less family size than the reported work from southern Ethiopia 6.95 persons reported by Mekonnen G/Egeziabeher (2007 and similar to the national report with the average of 5 persons per household (CSA, 2011/12). Moreover land holding characteristics of the respondents are presented in Table 4.2. The total land holding/household was showed non-significant ($p>0.05$) difference among the three districts. The result was higher than the reported data 1.01, 0.75, 1.28 and 1.23 ha land holding/HH of national, Amhara Region, north Gondar zone (WB, 2004), northwestern Amhara (Fisseha Moges, 2009), respectively.

The overall chick, hen, pullets, cockerels and cock of the study area were 7.35±1.758, 1.93±0.351, 2.01±0.490, 1.08±0.277 and 0.97±0.180, respectively (Table 4.2), which is not in line with Gueye (1997), who reported that the flock sizes generally ranged from 5 to 20 fowls per African village household. An average flock size of 16 birds was also reported in the central parts of Ethiopia and in the Kwale district of the South coast Kenya (Tadelle Dessie *et al.*, 2003; Njenga, 2005). In the present study, the respondents stated that flock size varies between seasons mainly due to the availability of feed, the occurrence of diseases, the presence of predators as well as the economic status of the owners. However, flock size in the study was almost consistently going across districts without affecting the population number counting together the blood level and cross breeding effect.

Table 3. Flock Structure and Land Size in Dembiya, Gondar Zuria and Lay Armachiho districts

Characters	**Dembiya**	**Gondar**	**Lay**	**Overall**	**Sig.**

	Mean ±SD	zuria Mean± SD	Armacheho Mean± SD	Mean± SD	
Chick	8.08±1.344[a]	6.97±1.948[b]	7.00±1.717[b]	7.35±1.758	***
Hen	2.02±0.291[a]	1.90±0.354[ab]	1.87±0.389[b]	1.93±0.351	**
Pullets	1.97±0.581[ab]	1.92±0.424[b]	2.13±0.430[a]	2.01±0.490	**
Cockerels	1.12±0.324	1.03±0.181	1.10±0.303	1.08±0.277	NS
Cock	0.98±0.129	0.97±0.181	0.95±0.220	0.97±0.180	NS
Land size	1.48±0.234	1.43±0.168	1.45±0.197	1.45±0.202	NS
Family size	3.88±0.958	4.17±1.011	3.88±1.059	3.98±1.014	NS

4.2. Chicken Production System

4.2.1 Feeding practice

Feed resources, major feeds and feeding practices of chickens in the study area as indicated by the respondents were all most all are traditional production with extensive management activities. There is no purposeful feeding of rural household chickens in the area and the scavenging feed resource is the major feed sources. According to the results of this study, almost all of the respondents (88.8 %) reported that scavenging system with a little supplementary feed is the two feed resources. The result of this study was in agreement to that of Assefa Tadesse (2007), Mekonnen G/egeziabeher (2007) and Addis Getu *et al* (2014) who reported that 95-98% of the small scale household poultry producers in Awassa Zuria, Dale and north Gondar zone were offering little supplementary feed to their chickens. The respondents of the current study also confirmed that the scavenging feed resource is consisted with insect, grass and harvest leftovers indicating that the village chicken production system is friendly with the environment. Unfortunately, all the available evidences tend to indicate that scavenging feed resource base for local birds are inadequate and variable depending on season (Hoyle, 1992 and Alemu Yami and Tadelle Dessie, 1997). About all respondents described that cereal grains (maize and sorghum) and household scraps are the major supplementary feeds offered, the amount of each being dependant on seasons of the year and the quantity and availability of the resources at the household level. About 48.3% of respondents offer supplement twice a day (morning and afternoon).

4.2.2 Housing

Housing in the study result showed that the farmers usually kept their chickens which are considered without individual housing provided. In most cases about 84.5 % of the representative interviewers were roost the chicken inside the family dwelling at night and the roost being made of two or three raised planks of wood placed in house. A few households (11.5%) have constructed a small enclosure outside the house made from stones, and the poultry night shelter is occasionally cleaned by the house wife. This type of management is not in line with the result of Mapiye and Sibanda (2005) reported in Rushinga district of Zimbabwe all farmers provided housing to their chicken. Lack of adequate housing can partly explain chicken mortalities and thus good housing is a prerequisite for any viable and sustainable chicken project.

4.3. Phenotypic Characteristics of Chickens

From the sampled adult chickens, observable parameters were documented through direct visualization. Of the total chicken populations about (29%) red (*Kiy*) followed by (13.4%) white (*Nech*) and (12%) Grayish mixtures (*Gebsema*) were the most frequent dominant plumage colors of chickens. However, considerable numbers of chickens showed heterogeneity and had diverse additional plumage color like reddish brown (*Kokima*), Red with white trips (*kiy Teterma*), black with white tips (*Tikur Teterma*), black White with black tips (Nech Teterma), multicolor (Ambesa) and White black red trips (*Kiy Tikur Teterma*), Bulla (whitish) and *Dalechema* which accounted for 1.3%, 11%, 8%, 12%, 2% , and 13%, 5% and 1%, respectively This finding is in line with the findings of Halima et.al. (2007b) and Nigussie Dana *et al*., (2011) who reported that each ecotype possessed multiple variations of plumage colors. Individual characteristics of the ecotype are described.

According to Halima Hassen (2007) the plumage color proportion of indigenous chickens were reversely agreed to the current study who reported that about (13.40%) white, (29.00%) red and (12.00%) Grayish mixture was the dominant color of indigenous chickens. The overall observed skin color of chickens in this investigation was white (67.89 %), yellow (21%) and red (6%) and had the average shank colors of yellow (63%), white (18%), green (5%), black (9%) and red (5%). This result is agreement with the

report of Aberra Mellese and Tegene Negesse (2011) who showed that yellow shank color was the dominant one in southern regions of Ethiopia. Regarding to body shapes most of the chickens were found to be blocky 61% and triangular 34.22% inters of head profile most were plain, crest and pea type are about 55%, 61% and 58%, respectively. According to Halima Hassen *et al.* (2007b) and Nigussie Dana *et al*. (2010) comb type distribution was not in lined with this result which pea comb was as a predominant type in other parts of Ethiopia.

4.3.1 Qualitative traits

The identified three chicken ecotypes in the area were reported earlier than the present investigation without the effects of agro ecologies like Necked neck, *Yetilku zere* (*yesegone zere*) and *kechere*. The results are due to measurable traits and observation of 450 sampled adult chickens with visible parameters through direct visualization. Of the total three chicken populations, white, red (*Kiy*) and Grayish mixtures in color are the frequent dominant plumage colors of chickens. However, considerable numbers of chickens had diverse additional plumage color like reddish brown (*Kokima*), white with red tips (*kiy Teterma*), black with white tips (*Tikur Teterma*), black (*Tikur*), multicolor (*Ambesa*) and White black red trips (*Kiy Tikur Teterma*) which accounted similarly (Halima Hassen, 2007; Nigussie Dana, 2011 and Addis Getu *et al* 2014). Reported each ecotype possessed multiple variations of plumage colors. In addition to plumage colors other qualitative traits like rose comb type, sicken color, eye color, body shape and head shape chickens were the documented morphology of chickens. In addition to the focus groups and key informant discussion made and qualitative, quantitative analysis of the three identified different chicken ecotypes are described as follows:

4.3.2 *Quantitative traits*

From the total sampled adult chickens whose age was approximately 36 weeks/to avoid maternal immunity with twelve measurable parameters such as wing span (WS), shank length (SL), body length (BL), comb length (CL), comb length (CW), wattle length (WL), wattle length (WW), beak length (bl), keel length (KL) in (cm) and body weight (Wt) (in kg) for different sexes were considered. The GLM least squares mean of body weight and liner body measurements of chickens from Dembiya, G/Zuria and Lay Armacheho and

their variations are presented from Table 4. The overall mean square of body weight obtained for mature chickens were significantly varied in body weight ($p < 0.05$). Thus, cocks and hens has found to the average shank length which is relatively similar to the report of Nigussie Dana (2011) with the shank length of 9.22cm for cocks and 9.04 cm for hens. This result was more significantly ($p < 0.01$) thicker shank circumference than the report of Halima (2007) with the shank circumferences of 0.82 and 0.62cm for cocks and hens, correspondingly. Comb width is not significantly different ($p>0.05$) within sexes. However, it was also non-significant ($p>0.05$) different between sexes in different ecotypes for cocks and hens in three various ecotypes were recorded (Table 4.4). The overall mean for body weight obtained for mature chicken was 1.45±0.01 kg which was less than other Ethiopian chickens 1.6 kg and heavier than 1.2 kg (Nigussie Dana, 2011) and northwest Ethiopia Halima Hassen (2007) with 1.26 and 0.87kg for mature cocks and hens, respectively.

Table 4. Phenotypic measurements (LSM ± SE) of body weight (kg) and linear body measurements (cm) of the three indigenous chicken's ecotypes

Parameters	Agro-ecology					Sex			Ecotype			
	Dembiya	G/Zuria	L/Aremachiho	Overall	Sig.	Male	Female	Sig.	Necked neck	Yetileku zer	Kechere	Sig.
N	150	150	150	450		210	240		120	150	180	
WS	36.79±1.34	36.86±1.34	36.77±1.89	36.61±0.07	NS	37.24±1.59^{a}	36.42±1.39^{b}	***	37.92±0.95^{a}	37.80±0.82^{a}	35.24±0.84b	***
SpL	0.25±0.25	0.20±0.22	0.23±0.25	0.23±0.01	NS	0.31±0.24^{a}	0.15±0.23^{b}	***	0.30±0.26^{a}	0.28±0.24^{b}	0.14±0.21c	***
ShL	8.77±0.51^{a}	8.53±0.62^{a}	8.17±0.74^{b}	8.49±0.03	***	8.61±0.61^{a}	8.38±0.72^{b}	***	8.62±0.63^{a}	8.65±0.54^{a}	8.27±0.75b	***
SC	3.46±0.15^{a}	3.37±0.28^{b}	3.30±0.25^{b}	3.28±0.01	***	3.41±0.20^{a}	3.35±0.27^{b}	**	3.34±0.23	3.38±0.28	3.39±0.22	NS
CL	2.91±0.28^{a}	2.31±0.30b^{c}	2.69±0.42^{b}	2.64±0.02	***	2.70±0.43^{a}	2.59±0.40^{b}	**	2.60±0.40	2.69±0.42	2.62±0.42	NS
CW	1.89±0.29^{a}	1.64±0.29^{b}	1.74±0.33^{a}	1.76±0.01	***	1.73±0.33	1.78±0.31	NS	1.75±0.34	1.78±0.32	1.75±0.30	NS
WL	1.82±0.92^{a}	1.68±0.77^{b}	1.39±1.03^{c}	1.63±0.04	***	1.93±0.68^{a}	1.37±1.04^{b}	***	1.77±0.74^{b}	2.09±0.63^{a}	1.16±1.03c	***
WW	1.92±0.68^{a}	1.54±0.54^{b}	1.56±0.77^{b}	1.67±0.03	***	1.71±0.67	1.64±0.71	NS	1.72±0.80^{a}	1.65±0.71^{b}	1.66±0.59b	NS
Wt	1.53±0.28^{a}	1.44±0.33^{b}	1.37±0.26^{c}	1.45±0.01	***	1.57±0.27^{a}	1.34±0.28^{b}	***	1.53±0.32^{a}	1.43±0.29^{b}	1.40±0.28b	***
BoL	37.03±0.91^{a}	36.30±1.50^{b}	36.23±0.88^{b}	36.52±0.05	***	36.65±1.32^{a}	36.40±1.05^{b}	*	36.83±0.95^{a}	36.92±1.10^{a}	35.97±1.20b	***
KL	8.40±0.60^{a}	8.61±0.60^{a}	8.27±0.56^{b}	8.43±0.03	***	8.49±0.66^{a}	8.37±0.55^{b}	*	8.67±0.61^{a}	8.51±0.55^{a}	8.19±0.56b	***
BL	1.99±0.16^{a}	1.85±0.09^{a}	1.78±0.15^{b}	1.87±0.01	***	1.88±0.18	1.87±0.14	NS	1.90±0.24^{a}	1.87±0.14^{b}	1.85±0.09	**

WS = wingspan, SpL = super length ShL = shank length, SC= shank circumstance (cm), CL= comb length, CW = comb width, WL= wattle length, WW = wattle width, Wt = weight (kg), BoL= body length, KL= keel length, and BL = beak length

N= number of observation, different subscribe of a, b, c are significant variation (***P<0.001; **P< 0.01and *P<0.05 are strongly, highly and significant, respectively); NS= Not Significant.

4.3.3. Phenotypic description of the study ecotypes

4.3 .3.1 Necked Neck chicken ecotype

Necked neck chicken ecotype is dominantly found in a very hot ecological zone at altitude ranging from 528-654 masl with the maximum temperature of 44ºc (Addis Getu, *et al*, 2014). This chicken ecotype was historically originated and come to Shenfa around border of Gelavat particularly from Gumze ethnic group. The peculiar features of the chickens are defeatherinig at neck and chest, highly aggressive, high feed intake, good productive and reproductive performance; high disease resistance and cleaned & high carcass body weight are the exceptional features of the ecotype.

The chickens have predominantly red and white red body plumage colors. However, they had heterogeneity and diverse additional plumage colors like: red-braunish, white with red tips, black with white tips, black and multi color, yellow skin colored, single combed and plain headed, respectively (Figure 4.3).

Figure 2 Typical Necked neck chicken ecotype male in the right and female in the left

4.3.3.2Yetilku zere chicken ecotype

According to the key informants during group discussion Yetilku zere chicken ecotype is dominantly found in a very topography particularly mid and plain topography is suitable for this ecotype.

The chickens have predominantly red body plumage colors with other diverse plumage color of white, red-braunish and multicolor. Rose comb type, long shank length, long necked (especially males), fast growth rate, high cultural and social value, docile and

good productive and reproductive performance and attractiveness (good looking) is the main distinct feature of the ecotype.

Figure 3: Typical Yetilku zere, male (left and female (right) chicken ecotype

4.3.3.3 Kechere chicken ecotype

The respondents reveled that this chicken ecotype was inherited from early lived parents and transmitted from generation to generation and suited in different ecological zone. The chickens have predominantly red brownish body plumage colors and unique characteristics of the breed is small body size, short beak length, very small size wattle in females, docile, and small size egg with less production of egg & good hatchability are the critical behaviors of the ecotype.

Figure 4: Typical short beak and leg *Kechere* chicken ecotype

4.4. Performance of Local Chicken Ecotypes

Districts with average productive and reproductive performance of chicken ecotypes were characterized under traditional production systems conducting through semi structured questionnaire. According to the respondents' information during data collection, the performance of chicken could be attributed to non-genetic factors such as supplementary feed and care of farmers given to their chickens. Currently, this work finding showed a mean age at first sexual maturity was 5.05±0.03, 5.01±0.27, 4 .87±0.02 and 5.01±0.27

months from rural and urban areas in case of female and male chickens, respectively. Average productive and reproductive performances of chicken ecotypes and their significant difference were estimated under existing farmers' management condition (Table 4.4). Whereas, egg production performance of Necked Neck ecotype was better than the other chickens in terms of agro ecologies and production systems. Therefore, the result indicated us the average age at first female sexual maturity was much earlier than 6.8 months reported by (Tadelle Dessie *et al.*, 2003) and similar to 5 months reported by Halima Hassen (2007).

Whereas, the reproductive performances based on the production system obtained from the present study had smaller clutch size than Addis Getu *et al. (*2014) who reported that the average clutch size of local chickens were 3.53±0.10 clutches/hen/year. Mean annual egg production in rural and urban area was 46.08±8.54 and 43.06±0.44 which were lower than those reported 55.2 eggs/year from southern Ethiopia (Mekonnen G/Egeziabeher, 2007) and larger than and similar to (36-42 eggs/year from Ambo (Fikre, 2000), 32 eggs/year from Assela (Brannang and Pearson, 1990) and 36 eggs/year from Fogera (Bogale Kebret, 2008). This indicated that the different performances of the ecotypes and existence of variability in egg production could be indicated us the presence of varied genetic potential for genetic improvement through selection followed by cross breeding. Generally site effect on the performance chicken was not created as such variations except some production traits. Current work and its result were not affected by rural and urban chicken production except annul egg production and egg per clutch. Following that the present investigation showed that hatching performance of chicken was highly influenced by ecotypes than agro ecologies and production systems (Table 5). However, the present study reported that the survival rate of the hatched chickens was positively associated with all the fixed effects of agro ecologies, ecotypes and production systems.

Table 5. Productive and Reproductive Performances of chicken ecotypes in the study district

Parameters	Agro-ecology					Sex			Ecotype			
	Dembiya	G/Zuria	L/Aremachiho	Overall	Sig.	Male	Female	Sig.	Naked neck	Yetileku zer	Kechere	Sig.
N	150	150	150	450		210	240		120	150	180	
WS	36.79±1.34	36.86±1.34	36.77±1.89	36.61±0.07	NS	37.24±1.59^{a}	36.42±1.39^{b}	***	37.92±0.95^{a}	37.80±0.82^{a}	35.24±0.84b	***
SpL	0.25±0.25	0.20±0.22	0.23±0.25	0.23±0.01	NS	0.31±0.24^{a}	0.15±0.23^{b}	***	0.30±0.26^{a}	0.28±0.24^{b}	0.14±0.21c	***
ShL	8.77±0.51^{a}	8.53±0.62^{a}	8.17±0.74^{b}	8.49±0.03	***	8.61±0.61^{a}	8.38±0.72^{b}	***	8.62±0.63^{a}	8.65±0.54^{a}	8.27±0.75b	***
SC	3.46±0.15^{a}	3.37±0.28^{b}	3.30±0.25^{b}	3.28±0.01	***	3.41±0.20^{a}	3.35±0.27^{b}	**	3.34±0.23	3.38±0.28	3.39±0.22	NS
CL	2.91±0.28^{a}	2.31±0.30b^{c}	2.69±0.42^{b}	2.64±0.02	***	2.70±0.43^{a}	2.59±0.40^{b}	**	2.60±0.40	2.69±0.42	2.62±0.42	NS
CW	1.89±0.29^{a}	1.64±0.29^{b}	1.74±0.33^{a}	1.76±0.01	***	1.73±0.33	1.78±0.31	NS	1.75±0.34	1.78±0.32	1.75±0.30	NS
WL	1.82±0.92^{a}	1.68±0.77^{b}	1.39±1.03^{c}	1.63±0.04	***	1.93±0.68^{a}	1.37±1.04^{b}	***	1.77±0.74^{b}	2.09±0.63^{a}	1.16±1.03c	***
WW	1.92±0.68^{a}	1.54±0.54^{b}	1.56±0.77^{b}	1.67±0.03	***	1.71±0.67	1.64±0.71	NS	1.72±0.80^{a}	1.65±0.71^{b}	1.66±0.59b	NS
Wt	1.53±0.28^{a}	1.44±0.33^{b}	1.37±0.26^{c}	1.45±0.01	***	1.57±0.27^{a}	1.34±0.28^{b}	***	1.53±0.32^{a}	1.43±0.29^{b}	1.40±0.28b	***
BoL	37.03±0.91^{a}	36.30±1.50^{b}	36.23±0.88^{b}	36.52±0.05	***	36.65±1.32^{a}	36.40±1.05^{b}	*	36.83±0.95^{a}	36.92±1.10^{a}	35.97±1.20b	***
KL	8.40±0.60^{a}	8.61±0.60^{a}	8.27±0.56^{b}	8.43±0.03	***	8.49±0.66^{a}	8.37±0.55^{b}	*	8.67±0.61^{a}	8.51±0.55^{a}	8.19±0.56b	***
BL	1.99±0.16^{a}	1.85±0.09^{a}	1.78±0.15^{b}	1.87±0.01	***	1.88±0.18	1.87±0.14	NS	1.90±0.24^{a}	1.87±0.14^{b}	1.85±0.09	**

WS = wingspan, SpL = super length ShL = shank length, SC= shank circumstance (cm), CL= comb length, CW = comb width, WL= wattle length, WW = wattle width, Wt = weight (kg), BoL= body length, KL= keel length, and BL = beak length

N= number of observation, different subscribe of a, b, c are significant variation (***P<0.001; **P< 0.01and *P<0.05 are strongly, highly and significant, respectively); NS= Not Significant.

4.5. Breeding Objective in the Study Areas

The confirmatory filed work has been revealed that the information obtained from the respondents were on the selection practices of chickens which were based on different characters mainly the three essential breeding objectives that to obtain in the requirement of better confirmed chicken about the performance of egg production (for home consumption), meat production (for home consumption) and source of income with the overall index rank value of I = 0.28, I = 0.37, and I = 0.35, respectively. The function of chickens as source of cash income and meat for home consumption was equally important from Dembiya and Lay Armacheho districts and less important than chicken for income production where as egg production for home consumption from Lay Armacheho is the priority area for chicken production and was the most essential reason for production of chickens. Whereas the function of chicken production for meat (for home consumption) was more important than egg production in lay Armacheho district. This work is in lined with the previous reported work in the same area reported by (Addis Getu *et al.,* 2014) and different area by Nigussie Dana (2011) who investigated that the function of chickens as source of cash income was rated to be as the first breeding objectives.

Table 6. Major Breeding Objectives and Its Index with Ranks Value in the Study Area

Functions of chicken	**Districts**			**Weighted value**
	Dembiya	**Gondar Zuria**	**Lay Armachiho**	
Meat (home consumption)	0.34 (2)	0.32 (3)	0.33 (2)	0.28 (3)
Egg (home consumption)	0.31 (3)	0.33 (2)	0.34 (1)	0.37 (1)
Marketing as a source of income	0.35 (1)	0.35 (1)	0.33 (2)	0.35 (2)

4.5.1.Trait Preferences of Respondents in The Study Area

Preferred traits of farmers in the studied area are presented in Table 4.6. All interviewed farmers practiced selection to pick breeding and replacement cocks and hens to improve the performances of chickens based on color, live weight, comb type, conformation and breeding ability of chickens. The emphasis given to each trait category is the same in sexes in all districts like the report of Nigussie Dana (2011) and unlike Addis Getu *et al*

(2014). Farmers in all districts give the highest emphasis for plumage color as used as the most important selection criteria with index value of 0.35, 0.37 and 0.41 from Dembiya, G/Zuria and Lay Armacheho district for both male and female chickens, respectively. The emphasis given to each trait category is not similar across the districts except comb type which is almost equally important character for selection of chickens. In addition, this criterion is critical point for farmers to select chickens from purchasing of breeding cocks and hens for production, religious contribution and home consumption.

Table 7. Trait preference of respondents in the study area

Traits	Dembiya	Gondar/Zuria	Lay Armachiho	Over all
Color	0.35(1)	0.37(1)	0.41(1)	0.38(1)
Weight	0.29(2)	0.26(2)	0.23(2)	0.26(2)
Comb	0.17(3)	0.19(3)	0.16(3)	0.17(3)
Conformation	0.11(4)	0.07(5)	0.11(4)	0.10(4)
Breeding ability	0.08(5)	0.11(6)	0.09(5)	0.09(5)

Different number is indicated for its significant variation

4.5.2.Breeding practice of chicken in the study area

Through farmers had preferred traits and breeding objectives, there is no designed selection and controlled breeding of village chickens. All chickens are moved without restraint in and around the village through cocks and hens mate indiscriminately without systemic mating where the dominant cocks in the vicinity became a sire. Though breeding practices of the village chicken owners were completely uncontrolled and replacement stocks were produced through natural incubation using broody hens the breeding experiences of the respondents are improving their chicken productivity either by purchasing of best cock based on farmers selection criteria , purchasing of exotic fertile eggs incubated and hatching by local broody hen which were 11 and 13% of the respondents were had an experience from Dembiya and lay Armachiho districts, respectively.

Poor productive and old age chickens through selling and slaughter were the major factors and methods of culling of chickens from the flock, in that order. The farmers in the districts seem to be very conscious and concerned in the preparation of appropriate incubation nest boxes and place to set the broody hens. The interviewed people to be

found the incubation boxes in a protected, quite and dark corner of the family set with the use of cereal straws bedding either on clay pot or on bare ground sandstones.

Whereas, respondents avoid the broody character of the hens using different methods to adjust their broody manners when incubation was not preferred and the hens were necessary to start again mating and laying eggs. Some of the most popular methods reported were hanging the hen up-side-down for a day, moving the hen to neighboring houses and tethering for three to four days.

4.6. Marketing Price and Marketing Chain

4.6.1 . Marketing price of chicken and egg at the survey areas

Urban and rural production system was the major production activities in the study area. As the respondents indicated, the performances and current marketing prices chickens are highly influenced by the production system. According to Wondu Mamo *et al* (2013) urban productions is important in Ethiopia and required for the development of successful poultry production strategies. During data collection, the communities were stated that live chickens and eggs are sold from the ordinary days from unrestricted marketing place. On the other hand, the prices of chickens and their products are influenced by phonotypic natures of chickens, size of chickens, seasons and holidays of the year. In the usual market the owners get better prices from matured chickens up to 171±0.40 and 128±1.00 with the overall mean prices of 108±0.80 and 100±0.60 birr from urban and rural area for matured cocks and hens, in that order. The prices obtained in this findings were significantly higher compared to Mekonnen G/Egeziabeher (2007) who reported that 21.74±0.54 (78) and 13.95±0.43 (78) as well as (Tadelle Dessie *et al.*, 2003b) on the price of 21.5 (30) and13.4 (30) birr for matured cocks and matured hens, respectively. This finding is still higher than Assefa Tadesse (2007) who reported that 27.24 and 15.51 birr was required for matured male and female chickens, respectively in the study made around Awassa Zuria. Market and road accessibility in particular, phenotypic nature of an animals, seasons, inflation and holydays in general play important role for the variations of chicken price and market defilation and inflation in the study area (Table 8).Whereas average productive and reproductive performances of chickens were characterized under rural and urban production systems (Table 5). Even, lower performance record was reported (36.94±2.05) from Mekonnen G/Egeziabeher and Fikre than small size female prices of eggs/hen/year.

This indicated that the better performance of the ecotypes and existence of variability in prices could be an indication of the potential for genetic improvement through selection and the demand increment followed by chicken production opportunity observed in the country. This consideration was focused on market price variation between production systems.

Table 8. Marketing price (ETB) of chicken at different age and production system

PS	MSs	MMs	MLs	FSs	FMs	FLs	Overall
Sig.	NS	NS	**	**	***	NS	*
Rural	82^{b}±0.40	126^{b}±0.3	164^{b}±0.4	47^{b}±0.30	64^{b}±0.80	121^{b}±0.40	100b±0.6
Urban	93^{a}±0.90	133^{a}±0.7	171^{a}±0.4	53^{a}±0.60	75^{a}±0.50	128^{a}±0.91	108^{a}±0.8

PS= production system; MSs is male small size, MMs is male medium size, MLs is male large size, FSs is female small size, FMS is female medium size, FLS is female large size

4.6.2 Marketing chain and input suppliers

Irregular marketing practices like without formal poultry and poultry products was conducted on a marketing channel in through informal marketing of live birds and eggs was involving on common open markets throughout the district. According to the information obtained the chicken owners directly sold their chicken to both consumers and small retail traders who take them to large urban centers,While all most all respondents practiced that the live chickens and eggs are sold either at farm gate, small village market (primary market) or at larger Woreda market (Secondary market in the town). As the respondents indicated that exchange of the commodities were done in a week with one regular market day at the center of each Kebeles. Respondents underlined that eggs are most frequently selling products at the market and at villages' level. So the results of this study clearly showed that both eggs and chickens pass through different individuals before reaching to the consumers. The regular chain is presented from (Figure 5). About 10% of chickens are collected by village collectors and consumers. At all the market areas, selling and purchasing of the live chickens and eggs are the responsibility of female for household immediate income to meet household expenses. About 99.6% of interviewed village chicken owners involved in marketing of live chicken, since sale of chickens are the major reason for them to keep chicken. The marketing of birds takes placed in various places

including: urban market, local markets and around the villages (farm gates). Whereas, the near and the major four live chicken, fertile eggs and commercial feeds without vaccine drug input suppliers in poultry production in the study area was found in the urban areas which was connected the supplier with the users by lives project through training and promoting different events. Though, the major constraints for input supplier in the study area were practicing training, promotion and awareness creation to the user to buy the inputs. However, some NGO like LIVES was performed on going work to connect the suppliers and the producers through training and visiting in the last two consecutive years in urban and rural areas even if the suppliers are absent in the rural areas.

Women and children were the major members of the household involved in marketing of live birds. Urban market was the first priority place for most village chicken producers (56.7%) of the study area to sale live birds and eggs. Regarding the marketing channel of live birds, most chicken owners (33.3%) sold birds directly to consumers and middle men. The rest of the birds were usually sold to other urban and rural chicken producers and retailers (hotels and restaurants). Figure 5 showed the marketing channel of live birds and eggs in the district.

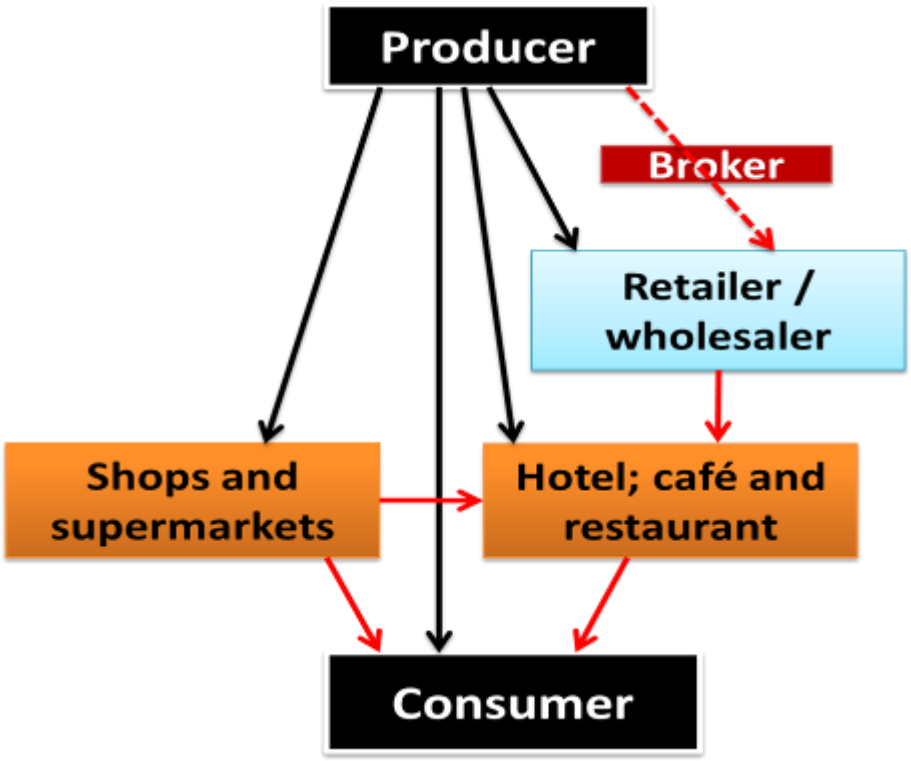

Figure 5 Marketing channel of chicken and eggs in the study area

According to the study result, marketing place to the main area where the producers are found its own contribution for the prices of chicken and its products. The prices of chicken and eggs at village of the rural areas are reduced by 50% from the main marketing places. Whereas, both public and private service providers and input suppler like breed, feed, vaccinations, drugs, awareness creation and price inconsistency are the major critical constraints in chicken marketing.

4.7 Major Constraints of Chicken Production in the Study Area

Major constraints of chicken production are presented in Table 9. Among the reported constraints of chicken production prioritized by the interviewers were presence of disease, predators and feed shortage with the overall weighted value of 0.38, 0.31 and 0.31, respectively. The frequently mentioned constraints was diseases and rated as the first ranked chicken production constraint in all districts whereas predators were the second problems in all districts of different agro ecologies. Feed availabilities including its qualities were the bottleneck of chicken production in all districts where as poor veterinary and lack of extension services were identified and unranked common limitation in all districts. Constraints were not different from those reported by others in Ethiopia such as Solomon Demek (2007), Bogale Kiberet (2008), Meseret Molla (2010) and Addis Getu *et al.* (2014) who reported that the main constraint of traditional chicken production system was disease. This result is in lined with Solomon Demek (2007) who reported that the bio-security of the backyard poultry production system is very poor and risky, since scavenging birds live together with people and other species of livestock.

Table 9. Rating of major constraints of chicken production in the study area

Constraints	Districts			Overall
	Dembiya	Gondar Zuria	Lay Armachiho	
Disease	0.37 (1)	0.38 (1)	0.37 (1)	0.38 (1)
Predator	0.33 (2)	0.32 (2)	0.32 (2)	0.31 (2)
Feed shortage	0.30 (3)	0.30 (3)	0.31 (3)	0.31 (2)

CHAPTER 5. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

The identified chicken populations generally showed less phenotypic variations with their adopted environments. Almost all of the differences in the populations could be explained by the genetic variability of individuals among the population. The main chicken breeding objectives of the study areas were home consumption and for income generation, to fulfill the required commodities and consumables of the household. The main production problems, as the respondents indicated, were disease (lack of veterinarian and experience of vaccination by the producers), feed shortage (lack of access and understanding to provide better feed for poultry) and predator. While, the respondents indicated that the main involved actors for the marketing chain were in the area producers, middle men, retailers and direct consumers.

Breeding objectives of the respondents were linked to increase performances per animals through obtaining well performed chickens for meat, egg and religious roles to insure their incomes and home consumptions. Whereas, the breeding practices in the area was uncontrolled mating and absence of planned breeding programme.

The morphologies, performance and measurable traits are giving powerful evidence on the uniqueness of ecotypes from the common chicken ecotypes. The liner body measurement analyses indicated that the chickens are uniquely different one from the other. In addition qualitatively as Necked neck chickens ecotype was easily identified by their complete absence of feather at neck and chest. Whereas, *Yetilku zere* chicken ecotype was also characterized by their normal feather (not bold or muffed) and long necked.

5.2. Recommendations

Based on the facts and figures obtained in this study, the following recommendations were amended.

- ✓ Indigenous chicken genetic resources are created a great importance and could be utilized for the purpose of home consumption and income generation which needs

better conservation plan for breeding strategies so as to utilize in a sustainable way based on different districts.

- ✓ Intensive and monitoring studies to be proceed on type and coverage of chicken production constraints which affect the income of farmers should be conducted.
- ✓ Marketing actor in a chain is dominated by the middle men that reduce the income of the producer; those direct marking between the producer and the consumers should better be designed.
- ✓ The future breeding programme development should incorporate the breeding objectives of farmers'.

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7. APPENDICES

Questionnaires for phenotypic characterization of local chicken ecotype based on agro ecologies in North Gondar Zone: NARS, Ethiopia.

1. Semi structured questionnaires (30 respondents per ecotype)

a. Enumerator's Name ---------- age, ---------- **ecotype/50/ kebeles** ----------

b. District (agro ecology) ----------, Peasant Association (Keble) ----------

c. Date of interview----------

d. Identified number of the respondent----------

e. Sex of the respondent a. Male b. Female

f. Major occupation 1.Agriculture2. GO employer3. Construction4. Unemployed

g. Educational level of the respondent

a. Illiterate b. Read & write c. 1st –4th

d. 5th –8th e.9th-12th

h. Religio**n**

1. Muslim 2. Orthodox 3. Others

j. Marital status

A. marred b. unmarred c. widowed

k. Land size /ha/ ----------

L. Family size of the respondent ----------

	Male	Female	Total
a) Ages under 14 years	---------	----------	
b) Ages between 15 to 30 years	----------	----------	--------
c) Ages between 31 to 60 years	----------	----------	--------
d) Ages above 60 years	---------	----------	--------
e) Total number	----------	--------	----------

2. Chicken types

2.1. Flock size and structure

Chicken Stock Type's	No. of Chicken	Source of Replacement stock	Source of foundation stock	family member Responsible to manage
Local				
Chicks				
Cocks				
Pullet				
Hens				
Cockerels				
Total				
Exotics				
Chicks				
Cocks				
Pullet				
Hens				
Cockerels				
Total				

2.2. Sources of foundation or replacement stock

a. Purchase b. Gift c. Hatched d.Other especify

2.3. The extent of exotic chickens (RIR, WLH,) distribution in the area

2.4. What are the constraints in ordering to consume poultry product at family level?

1st ----------
2nd----------
3rd----------
4th----------
5th----------Chicken management system

2.5. Housing

2.5.1. What type of management system do you practice for your chicken rising?

a. Extensive b. Semi-intensive c. Intensive d. Others specify ----------

---

2.5.2. Do you have separate poultry house from your family

1. Yes 2. No

2.6. If they rest in separate house, do you practice cleaning of poultry house**?** Yes---no

2.7. If yes, how many days in a week) do you clean? ----------

2 .8 Feed Resources and Feeding Strategy

2.8.1 Do y2our chickens scavenging (forager) in? 1. Yes 2.No

2.8.2 Do you provide supplementary feed for your chicken? 1. Yes 2. No

2.8.3 If yes, indicate the ingredients you provide supplementary feed for your poultry fill the following table**:**

2.8.4 If you provide feed, how frequently do you feed your chickens daily?

a) Morning only (a) Once (b) Twice) three times or more (d) - None

b) Evening only (a) Once ------- (b) Twice ------ c) three times or more -------- (d) - None

c) Afternoon only (a) Once (b) Twice c) three times or more ------- (d) - None

d) Any time during the day----------

e) Morning and evening---------- ----------

f) Morning and afternoon---------- ----------

g) Morning, evening and afternoon----------

2.8.5 If you give feed how do you feed your chickens?

a. in a feeding trough
b. on the bare ground
c. Others specify

2.8.6 Why you give supplementary feed?

(a) To increase egg yield (b) to increase meat yield (c) Aging

(d.) Broodiness (during incubation) (e) others

2.9. At which season you are practicing incubating eggs? a. Rainy season b. Dry season

2.10 Do you practices to avoid broody behavior? 1. Yes 2. No

2.11 If yes, what types of technique do you practice & way do you use? & rank it?

(a) Hanging the bird upside down (b) Depriving of the birds from feed & water

(c) Disturbing in the nest (d) Moving to neighbors e) Others----------

2.12 Do you select egg for incubation? A. yes b. No c. specifies ----------

2.13 How long do you store eggs before incubation?

2.14 Production System/Husbandry Practices

2.14.1 For what purpose do you practice in chicken production Rank in order of importance?

(a) Egg for home conception ------ (b) meat home conception----- (c) Cultural/Religious------- (d) Source of income----------

2.14.2 How long has poultry been kept in the household? ----------

2.14.3What chicken type do you raise? 1**.** Starter/layer/ chicken 2. Finisher 3.grower

2.14.4 For which of the following purposes you spend money in poultry production?

a. Purchase of chickens
b. Purchase of poultry feeds
c. Purchase of veterinary product
d. Others (specify

2.14.5 Source of money to finance your poultry farming?

a) Poultry sales
b) Crop sales
c) Money lender family or friends
d) Egg sales
e) Livestock sales
f) Bank
g) Cooperatives
h) Off-farm
i) Others, specify

2.14.6 Do you feel the need to improve your poultry production? (a) Yes (b) No.

2.14.7 If yes, How 1.importing (exotic) 2.indigenous

2.15 Reproductive Performance

1. Approximate age of female sexual maturity months? ----- Months?

2. Age of first mating male, Cock (age at 1st mate) ----------months?

3. How many times brood/ year? ----------

4. Clutch frequency per year ----------

5. Day per clutch ----------

6. Hen at first egg ----------

2.16 Culling and breeding practice

2.16.1 Do you have breed improvement practice? How 1.Importing 2. Improving indigenous chicken by itself?

2.16.2 which trait you prefer? For conception or income or selection (Rank)

1. Male a. wt b. color, c. comp, d. breeding ability e. Conformation

2. Female a. wt b. color c. comp, d. breeding ability e. Conformation

2.16.3 Why do you cull chicken? 1. Culling underproductive 2. Lack of broodiness

2.16.4 Frequent broodiness 4. Sickness 5. Other specify ------

6.2.5 How do you cull chicken?

1. Culling at young stage	2. Dealing the best cock and hen during conception period	3. Preventing unwanted cock to mate hen

6.3. For what purpose (breeding objective) chickens are selected?

1. Meat for home
2. Egg for home
3. Egg and meat for Income
4. Others

6.4. How do you get (improved Spps) ----------?

7. Constraints of poultry production

7.1 Potential / Production constraints to chicken production and productivity (Specify in order of their economical importance)

a. 1st--------

b. 2nd-------

c. 3rd --------

d. 4th----------

7.2 Health and disease control a. Do you understanding serious disease outbreaks? 1.Yes 2.no

8. Marketing

8.1 Rank marketing chain

1. Producer – trader ---- consumer
2. Producer – consumer
3. Producer –middle men – retailer--- consumer

8.2 What are marketing problems relating to chicken?

1. Instable Chicken price
2. Poor sales (demand seasonality)
3. Lack of market place
4. Availability of substitute
5. Poor infrastructure (road, market…)
6. Others specify

1. How far the market place from the home area?

Current market price of chicken

Male chicken			Female chicken		
Small size	Medium size	Large size	Small size	Medium size	Large size

8.2.1 Where do you buy poultry production inputs?

1. NGO 2.Goverment 3.Private companies 4. If others specify

8. Marketing

8.1 Rank marketing chain

1. Producer – trader ---- consumer
2. Producer – consumer
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8.2 What are marketing problems relating to chicken?

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2. How far the market place from the home area?

Current market price of chicken

Male chicken			Female chicken		
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9. Phenotypic Data

A. Categorical Traits

1. Age (days/wks) of chickens---------- type of ecotype ----------

2. Sex of chickens

1. Male
2. Female

3. Feather distribution

1. Normal

4. Plumage color

1. Completely white
2. Completely black
3. Completely red
4. Grayish/Gebsema
5. Multicolor/Anbesma
6. Black with white tips/Teterma
7. Red brownish/Kokima
8. White with red stripes
9. Others/Specify

5. Breast color

1. Naked neck
2. Shank feathered & feet; muffs

1. Black
2. Red
3. White
4. Others/specify

6. Neck color

1. Completely white
2. Completely black
3. Completely red
4. Grayish/Gebsema
5. Multicolor/Anbesma
6. Black with white tips
7. Red brownish 8. White with red stripes
9. Others

7. Back color

1. Completely white
2. Completely black
3. Completely red
4. Grayish
5. Multicolor
6. Black with white tips
7. Red brownish
8. White with red stripes/Seran
9. Others/Specify--------

8. Comb type

1. Rose
2. Pea
3.Watnut/strawberry
4. Single
5. Duplex
6. Cushion,

9. Head shape

1. Plain
2. Crest /Gutya
3. Others, specify ----------

10. Ear lobe/presence (P/A)

1. Present
2. Absent

11. Ear lobe color

1. White
2. Red
3. Black
4. White and red
5. Others,

12. Ear mark

1. Present
2. Absent

13. Shank feather

1. Present
2. Absent

14. Eye color

1. Orang
2. Brown
3. Red
4. Pearl

15. Shank color
    1. Yellow
    2. Black
    3. White
16. Skin color
    1. Silky
    2. White
    3. Yellow1

17. Body shape
    1. Wedge
    4. Blue
    5. Green
    6. Grey-blue

2. Triangular

3. Blocky

B. Linear Body Measurement (Measurable traits per ecotype)

1. Wing span (arrested) /cm/
2. Spur length (cm)
3. Shank length (cm)
4 .Shank circumferences (cm)
5. Comb length (cm)
6. Comb height (cm)
7. Wattle lengths (cm)
8 Wattle height
9. Body weight (kgs/
1o. Body length (cm)
11. Keel length,
12 Beak lengths

Appendix table 1. Analysis of variance (ANOVA) of phenomic measurements of characterization

Source	Dependent Variable	Type III SS	Df	Mean Square	F value	Sig.
Agro ecology	Wing Span	.306	2	0.153	0.386	0.680
	Spur Length	.273	2	0.137	3.061	0.048
	Shank Length	21.883	2	10.942	41.985	0.000
	Shank Circum	1.699	2	0.850	18.546	0.000
	Comb Length	25.978	2	12.989	175.154	0.000
	Comb Width	5.257	2	2.629	38.922	0.000
	Wattle Length	28.848	2	14.424	105.645	0.000
	Wattle Width	28.023	2	14.011	66.003	0.000
	Weight	2.586	2	1.293	19.751	0.000
	Body Length	48.807	2	24.404	33.195	0.000
	Keel Length	9.075	2	4.538	16.185	0.000
	Beak Length	4.168	2	2.084	129.614	0.000
Sex	Wing Span	112.314	1	112.314	282.953	0.000
	Spur Length	3.388	1	3.388	75.965	0.000
	Shank Length	4.023	1	4.023	15.436	0.000
	Shank Circum	.320	1	0.320	6.987	0.009
	Comb Length	1.415	1	1.415	19.075	0.000
	Comb Width	.337	1	0.337	4.995	0.026
	Wattle Length	26.273	1	26.273	192.431	0.000
	Wattle Width	.538	1	0.538	2.533	0.112
	Weight	5.446	1	5.446	83.204	0.000
	Body Length	14.083	1	14.083	19.157	0.000
	Keel Length	2.503	1	2.503	8.926	0.003
	Beak Length	.005	1	0.005	0.299	0.585
Ecotype	Wing Span	762.785	2	381.392	960.840	0.000

	Spur Length	2.763	2	1.382	30.982	0.000
	Shank Length	15.024	2	7.512	28.825	0.000
	Shank Circum	.200	2	0.100	2.183	0.114
	Comb Length	.799	2	0.399	5.385	0.005
	Comb Width	.029	2	0.014	0.211	0.809
	Wattle Length	65.518	2	32.759	239.939	0.000
	Wattle Width	.420	2	0.210	0.989	0.373
	Weight	1.187	2	0.593	9.067	0.000
	Body Length	99.039	2	49.519	67.359	0.000
	Keel Length	17.627	2	8.814	31.436	0.000
	Beak Length	.229	2	0.115	7.134	0.001
Agro ecology * ecotype	Wing Span	29.929	4	7.482	18.850	0.000
	Spur Length	.634	4	0.158	3.553	0.007
	Shank Length	18.684	4	4.671	17.924	0.000
	Shank Circum	3.920	4	0.980	21.390	0.000
	Comb Length	10.697	4	2.674	36.061	0.000
	Comb Width	9.269	4	2.317	34.309	0.000
	Wattle Length	40.488	4	10.122	74.137	0.000
	Wattle Width	72.545	4	18.136	85.434	0.000
	Weight	1.469	4	0.367	5.611	0.000
	Body Length	99.789	4	24.947	33.934	0.000
	Keel Length	6.865	4	1.716	6.121	0.000
	Beak Length	1.109	4	00.277	17.244	0.000

***P<0.001; **P< 0.01; *P<0.05; NS= Not Significant.

Appendix table 2. Analysis of variance (ANOVA) of Productive and Reproductive Performances of chicken ecotypes for rural production system

Source	**Dependent Variable**	**Type III SS**	**df**	**Mean Square**	**F value**	**Sig.**
Agro ecology	AAFMSM (Month)	0.914	2	0.457	7.953	0.000
	AAFFSM (Month)	4.089	2	2.045	44.258	0.000
	CSPY	0.033	2	0.017	0.111	0.895
	DPC	27.878	2	13.939	6.018	0.003
	EPY	875.544	2	437.772	63.802	0.000
	NEI	60.278	2	30.139	31.254	0.000
	ChpI	14.211	2	7.106	4.558	0.012
	Csph	22.078	2	11.039	14.029	0.000
	Epc	91.433	2	45.717	18.988	0.000
Ecotype	AAFMSM (Month)	1.776	2	0.888	15.450	0.000
	AAFFSM (Month)	17.714	2	8.857	191.718	0.000
	CSPY	0.100	2	0.050	0.332	0.718
	DPC	410.811	2	205.406	88.687	0.000
	EPY	8182.144	2	4091.072	596.244	0.000
	NEI	317.011	2	158.506	164.369	0.000

	ChpI	295.211	2	147.606	94.693	0.000
	Csph	111.144	2	55.572	70.627	0.000
	Epc	2678.800	2	1339.400	556.321	0.000
Agro ecology * Ecotype	AAFMSM (Month)	0.801	4	0.200	3.485	0.009
	AAFFSM (Month)	3.334	4	0.834	18.043	0.000
	CSPY	1.067	4	0.267	1.771	0.137
	DPC	220.789	4	55.197	23.832	0.000
	EPY	2847.922	4	711.981	103.766	0.000
	NEI	44.389	4	11.097	11.508	0.000
	ChpI	66.756	4	16.689	10.706	0.000
	Csph	17.222	4	4.306	5.472	0.000
	Epc	215.267	4	53.817	22.353	0.000

***P<0.001; **P< 0.01; *P<0.05; NS= Not Significant.

Appendix table 3. Analysis of variance (ANOVA) of Productive and Reproductive Performances of chicken ecotypes for rural production system

Source	**Type III SS**	**df**	**Mean Square**	**F value**	**Sig.**
AAFMSM (Month)	0.745	1	0.745	11.103	0.001
AAFFSM (Month)	6.837	1	6.837	43.515	0.000
CSPY	0.053	1	0.053	0.338	0.562
DPC	4.553	1	4.553	0.852	0.357
EPY	356.360	1	356.360	5.987	0.015
NEI	69.334	1	69.334	23.262	0.000
ChpI	0.574	1	0.574	0.174	0.677
Csph	15.313	1	15.313	11.410	0.001
Epc	74.520	1	74.520	4.868	0.028

***P<0.001; **P< 0.01; *P<0.05; NS= Not Significant.

Appendix table 4. Analysis of variance (ANOVA) of Marketing price (ETB) of chicken at different age and egg at different size at urban and rural production system

Source	**Type III SS**	**df**	**Mean Square**	**F value**	**Sig.**
MSs	4020.731	1	4020.731	142.999	0.000
MMs	1503.324	1	1503.324	44.771	0.000
MLs	17858.818	1	17858.818	224.255	0.000
FSs	226.227	1	226.227	10.762	0.001
FMs	2.424	1	2.424	0.236	0.628
FLs	9.198	1	9.198	0.129	0.720
SSe	0.000	1	0.000	0.008	0.930
Lse	0.015	1	0.015	0.829	0.364

***P<0.001; **P< 0.01; *P<0.05; NS= Not Significant

BIBLOGRAPHICAL SCETCH

Hana Asmamaw, the author, was born in Dembiya District North Gonder, Amhara Regional State in 1980 EC. She started her elementary school education at kolladiba in 1986 EC, and completed her Secondary school in 1995 EC. Then, she joined Woreta TVIT College of Agriculture, in 1996 EC graduated with Diploma in Agriculture (Animal science) in 1998 after her graduation; she was employed by the Ministry of Agriculture and served as Animal Production Expert at Dembia District Agriculture and Rural Development Office of North Gondar Zone, then she joined Bahir Dar University, College of Agriculture and environmental sciences, in 2001 EC, and graduated with B.Sc. degree in Agriculture (Animal Production and technology) in 2003 EC. After her graduation, she was employed by the Ministry of Agriculture and served as Animal Production Expert at Dembia District Agriculture and Rural Development Office of North Gondar Zone. Then she joined the Graduate School of the Bahirdar University for a Master of Science degree in Animal Genetics and breeding in ocutober 2006 EC.