ASSESSMENT OF VILLAGE CHICKEN PRODUCTION SYSTEM AND EVALUATION OF EGG QUALITY IN DEDO AND MANA DISTRICTS OF JIMMA ZONE, SOUTH WEST ETHIOPIA

MSc. Thesis

BY

SHUKURALA CHAIMISO

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Assessment of Village Chicken Production System and Evaluation of Egg Quality in Dedo and Mana Districts of Jimma Zone, South West Ethiopia

MSc. Thesis

By

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Thesis Submitted to the Department of Animal Science, College of Agriculture and Veterinary Medicine, Jimma University, In Partial Fulfillment of the Requirements for the Degree of Master of Science in Animal Science (Specialization: Animal Production)

Major Advisor: Zemene Worku (Msc, Asst.prof.)

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DEDICATION

This thesis work is dedicated to Almighty God, who gave me all strength and fortitude.

STATEMENT OF AUTHOR

I confirm that the thesis hereby submitted for the MSc. degree at the Jimma University, College of Agriculture and Veterinary Medicine is my own work and has not been previously submitted by others or me at another University or institution for any degree. I declare copyright of the thesis in favor of the Jimma University, Collage of Agriculture and Veterinary Medicine.

Name: - Shukurala Chaimiso Signature _____Date of submission:-_____

BIOGRAPHICAL SKETCH

Shukurala Chaimiso, the author, was born in Sheshogo woreda, SNNPR in 1990 G.C. He started his elementary school education at Urebacha in 1996, and completed his elementary and junior secondary school at Urebacha elementary and secondary school in 2004 G.C. He joined his secondary school at Bonosha high school in 2005, and completed in 2006 GC and he completed his preparatory school at Wachamo Preparatory school in 2008 G.C. Then he joined Arba Minch University in 2009, and graduated with Bsc degree in Agriculture (Animal Science) in 2011 G.C. After graduation, he joined Haddiya Zone Gombora Woreda Livestock and Fishery resources development office, as poultry production expert and served until he joined Jimma University, School of graduate for degree of Master of Science in Animal Production in 2017.

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LIST OF ABBREVIATIONS

AH	Albumen Weight
ANOVA	Analysis of Variances
CSA	Central Statistic Authority
EW	egg weight
FAO	Food and Agricultural Organization of United Stated of Nations
g	Gram
ha	hectare
HU	Hough Unit
ILCA	International Livestock Research Center for Africa
ILRI	International Livestock Research Institute
JUCAVM	Jimma University College of Agriculture and Veterinary Medicine
NCD	New Castle Disease
SD	Standard Deviation
SI	Shape Index
SPSS	Statistical Package for Social Science
USDA	United State Department of Agriculture
YH	yolk height
YW	Yolk Weight

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ABSTRACT

The study was conducted in Dedo and Mana Districts of Jimma Zone, South West, Ethiopia, to assess village chicken production systems and to analyze chicken egg quality parameters. A total of 12 kebeles were purposively selected based on their potential of chicken production, representativeness and accessibility to run the study. About 276 households were randomly selected for the survey part and interviewed by semi-structured questionnaire. To conduct egg quality analysis, 880 eggs were collected from local market and farm gate. The main purpose of keeping chicken in Dedo and Mana woreda in order of importance were income generation (56.9%), household consumption (16.3%), egg production (14.5%), breeding/hatching (10.5%) and cultural/religious ceremonies (1.8%). The average flock size per household in Dedo and Mana woreda were 6.24 and 7.04 chicken, respectively with overall average mean of 6.64±5.7 chickens/HH. About 23.5% chicken owners in Mana woreda constructed separate overnight shelter for chicken as compared to 17.4% chicken owners of Dedo woreda. On average (97%) chicken owners practiced supplementary feeding of chicken in Mana than 93.8% chicken owners of Dedo woreda with overall average of 95.3% chicken owners. In the study districts, the major sources of supplementary feeds for chicken were both home grown crop and purchase (42.6%), home grown crop alone (52.1%) and purchased from local market (5.4%), and the major water sources for chickens in the study areas were pipe, river and rainy water. Women were the major responsible member of the household who were involved in various village chicken husbandry activities like; cleaning chicken's house and feeding chickens, represented by 70.8% and 55.9% in Dedo while 71.3% and 56.5% in Mana Wereda, respectively. On the other hand, men were involved mainly on shelter construction and taking sick chickens for treatment, constituted 60.9% and 61.5% in Dedo while 61.7% and 63.5% in Mana wereda, respectively. The average age of cockerels at first mating and pullets at first egg laying in Dedo woreda were 6.32 and 6.28months, respectively and 5.98 and 6.18months in Mana woreda, respectively. The average number of eggs laid/hen/clutch, average number of egg laid/hen/year and average clutch/hen/year in Dedo woreda were 12.5, 45.6 and 3.86, respectively while 13.2, 49.6 and 3.77 in Mana Woreda, respectively. The average mean egg weight, shape index, Hough unit, albumen height, yolk height and egg strength of eggs collected from study districts of farm gate and local market were 48.1g,73.84%, 72, 4.6mm, 15.89mm,4.1kg and 44.1g, 73.84%, 69.6,4.26mm, 15.4mm, 3.5kg, respectively. The average mean of TABC of eggs collected from study districts of farm gate and local market were 2.9log$_{10}$CFU/ml and 2.62log$_{10}$CFU/m while 2.86log$_{10}$CFU/ml and 2.59log$_{10}$CFU/ml of TCC, respectively. In conclusion, the results of the current study revealed that the productivity of village chickens was low under the prevailing husbandry practices suggesting that further efforts need to be exerted to improve productivity of village chicken in sustainable way. Ensuring quality and safety of chicken eggs by undertaking proper handling and storage of eggs with all-inclusive and multi-disciplinary provision of services like training on modern poultry production system, proper handling and storage of eggs at the marketing and production time in both Dedo and Mana Woredas of Jimma Zone should also be practiced.

Keywords: Egg Quality, Microbial Quality, Village Chicken

1. INTRODUCTION

1.1. Background

Almost all rural and peri-urban families in the developing world keep household poultry. With estimated population of 19 billion and about three chickens per person, domestic chicken is the most numerous livestock species in the world (The Economist, 2011). Poultry contribute about 30% of all animal protein consumed in the world Permin and Pedersen, (2000). Moreover, they share 34.6% of the global livestock meat consumption, chicken account 88% of the global poultry meat and 30.1% global animal meat (FAO, 2012).

Poultry farming is widely practiced in Africa and account about 1.5 billion chicken, 80% of them belonging to local chicken population and found in the rural and per-urban area, where birds are raised in small numbers by traditional extensive or semi-intensive, low input and output system (Sonaiya, 1997; Gueye, 1998). Various scholars and rural development agencies have recognized the importance of rural poultry in national economies of developing countries and its role in improving the nutritional status and incomes of small farmers and landless communities in the last two decades. Village poultry are a valuable asset to local populations throughout Africa and they contribute to food security, poverty alleviation and promote gender equality, especially in the disadvantaged groups (HIV/AIDS infected and affected people, women, poor farmers) and less favored areas of rural Africa where the majority of the poor people live **(**RSHD, 2011).

Ethiopia has large population of chicken, estimated to 56.87 million chicken with regard to blood level of chicken, 95.86 %, 2.79 % and 1.35 % of the total poultry were reported to be indigenous, hybrid and exotic (CSA, 2015), respectively. From the total population of chicken in Ethiopia, 99 % are raised under the traditional back yard system of management, while 1 % is under intensive management system (Tadelle *et al*., 2003). The total national annual poultry meat and eggs production is estimated at 72 300 and 78 000 metric tons, respectively and indigenous poultry contribute almost 99% of the national egg and poultry meat production (Tadelle *et al.*, 2003).

Rural household poultry is economical source of animal protein and sources of family income. Poultry is a source of self-reliance for women because; poultry and egg sales are decided by women (Aklilu *et al.*, 2007) both of which provide women with an immediate

income to meet household expenses and sources of food. Household poultry require limited space, feed and capital investment compared to other domestic animals kept in rural Ethiopia. The indigenous chickens also represent part of the livestock production system. Thus, household poultry of the Ethiopian indigenous chicken has a unique position in the rural household economy and plays a significant role in the religious and cultural life of the society (Tadelle and Ogle, 1996). However, the contribution of the indigenous chicken resource to human nutrition and export earnings is disproportionately small. All the available literature tends to indicate that the precipitate poultry and poultry product consumption in Ethiopia is one of the lowest in the world: 57 eggs and 2.85 kg of chicken meat per annum (Alemu, 1995).

At the same time the quality and safety issue of poultry product food has not been paid critical attention in the world especially developing countries of marginalized society. The reason could be attributed to many factors that arise from the producer through all the way to the end consumers following formal and informal marketing channels. Especially the quality of egg depends on physical make-up and chemical composition of its constituent namely eggshell, albumen and yolk. Environmental factors such as temperature, humidity, and the presence of CO_2 are also of prime importance to maintain of egg quality. However, eggs remained acceptable sensorial up to 10 days of storage at ambient condition (Jones, 2007) and naturally occurring microorganisms on the eggshell surface and in egg contents were markedly increased during storage. Freshly laid eggs are generally devoid of organisms. However, following exposure to environmental conditions (for example, soil, dust and dirty nesting materials), eggs become contaminated with different types of microorganisms (Ellen *et al*., 2000).

Microbial contamination of egg has significant outcome to the poultry industry and illness from contaminated egg is a serious public health problem around the world. This may induce cases of food-borne infection or intoxication to consumers, which constitute public health hazards (Osei Somuah *et al*., 2003). Microbial contamination of table eggs in the process of production, handling and marketing has been a major public health worry. Until recently, little is known regarding microbial quality of table eggs and most studies are concerned with the quality of hatching eggs (Knape *et al*., 2002). Studies made elsewhere indicated that chicken eggs are important sources of microbial infection (USDA, 2005).

1.2. Statement of the Problems

From the existing situations around Jimma town, qualities of village chicken eggs are expected to be of inferior and unsafe for consumption. Village chicken eggs in Jimma zone like any other parts of the country may be stored for longer periods along the value chain, which may lead to quality deterioration. In addition, significant number of eggs may be cracked and even broken during transport from farm gate to market places which exposes the eggs for microbial contamination on top of economic loss by breakage. The eggs are marketed in different places such as open market, ordinary shops and directly from the producers. In each of these places may be stored for some period. Duration of storage is one of the devastating factors for the expected quality deteriorations of chicken eggs in Dedo and Mana districts of Jimma zone. Actually, researches of the previous times were conducted focusing on increasing quantity of chicken's eggs while there was not sufficient data on quality and safety issues of village chicken eggs. Few researches have been conducted regarding quality of chicken eggs at few woredas of Jimma zone. However, there is no research (study) done regarding quality and safety issues of village chicken's eggs in Dedo and Mana woredas of Jimma Zone. Therefore, there is an information gap on assessment of village chicken production system and Evaluation of Egg Quality in Dedo and Mana districts of Jimma zone with the following objectives:-

1.3.General Objective

- To assess village chicken production system and Evaluation of Egg quality in Dedo and Mana districts of Jimma zone, South West Ethiopia

Specific objectives: -

1) to assess village chicken production systems at Dedo and Mana districts of Jimma zone, South West Ethiopia
2) to evaluate the internal and external qualities of village chicken eggs collected from farm gate and local markets of the study areas
3) to determine the microbial qualities of village chicken eggs collected from common eggs marketing places of the study areas

2. LITERATURE REVIEW

2.1. Livestock Production in Ethiopia

Livestock is known to play an important role in social and cultural life of developing countries in general and in Sahelian countries in particular (Tadelle and Ogle, 1996). Ethiopia has the largest national total of ruminants and equines population in Africa including 30 million cattle, 22million sheep and 23.4 million equines (FAO, 1999). On these resources; 20% of cattle, 25% of sheep, 73% of goats and 100% of camel were found in the low land pastoral areas of the country (Belachew and Jemberu, 2003).

In Ethiopia, the contribution of livestock and livestock product to the agricultural economy is about 30% and to export earning about 19%. The figure could even be higher if the nonmonetary contributions are taken in to account (Azage and Alemu, 1998). Livestock play an important role in the livelihood of rural people by providing quality food (meet, eggs and milk) for household consumption and cash income, fiber, skin and wool. Hides and skins are important out puts, which are exported to earn foreign exchange (Getnet, 1999). In Ethiopia, the sales of livestock products represent the main sources of cash income for smallholder farmers (Gryseels, 1988).

Livestock promote livelihood security by diversifying risk and by generating cash through the sale of its products in time of need. Furthermore, livestock are closely linked to the social and cultural life of several million-smallholder farmers for whom animal ownership ensures varying degree of sustainable farming and economic viability (Azage and Alemu, 1998). According to FAO (1995) livestock production system in Ethiopia is generally subsistence oriented and productivity is very low. The level of beef production productivity in the country (110 kg/head) was about 25-30% lower than East Africa (143 kg/head) or the continental overage of 156 kg/head. The annual off take rate was estimated as 10% for cattle, 35% for sheep, 38% for goats and 6.5% for camel (Belachew and Jemberu, 2003).

2.2. Poultry Production System

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 (Nzietcheung, 2008). There are few studies about diseases affecting poultry in this production system. Kinung'hi *et al*. (2004) mentioned coccidiosis 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. As such, it does not involve investment beyond the cost of the foundation stock, a few handfuls of local grains and possibly simple nightshades, mostly nighttime in the family dwellings. Mostly, indigenous chickens are kept although Some Hybrids and Exotic Breeds may be kept under this system (Dawit e*t al*., 2008).

2.3. Village Chicken Production Systems in Ethiopia

In Ethiopia, chickens are the most widespread and almost every rural family owns chickens, which provide a valuable source of family protein and income (Tadelle *et al.*, 2003). The country has diverse agro-climatic conditions favoring production of many different kinds of crops, providing a wide range of ingredients and alternative feedstuffs suitable for poultry feeding. Making use of these resources to complement the scavenging resource base promises a considerable potential for success (Dessie and Ogle, 2001).

2.3.1. Housing, feeding and watering under village condition

Housing systems in backyard system is elementary and mostly built with locally available materials. In traditional free range, there is no separate poultry house and the chickens live in family dwelling together with humans (Solomon, 2007). Fisseha *et al* (2010) reported that in Bure district, North West Ethiopia, 77.9% of the village chicken owners provide only night shelter and only 22.1% provided separate poultry house. Another study by Mengesha *et al.* (2011) in Jamma district, South Wollo reported that 41.3% and 21.2% of chicken owners share the same room and provided separate poultry house, respectively.

Family chicken production is an appropriate system that makes the best use of locally available resources (Tadelle *et al.,* 2003). Village chicken also play a role of converting household leftovers, wastes and insects into valuable and high quality protein (Doviet, 2005). Village chicken production systems are characterized by low input low output levels. A range of factors such as suboptimal management, lack of supplementary feed, low genetic potential and high mortality rate are the major causes for the apparent low output level (Tadelle, 2003). Different feeding materials are present for scavenging including crop as visually observed, seeds, plant materials, worms, insects and unidentified materials (Tadelle and Ogle, 2000). Feed supplementation has been reported in various countries as a common practice to promote chicken performance, Malawi (Gondwe, 2004); Ethiopia (Dessie and Ogle, 2001).In Ethiopia, 99%, 97.5% and 98% feed supplementation by chicken owners were reported by Halima (2007); Fisseha *et al* (2010); Mengesha *et al.* (2011), respectively. In India, 97.25% backyard chicken owners provide additional supplement (Khandait *et al.,* 2011). To make full use of the productive potential of hybrid layers a feed, which is sufficient in both quality and quantity has to be provided. Scavenging laying hen can find approximately 60 to 70% of their feed requirement (Rahman *et al.,* 1997). It is also reported that free-range scavenging chickens fulfill their nutrient requirements from protein, vitamins, and minerals through scavenging feed resources (Payne and Wilson, 1999; Dessie and Ogle, 2001). However, this is dependent on factors such as available scavenging area per bird, quality of scavenging feed resources; season and production stage (Abdelqader *et al.,* 2007). Maize is always the most preferred food under every form for chicken. This is consistent with choice feeding trial or free-choice feeding (Benvenuti *et al*., 2012). Wilson (2010) suggested that provision of shelter, regular

supplies of clean drinking water and some supplementary feeding would improve growth and reproductive rates and greatly increase survival at village level.

2.3.2. Use of agricultural extension services

A holistic and multi-disciplinary support of services like extension, training, veterinary and credit are critical in supporting village chicken improvement programs (Fisseha *et al* (2010). Mengesha *et al.* (2011) reported that 50% of chicken owners used agricultural extension services on poultry productivity in south Wollo, Jamma district. Rural women contribute significantly in almost all activities related to poultry production. It is also reported that training for both farmers and extension staff focusing on disease control, improved housing, feeding, marketing and entrepreneurship could help to improve productivity of local chicken (Fisseha *et al.,* 2010).

2.3.3. Poultry health management

Unlike in commercial set-ups many factors influence the health of smallholder chicken populations. Such complex phenomena make it even more difficult to design improvement strategies to overcome health constraints (Mapiye *et al.,* 2008). High mortality rate is considered the major constraint to village chicken production systems (Muchadeyi *et al.,* 2004). Newcastle Disease (ND) is among the major causes of mortality. ND is one of the most significant diseases of poultry worldwide and a major constraint to village poultry production (Alders, 2004).The effective control of diseases is an essential first step towards improving village poultry production (Ahlers *et al*., 2009).

Fisseha *et al* (2010) suggested that improvement in veterinary and advisory service could help to achieve control of diseases at village level. The same author reported 96.4% of village chicken owners had no culture of vaccination against poultry diseases in North West Ethiopia. Village chicken vaccination particularly against ND is more important than other management interventions; benefit-cost calculations done for the Tigray region of Ethiopia indicated that ND vaccination was more economically beneficial than the provision of daytime housing, supplementary feeding, cross breeding and control of broodiness. Effective health coverage and vaccination programmes improved rural chicken performance in Pakistan (Javed *et al.,*

2003). In village production, study in different parts of Ethiopia, Fisseha *et al* (2010) and Mengesha *et al* (2011) reported no vaccination practice against poultry diseases.

2.4. Production Performances of Village Chickens

The productivity of village chicken's production systems in general and the traditional/free range system in particular is known to be low (Kondombo, 2005). The productivity of local scavenging hens is low not only because of low egg production but also due to high chick mortality (Nigussie *et al.*, 2003). Teketel (1986) and Aberra (2000) also reported that the low productivity of local chicken was expressed in terms the following parameters; low egg production performance, production of small sized eggs, slow growth rate, late maturity, small clutch size with long laying pauses, an instinctive inclination to broodiness and high mortality of chicks.

According to Pandey (1992) scavenging hens lay only 30 eggs/year while industrialized battery cage hens lay up to 300 eggs/year. Furthermore, it may take up to 12 months to raise a chicken for consumption. In Ethiopia native chicken produced 40 eggs/year (Tadelle *et al.*, 2000). Bessie (1987) also reported that village chicken, in Nigeria, produced 20-30 eggs/year under scavenging system with poor night shelter and no regular feed and water supply. The average egg weight of local hens around Arsi, Ethiopia, was reported to be 38g (Brannang and Persson, 1990). The average number of eggs/clutch in Burkina Faso local hens was estimated to be 12 eggs (Salam, 2005), which is comparable to the range of 12-18 eggs indicated by Gueye (1998), but it is higher than that of 10 eggs/clutch reported by Mourad *et al.* (1997) in Guinea and 9 eggs/clutch in Mali (Kuit *et al.*, 1986).

Halima (2007) reported an average of 9-19 eggs/clutch with 2-3 clutches periods/hen/year and an average total egg production ranged 18-57 eggs/year/hen for eight chicken ecotypes found in North-West Amhara. According to Moreki *et al*(2001) also reported an average number of clutch/year of 3, with an average of 15 eggs/clutch and a total egg production of 46 eggs/hen/year, in a study conducted on small-scale chicken production systems in Botswana. According to Khalafalla *et al*(2000) the average number of clutches/hen/year and number of eggs/clutch of Sudan local chicken ecotypes were 3 (ranged 1-6) and 12 eggs (ranged 2-20), respectively. The study also showed that about 78% of incubated eggs were hatched and 75% of which survived the brooding period.

According to Gueye (2000), the adult male and female weight of African village chicken ranged 1.2-3.2kg and 0.7-2.1 kg, respectively. Village chickens reached a market weight of 1-1.5kg at the age of 4-5 months in South-East Asia (Aini, 1990).

2.5. Challenges of Village Chicken Production

2.5.1. Disease and predation

Adene (1996) reported that Newcastle disease (ND), Infectious Bursal disease (IBD) or Gumboro, Marek disease (MD), Fowl typhoid, Cholera, Mycoplasmosis and Coccidiosis are widely distributed in most African countries. According to Chaheuf (1990), Ethiopia is not exception to this situation.

The Ethiopian indigenous flocks are said to be disease resistant and adapted to their environment. However, survival rates of chicks kept under natural brooding conditions is considered very low. Disease and predators are known to be the major causes of mortality in the country (Nigussie, 1999). According to Nigussie and Ogle (1999), losses attributed to Newcastle disease is estimated at about 57.3% of the overall annual chicken mortality whereas fowl pox, coccidiosis, and predation accounts for about 31.6%, 9.4%and 1.7% of the total annual flock mortality respectively. A survey conducted in Southern Ethiopia identified Fowl cholera followed by New Castle Disease, Coccidiosis, Fowl influenza [Infectious Bronchitis], Fowl pox, Fowl typhoid and Salmonella to be the major poultry diseases respectively (Aberra, 2007).

The general indications are that the health status of the backyard poultry production system is very poor and risky, since scavenging birds live together with people and other species of livestock. Poultry movement and droppings are very difficult to control and chickens freely roam in the compounds used by households and children. There is no practices (even means) of isolating sick birds from the household flocks and dead birds could sometimes be offered or left for either domestic or wild predators (Solomon, 2007).

2.5.2. Feed constraints

There is no purposeful feeding of chickens under the village conditions in Ethiopia and scavenging is almost the only source of diet. Scavenging feed resource base for local birds are inadequate and variable depending on season (Hoyle 1992 and Alemu and Tadelle, 1997).

The amount of feed available for scavenging in relation to the carrying capacity of the land areas and flock dynamics across the different seasons and agro ecologies is still not adequately quantified. However, studies conducted in three villages of the central highlands 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 (Tadelle and Ogle, 2000).

During the short rainy season (March to May) the percentage of seeds in the crop contents is higher at all the three study sites, probably because of the increase availability of cereal grains which had just been harvested and are given to the birds enlarger amounts than during the big rainy season and dry season of the year. The relative amounts of available plant materials are lower during the short rainy season. The mean percentage of plant materials in the crop contents is highest during the rainy season (June to September) because of the increased 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 that might be attributed to the relatively high and extended rainfall. A larger proportion of insects were also found during the short rainy seasons (Tadelle and Ogle, 2000).

The crop analysis result indicated that the physical proportion of seeds was higher in the short rainy season and the concentration of crude protein; calcium and Phosphorus were13 below the recommended requirements for egg production (Alemu and Tadelle, 1997). Both egg production and egg size vary with season, as the quality and availability of feed varies (Mbugua, 1990). According to the finding of Tadelle and Ogle (Tadelle and Ogle, 2000), the scavenging feed resource is deficient in protein, energy and probably calcium for layer birds, indicating the role of supplementation in bringing a considerable increase in egg production. There might be deliberate supplementary grain feeding during the ripening and harvesting period (October-March). The quantities of supplementation gradually decrease until June-August, during which scavenging is the only source of their feed (Alemu and Tadelle, 1997).

2.6. Importance of Village Chicken Production

The impact of village chicken in the national economy of developing countries and its role in improving the nutritional status and income of many smallholders has been very important

(FAO, 1997). According to John (1995) chicken were among the most adaptable domesticated animals and more people were directly involved in chicken production throughout the world than in any other single agricultural enterprise.

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). According to Moreki *et al* (2001), 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.

According to Alam (1997), family chicken meat & eggs were estimated to contribute 20–30% of the total animal protein supply in low-income and food-deficit countries. 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 (Alam, 1997).

Chicken provide major opportunities for increased protein production and incomes for smallholder farmers because of presence of small generation interval, high rate of productivity, the ease with which its products can be supplied to different areas, the ease with which its products can be sold due to their relatively low economic values, its minimal association of with religious taboos and its complementary role play in relation to other crop livestock activities (Muchenje *et al.,* 2000).

According to Anders (1997), some of the important factors contributing in the continuing growth of the chicken industry in many countries included: the ease and efficiency of chicken to convert vegetable protein into animal protein, the attractiveness and acceptability of its meat, their competitive cost and the relative ease with which new technologies such as, health care systems can be transferred between countries and between farmers.

2.7. Market Places of Chickens Eggs

The informal marketing of poultry and poultry products at open markets is common throughout the country and both live birds and eggs are sold on roadsides. Almost every little

shop or kiosk sells table eggs in the country. Supermarkets have taken over food supply in developed countries and are increasing their reach in the cities of the developing world. They offer the convenience of having everything under one roof, a consistent level of safety and quality and, for wealthier consumers, competitive prices (Solomon, 2008).

2.8. Chicken Egg Quality

2.8.1. Factors affecting chicken egg quality

The quality of eggs is measured externally (eggshell) and internally (yolk and albumen). The eggshell significance is related to its function to resist physical and pathogenic challenges from the external environment (Hunton, 2005). Subsequently its quality plays a key role in the economics of egg production because egg breakage accounts from 8 to 10% of total egg production causing economic losses. In addition, eggshell strength ultimately affects the soundness of the shell with weaker shells more prone to cracks and breakage and subsequently microbial contamination (Mabe, *et al.*, 2003).

Although factors associated with the management and nutrition of the hen do play a role in internal egg quality, egg handling and storage practices do have a significant impact on the quality of the egg reaching the consumer. The main factors influencing internal egg quality after the egg is laid are duration, temperature and humidity of storage, and there is a significant interaction between these factors. Unlike external (shell) quality, internal quality of the egg begins to decline as soon as the egg is laid. The yolk of a freshly laid egg is round and firm (Tadesse, 2012). However, as the egg ages and the vitelline membrane degenerates, water from the albumen moves into the yolk and gives the yolk a flattened shape. Similarly, as the egg ages and carbon dioxide is lost through the shell the content of the egg become alkaline causing the albumen to become transparent and increasingly watery. At higher temperature loss of carbon dioxide is faster and the albumen quality deteriorates faster (Benton and Brake, 2000). Cooling of eggs from the beginning of storage is therefore recommended whenever eggs are not sold and consumed within short time. Longer transportation from producer to consumer is a contributing factor for egg quality deterioration. Indigenous birds and eggs can be transported over long distances to supply urban markets which results in a deterioration in quality. Both eggs and live birds are transported on foot or

using public transportation along with other bags, sacks of grains, bundles of firewood etc (Solomon, 2008).

2.8.2. Internal egg quality

Food products from villages which are particularly advertised as natural and fresh are in the focus of consumers‟ preferences (Tugcu, 2006). Besides, the positive effects of eggs, which are not produced under suitable conditions or are not consumed, when they are not fresh can cause severe health problems. In this respect, internal and external egg quality characteristics are of high importance. When analyzed of internal egg quality characteristics, thick albumen is quite an important measure for the freshness of an egg. The longer an egg is stored the more the height of the thick albumen decreases (Toussaint, 999).

2.8.3. External egg quality

Some of the external eggs quality traits included; egg weight, egg shape index, egg shell thickness and shell color. Egg shape is important when eggs are packed in uniform trays for transportation. Abnormal shaped eggs become broken in the handling process because they do not fit in to the egg trays (Aberra, 2007). The ideal shape is defined by the relationship between the length and the width of the egg.

The eggshell is an important structure for two reasons. Firstly, it forms an embryonic chamber for the developing chick, providing mechanical protection and a controlled gas exchange medium. Secondly, it is a container for the market egg, providing protection of the contents and a unique package for a valuable food (Ashraf *et al.*, 2003). Shell quality, which is related to shell thickness, is a very important characteristic. The quality of the shell is related to hatchability. Eggs possessing strong shells hatch better than eggs with thin shells (Aberra, 2007).

Eggshell color is believed, primarily, to be a breed characteristic although there is often variation among individual hens in a particular flock even if all are of the same breed and ecotype. Though it is not a guide to egg quality, there is usually a consumer preference to either white or brown, which needs to be given a due consideration in marketing eggs.

2.9. Microbial Loads of Chicken Eggs

Eggs are one of nature's most nutritious and economical foods. To avoid contamination and food poisoning special care is needed with handling and preparing fresh eggs or egg products; frozen, liquid or dried egg products for consumption, as per the guidelines of USDA (USDA, 2013). However, before that proper practices in egg production and processing must be followed to avoid potential food borne consumer illnesses. These illnesses may arise from either chemical (toxicants) or microbial contamination of eggs.

Chemical contaminants originate from residues of either intended treatments involving veterinary drugs or feed additives, or inadvertent contaminants of environmental origin such as dioxins, furans, and polychlorobiphenyls (Jondreville, *et al*., 2011**)**.

Microbial contaminants of eggs are usually enteric bacteria, *Salmonella enteritidis* being the greatest threat. Egg contents are often suitable media for bacterial growth. Hence, risk of egg contamination by pathogenic bacteria, especially *S. enteritidis*, is a major concern for egg production and egg product manufacturing industries (Baran and Jan, 2011).

The "Code of Hygienic Practice for Eggs and Egg Products (CAC/RCP 15—1976)", adopted in 1976, revised in 2007, recommends practices for primary production, sorting, grading, storage, transport, processing, and distribution of eggs for human consumption. Overall this document deals with key aspects of hygiene in controlling and preventing contamination of eggs and egg products (FDA, 2009).Measures taken to avoid contamination of the hens include: the selection of breeding stocks for pathogen resistance; maintain a pathogen-free status in parental flocks; use systems and procedures that prevent cracked eggs; decontaminate facilities between flocks; vaccinate hens against pathogens; use pathogen-free feeds and feedstuffs; maintain pest-free facilities; facilitate gastric microbiota development to enhance passive immunity; maintain facilities favoring clean egg production. Those measures to maintain pathogen-free eggs include:- collect and cool as soon as possible and maintain in cool, clean storage; clean soiled eggs; if possible, pasteurize contaminated eggs. Having said that consumers are advised to buy eggs that have been refrigerated, clean and not cracked before processing/cooking. Especially pregnant women, babies, older adults and people with weakened immune systems should use egg products with care (Ruxton, 2013; USDA, 2013 and London and Albarellos, 2015).

3.2. Selection of Study Area and Sampling Techniques

3.2.1. Survey part

A Multi-stage sampling procedure (purposive & random) was applied for the current study; hence the study woredas (Dedo and Mana) were purposively selected based on accessibility and chicken population potential. A total of 12 (7kebeles from Dedo and 5Kebeles from Mana) were used for household selection in the study area. Prior to household selection development agents and kebeles leaders of the selected kebeles were requested to prepare register a list of household's currently rearing chicken in their respective sites in both study districts.

Then simple random sampling technique was applied to choose 23 chicken owner respondents in each of the selected kebeles by giving equal chance. Hence, a total of 276 (161 from Dedo and 115 from Mana) village chicken owner households were interviewed by using pre-tested semi-structured questionnaire.

Table 1.List of Studied Kebeles, Number of Chicken Owners Freshly Registered in Each Kebele and Number of Chicken Owners Interviewed in the Study Districts

Study districts	Names of kebeles selected	No of chicken owners freshly registered	No of chicken owners selected
Dedo	Kuno	102	23
	K/Wasabi	95	23
	Korjo	91	23
	Chalet Bulo	110	23
	O/Hidhate	100	23
	K /kedida	98	23
	Defikala	89	23
Total	7kebeles	685	161
Mana	Buture	107	23
	Harro	95	23
	G/Boseka	80	23
	Kella Guda	114	23
	Tombo Mana	94	23
Total	5kebeles	490	115
Grand total	**12Kebeles**	**1175**	**276**

Total sample size of respondents for the current study was determined by using Cochran (1977), sample size determination techniques formula where 5% sampling error was used as a standard.

$$no = \frac{Z^2 * p * q}{d^2}$$ Where

no= desired sample size

Z = standard normal deviation (1.96 for 95% confidence level)

P = 0.235 (proportion of population to be included in sample (23.5%)

q =is 1-0.235=0.765

d =is degree of accuracy desired (0.05)

n= $\frac{(1.96)^2 \times 0.235 \times 0.765}{(0.05)^2}$ = 3.8416×0.235×0.765/0.0025=**276**

Therefore, a totally 276 respondents were selected where 161 and 115 chicken owners from Dedo and Mana district were selected for survey data assessment from both districts, respectively.

3.2.2. Egg quality analysis:

Totally 800 eggs were used to analyze the internal and external quality parameters of the eggs. These eggs were collected from both of the study districts of common eggs marketing places (farm gate and local market). Four hundred eggs were collected from farm gate and local market (200 from farm gate and 200 from local market) respective to each districts making 800 egg samples from both districts. The collected eggs from both woredas of farm gate were by making special agreement with the farmers who can sale eggs if we ready to do laboratory analysis of eggs.

Table 2. List of study districts, sources of eggs and numbers of eggs sampled

Dedo		**Mana**	
Farm gate	Local market	Farm gate	Local market
200eggs	200eggs	200eggs	200eggs

3.3. Data Collection

The current study had two parts where the first part was survey designed to collect wide range of information by using semi-structured questionnaire. For the survey work, the method of data collection was through a single- visit-multiple-subject survey (ILCA, 1993). The data collected during the survey work includes the following major data categories:

Socio-economic characteristics of the respondents: (sex, age, family size, education level, marital status of respondents, religions of household and economic variables such as: - land size holding, major works of respondents and chicken flock size of respondents.

Poultry production systems: (purpose of chicken rearing, purpose of egg production, Productive and reproductive performances of local chickens)

Chickens management systems of the study areas: (Feeds and feeding system, water sources and provision system, Chicken house and housing system, health and disease management system, chicken culling system)

Constraints of village chicken production system

3.4. Egg Quality Measurement and Laboratory Analysis

The physical and microbial qualities of the egg samples were determined in laboratory at JUCAVM.

3.4.1. Egg quality measurement and analysis

3.4.1.1. External and internal qualities of chicken eggs

Egg weight- was measured by sensitive balance before breaking the eggs.

Eggshell thickness was measured by digital caliper from shell of eggs taken at three sites of an egg: broad end, middle part and narrow end after which the average was taken to be shell thickness.

Shell weight was measured by breaking an egg, carefully remove all the egg contents then measuring shell weight of each egg after that the average was taken to be shell weight.

Yolk height and albumen height were measured by tripod micrometer and Albumen height measured from a distances of 1cm from the edge of the yolk.

Yolk color was measured by roach color fun numbered from 1-9 where 1 indicates light yellow and 9 indicates deep yellow.

Albumen and yolk weight (g): - the yolk was separated from albumen by using yolk separating spoon then the weight of yolk was measured by using digital balance and the weight of albumen was calculated by egg weight –(shell weight plus yolk weight).

Egg strength: -was measured by using egg force reader

Egg width and length: -was measured by using caliper

Egg shape index: -calculated as: (egg width/egg length) *100).

Hough unit (HU): -was measured by using albumen height and egg weight calculated using the formula: HU = 100log (AH -1.7$EW^{0.37}$+7.6), (Haugh, 1937). Where; HU = Hough unit, AH = Albumen height and EW = Egg weight

3.4.2. Microbial quality analysis of egg

Twenty eggs were randomly sampled and pooled for microbial analysis from farm gates and other twenty eggs were purchased from local markets and pooled for microbial analysis from each study districts. The surface of the egg was sterilized by immersing in 70% alcohol for 2 min; air dried in a sterile chamber for 10 min and then cracked with a sterile knife. Each pooled egg contents was mixed carefully and 25 ml of the mixed egg content inoculated into 225 ml of peptone water and homogenized for 2 min with shaker. One (1) ml of homogenized egg (yolk and white together) content was used for both total aerobic bacterial counts (TABC) and total coliform count (TCC). All the media was prepared following the manufacturer's instruction and sterilized by autoclaving at 121-degree celcious for 20 minute. Standard plate counts were done on plate count agar (PCA) using the pour plate technique (De Reu *et al*., 2005).

Total aerobic bacterial and coliform count:-Add up of egg contents were determined by pooling the contents of twenty eggs from each egg marketing places (farm gate and local markets) of both study districts. Total viable count of all the egg content samples was determined by standard plate count method as described by American public health association (APHA) (Ricke *et al*., 2001).

Serial dilutions of the samples were done with peptone water (PW),1 ml from each dilution (10^{-1} to 10^{-6}) was pour plated on standard plate count agar(PCA) (Himedia, M091A, India) and violet red bile agar (VRBA) medium in duplicates for total aerobic bacterial counts (TABC) and total coliform count(TCC), respectively. The plates were then incubated at 37-degree celcious for 24-48 hours and plates with colonies from 30 to 300 were used for determining TCC and TABC (De Reu *et al.*, 2005). Colonies were measured as log colony-

forming units (CFU) per ml using number of bacteria/ml = Number of colonies on the plate *reciprocal of the dilution of the sample.

3.5. Data Analysis

Descriptive statistics such as mean, frequency and percentage were calculated and all the surveyed data were analyzed using Statistical Package for Social Sciences (SPSS) version 16 (2007). The descriptive statistics mean and standard deviation for numerical survey data were subjected to analysis of variance (ANOVA) using the general linear model procedure of SPSS. Data collected from experimental work were subjected to ANOVA using the linear model equation of Statistical Analysis System (SAS) version 9.2 (SAS, 2008).

1. **Model for survey data**

$\boldsymbol{Y_{ij} = \mu + A_i + e_{ij},}$ Where:

Y_{ij}= observation of survey data

μ = Overall mean,

Ai = the effect of i^{th} districts (i= 1-2, Dedo and Mana Woredas)

e_{ij}= Error term

2. **Model for experimental data**

$\boldsymbol{Y_{ij} = \mu + A_i + e_{ij},}$ Where:

Y_{ij}= Individual observation of egg quality

μ = Overall mean, A_i = the effect of i^{th}egg marketing place on egg quality (i= 1-2, farm gate and local market of study woredas)

e_{ij}= Error term

4. RESULT AND DISCUSSION

4.1. Socio-Economic Characteristics of the Households

The household characteristics of respondents indicated that the proportion of male respondents were higher than female in both study districts (Table 1). Accordingly, from the 276 interviewed village chicken owners of the study area, 73.6% were males and (26.4%) were females. From those about (97.8%) of the respondents were married and 2.2 % were unmarried. Regarding the age of respondents, the average age of the respondents was 42.09 years.

The survey result indicated that (92.4%) of the respondents were Muslim whereas the remaining (5.1%) and (2.5%) were Orthodox Christian and Protestants, respectively. Regarding the education level of respondents, (17%) were illiterate (uneducated), (26.8%) read and write, (24.3%) grade1-4, (20.7 %) grade5-8 and (11.2%) were above grade 9. The average percentage of uneducated households observed in this study were lower than the reported 23.3% for Gomma Woreda of Jimma zone by (Mesert, 2010) and 82.1% for North-West Ethiopia by (Halima, 2007).

The overall mean number of families per households were 7.07±3.07and 5.65±3.2, for Dedo and Mana, respectively. In addition, the current study result indicated that the average family size showed in Dedo woreda was higher than Mana Woreda. The overall average percentage of family size per household of the study woreda was 6.48±3.2.The average family size in the study woredas was higher than the national average of 5.2 persons as reported by (CSA 2003) and the reported 5.4 for North-West Amhara (Halima, 2007).

The average total land holding per household of the study woreda, used for different farming an activity, was 1.22±0.77ha. The current result was higher than the national average of 1.02 ha (EEA, 2002). However, similar with the study conducted by Feyera (2016), who reported that 1.23, in western Oromia, Ethiopia.

The major work (97.1%) of the respondents was agriculture and remaining (2.9%) of respondents engaged in both agriculture and trade in the study districts. In addition, the survey result revealed that (98.1%) respondents in Dedo woreda were more agriculture led way of

life farmers than (95.7%) respondents in Mana woreda of Jimma Zone. The average percentage of farming (agriculture) resulted on current study was lower than the reported 95.6% for Gomma Woreda Jimma zone by (Mesert, 2010).

Table 3.Socio-Economic Characteristics of the Respondents (N=276)

Parameters	Study districts					
	Dedo		Mana		Overall	
	freq	(%)	freq	(%)	Freq	(%)
Sex of the respondents						
Male	118	73.3	85	73.9	203	73.6
Female	43	26.7	30	26.1	73	26.4
Educational status of respondents						
Illiterate	29	18	18	15.7	47	17.0
Read and write	43	26.7	31	27	74	26.8
Grade(5-8)	33	20.5	24	20.9	57	20.7
Grade(1-4)	39	24.2	28	24.3	67	24.3
Grade above 9	17	10.6	14	12.2	31	11.2
Marital status of households						
Married	159	98.8	111	96.5	270	97.8
Single	2	1.2	4	3.5	6	2.2
Religion of the respondents						
Muslims	151	93.8	104	90.4	255	92.4
Orthodox	8	5	6	5.2	14	5.1
Protestants	2	1.2	5	4.3	7	2.5
Major work of the respondents						
Agriculture	158	98.1	110	95.7	268	97.1
Both agriculture & trade	3	1.9	5	4.3	8	2.9
Age of the respondents(year)		42.27±10.5		41.84±10.5		42.09±10.48
Total land holding ha(Mean+SD)		1.24±0.77		1.19±0.8		1.22±0.8
average family size/hh(Mean+SD)		7.07±3.07		5.65±3.2		6.48±3.2

4.2. Flock Size and Structure

The average chicken flock size per household and flock structure is presented in (Table 4).The average chicken flock size/household for hens, chicks, cocks, pullets and cockerels were 2.3, 1.6, 0.76, 1.1 and 0.86, respectively; with a total flock size of 6.64 chickens per household. The mean number obtained in this study was similar to the reported mean flock size of 7-10 and 5-10 chickens/household from the central highlands of Ethiopia and Africa(Tadelle and Ogle,1996a; Sonaiya ,1990b), respectively. In contrast, the mean flock size recorded in this study was lower than the mean flock size of 8.8 and 9.2 chickens/ household reported by Asefa (2007) for Awassa Zuria and by Mekonnen (2007) for Dale Wereda in Ethiopia, respectively.

On the other hand, the mean flock size recorded in this study is higher than the national (4.1) and Oromia Regional State (3.6) averages as reported by (CSA, 2003); but lower from Tigray (7.2), Gambella (7.5) and Benshangul-Gumuz (7.6) regions (CSA, 2003). The general indication is that the national average flock size reported from Ethiopia (4.1) is lower than that reported from other developing countries such as Philippines (19), Uganda (18) and Sudan (22) (Eugene, 2004; Sewannyana *et al*., 2004 and Khalafalla *et al*, 2000), respectively. The flock size variation and lower flock size in rural areas has been attributing to the farming systems practiced and prevalence of local factors such as diseases and predators (Kuit *et al.,* 1986).

The current study indicated that there was significantly ($P<0.05$) higher proportion of hens in the Mana than Dedo district (Table4). The larger proportion of hens per household in Mana district might purposively be made by the farmers to increase egg production and securing the sources of replacement flocks. In support of this explanation, Wilson *et al. (*1987) and Abdou *et al. (*1992) reported that the higher proportion of hens in the flocks is an indication of strong desire for egg and chick production. It might also be attributed to lack of strong selection and culling against the hens and build up of old and unproductive hens in the flocks. The comparatively larger number of pullets per household compared to the proportions of cockerels and cocks within both Mana and Dedo districts indigenous chicken population could be a copping mechanism to replace the number of chicken reduced by selling, consumption and loss due to different reasons.

Few cockerels and cocks were maintained in a flock for breeding purposes. The lower proportion of the cockerels and cock within the indigenous chicken population might be attributed to the selling of cockerels and cocks to earn money for miscellaneous purposes. Other than maintaining few cockerels for breeding purpose, sharing of cocks among neighbors was reported to be a breeding strategy in the community.

Table 4:-Chicken Flock Size per Household in the Study Areas (N=276)

Study districts	Chickens age group					Total flock size/hh
	Hens	Cocks	Chicks	Cockerels	Pullets	
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Dedo(N=161)	2.1±1.4[b]	0.74±0.72[a]	1.6±1.44[a]	0.84±0.84[a]	0.96±0.9[b]	6.24±5.3[b]
Mana(N=115)	2.6±1.8[a]	0.8±0.7[a]	1.54±1.4[a]	0.88±0.9[a]	1.22±1.22[a]	7.04±6[a]
Overall mean	2.3±1.6	0.76±0.71	1.59±1.43	0.86±0.88	1.1±1.1	6.64±5.65
P-value	P<0.009	NS	NS	NS	P<0.048	

4.3. Sources of Chicken Foundation in the Study Areas

Source of foundation stock of chicken are summarized in (Table 5). The major source of chicken for parent stock was market (68.5%), while family and gift accounts (19.9%) and (11.6%) for the remaining percentages, respectively. The current survey result indicated that 68.3%, 19.9% and 13% of respondents gate foundation stock of chicken from market, family and gift, respectively in Dedo Woreda and 68.7%, 20% and 11.6% of respondents' gate from market, family and gift, respectively in Mana woreda. The current study revealed that there was no difference in sources of foundation stock of chickens between Dedo and Mana woredas of Jimma Zone. This indicates that most of the households started poultry keeping with foundation chicken obtained from the market, which is followed by negnbouring families. This study was corroborated with report of Tadelle *et al., (2003),* in Ethiopia, that identifies, purchase as the main source of chickens for foundation.

Table 5.Sources Of Chicken for Foundation Stock in the Study Areas

Parameters	Study districts				Overall	
	Dedo		Mana			
	Freq	**%**	**freq**	**%**	**freq**	**%**
Sources of foundation stock of chicken						
Market	110	68.3	79	68.7	189	68.5
Family	32	19.9	23	20.0	55	19.9
Gift	19	11.8	13	11.3	32	11.6

4.4. Purpose of Rearing Village Chicken in the Study Area

The interviewed farmers reported that village chicken production in the study districts have different purposes (Table 6). Sale of chickens as source of income generation was the first purpose (56.9%) of rearing chicken in the study districts. The other purposes of village chicken rearing, in order of importance, were home consumption (16.3%), for use of egg production (14.5%), for breeding purpose (10.5%), and use of chicken for cultural and/ religious ceremonies (1.8%). The main purpose of chicken rearing for (58.4%) income generation and (11.8%) breeding/replacement/ of chicken which were higher in Dedo than Mana Woreda. The purpose of chicken rearing for egg production was higher in (18.3%) Mana than (11.8) Dedo district (Table 6)which may be attributed to the fact that more educated people are more likely to seek better nutrition than less educated counterpart and hence pay more value for these animal source food.

The current study also showed that the main purpose of rearing village chicken was for income generation, which was similar with Mesert (2010), who reported the purpose of chicken rearing in the study areas was for sale (50%), replacement (35%) and consumption (15%), showing household indigenous chicken as a source of family income in the Jimma zone, Gomma Wereda. However, the results of this study was not in line with Tadelle *et al*., (1999), who reported that 52% of the eggs produced under the Ethiopian village chicken production system was incubated in order to replace the old breeding stock.

Table 6:-Purpose of Village Chicken Rearing and Eggs Utilization in the Study Areas (N=276)

Variables	Study districts				Overall	
	Dedo		Mana			
	freq	**%**	**freq**	**%**	**Freq**	**%**
Purpose of chicken rearing						
For income generation	94	58.4	63	54.8	157	56.9
For home consumption	26	16.1	19	16.5	45	16.3
For breeding/ replacement of flock	19	11.8	10	8.7	29	10.5
Egg production	19	11.8	21	18.3	40	14.4
Cultural/ religious ceremonies	3	1.9	2	1.7	5	1.8
Purpose of egg production						
For income generation	31	19.3	23	20.2	54	19.75
For home consumption	10	6.3	8	7.2	18	6.75
For breeding/ incubation/	120	74.4	84	72.6	204	73.5

According to interviewed respondents, the use of eggs for breeding/ incubation/was the first most important (73.5%) function of eggs and remaining 19.75% and 6.75% were for income generation and home consumption, respectively, in the study districts. Also the current study indicated that the main purpose of egg at Dedo woreda was accounted as 74.4%, 19.3% and 6.3%, for breeding/ incubation/, income generation and home consumption, respectively while for Mana woreda there were 72.6%, 20.2% and 7.2%, for breeding/replacement of stock, income generation and home consumption, respectively. The current finding was similar with (Fisseha, 2009) who reported in north-west Amhara as the use of eggs for hatching/replacement was the first most important (71.7%) function of eggs.

4.5. Production Practices and Management of Village Chickens

4.5.1. Poultry housing systems

The chicken housing characteristics of respondents were presented in the (Table7). Around (19.9%) of respondents reported to have separate overnight poultry house at the Dedo and Mana woredas of Jimma zone. Among the households who have no separate poultry houses, about 32.6, 40.6, 2.5 and 4.3% of the respondents indicated that the type of chicken housing

as chicken's perch in the kitchen, family dwelling (perch inside the house, on the perch at veranda and under the basket in the house during night time, respectively.

Housing facilities in the study area included the use of baskets and cartoons placed on the bare floor of the family house. Woods and bamboos were used for construction of perches within the family houses and at veranda of their houses. About 40.6% of the respondents in the study area reported that their chickens were confined within the above listed perching areas during night time and released for scavenging early in the morning. The current survey result indicated that separate poultry house construction was better by (23.5%) in Mana district than (17.4%) in Dedo districts. This might be due to different reasons especially the chicken owners in Mana districts have given more attention (awareness) to poultry management system than in Dedo districts (Table7).

The current survey result is comparable with Feyera (2016) who reported that village chickens mainly perched within same room of family house (52.9%), separate shelter (21.2%), perch in kitchen (18.5%) and rest at night under veranda (7.4%) in the western Oromia, Ethiopia. In contrast to the current study districts situation, Halima (2007) proofed that significant size of the rural households (51%) of Northern Ethiopia had separate sheds for their chickens whereas Mekonnen (2007) reported that there was no specific separate poultry houses in Dale Wereda, implying that housing of chicken varies from place to place in the country.

Regarding reasons of no construction of chicken's house , respondents indicated that, lack of attention to village chickens by (46%), lack of construction materials by (5.1%), lack of knowledge and awareness by (21%), risk of predators by (4.7%) and fear of thieves by (3.3%) among the major reasons mentioned by chicken owner farmers in the study district (Table7). Also the study result showed that the reason of not construction of poultry house were reported as lack of attention to poultry production (47.2%), and lack of knowledge and awareness(23.0%) which were more pronounced in Dedo district than Mana district.

Table 7:-Village Chicken Housing Practices and Reason for Not Construction (N=276)

Parameters (%)	Study Districts					
	Dedo		Mana		Overall	
	Freq	%	freq	%	freq	%
Do you construct separate poultry house						
Yes	28	17.4	27	23.5	55	19.9
No	133	82.6	88	76.5	221	80.1
Type of night sheltering						
In the kitchen	53	32.9	37	32.2	90	32.6
perch inside the house	68	42.2	44	38.2	112	40.6
Under the basket in the house	7	4.3	5	4.3	12	4.3
On the perch at Brenda	5	3.1	2	1.7	7	2.5
Reason for not constructing separate poultry house						
lack of attentions to poultry	76	47.2	51	44.3	127	46.0
lack of knowledge & awareness	37	23.0	21	18.3	58	21.0
lack of construction materials	8	5.0	6	5.2	14	5.1
risk of predators	7	4.3	6	5.2	13	4.7
fear of thieves	5	3.1	4	3.5	9	3.3

4.5.2. Feeds and feeding practices of village chickens

Feed and feeding practice of village chickens in the study areas were summarized in the (Table 8). The current study indicated that farmers practiced extensive chicken management system with supplementary feeding. According to the result of this study, 95.3% respondents reported to practice scavenging system with supplementation. The current study revealed that (97.4%) farmers of Mana district provided supplementary feed to their own chickens during rainy season which was better than (93.4%) chicken owners did in Dedo districts. This may be due to the chicken owners of Mana woreda have better awareness towards chicken management.

The result of this study was comparable to that of Asefa (2007) and Mekonnen (2007) who reported 95 -98% of the household poultry producers in Awassa Zuria and Dale offer supplementary feeding to their chickens. The current study result was similar with the study done by Mesert (2010) who reported that (97.8 %) respondents reported to practice scavenging system with supplementary feeding in Gomma Woreda of Jimma Zone.

The major supplementary feed types for the chicken reported in the districts were both grains and household left over (73.9 %), grains only (13.8%) and household left over only (7.6%). In addition, the current study result indicated that Mana woreda chicken owners(75.7%) provided fairly more both gains and household leftover to their chicken than (72.7%)chicken owners of Dedo woreda. This may be due to their better awareness towards chicken management. The supplementary feed types are obviously associated with the available grain types produced by the chicken owners for family consumption.

These supplementary feeds were provided for the chickens by spreading the grain on the floor without feeder. Only 10.1% of farmers provided supplementary feed with feeder in both study districts. However, Mana woreda chickens owners were fairly better than Dedo woreda chicken owners by providing supplementary feed to their chicken with feeding trough (Table8).

The current finding is similar with the study conducted by Fisseha (2009) and Mapiye *et al.* (2005) who reported that spreading the grain on the floor, without feeder, was the major (91.4%) and the only 11.4% of village chicken growers in Rushinga district of Zimbabwe prepared feeding trough for village chicken.

Table 8:-Supplementary Feeding Practices in the Study Districts (N=276)

Parameters	Study districts					
	Dedo		Mana		Overall	
	Freq	%	freq	%	freq	%
Do you practice supplementary feeding						
Yes	151	93.8	112	97.4	263	95.3
No	10	6.2	3	2.6	13	4.7
Types of Supplementary Feed						
both grains and household leftover	117	72.7	87	75.7	204	73.9
only grains	21	13	17	14.8	38	13.8
only household left over	13	8.1	8	7.0	21	7.6
Ways of Provisions of Supplementary Feeds						
with feeder	13	8.1	15	13	28	10.1
by spreading on the floor	138	85.7	97	84.3	235	85.2
Sources of Supplementary Feeds						
from both crop harvest and purchase	59	42.8	44	42.3	103	42.6
from crop harvest	73	52.9	53	51.0	126	52.1
purchase from local market	6	4.3	7	6.7	13	5.4
Season for Supplementation of Feed						
rainy season	139	92.1	104	92.8	243	92.4
dry season	12	7.9	8	7.2	20	7.6

The current study indicated that 95.3% of chicken owners provided supplementary feed to village chicken mostly during (92.4%) rainy season and remaining (7.6%) provided during dry season. About 52.1%, 42.6% and 5.4% of those farmers obtained chicken supplementary feed from crop harvest, both from crop harvest and purchased, purchased from local market, respectively (Table8). From the study districts, Dedo woreda chicken owners (52.9%) got chicken supplementary feed more from crop harvest than Mana (51.0%) woreda. Moreover, Mana woreda chicken owners provided more supplementary feeding than Dedo during rainy season.

4.5.3. Watering practices of chickens

Watering practice of village chicken in the study was summarized in the (Table 9). The current survey result indicated that (95.7%) interviewed farmers provided water for their chickens, indicating that 12.3%, 78.6%, and 4.7% from river, pipe and rainwater, respectively. In addition, current study result showed that (96.5%) chicken owners in Mana woreda provided better watering for chicken than (95.0%) chicken owners in Dedo woreda. The current result was in line with Feyera (2016), who reported that water was supplied for birds from river (66.1%) and tape water (21.7%) in western Oromia.

Regarding watering trough used, about (73.6%) farmers provided water in plastic made materials, (12.7%) by earthen materials, and 9.4% by wooden materials. The current study result was similar with Mesert (2010) who reported that farmers used materials to provide water to chicken was any plastic made (71.2%), any wooden made materials (10.7%), stone dish (14.7%) and any broken materials (3.4%) in Gomma woreda Jimma Zone.

Table 9:-Watering Practices of Chicken in the Study Districts (N=276)

Parameters	Study districts					
	Dedo		Mana		Overall	
	freq	**%**	**Freq**	**%**	**freq**	**%**
Do you give water for your chicken						
Yes	153	95.0	111	96.5	264	95.7
No	8	5.0	4	3.5	12	4.3
Sources of water for your chicken						
Pipe water	126	78.3	91	79.1	217	78.6
River	20	12.4	14	12.2	34	12.3
Rainwater	7	4.3	6	5.2	13	4.7
Types of trough used to supply water						
Earthen made materials	20	12.4	15	13	35	12.7
Plastic made materials	118	73.3	85	73.9	203	73.6
Wooden made materials	15	9.3	11	9.6	26	9.4

4.5.4. Breeding practices of village chicken in the study districts

The specific criteria used for selecting breeds of chicken in the study area were summarized in (Table10). About (73.6%) respondents reported that they had criteria to select best chicken for breeding purpose. The criteria that were used by respondents of the study areas included; body size (weight), previous hatching history, broodiness, feather color, age of cock and breed type. Large broody hen having good previous history of hatching was preferably selected by the respondents. The criteria has scientific background since size matters for the size of the eggs to be incubated and ultimately would be hatched (Tona *et al*., 2005). Similarly, a none-broody hen could not sit on the eggs to be hatched. Sonaiya and Swan (2004) noted that the broody hen chosen for natural incubation should be large which agrees with the current finding.

Selection of breeding chickens was made on males (13.8%), females (26.4%) and both male and females (33.3%).The current study revealed that the selection of chickens for breeding was comparatively more practiced in Mana woreda than Dedo districts (Table10).

The current study showed that the specific selection criteria of hens for breeding in study districts were based on (11.9%) body size, (22.2%) large broody hens having good previous hatching history, and (12.7%) broodiness. The current survey result indicated that the specific selection criteria of male for breeding in both Dedo and Mana woreda were (1.9%)feather type, (4.7%)age of cock, (6%)breed type and (7.1%)Body(weight, height, length)& comp type in the study districts(Table10).

Table 10. Chicken Selection Practice and Interest of Households for Breeding (N=276)

Parameters	Study districts					
	Dedo		Mana		Overall	
	freq	%	freq	%	freq	%
Do you select chicken for breeding purpose						
Yes	117	72.7	86	74.8	203	73.6
No	44	27.3	29	25.2	73	26.4
Which sex do you select for breeding chicken						
Male	25	15.5	13	11.4	38	13.8
Female	38	23.6	34	30.4	73	26.4
Both male & female	54	33.5	38	33.0	92	33.3
Specific selection criteria of hens for breeding						
Body size	16	10.1	16	13.7	32	11.9
Large broody hens having good previous hatching history	33	20.5	27	23.9	60	22.2
Broodiness	18	11	16	14.4	34	12.7
Specific selection criteria of male for breeding						
Feather color	3	2.1	2	1.7	5	1.9
Breed type	13	8	5	4	18	6
Age of cock	10	6.2	4	3.1	14	4.7
Body size (weight, height, length) and comp type	15	9.1	6	5.2	20	7.1

4.5.5. Culling practices of village chicken in the area

Culling practice of village chicken in the study area was summarized in (Table11). The current survey result indicated that about 94.9% farmers have been practicing culling due to poor productivity in terms of egg (24.6%), poor growth performances (24.6%), lack of broodiness (22.5%) and sickness of the chickens (23.2%). Consumption at home (6.5%), selling (10.1%) and both selling and consumption (78.3%) of village chickens were the means of culling the undesired chicken. The current study indicated that practice of culling chicken

was due to (26.1%) Poor productivity in terms of egg and (23%) Lack of broodiness which were higher in Dedo woreda than (22.6%)Poor productivity in terms of egg and (21.7%)Lack of broodiness in Mana district. However, not difference on means of culling undesired chicken in Mana and Dedo woredas of Jimma Zone (Table11). The current culling strategies of unproductive village chicken were also reported to be practiced in western Oromia regional state (Feyera, 2016).

Table 11: - Culling Practices of Village Chicken in the Study Area (N=276)

Parameters	Study districts					
	Dedo		Dedo		Overall	
	freq	**%**	**freq**	**%**	**freq**	**%**
Do you practice culling of chickens						
Yes	153	95.0	109	94.8	262	94.9
No	8	5.0	6	5.2	14	5.1
Ways of culling chickens						
By consumption at home	11	6.8	7	6.1	18	6.5
By selling	16	9.9	12	10.4	28	10.1
Both by selling and consumption	126	78.3	90	78.3	216	78.3
Factors determine to culling of village chicken						
Poor productivity in terms of egg	42	26.1	26	22.6	68	24.6
Poor growth performances	40	24.8	28	24.3	68	24.6
Sickness of chickens	34	21.1	30	26.2	64	23.2
Lack of broodiness	37	23	25	21.7	62	22.5

4.5.6. Health and disease management in the study areas

The experience of chicken owners on chicken disease was summarized in the (Table12). About (98.2%) of village chicken owners in the study area experienced chicken disease problems in their locality. In addition, the study showed that there was no difference in experience of chicken disease problem between Dedo and Mana Woredas of Jimma zone (Table12). Discussions with the veterinarian and agricultural experts of the study districts revealed that Newcastle disease is the most frequently observed disease in the study areas.

Accordingly, the major diseases reported in the study districts in the order of their importance were 82.6% Newcastle disease (NCD), 9.8% Fowl pox, and 5.8% Coccidiosis. Consequently, Newcastle disease (NCD) was the most common and economically significant (82.6%) disease problem affecting village chicken production in the study districts (Table12).

The current study was similar with the study done by Halima (2007), who reported that the major causes of death for local chicken ecotypes in North-West Amhara were seasonal outbreaks of chicken diseases, especially Newcastle disease. Yongolo (1996) and Spradbraw (1993) also supported the argument that NCD was the most shocking disease and considered to be a major constraint to the development of both village and commercial chicken industry in Africa.

About 92.0 % of the respondents reported that there is no control of the free movement of their chicken during disease outbreaks. In addition, the current finding indicated that (8.7%) Mana woreda was better in controlling free movement of chicken than (7.5%) Dedo woreda during seasonal disease outbreak. This might be due to more awareness for chicken management in Mana woreda than Dedo woreda's chicken owners (Table7).

In the study area when disease outbreaks occur, the chicken owners take different measures which include; (42%) selling them immediately, (37.3%) treating them by themselves, (16.3%) calling veterinarians, and (4.3%) slaughtering. The current study showed that only 11.6% of the chicken owners reported disposal of died chickens in the ground. The current study revealed that (13%) chicken owners in Mana district was better in disposing of died chickens than Dedo districts (10.6%) chicken owners. Just like the current finding, Mesert (2010) reported that 91.7% of the respondents did not control the free movement of their chickens during disease outbreak and Sick birds were sold immediately or slaughtered for home consumption at Gomma woreda Jimma zone.

Chicken owners also reported that the occurrence of the poultry disease and chicken mortality were higher at the time of rainy season, mainly (19.6%) June, (60.3%) July and (18.2%) August. The current study result revealed that the occurrence of common chicken disease was high at rainy season especially July (62.3%) in Mana than July (58.3%) in Dedo woreda.

Table 12:-Most Common Chicken Diseases Symptoms and Occurrence Season (N=276**)**

Parameters	Study districts					
	Dedo		Mana		Overall	
	freq	%	freq	%	freq	%
Do you experiences chicken disease problems						
Yes	158	98.1	113	98.3	271	98.2
No	3	1.9	2	1.7	5	1.8
Most common symptoms in the area (%)						
NCD(paralysis of legs and wings, bend of the head and neck, rotating, greenish watery diarrhea	134	83.2	94	81.7	228	82.6
Fowl pox(quieter, respiratory illness)	15	9.3	12	10.4	27	9.8
Coccidiosis(diarrhea, blood mixed diarrhea)	9	5.6	7	6.1	16	5.8
Months of the year chicken disease occur						
June	30	18.8	23	20.5	54	19.6
July	94	58.5	72	62.3	166	60.3
August	34	20.8	17	15.5	51	18.1
What do you do when your chickens are sick?						
Sale them immediately	70	43.5	46	40.0	115	42.0
Treat them by themselves	60	37.3	43	37.4	103	37.3
Call to veterinarians	24	14.9	21	18.3	45	16.3
Slaughter them for home consumption	7	4.3	5	4.3	13	4.3
Do you control free movement of chicken during disease outbreak						
Yes	12	7.5	10	8.7	22	8.0
No	149	92.5	105	91.3	254	92.0
What do you do when your birds are died						
Simply remove out of the house	144	89.4	100	87.0	244	88.4
Dispose in the ground	17	10.6	15	13	32	11.6

4.5.7. Labor division for poultry activity

Share of labor for poultry activities were summarized in the (Table13).The current study indicated that 61.2% poultry house construction was reported to be under taken by men, 71.0% of poultry house cleaning was done by women, 56.2% of feeding and watering of village chicken was done by women, and 62.3% treating of sick chickens responsibility was done by husbands. Cleaning poultry house (71.0%) and feeding and watering of village chicken (56.2%) in the study area were dominated by women. The study revealed that the labor share of family members live in both Dedo and Mana woredas were not difference except around (63.5%) men in Mana woreda were more responsible to treat sick chicken than (61.5%)men in Dedo woreda.

The current survey result was similar with the study done by Fayera (2016) who reported that women undertook local chicken feeding and watering by 58.2% and 61.8% house constructions responsible was operated by husbands in Western Oromia, Ethiopia. The current study result was in line with (Abubakar *et al.* (2007) who reported that women and children contribution were by far the highest on village flock's management labor profile activities included; sheltering birds (shut down and let out), cleaning bird's house, feeding and watering of birds in some parts of Nigeria and Cameroon. The current survey was comparable with study done by Mapiye *et al.* (2005) who reported that women, in Rushinga district of Zimbabwe, were dominated in most of the activities on village chicken production like; feeding (37.7%), watering (51.2%) and cleaning of bird's house (37.2%) where as men were dominant in shelter constructions (60%) and treatment of chickens (40%).

Table 13:-Household Labor Share for Chicken Farming Activities in the Study Areas (N=276)

Family members(variables)	Study districts					
	Dedo		Mana		Overall	
	freq	**%**	**freq**	**%**	**freq**	**%**
Responsibility of Chicken house construction						
Men	98	60.9	71	61.7	169	61.2
Women	14	8.7	11	9.6	25	9.1
Children	30	18.6	19	16.5	49	17.8
All member of the family	19	11.8	14	12.2	33	12.0
Responsibility of Cleaning of chicken house						
Women	114	70.8	82	71.3	196	71.0
Children	22	13.7	16	13.9	38	13.8
Both women & children	25	15.5	17	14.8	42	15.2
Responsibility of Feeding & watering of chicken						
Men	6	3.7	5	4.3	11	4.0
Women	90	55.9	65	56.5	155	56.2
Children	65	40.4	45	39.1	110	39.9
Responsibility to treat sick chickens						
Men	99	61.5	73	63.5	172	62.3
Women	49	30.4	34	29.6	83	30.1
Children	13	8.1	8	7.0	21	7.6

4.6. Reproductive and Production Performance of Village Chickens

4.6.1. Age at sexual maturity

Ages at sexual maturity of the village chickens in the study area were summarized in the (Table14). On average, mean sexual maturity of village chicken at the study districts were 6.18±1.15 and 5.99±1.14 months for male and females, respectively. The current study result indicated that the average age of cockerels and pullets at first mating in Dedo were 6.32 and

6.1 months, respectively and in Mana woreda, the average age of cockerels and pullets at first mating were 5.98 and 5.83 months, respectively. The result revealed that there was significance difference (P<0.05) on the average age of cockerels and pullets at first mating which was lower in Mana woreda than Dedo district.

The current finding was similar with Addisu *et al.* (2013) who reported that the overall mean age of sexual maturity were 24.25±0.04 and 23.84±0.05 weeks for male and female chicken, respectively in North Wollo district. However, the current study was not in line with Mesert (2010) who reported that overall mean age at sexual maturity were 6.47±0.91 and 6.33±0.80 months for males and females, respectively in Gomma woreda of Jimma zone, Ethiopia.

4.6.2. Age at first egg laying

The current study indicated that the overall mean age at first egg laying was 6.24±1.16 (Table14). The study result indicated that there was significantly (P<0.05) higher on (6.28months) average mean age of local pullets first lay egg in Dedo woreda than (6.18months) Mana woreda. This result was in line with the findings of Mesert (2010) who reported that mean sexual maturity expressed in terms of age at first egg was reported to be 6.33±0.80 months in Gomma woreda Jimma Zone, Ethiopia. However, the current study result was not in line with the finding of Addisu *et al.* (2013) and Tadelle *et al*. (2003) who reported that the age at first egg laying for female chicken ecotypes was 25.97±0.04 weeks in North Wollo district and the mean age at first egg laying of indigenous hens in different part of Ethiopia was 27.2 weeks.

4.6.3. Egg production performance

The current survey result indicated that the overall total mean egg laid per hen per year was 47.27±11.8 and 12.77±3.44 eggs/hen/clutch in both districts. In addition the current study showed the average number of eggs laid/hen/year and average number of eggs laid/hen/clutch in Dedo were 45.6 and 12.5eggs , respectively and in Mana woreda, were reported to be 49.6 and 13.2eggs, respectively. The result revealed that there was significantly higher (P<0.05) on the average number of eggs laid/hen/year and average number of eggs laid/hen/clutch in Mana woreda than Dedo district. The average number of clutches per hen per year recorded in study districts was 3.82.

This result is similar to Addisu *et al(*2013) who reported that the average numbers of egg production/hen/ clutch and mean annual egg production/hen/year were 12.64±0.1 and 49.51±0.38, respectively, in North Wollo districts. The average number of eggs/hen/clutch which was reported from study area by (12.77) is similar to the national average (12) as reported by CSA (2003). Different reports in different site showed that the quantitative traits performance of local chicken is varied because of genotype (additive and dominant) and environmental effect which produced 18-57eggs/year/hen (Halima, 2007) at North West Amhara, 10.05±0.15egg/cultch (Fisseha, 2009) at Bure district and the other recent study reported that local chicken eggs laid ranges from 53-60 egg/hen/year (Fisseha *et al.*, 2010) at North-West Ethiopia.

Table 14:-Reproductive and Productive Performances of Village Chickens (N=276)

Parameters	Study districts		
	Dedo	Mana	Overall
	(Mean ±SD)	(Mean ±SD)	(Mean ±SD)
Average age of cockerels at 1st mating(month)	6.32±1.0	5.98±1.26	6.18±1.14
Average age of pullets at 1st mating(month)	6.1±1.0	5.83±1.25	5.99±1.14
Age of pullets at 1st lay eggs(month)	6.28±1.2	6.18±1.0	6.24±1.16
Average number of eggs laid/hen/clutch	12.5±3.4	13.12±3.6	12.77±3.44
Total number of eggs laid/hen/year	45.6±10.88	49.57±12.6	47.27±11.8
Average number of clutch/hen/year	3.86±0.43	3.77±0.5	3.82±0.48
Average number of days/clutch	18.26±3.6	19.1±5	18.6±4.24

4.7. Constraint of Village Chicken Production and Controlling Mechanisms

Major constraints of chicken production in the study area were briefed in the (Table15). The overall chicken disease incidence in both districts was 39.1%, which was the major and economically important constraint for the existing village chicken production system resulting in reduction in number and productivity of village chickens. The current study revealed that the major cause of chicken death/loss in the study area was (86.6%) chicken diseases. According to interviewed chicken owners, mortality of village chickens due to chicken

disease was usually higher during the rainy season, mainly on July (60.3%), June (19.6%) and August (18.2%). In addition to occurrence of village chicken disease, (23%) predation was the other economically important constraint for village chicken production system of the study districts (Table15). The current result was in line with Halima (2007) who reported that predation was one of the major village chicken production constraints in North-West Ethiopia.

According to village chicken owners, wild bird (locally called *"Culullee")* was the first major and dangerous type of predators (59.8%) affecting village chicken in the study area. In addition to wild birds, Aner (locally called "*Qeeransa"*) *by* (22.1%) and wild cats (locally called "*warroo*") by (18.1%) were the other economically main predators affecting village chicken production in the study districts (Table15). This study is in line with (Halima, 2007); Fisseha *et al.,* 2010a) findings, which stated that predators were the major constraints in village chicken production, of which, wild birds (chilfit) were the first major and dangerous types of predators followed by "Aner" and wildcat in the Bure Woreda, North-West Amhara.

According to interviewed chicken owners, keeping chickens at home by providing feed and water (19.9%) and killing predators using toxins, dog and other materials (69.2%) were the most favored control mechanisms of predators (Table15). This study result supported by study finding of Feyera (2016) who reported that chicken predators were controlled by different mechanism such as keeping indoors, rearing surroundings, chasing by dogs, cleaning in home holes in Western Oromia, Ethiopia.

In addition, accounted to (23%) limitation on awareness for improved chicken management system (housing, feeding and health care) was the other recorded constraints of village chicken production system in the Dedo and Mana woredas of Jimma Zone. On the other hand, (10.6%) poor productive performance of village chickens recorded in the study districts were also one of the constraint for chicken production.

Table 15:-Constraints of Chicken Production, Cause for Chicken Loss, Type of Predators and Control Mechanisms (N=276)

Parameters	Study districts					
	Dedo		Mana		Overall	
	freq	%	freq	%	freq	%
Constraints of chicken production						
Disease	62	38.2	46	40	108	39.1
Lack of awareness	38	23.6	26	22.5	64	23
Predators	19	12	15	13.2	34	12.6
Poor productive performance	18	11.2	11	9.9	29	10.6
Lack of improved chicken breeds	24	15	17	14.4	41	14.7
Major cause of chicken loss in the area						
Disease(chicken disease)	138	85.7	101	87.8	239	86.6
Predators (predation)	23	14.3	14	12.2	37	13.4
Main chicken predators in the area						
Wild birds(Cululle)	14	59.0	9	60.9	23	59.8
Aner(Qeeransa)	5	22.4	3	21.7	8	22.1
Wild cat(warroo)	4	18.6	2	17.4	6	18.1
Predators controlling mechanisms in the areas						
killing predators using dog, toxins &materials	113	70.2	78	67.8	191	69.2
by making poultry house & giving feed & water	28	17.4	27	23.5	55	19.9
killing predators by making association	20	12.4	10	8.7	30	10.9

4.8. Evaluation of Internal and External Qualities Eggs

The result of the current study showed that the average strengths of eggs collected from Dedo and Mana woreda were 3.85kg and 3.6kg, respectively. The average weight of the eggs sampled from Dedo and Mana woredas of Jimma Zone were 44.2g and 48g, respectively. The mean width and length of eggs collected from different sources of Dedo and Mana were 37mm, 52mm, 39mm and 51.9mm, respectively. As far as shell thickness of eggs is concerned, 56.8mm and 56.7mm were recorded from Dedo and Mana, respectively.

The current study result indicated that the average Hough unit of eggs collected from different sources of Dedo and Mana were 70.21 and 70.8, respectively. Of all the internal and external egg quality characteristics, thick albumen is quite an important measure for the freshness of an egg. The longer an egg is stored and exposed to sunlight, the lower the height of the thick albumen could be (Toussaint and Latshaw, 1999). The result of the current study showed that the average albumen height of eggs collected from common egg marketing places of Dedo and Mana districts were 4.4 and 4.5mm, respectively. Except shell thickness and yolk color, the rest of egg quality parameters showed significant variation ($p<0.05$) between the study districts. Eggs sampled from Mana district were of superior quality than those of Dedo district which might be attributed to management difference between the study districts.

Table 16. External and Internal Qualities of Village Chicken Eggs Collected From Study Woredas (N=800)

Parameters	Study districts		
	Dedo	Mana	Overall
	Mean ±SD	Mean ±SD	Mean ±SD
Egg weight(g)	44.2±5.4[b]	48±8.9[a]	46.1±8
Shell weight(g)	5.4±0.7[a]	5.2±0.9[b]	5.3±0.8
Shell thickness from middle(mm)	59±0.2[a]	58.9±0.2[a]	57.5±0.2
Shell thickness from broad end(mm)	57.9±0.2[a]	56.7±0.2[a]	56.7±0.2
Shell thickness from narrow end(mm)	53.5±0.2[a]	53.5±0.2[a]	53.5±0.2
Average shell thickness(mm)	56.8±0.2[a]	56.7±0.2[a]	56.7±0.2
Hough unit	70.2[b]	70.8[a]	70.5
Albumen height(mm)	4.3±1.2[b]	4.6±1.5[a]	4.46±1.4
Albumen weight(g)	23.2±3.7[b]	28.1±7[a]	25.7±6
Yolk weight(g)	15.5±2.3[b]	16.8±2.8[a]	16.1±2.7
Yolk color	8.1[a]	8.12[a]	8.1
Yolk height(mm)	15.4±2[b]	16±2[a]	15.7±2
Egg strength(kg)	3.85±0.8[a]	3.6±1[b]	38±0.9
Egg length(mm)	52±0.2[a]	51.9±0.4[a]	52±0.3
Egg width (mm)	370.2[b]	39±0.3[a]	38.4±0.2

[a,b], means within a raw with different superscript differ significantly ($P<0.05$)

The current study result showed that the average weight of eggs collected from farm gate and local market was 46.1±8. The average albumen height of eggs collected from farm gate and local market were 4.6±1.5 and 4.26±1.2mm, respectively and the average yolk height of eggs collected from farm gate and local markets were 15.9±1.6 and 15.4±1.9, respectively. The average Hough unit calculated from the eggs purchased from farm gate and local markets of the study districts was 70.8. The current study result revealed that the average Hough units calculated from eggs purchased farm gate and local markets of the study districts were 72 and 69.6, respectively.

The current study result was similar with the study done by Teketel (1986) who reported an average egg weight of 46g for Ethiopian local breed chicken. The average Hough unit value obtained from this study was higher than the reported 61.1 by Halima (2007) for eggs collected from local chicken ecotypes of North-West Amhara and lower than the reported 81.0, by the same author for eggs collected from intensively managed RIR chicken breeds. Asuquo *et al*. (1992) also reported higher Hough unit values of 79.8 and 89.9 for eggs collected from Nigerian local hens and Isa-Brown chicken breeds, respectively.

In the current study, significant variation was declared between market places in terms of egg weight, albumen height, albumen weight, yolk height, yolk weight and Hough unit. Eggs collected from open market were found to be of inferior quality than eggs collected from farm gate, which may be due to various factors. According to Samli *et al* (2005), most of changes in egg quality in terms of albumen height, HU and yolk index, could be attributed to water loss by evaporation through the pores in the shell and the run off of carbon dioxide from albumen, the net effect of which results in progressive loss in egg weight and a continual decline in egg quality. Egg length, egg width, shell weight and yolk color showed no difference between the two sources of eggs for the current research indicating that these parameters are not influenced by the places considered in here.

Table 17. External and Internal Qualities of Village Chicken Egg collected from different Market Sources (N=800)

Variables	Source of eggs (Dedo)		Source of eggs(Mana)		Average of Markets	Average of farm gates	Overall (N=800)
	Market (N=200)	Farm gate(N=200)	Market(N= 200)	Farm gate (N=200)			
	Mean±SD	**Mean±SD**	**Mean±SD**	**Mean±SD**	**Mean±SD**	**Mean±SD**	**Mean±SD**
External quality							
Egg Strength (kg)	3.5±0.6	4±0.8	3.46±0.92	3.9±1.12	3.5±0.77[a]	4.1±0.9[b]	3.77±0.9
Egg weight (g)	42.4±5.5	46.8±4.5	45.8±8	50 ±7	44.1±7.12[a]	48.1±7[b]	46.1±8
Shell weight (g)	5.3±0.64	5.4±0.74	5.2±0.94	5.28±0.57	5.27±0.8[a]	5.3±0.77[a]	5.3±0.9
Shell thickness (mm)	57±0.15	57.6±0.15	56.7±0.15	57±0.16	56±0.16[a]	57±0.16[a]	57±0.15
From narrow end(mm)	55±0.15	55±0.15	54±0.15	55±0.15	55±0.15[a]	56±0.15[a]	55±0.15
From middle part(mm)	59±0.16	6±0.16	59±0.16	59±0.16	59±0.17[a]	59±0.17[a]	59±0.16
From broad end (mm)	57±0.15	0.58±0.15	0.57±15	58±0.16	58±0.16[a]	58±0.16[a]	58±0.15
SI (%)	72.8	73	74.95	75.2	73.84[a]	73.84[a]	73.84
Egg width(mm)	37.9±0.2	38±0.2	38.9±0.27	39±0.27	38.1±0.25[a]	38.±0.2[a]	38.4±0.25
Egg length(mm)	52±0.18	52±0.2	51.9±0.43	51.8±0.38	52±0.3[a]	52±0.3[a]	52±0.3
Internal egg quality							
Albumen weight (g)	21.9±3.2	24.6±3.6	25.44±7.29	30.86±5.5	23.6±5.9[a]	27.7±5[b]	25.7±6
Albumen height (mm)	4±0.93	4.7±1.3	4.42±1.33	4.6±1.6	4.26±1.2[a]	4.6±1.5[b]	4.4±1.3
Yolk weight (g)	14.9±2.4	15.89±2	14.97±2.3	18.5±2.1	14.9±2.4[a]	17.2±2.4[b]	16±2.7
Yolk height (mm)	14.8±2.2	15.95±1.3	15.844±1.84	16.04±1.4	15.4±1.9[a]	15.89±1.6[b]	15.6±1.8
Yolk color	8.12±0.89	8.12±0.89	8.11±0.93	8.12±0.93	8.11±9[a]	8.11±9[a]	8.12±0.9
Hough unit	68.12	72.3	70	71.6	69.6[a]	72[b]	70.8

[a, b] least square means with different superscript with in a raw are significantly different at (P <0.05

Table 18. The egg quality parameters interacting between woredas and egg marketing places

Districts	Sources of egg	EW	SW	SE	MP	BE	AH	AW	YC	YH	YW	EST	EL	Ewd
Dedo	Market	42.3^{c}	5.3^{b}	0.529^{a}	0.59^{a}	0.58^{a}	4.1^{b}	21.9^{c}	8.1^{a}	14.8^{b}	14.9^{c}	3.5^{b}	52.7^{a}	3.79^{b}
	Farm gate	46^{b}	5.6^{a}	0.53^{a}	0.59^{a}	0.58^{a}	4.6^{a}	24.6^{b}	8.1^{a}	15.9^{a}	15.89^{b}	4.2^{a}	52.6^{a}	3.8^{b}
Mana	Market	45.8^{b}	5.28^{b}	0.53^{a}	0.59^{a}	0.58^{a}	4.47^{a}	25.4^{b}	8.1^{a}	15.7^{a}	14.97^{c}	3.5^{b}	52.1^{b}	3.9^{a}
	Farm gate	55.5^{a}	5.28^{b}	0.528^{a}	0.59^{a}	0.58^{a}	4.6^{a}	30.9^{a}	8.12^{a}	15.8^{a}	18.5^{a}	3.9^{a}	51.9^{b}	3.89^{a}
P value		<0.0001	<.0001	NS	NS	NS	<0.0003	<0.001	NS	<0.001	<0.0001	<0.0001	<0.03	<0.001

Means within a column with different superscript differ significantly (P<0.05), EW=egg weight, SW= shell weight, NE=shell thickness from narrow end, MP= shell thickness from middle part, BE=shell thickness from broad end, AH= albumen height, AW= Albumen weight, YW=yolk weight, YH= yolk height, EST= egg break strength, EL=egg length and Ewd= egg width.

As shown in the Table 18, the interaction between wereda and marketing places show that , significantly heavier (P<0.0001) egg weight was recorded from eggs collected from farm gate of Mana woreda (55.5g) while significantly lower (P<0.0001) egg weight recorded from eggs collected from local market of the Dedo district (42.3g) compared to all the others. The eggs sampled from farm gate of Dedo woreda had significantly heavier shell weight (5.6g) than all the other combinations (Table18). The eggs collected from local markets of Dedo woreda had significantly lower (P<0.0003) albumen height (4.1mm) than all the other combinations (Table18). This might be due to the fact that eggs were often sold at local markets of Dedo woreda was more exposed to sun light during marketing time of eggs.

The eggs sampled from farm gate of Mana woreda was significantly heavier (P<0.0001) in albumen weight (30.86g) while significantly lower (P<0.0001) albumen weight was recorded from eggs collected from local market of the Dedo district (21.9g) compared to all the others (Table18). The eggs collected from local market of Dedo woreda was significantly lower (p<0.0001) in yolk height (14.8mm) than all the other combinations. The eggs sampled from the local markets of Dedo and Mana woredas were significantly (p<0.0001) lower in yolk weight than eggs collected from farm gate of Dedo and Mana woredas of Jimma zone. Significantly heavier (P<0.0001) egg strength was recorded from eggs collected from farm gate of Mana (3.9kg) and Dedo woredas (4.17kg) compared to all others (Table18). The eggs collected from the common egg marketing places of Dedo woreda and Mana woreda were significantly different in egg length and width (Table18). This might be due to the availability of different breeds of chicken in both study districts that affect the size of eggs.

4.9. Microbial Quality Analysis of Egg

The result of microbial growth on all samples of pooled eggs from which the egg contents were cultured belonging to all common egg marketing places (farm gate and local markets) of Dedo and Mana woredas of Jimma Zone was presented in (Table 19). The average mean of total aerobic bacteria count (TABC) from eggs sampled from farm gate and local market of the study areas were 2.62 and 2.9$\log_{10}$CFU/ml, respectively and the average mean of total coliform count from farm gate and local market were 2.59and 2.86$\log_{10}$CFU/ml, respectively. There were no significant (P<0.05) difference in average total aerobic count and coliform counts between eggs sampled from local markets and farm gates of the study woredas (Table19).

The current study result was lower in average mean total aerobic and total coliform count than the study done by Senbeta, *et a l*(2015), who reported that the average TABC and TCC in retail eggs were 5.378, 5.596 and 5.597$\log_{10}$CFU/ml of TABC and 5.296, 5.511 and 5.487log10CFU/ml total coliform count in eggs of Haramaya, Harar and Dire Dawa, Eastern Ethiopia, respectively. This might be due to the fact that the eggs sampled from the retailers were contaminated by different microbes due to different reasons. On the other hand, the current average mean of TABC and TCC were higher in the average mean of 1.226log10CFU/ml of TABC and 1.234log10CFU/ml of TCC in Haramaya university poultry farm eggs, which was reported by (Senbeta, *et al*(2015)), at Eastern

Ethiopia. This might be due to the sampled eggs from intensive poultry farm where the microbial contaminations of chicken eggs were less than the other.

The greater incidence of total aerobic bacterial count and total coliform counts in eggs collected from local markets of the study districts could be attributed to unhygienic conditions in the market places that predispose the eggs to contamination and absence of standard storage and transporting facilities that increase eggs cracking which in turn facilitates microbial entrance to the contents.

This agrees with the report of USDA (2006) that microorganisms can be found inside egg content; may be due to the fact that the egg emerges from the hen's body through the same passageway where feces is excreted and fecal contamination through the pores on the shell after they are laid. Similarly, Bruce and Drysdale (1994) reported that microorganisms inside an uncracked or whole egg might be due to the presence of pathogens within the hen's ovary or oviduct before the shell forms around the yolk and albumin.

The current study result showed that the average total aerobic bacterial count and total coliform count for egg contents collected from the common egg marketing places of Dedo and Mana Woredas of Jimma Zone were less than the accepted 6.0 $\log_{10}$CFU/ml, recommended by the International Commission on the Microbiological Specification for Food (ICMSF, 1998). But the result suggests that eggs purchased from the markets of Dedo and Mana woredas must be consumed with care and it was concluded that the chicken eggs purchased from local markets of the study districts should not be consumed raw. Because, the consumption of 7-21 days old eggs without proper cooking increases the probability of occurrence of health problems (Obi and Igbokwe, 2007).

Table 19.Microbial Qualities of Eggs in the Study Area (log_{10} CFU/ml)(N=80)

Variables	Sources of the eggs were used to study				Average mean (local market)	Average mean (farm gate)	Overall
	local market of (Dedo)	Farm gate of Dedo	Local market of Mana	Farm gate of Mana			
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
TABC	2.92±0.24 (Range2.5-3.3)	2.69±0.39 (Range 2.2-3)	2.88±0.27 (range 2.4-3.3)	2.56±0.24 (range 2.2-2.95)	2.9±0.26[a] (Range 2.5-3.3)	2.62±0.27[a] (Range2.2-2.95)	2.76±0.27
TCC	2.9±0.3 Range (2.5-3.5)	2.6±0.29 (range 2.2-3)	2.83±0.34 range (2.3-3.4)	2.58±0.3 range (2.2-3)	2.86±0.3[a] Range (2.4-3.45)	2.59±0.3[a] Range (2.2-3)	2.72±0.3

[a, b] least square means with different superscript with in a raw are significantly different at ($P < 0.05$), TABC=total aerobic bacterial count, TCC=total coliform count.

5. CONCLUSION AND RECOMMENDATIONS

The results of the study showed that the dominant chicken production system of the Dedo and Mana districts were scavenging with seasonal/conditional feed supplementation. The average flock size per household in Dedo and Mana woreda were 6.24 and 7.04, respectively, with overall average mean of (6.64±5.7) chickens per household. The main purpose of chicken rearing in the study districts were as source of (56.9%)income generation and the other purposes of chicken rearing in the study area were (16.3%)home consumption, 14.5% egg production, 10.5% for breeding/hatching and use for (1.8%)cultural/religious ceremonies.

The only 19.9% of village chicken owners constructed separate poultry for their chickens in the Dedo and Mana woredas of the Jimma zone. Lack of attention to village chickens was the major reason (46%) for not constructing a separate chicken house. The other reasons indicated were lack of knowledge and awareness(21%), lack of house construction materials(5.1), risk of predators(4.7%) and (3.3%)fear of thieves.

The average ages of local cockerels at first mating and pullets at first egg lay reported in the study areas were 6.18months and 6.24months, respectively. The average number of eggs laid per clutch of local hens was 13 and the number of total clutch periods/hen/year was 3.82. The mean annual egg production of local hens under the farmer's management condition in the study woredas was 47 eggs.

Women involved in different village chicken production activities like; cleaning chicken house (71%) and feeding and watering of chickens (56.2%). Children alone and together with other family members were also found participated in various village chicken production activities like; cleaning of chicken house, construction of chicken house, provision of supplementary feed and water to village chickens in the study districts. Men on the other hand, were mostly in shelter construction (61.2%) and taking sick birds to get treatment (62.3%).

Regarding to external quality of eggs, the average weight of eggs and shell weight of eggs collected from the common egg marketing places of study districts was 46.1±8g and 5.6g, respectively. The average weight of eggs collected from the (48.1g) farm gate was significantly heavier than egg weight collected from (44.1g) local markets of the study districts.

Based on the result of this study, the average values of almost all parameters of egg quality evaluation eggs purchased from farm gate was better in egg quality than that of eggs purchased from local market of the study area (Table16) indicating quality deterioration as a result of longer period of storage, long distance of transportation, exposure of eggs to sun light during marketing time at local markets of the study districts.

The microbial analysis of eggs collected from the local market and farm gate of the study districts were contaminated with different bacteria. But, there was no significant difference in contamination of bacteria between eggs purchased from local markets and farm gates of study areas.

Based on the current study results the following recommendations are suggested;-For the existing village chicken production system of the study areas, village chickens are preferred and their productivity could be enhanced by relatively simple changes in management interventions such as:-

- ✓ There is need for appropriate intervention in constructions of separate poultry houses, diseases and predator control activities to reduce chicken mortality and improve productivity of village flocks of the study woredas.
- ✓ In addition, improvement in feed and feeding systems should be the other areas of intervention. Provision of proper trainings to chicken producers on importance of feeding chickens.
- ✓ Also, the current study on effect of marketing places on village chicken eggs in study areas indicated that the marketable eggs were relatively poor in quality. Therefore, interventions focused on the quality and safety issues of chicken eggs should be paid much attention by the producer and retailers through exchange of eggs immediately and handling properly

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7. APPENDIXES

APPENDIX 7. 1. ANOVA TABLES

Table 7.1. 1.Chicken flock size per household in Dedo and Mana districts (N=276)

Flock structure	Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Number of hens	Between Groups	17.064	1	17.064	6.870	.009
	Within Groups	680.574	274	2.484		
	Total	697.638	275			
Number of pullets	Between Groups	4.350	1	4.350	3.930	.048
	Within Groups	303.342	274	1.107		
	Total	307.692	275			
Number of cocks	Between Groups	.183	1	.183	.357	.551
	Within Groups	140.035	274	.511		
	Total	140.217	275			
Number of chicks	Between Groups	.598	1	.598	.293	.589
	Within Groups	559.953	274	2.044		
	Total	560.551	275			
Number of cockerels	Between Groups	.106	1	.106	.136	.713
	Within Groups	214.097	274	.781		
	Total	214.203	275			

Table7.1. 1.Average age of Village pullets at 1st mating in farmers management (months) in the study areas

Sources of variation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.308	1	4.308	3.297	.070
Within Groups	357.996	274	1.307		
Total	362.304	275			

Table7.1. 2.Average age of Village cockerels at first mating in farmers management (months) in the study areas

Sources of variations	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7.491	1	7.491	5.785	.017
Within Groups	354.810	274	1.295		
Total	362.301	275			

Table7.1. 3.Average age of your pullets at first egg in Farmers management in the study districts

Sources of variations	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.713	1	.713	.670	.414
Within Groups	291.522	274	1.064		
Total	292.236	275			

Table7.1. 4. Average number of eggs lay per clutch per hen in study districts

Sources of variations	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	24.150	1	24.150	2.043	.154
Within Groups	3238.470	274	11.819		
Total	3262.620	275			

Table7.1. 5. Average number of eggs /hen/year in the study districts

Sources of variations	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1060.041	1	1060.041	7.836	.005
Within Groups	37067.205	274	135.282		
Total	38127.246	275			

Table7.1. 6. Average weight of eggs collected from local market and farm gate of the study districts

Sources of variations	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	9013.277	1	9013.277	166.9	.000
Within Groups	43091.522	798	53.999		
Total	52104.799	799			

Table7.1. 7. Average albumen height of eggs collected from local market and farm gate of study districts

Sources of variations	Sum of Squares	df	Mean square	F	Sig.
Between Groups	22.579	1	22.579	11.755	.001
Within Groups	1532.848	798	1.921		
Total	1555.428	799			

Table7.1. 8. Average yolk weight of eggs collected from local market and farm gate

Sources of variations	Sum of squares	df	Mean Square	F	Sig.
Between Groups	343.194	1	343.194	51.743	.000
Within Groups	5292.909	798	6.633		
Total	5636.102	799			

Table7.1. 9. Average Yolk color of eggs collected from local market and farm gate of study districts

Sources of variations	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.000	1	2.000	.000	1.000
Within Groups	698.320	798	.875		
Total	698.320	799			

Table 7.1. 10. Average yolk height of eggs collected from local market and farm gate of study districts

Sources of variations	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	61.938	1	61.938	19.434	.000
Within Groups	2543.256	798	3.187		
Total	2605.194	799			

Table7.1 11. Egg quality evaluation between Dedo & Mana districts

Sources of variations		Sum of Squares	df	Mean Square	F	Sig.
egg weight * study districts	Between Groups	8424.929	1	8424.929	153.917	.000
	Within Groups	43679.870	798	54.737		
	Total	52104.799	799			
shell weight of egg * study districts	Between Groups	8.736	1	8.736	12.377	.000
	Within Groups	563.249	798	.706		
	Total	571.985	799			
Albumen height * study districts	Between Groups	4.061	1	4.061	2.089	.149
	Within Groups	1551.366	798	1.944		
	Total	1555.428	799			
Albumen weight * study districts	Between Groups	4793.967	1	4793.967	151.345	.000
	Within Groups	25277.250	798	31.676		

	Total	30071.217	799			
Yolk weight * study districts	Between Groups	343.194	1	343.194	51.743	.000
	Within Groups	5292.909	798	6.633		
	Total	5636.102	799			
Yolk color * study districts	Between Groups	.000	1	.000	.000	1.000
	Within Groups	698.320	798	.875		
	Total	698.320	799			
yolk height * study districts	Between Groups	61.938	1	61.938	19.434	.000
	Within Groups	2543.256	798	3.187		
	Total	2605.194	799			
egg strength * study districts	Between Groups	5.156	1	5.156	6.161	.013
	Within Groups	667.864	798	.837		
	Total	673.020	799			
Length of egg * study districts	Between Groups	.387	1	.387	3.710	.054
	Within Groups	83.280	798	.104		
	Total	83.667	799			
width of an egg * study districts	Between Groups	1.960	1	1.960	32.565	.000
	Within Groups	48.035	798	.060		
	Total	49.995	799			

Table7.1. 12. Microbial quality analysis of Egg sampled from farm gate and local markets

Sources of variations		Sum of Squares	df	Mean Square	F	Sig.
TABC * sources of eggs	Between Groups	.324	3	.108	1.51	.262
	Within Groups	.856	12	.071		
	Total	1.180	15			
TCC * sources of eggs	Between Groups	.288	3	.096	.975	.437
	Within Groups	1.180	12	.098		
	Total	1.467	15			

Appendix 7. 1. Research Questionnaire

Questionnaire for the Assessment of village chicken Production System and Evaluation of Egg Quality in Dedo and Mana districts of Jimma Zone, South West Ethiopia

General information

Farmer's Name---------- District (woreda) ----------*Kebele*-----

Enumerator's Name----------signature _____Date----------

Agro-ecology a. Midland b. lowland c. highland

II. *Socio- economic characteristics of the respondents*

1. Name of the **respondents**----------
2. Sex of the respondent 1. Male 2. Female
3. Age of the respondent _____
4. Major occupation (work) ----------
5. Educational level of the respondent1. Illiterate 2. Read & write 3. grade (1 –4) 4. grade (5 –8) 5. grade (9-12) 6. above 12
6. Religion of household 1. Orthodox 2. Muslim 3. Protestant 4. Other, specify
7. Marital status: 1. Married 2. Single
8. Total family size _____
9. Total farmland size _____
10. Major crops grown in the area 1st. ---------- 2nd. ---------- 3rd. ---------- 4th. -----
11. Flock size and structure

No	Live stock type	Number of chicken you own	Total number
1	Poultry (chickens)		
	✓ Hens		
	✓ Cocks		
	✓ Pullets		
	✓ Cockerels		
	✓ Chicks		
	Total of chickens		

II. Poultry (chicken) production system

1. Where do you get your chicken first? 1. Market 2. Family 3.Gift 4. Other (specify) ____
2. When did you start rearing chicken? _____
3. How do you start chicken rearing (*Source of knowledge for chicken rearing*)?

1. Learning from my parents 2. From my own interest 3.From colleagues and neighbors 4.Training 5. Others (Specify_____

4. What type of poultry production system do you practice? 1. Traditional (*Scavenging only*) 2. Scavenging + Seasonal/conditional supplementation 3.Semi scavenging (Scavenging + Regular supplementation) 4. Intensive system

5. Why do you keep (rear) chickens?

No	*Purpose of keeping chicken*
1	
2	

6. *For what purpose* do you use Eggs?

No	Purpose eggs
1	
2	

7. What do you think the advantages and disadvantages of poultry rearing?
Advantage: -1. _____
2._____
Disadvantage1._____
2._____

8. When (which season) do you rear more chickens?
1. Bega (why?)1._____2._____3._____
2.Kermit (why?)1._____2._____3._____
3. Both Bega and Kermit (why?) 1._____2._____

III. Chickens management system

A. *Housing*

1. Do you have separate poultry house? 1. Yes 2. No

2. If your answer to question 1 is No, why not you construct house for your Poultry?

1. Lack of knowledge (awareness) 2. lack of attention to poultry 3. lack of construction materials (unavailability & cost) 4. risk of predators 5. risk of thief 6. others specify_____

3. If your answer to question 1 is No, where does your chicken stay at **night**?

1. in the kitchen **2**. Family dwellings **3**.rest on trees **4**. Under basket **5**.In cages **6**. In the house purposely made for chicken **7.** Others specify----------

4. If your answer to question 1 is No, where do your chickens stay during **day times**? ----------

5. If they rest in basket or cage, or in a separate house, do you practice **cleaning** of poultry house? 1. Yes 2. No

6. If your answer to question ***5 is yes***, how often you clean poultry house (How many days in a week) ----------

7**.** If your answer for question number ***3 is choice 6***, the house is made from 1) Mud of blocks 2) iron sheet roof & wood 3) others specify----------

B. Feed resources and feeding system

1. Do you practice purposeful feeding of your chicken in confinement? 1. Yes 2. No

2. Do you practice supplementary feeding of your chicken? 1. Yes 2. No

3. If the answer for question no 2 is yes, what type of supplementary feed you provide mostly?1.Grains 2. Household left over 3. Grains and household left over 4. other (specify)_____

4. If your answer to question 2 is yes, when do you usually offer the supplement? 1. in the morning before they go out for scavenging 2. In the evening after scavenging 3.In the afternoon while scavenging 4. Any time during day times 5. Others, specify----------

5. If the answer for question no 2 is **yes**, what amount of supplemental feed you provide per chicken? 1. Hand full 2. Unknown 3. Other (specify) _____

6. If your answer to question 2 is yes, how do you feed your chicken?

1. with feeder 2. By spreading on the bare ground (on floor) 3. Others, specify----------

7. How do you give the extra feeds? 1. Separate to different classes 2. Together for the whole groups (for group feeding)

8. Indicate seasonal extra feeding of your chicken using the following table. (At which season(s) do you offer more extra feed to your birds?)

Class	Rainy season	Dry season
Layers		
Pullets		
Cocks		
Chicks		

9. Where do you get the supplementary feed?1. Crop harvest (Self produced) 2. Purchased from market 3.Harvest and Purchase 4. Other (specify) _____

10. If your answer to question **2** is No, what is the reason? 1. Lack of awareness about feed 2. Unavailability of feed and feed ingredients 3.High cost of feed and feed ingredients 4.Shortage of time 5.Lack or shortage of financial resource 6.others, specify----------

12.How do you reduce the risk of chicken rearing during the time feed shortage and other Problems, like risk of predators, diseases and cropping seasons? 1._____2._____3._____

C. Water and Watering System of Poultry

1. Do you give water to your chicken? 1. Yes 2. No (why) ----------

2. If yes, which season of the year you provide water? 1. Bega 2. Kermit3. All season (Bega & Kermit)

3. If you give water for your chickens during above season, how frequent do you provide?

1. Once a day 2. Twice/day 3.others specify_____

4. If you give water for the chickens, *where* do you get the water from? 1. Rainy water 2. River 3. Other, specify----------

5. Do you have watering trough (Waterier)? 1. Yes 2. No

6. What type of watering trough do you use to supply water? 1. Plastic made 2. Earthen pot 3.Wooden trough 4. Stone made 5. Other (Specify) _____

D. Culling

1. Do you purposely cull your birds at any time? 1. Yes 2. No

2. For what purpose do you cull the poultry? 1. Consumption 2. For sale 3. Other (specify)

3. What factors determine which bird you will cull? 1. Poor productivity 2. Sickness 3.Lack of broodiness 4. Old age 5. Frequent broodiness 6. Other, specify------

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

5. If you culled poor productive birds, what is their level of productivity? 1. Number of eggs/clutch 2. Number of clutch/year 3. Number of eggs/year

E. Productivity and reproductively of village chicken

1**.** Do you have your own Cock? 1. Yes 2. No

2. If yes which breed? 1. Local Cock 2. Cross Breed 3. Pure Exotic Cock

3. If no, where do you get a cock for your hen? 1. from neighbors 2. I do not need a cock for my hen 3. Other (specify) _____

4. What is the average age of a cockerel at first mating in your management?

1. Local breed ___ months 2. Cross breed ___ months 3. Exotic breed ____ months

5. What is the average age of a pullet at first egg laying in your management?

1. Local breed ---------months 2. Cross breed --------months 3. Exotic breed ------- months

6**.** State the egg productivity of your birds (chickens) in the following table

Chickens breed	Number of eggs per clutsh	Number of clutsh per year	Number of days per clutch	Number of eggs per year per hen
Local hen				

Crossed hen				
Exotic hen				

7. Do you have any local practices used to avoid broodiness? 1. Yes 2. No
8.If yes, what type of practices you used? 1st _____2nd _____3rd _____

9. What method do you use for brooding and rearing chicken?
1. Broody hen (natural methods) 2. Hay box brooder 3. All methods

F. Health and Disease control

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

2. If yes, describe the common diseases you have experienced in your flock_____

3. How do you identify sick birds? _____

4. What do you do when birds are sick? 1. Treat them myself 2. Call to veterinarian 3. Call to development agents 4. Cull/kill them all immediately 5. Slaughter them all immediately for home Consumption 6. Sell them all immediately 7. others. (Specify)_____

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

6. If yes, would you mention the reason? 1. To protect from predator's attack 2. To avoid risk of contagious diseases 3.To protect from mixing with the village flock 4.To protect birds from picking and destroying crops/ vegetables

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

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

9. What do you do when your birds are dead birds? ----------

G. Chicken production constraints

1. State major poultry production constraints in your area

No	Constraint type	Preventative mechanisms
1		
2		

2. What are the major causes of chicken losses? Rank them

No	Causes of chicken losses
1	
2	