CHARACTERIZATION OF VILLAGE CHICKEN PRODUCTION AND MARKETING SYSTEM IN DEDO WOREDA, JIMMA ZONE, SOUTH WEST ETHIOPIA

M.Sc. Thesis Research

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Jimma, Ethiopia

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DEDICATION

I dedicate this work to My Mother W/ro Almaz Haile for her strength and Gentleness.

STATEMENT OF THE AUTHOR

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

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Date of Submission: ……

BIOGRAPHICAL SKETCH

The author, Meskerem Assefa, was born in Denbi town located in Dedesa Woreda, Ilubabor Zone of the Oromia Regional State in September 1, 1987 G.C. She completes her primary and junior secondary education at Denbi Elementary and junior secondary school in 2000 and 2002 respectively. She joined preparatory high school of Bedele in 2002 and completed her high school secondary education in 2003. Finally she joined Haramaya University, in 2004, and graduated with B.Sc. Degree in Agriculture (Animal Production) in 2008.

Soon after her graduation Meskerem Assefa was employed by Oromia Regional State Ministry of Agriculture and worked as Shebe Sombo Woreda Animal Health and Livestock expert until she joined Jimma University, School of Graduate Studies for the Degree of Master of Science in Animal Production in 2012.

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List of Abbreviation

AACMC	Australian Agricultural Consulting and Management Company
ANOVA	Analysis of Variance
BB	Bovan Brown
BN	Bovan Nera
CACC	Central Agricultural Census Commission
CO2	Carbon dioxide
CSA	Central Statistic Authority
DB	Dominant Black
DD	Dekalb Delta
DFI	Daily feed intake
EARO	Ethiopian Agricultural Research Organization
EEA	Ethiopian
ETB	Ethiopian Birr
FAO	Food and Agricultural Organization of the United Nation
GLM	General Linear Models
HU	Haugh unit

HH	House Hold
ILRI	International Livestock Research Institute
JICA	Japan International Cooperation Agency
JUCAVM	Jimma University, Collage of Agriculture and Veterinary Medicine
ND	Newcastle disease
NGO	Non-Governmental Organization
PA	Peasant Associations
PK	Potchefstroom Koekoek
RIR	Rhode Island Red
SAS	Statistical Analytical Systems
SD	Standard Deviation
SNNP	Southern Nations and Nationalities People
SPSS	Statistical Package for Social Science
UK	United Kingdom
USAD	United States Agency for International Development
WLH	White Leghorn

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Field Code Changed

CHARACTERIZATION OF VILLAGE CHICKENPRODUCTION AND MARKETING SYSTEM IN DEDO WOREDA, JIMMA ZONE, SOUTH WEST ETHIOPIA

ABSTRACT

This study was conducted to characterize village chicken production and marketing system of Dedo Woreda of Jimma Zone. Three different agro- ecologies (high, mid and lowlands) of the Woreda were purposively selected based on poultry population and accessibility. Stratified probability random sampling method was followed to select two peasant associations (PA) from each of the three agro-ecology and 30 households from each of the six PAs. Thus a total of 180 (6x30) households (hh) were used to carry out the survey on management practices, marketing system and production performance of village chickens. Eggs collected from the different altitudes were studied for quality, hatchability and chick performance. The results obtained showed that the major scavenging poultry supplementary feed in Dedo woreda was 88.3% cereal grains. . About 70.6% of the respondents said to have provided separate poultry house during night times. About 45, 23.3, 15, 12.8,2.6 and 1.1% of the respondents indicated that Coccidiosis, Cholera, Infectious bronchitis, Newcastle disease , Fowl pox and External parasite as economically important poultry disease with frequent outbreak in the study area. About 49.2% of the respondents indicated that wild Egyptian Vulture was dangerous predator attacking young chicks. About 96.1% of the chicken found in the study area belongs to the non-descriptive indigenous chickens. The annual income from the sale of poultry and poultry products in the study area was Birr 335/hh. About 47.8% of the respondents reported to have access to the extension service of the Woreda. About 78 % of the respondents reported to attain annual egg production level of 35-62 from indigenous hen with an estimated hatchability of 20.8%, with the use of natural incubation. About 95% of the respondents indicated that women and children are responsible for the management and marketing of chickens. This study showed that eggs collected from Dedo Woreda were poor in most of the egg quality parameters. The growth performance and survival rate of chicks hatched from eggs collected from Dedo Woreda were also found to be poor. Appropriate intervention in health care and control of predators and Provision of better extension service, credit schemes and training opportunities tends to result in increased productivity of village poultry in the Dedo Wereda. Further investigation in to the constraints and potential of indigenous chicken based village poultry seems to be the future direction of research in Dedo Wereda.

Keywords: *Village chicken, Egg quality, productive and reproductive performance*

INTRODUCTION

The word poultry includes all domestic birds kept for the purpose of human food production (meat and eggs) such as chickens, turkeys, ducks, geese, ostrich, guinea fowl, doves and pigeons. In Ethiopia ostrich, ducks, guinea fowls, doves and pigeons are found in their natural habitat (wild) whereas, geese and turkey are exceptionally not common. Thus the word poultry production is synonymous with chicken production under the present Ethiopian conditions. According to Tadelle *etal.*, (2003), the total poultry population of Ethiopia is estimated to be about 50 million. The large segment of country's poultry comprises of chicks (38.91%), followed by laying hens (32.77%). Pullets, cocks and cockerels are estimated to comprise about 9.72, 10 and 5.4% of the total poultry population of the country respectively (CSA, 2012/13).

The four major Regional States in terms of land area and human population (Oromia, Amhara, SNNP, and Tigray) collectively account for about 96% of the total national poultry population. Chicken rearing is not common in the lowlands of Ethiopia i.e. Somali, Gambella, Afar and Benishangul-Gumze Regional States, which collectively own 3.24% of the total national chicken population. The flock size per household is estimated at 4.1 birds at the national level whereas a higher flock size (7.2 - 7.6) is reported from the Regional States of Tigray, Benishangul-Gumze and Gambella. The flock sizes reported from all the other regional states is below the national average of 4.1birds/household (CACC, 2003). About 98% of the country's poultry population consists of non-descriptive breeds of indigenous chickens closely related to the Jungle fowl. They vary in color, comb type, body conformation and weight and may or may not possess shank feathers. Broodiness (maternal instinct) is pronounced and they are characterized by slow growth, late maturity and low production performance. The mean annual egg production of indigenous chickens is estimated at 60 small eggs with thick shells and a deep yellow yolk color (Yami and Dessie, 1997). The egg laying period and number of eggs laid per period are to some extent higher in urban than rural areas (CACC, 2003). The Ethiopian indigenous chickens are kept under the traditional poultry production system, characterized by lack of purposeful feeding, separate

poultry house, small flock sizes, low input and output and periodic devastation of the flock by disease. The mean survival rate to an age of 3 months of baby chicks reared under the natural brooding condition in Ethiopia is about 40% (Sub Sector Review 1984; Hoyle 1992; Ethiopian Statistical Authority 1985-1996) and keeping village poultry has become challenging due to the periodical and recurrent outbreak of poultry diseases and the high prevalence of predators (Hoyle, 1992). Alamargot (1987) reported a mortality rate of 20-50% in indigenous chickens due to disease and during some periods of epidemics, mortalities as high as 80% have been recorded. Recurrent outbreaks of Newcastle Disease at similar frequencies, usually once or twice a year demonstrate the endemic behavior of the disease in village poultry populations (Yami and Dessie 1997). It has been observed that the provision of vaccination, improved feeding, clean water and night time enclosure improves the production performance of indigenous chickens, but not to an economically acceptable level (Hassen, 1992 and Teketel, 1986).

In the past, the Ethiopian government development initiatives of village poultry placed special emphasis on genetic improvement through the introduction of exotic breeds of chickens and set up of national poultry extension package. The importation of exotic breeds of chicken goes back to the early 1950s. The initiation of the Ethiopian national poultry extension package also goes back to the early 1950s and comprised of the distributions of three months old exotic pullets and cockerels within the rural farming population. Until recently, about 99% of the Ethiopian poultry population consisted of indigenous chickens, while the remaining 1% consists of imported exotic breeds of chickens during the 1970s and 1980s. There has been an increase in the number of exotic breeds of chickens and at present, it is estimated that they make up about 2.18% of the national poultry population (CSA, 2004-2005). But the contribution of exotic poultry to the Ethiopian economy is significantly lower than that of other African countries (Solomon, 2007). All the available evidence indicates that all the imported breeds of chickens performed well under the intensive management system in Ethiopia (Yami and Dessie, 1997). In the recent years, a small number of NGOs and FAO are involved in the implementation of exotic chicken-based household poultry development projects in support of vulnerable households and small holder exotic poultry

production has been a sub component of a number of donor & NGO funded Projects (youth &women-led enterprise/ micro financing).The Ethiopian government is also involved in promotion of small poultry of exotic chicken.

There is no adequate data on the production performance of exotic chickens under the Ethiopian objective local condition. The general indication is that research aimed at promoting of village chicken production has concentrated on improvements in management while ignoring the potential role of socio-economic issues, such as marketing. According to Gausi etal, (2004) small holder village chicken producers tend to ignore new technologies due to market limitations. This implies that apart from meeting subsistence needs, engagement and level of investment of small holder farmers in agricultural enterprises need to respond to the existing market opportunities. According to Gueye (1998) and Pedersen (2002); it is difficult to design and implement chicken-based development programs that benefit rural people without understanding village chicken production and marketing systems Hellin *etal.*, (2005) also reported that the understanding of village chicken functioning and marketing structure are a prerequisite for developing market opportunities for rural households. Thus the efforts to improve the management and productivity of village chicken should be complemented by a supportive marketing system. This being the cases the major objective of this research work was to characterize village chicken production and marketing systems in Dedo Woreda of Jimma Zone, South West Ethiopia with the following specific objectives

1. To characterize the current traditional household poultry management and marketing system of Dedo Woreda of Jimma Zone.

2. To characterize the productive and reproductive performances of village chickens in Dedo Woreda of Jimma Zone.

3. To study into the internal and external egg quality in Dedo Woreda of Jimma Zone.

2. LITERATURE REVIEW

2.1. Ethiopian Poultry Production Systems

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 care, 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 ((Yami and Dessie, 1997).

2.1.1 Large Scale Commercial Production System

The large-scale commercial poultry production system is highly intensive production system involving relatively larger flock size (> 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 care, and modern management systems. It is estimated that this sector accounts for nearly 2 % of the national poultry population. This system is characterized by high productivity and is entirely market oriented aimed at meeting the large poultry demand of major cities. The existence of somehow better bio-security practices has reduced chick mortality rates to merely 5 % (Bush, 2006).

2.1.2 Small Scale Commercial Production System

In this system, modest flock sizes of (50 - 1000) exotic breeds are kept on commercial basis. Most small-scale poultry farms are located around Debre Zeit town and Addis Ababa city. This production system is characterized by medium level of feed, water and veterinary service inputs and minimal to low bio-security. Most of the small-scale poultry farms obtain their feed and foundation stock from large-scale commercial farms (Genesis or Alema) (Nzietcheung 2008). These are also involved in the production and supply of table eggs to various supermarkets, kiosks and small roadside restaurants through middlemen (Solomon, 2007). Some NGOs and FAO are reported to be involved in the implementation of market oriented small scale modern poultry development projects in support of vulnerable

households. Smallholder poultry production has also been a sub component of a number of Donor funded Projects (youth &women-led enterprise/ micro-financing). The major bottle necks of the small modern poultry sub-sector are the supply of improved genetic & feed materials and diseases control. Poor quality chicks, limited market access, high start-up costs, poor quality and high cost of feed, and low veterinary inputs are reported to be some of the major constrains of small-scale poultry of exotic chickens. Thus it seems that, there is strong need for the setup of input supply system (day old chicks, feed packages, vaccines) through the encouragement of the private & cooperative supplier system and provision of adequate technical and marketing support (Solomon 2007).

2.1.3. Traditional Production System

Poultry keeping practiced by rural households using family labor is referred as either village, rural or family poultry production system (Aklilu, 2007). In Ethiopia village poultry is rarely a sole means of livelihood for the household but is one of a number of integrated and complementary farming activities contributing to the overall well-being of the household. The Ethiopian traditional poultry production system comprises the indigenous chickens kept under the traditional production system. The traditional production system is characterized by small flock size and devastation of the flock by disease and predations (Nigussie *etal.*, 2010; Fisseha, 2009; Mammo, 2006). There is no separate poultry house and the chickens live in family dwellings together with human beings (Mengesha etal.2011). In some cases, there are rudimentary houses mostly built with locally available materials. In most parts of the country, village chicken owners provide only night times shelter (Moges etal, 2010a). There is no purposeful feeding and scavenging is almost the only source of diet in the traditional poultry production system. Scavenging laying hens could find approximately 60 to 70% of their feed requirement from the available scavenging feed resources (Rahman etal., 1997). It is reported that free-range scavenging chickens fulfill their protein, vitamins and minerals requirements from scavenging depending on factors such as available scavenging area per bird, quality of scavenging feed resources; season and production stage (Abdelqader etal.2007;Payne and Wilson, 1999; Dessie and Ogle, 2001)..

The majority of the Ethiopian chicken owners are reported to offer supplementary feeding on the top of scavenging (Halima, 2007, Moges et al., 2010a, Mengesha et al. 2011), to make use of the productive potential of hybrid layers. Ali (2002) found that at least 60g of feed supplementation is needed for the scavenging crossbred birds. Cereal grains, particularly maize is the most preferred supplementary feed used in most parts of the country. There is no designed selection and controlled breeding under the traditional production system and it is by natural incubation and brooding that chicks are hatched and raised all over the rural Ethiopia (Bushra Badhaso, 2012).

The bio-security of the traditional 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. Newcastle disease (ND) is the most important disease recognized all over rural Ethiopia and is widespread in the rainy season in the central highlands of Ethiopia (Tadelle and Ogle, 1996). Vaccination against ND occurs in rural areas only in response to an outbreak. Other poultry diseases found in rural poultry include Gomboro, Coccidiosis, Fowl pox, Fowl typhoid, Fowl cholera and External and Internal parasites.

2.2 Poultry Marketing System in Ethiopia

Poultry products in most developing countries, especially in Africa, are still expensive. The marketing system is generally informal and poorly developed. Unlike eggs and meat from commercial hybrid birds, local consumers generally prefer those from indigenous stocks.

The existence of a local market offering good sales opportunities and adequate transport facilities are obvious prerequisites for family poultry development. As most consumers with greater purchasing power live in and around cities, intensification of poultry production should be initiated in peri-urban areas or, at least, in areas having a good road network (Branckaert etal. 2000). According to Gausi *etal.*, (2004), small holder village chicken producers tend to ignore new technologies due to market limitations. It is difficult to design

and implement chicken-based development programs that benefit rural people without understanding village chicken production and marketing systems (Pedersen, 2002). The birds usually sold from the village flock are surplus males (cockerels and cocks), poorly developing pullets and non-productive old and sick birds. Growing chicken are sold just before the onset of disease conditions (Byarugaba, 2007).

In the Ethiopian highlands, the price, demand and supply of chicken are highly related to the Christian religious festivals and the egg marketing channel is more or less similar to that of chicken. Eggs are sold at the farm gate to egg collectors and in open markets to middlemen, direct consumers, retail shops, hotels and supermarkets. Eggs pass through a relatively longer chain to reach the consumers than chicken. The main actors in egg marketing are producers, collectors, traders or (wholesalers), local kiosk, shops and supermarkets. According to Moges *etal*., (2010) urban markets followed by the nearest local and farm gate markets are the preferred outlets for egg marketing by producers. The price of live birds varies depending on sex, color, size and market location and the demand for both eggs and live birds is sub jected to seasonal variations. According to Hoyle (1992) and Kenea *etal.*, (2003), late May to early June is the opening period of the "rainy season" which coincides with an outbreak of poultry disease, with farmers selling almost all of their flocks in the SNNP Regional State and in Eastern Shewa Zone of the Oromia Regional State.

In most parts of the country, prices fall to their lowest annual level until the end of August. Prices rise for the Ethiopian New Year (September 11) and for Meskel feast (September 27). The feast which occurs in December and April also leads to price rises, indicating that the largest off-take rates from flocks occur particularly during holiday's and festivals and during the onset of disease outbreaks. The latter is a measure to prevent or minimize expected financial losses from high morbidity and mortality. In such circumstances, prices fall dramatically since supply is higher than demand. According to Aklilu (2007) in northern Ethiopia (particularly in Tigray) most strict Orthodox Christians households abstain from eating animal products during the Easter fasting period, pre-Christmas fasting period and on Wednesday and Fridays, which in turn affects market price of poultry and poultry products.

Thus, there are fluctuations across the months of the year in sales as well as in consumption of both birds and eggs. The highest bird sales and consumption overlap with the major social and religious festivals of the year (Aklilu, 2007).

2.3. Socio-economic Role of Rural Poultry

In Ethiopia chickens are widespread and almost every rural family owns chickens, which provide a valuable source of protein and family income (Tadelle *etal.,* 2003a). The country has diverse agro-climatic conditions favoring production of many different kinds of crops and providing a wide range of ingredients that could be used as an alternative feed stuffs for poultry feeding. Making use of these resources to complement the scavenging resource base promises a considerable potential for success (Dessie and Ogle, 2001). Family chicken production is an appropriate system that makes the best use of locally available resources (Tadelle *etal.,* 2003a). Village chicken also play a role of converting household leftovers, wastes and insects into valuable and high quality protein (Doviet, 2005). The impact of village chicken in the national economy of developing countries and its role in improving the nutritional status, family income, food security and livelihood of many smallholders is significant owing to its low cost of production (FAO 1997; Gondwe 2004; Abdelqader 2007; Abubakar et al. 2007). Indigenous chickens based, rural household poultry provides employment and income generating opportunity and is a priority animal for holy day and religious sacrifices (Sonaiya 2000; Tadelle and Ogle 2001; Gueye 2003). According to Sonaiya (2004), smallholder families, landless laborers and people with incomes below the poverty line are able to raise chicken with low inputs and harvest the benefits of eggs and meat via scavenging feed resources. Family chicken meat and eggs contribute 20–30% to the total animal protein supply in low-income and food-deficit countries. Village chicken could be particularly important in improving the diet of young children in sub-Saharan Africa (Alemu 1997).

Chickens are rapid in the production of human food and provision of family income due to their short generation interval. Indigenous chicken production is part of a balanced farming system, plays an important role in the supply of high quality protein to the family food

balance, and provides small disposable cash income in addition to the socio-religious functions of rural peoples (Alemu & Tadelle, 1997). Eggs provide a small regular income while the sale of live birds provides a more flexible source of cash. Poultry also play an important socio-cultural role in many societies. Village poultry keeping uses readily available family labor and benefits children and women. For low income and food deficient smallholder farmer's village poultry represents one of the few opportunities for saving, investment and security against risk, while occasional consumption of eggs and poultry meat provides a valuable source of protein in the diet (Aklilu, 2007).

2.4. Production Performances of Indigenous Village Chickens

Less than 5 % of domestic birds in Ethiopia are internationally recognized or well-known breeds (Wilson, 2010). The Ethiopian indigenous chickens comprised of a wide range of morphologic or genetic diversity and show variation in body conformation, plumage color, comb type and productivity (Halima *etal.,* 2007). The egg production potential of local chicken kept under village management conditions is 30-60 eggs/year/hen with an average weight of 38g, thick shells and deep yellow yolk color. Some of the available evidences tend to indicate that the egg production potential of the Ethiopian indigenous chickens is comparable to the indigenous flocks of other African countries. The average number of eggs/clutch of local hens in Burkina Faso was estimated to be 12 eggs (Kondombo 2005), which is comparable to the range of 12–18 eggs reported by Gueye (1998), but higher than that of 10 eggs/clutch reported by Mourad et al. (1997) in Guinea and 9 eggs/clutch by Kuit etal.,(1986) in Mali. Halima (2007) reported an average productivity of 9–19 eggs/clutch with 2–3 clutch periods/hen per year and an average total egg production ranging from 18–57 eggs/year per hen for local hens in North-West Ethiopia. The average number of clutches/hen per year and the number of eggs/clutch of local chicken in Sudan were 3 and 12 eggs, respectively (Khalafalla etal., 2001).According to Sonaiya etal., (1998), Aini (1990) and Gueye (2000), the annual egg production/hen of local hens under village conditions ranged from 20 to 100 eggs; with an average egg weight ranging between 30 and 50gm (Alganesh *etal.*, 2003). According to Alganesh et al., (2003) and Negussie et al., (2003), the low

productivity of the local scavenging hens is attributed to their low genetic potential as well as to high chick mortality occurring before they reach an age of 8 weeks. About 40-60% of the chicks hatched died during the first 8 weeks of life (Hoyle, 1992, Dessie 1996 and CACC, 2003) mainly due to disease and predation. About half of the eggs produced have to be hatched to replace chickens that have died (Dessie 1996), and the brooding time of the laying bird is longer, with many brooding cycles required in order to compensate for unsuccessful brooding. The low productivity of local chickens is also attributed to the uncontrolled breeding and lack of selection. The carcass weight of local chickens at 6 months of age was reported to be 559 g which was significantly lower than that of the 875 g reported for Leghorn but higher in dressing percentage than exotic chickens (Teketel, 1986). Similarly Gueye (2000), reported adult male and female weight of African village chicken range from 1.2 to 3.2 kg and from 0.7 to 2.1 kg, respectively.

The low productivity of indigenous stock can also partially be attributed to the low management standard of the traditional production system. It has been observed that the provision of vaccination, improved feeding, clean water and night time enclosure improves the production performance of indigenous chickens, but not to an economically acceptable level (Hassen 1992; Burley, 1957 and Teketel, 1986).

2.5. Productive Performance of Improved Village Chickens

Poultry production is affected by factors such as breed and strain of chicken, environmental conditions in poultry house, management practices and feed and feeding management (Bell and Weaver, 2002). Hence knowledge of performance of the major economic traits in chicken is important for the development of breeding plans aimed at flock improvement. The rate of growth and egg production of a bird could partially indicate its genetic constitution and adaptation with respect to the specific environment (Ahmed and Singh, 2007). There are many factors that can adversely affect egg production. Egg production of improved breeds kept under village condition could be affected by feed and water availability, seasonal variation, parasite infestation, infectious diseases, management and environmental factors (Jacob *etal.*, 1998). Majaro (2001) and Yakubu *etal.*, (2007) reported significant effect of

breed on egg production and mortality rate of improved breeds of chickens subjected to rural village conditions. Abdel-Rahman (2000) reported that naked neck genotype was superior to full feathered mates in egg production, sexual maturity, mortality and feed efficiency. In an experiment conducted to compare productivity of Criolla local breed with Harco commercial breed kept under different management system, in the highlands of Bolivia. Altamirano (2005) reported that, Harco had significantly better production level under all the feeding regimes including the free range system with supplementation of 50 gram maize/day as compared to the other. Harco is a cross of Rhode Island Red × Barred Plymouth Rocks and has been demonstrated to be an excellent layer under free-range condition when supplemented with 50 grams of feed per day (Vries, 1993). Grobas etal., (2001) reported that the production performance of ISA was superior to that of Dekalb Delta in terms of egg weight, egg mass and feed efficiency. A study conducted in Nigeria by Olawumi and Dudusola (2010) showed that ISA genotype utilized locally available feeds efficiently, produced more number of eggs and appeared more profitable than Dominant Black genotype.

A recent study conducted under village conditions in Savannah region of Nigeria by Olawumi, and Dudusola, (2012) reported mean egg production of 5.96, 5.84 and 5.47 eggs per hen per week for ISA, Bovan Nera and Dominant Black genotype respectively. In northern Ethiopia, Lemlem and Tesfaye (2010) reported 173,185 and 144 eggs /year/ hen for White leghorn, Red Island Red and Fayoumi chicken under village household condition respectively. Solomon (2004) also reported 82 eggs/hen/year for White leghorn placed under rural household condition for 20 weeks with supplementations. In an attempt made to improve village poultry production through the use of commercialization potentials in suited areas of Ethiopia, Bovan Brown day old chicks were distributed to the farmers in Ada'a, Lume and Akaki districts. The distributed chicks were reported to have started lying at an age of 20 weeks.

On the other side, Sonaiya and Swan (2004) reported that hybrids chickens that have been carefully selected and specialized solely for the production of either meat or eggs are not suitable for breeding purposes, especially for mixing with local scavenging village stock, as

they have very low mothering ability and broodiness. Sørensen and Sewannyana (2003) described programmes in which cocks from the brown-egg layer hybrid were crossed with local hens under field conditions in Uganda. The results obtained showed that the daily gain of the 50% Bovan cross proved to be superior to that of the local chicks by 30% at one month of age, increasing to 38% at three months of age, after which the superiority decreased gradually. The Potchefstroom Koekoek produced by crossing the Black Australorp and the White Leghorn reached sexual maturity at an age of 130 days (Van Marle-Koster and Nel, 2000).The average egg weight of the cross was 55.7g and the color of the eggs was brown (Ramsey etal., 2000). It was concluded that this cross breed is one of the most promising in terms of egg production and hatchability under village condition.

2.6 Factors Affecting Productivity of Village Poultry

2.6.1 Poultry Housing and Feeding System

Housing systems in village poultry production system is rudimentary and mostly built with locally available materials. In the traditional free range there is no separate poultry house and the chickens live in family dwelling together with humans (Solomon, 2007). Moges et al., (2010a) reported that in Bure district, North West Ethiopia, 77.9% of the village chicken owners provide only night time shelter and 22.1 % provided separate poultry house. According to Mengesha et al., (2011) about 41.3 % of the farming population of Jamma district of South Wollo provide separate poultry house.

On the top of housing, a wide range of factors such as sub optimal management, lack of supplementary feed, genetic potential and high mortality are the major causes of low productivity of village poultry (Tadelle, 2003). Different feeding materials are present for scavenging chickens which include seeds, plant materials, worms, insects and un identified materials (Tadelle and Ogle, 2000). Supplementary feed offered has been reported to be inadequate under the local objective conditions of various African countries (Gondwe 2004, Dessie and Ogle, 2001 and Kondombo *etal.*, 2003). In Ethiopia, 99%, 97.5% and 98 % of the respondents reported to have feed supplementation (Halima, 2007, Moges *etal.*, 2010a)

and; Mengesha et al., 2011). In India, 97.25 % backyard chicken owners provide additional supplement (Khandait *etal.,* 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. Ali (2002) found that at least 60g of feed supplementation is needed for the scavenging cross birds. Scavenging laying hen can find approximately 60 - 70% of their feed requirement (Rahman *etal*., 1997). It has generally been agreed that daily supplementary feeding and provision of shelter and clean drinking water could improve growth and reproductive rates and greatly increase survival rate of the birds at village level (Henuk and Dingle, 2002: Benvenuti *et al.*, 2012 and Wilson (2010).

2.6.2 Poultry Health Management

The widely acknowledged constraint to village chicken production in developing countries appears to be the high prevalence of Newcastle disease (Permin and Pederson, 2002). Newcastle disease is highly infectious and causes more losses than any other diseases in the tropics. Several surveys conducted in Africa showed high rates of sero-positivity of the disease in the absence of vaccination. In developing countries, Newcastle disease occurs every year and kills an average of 70 - 80 % of the unvaccinated village chickens (Branckaert et al., 2000). It has been reported that mortality attributed to Newcastle disease could reach up to 100% (Nigussie *etal*., 2003; Serkalem *etal.*, 2005) indicating that the disease is among the major causes of mortality. Newcastle disease is reported to be one of the most significant diseases of poultry worldwide and a major constraint to village poultry production in rural Africa (Alders, 2004; Alexander *et al.*, 2004).

All the available evidences showed that effective control of Newcastle disease is an essential first step towards improving village poultry production (Ahlers *etal.,* 2009). Moges etal., (2010a) suggested that improvement in veterinary and advisory service could help to achieve control of Newcastle disease at village level where about 96.4% of village chicken owners had no culture of vaccination against poultry diseases. Village chicken vaccination against Newcastle disease is more important than any other management interventions. Some of the cost-benefit calculations done in the Tigray regional state of Ethiopia indicated that

Newcastle disease vaccination was more economical than the provision of daytime housing, supplementary feeding, cross breeding and control of broodiness (Udo *etal.,* 2001). Newcastle disease and infectious bronchitis produce watery albumen, and this condition may persist for long periods after the disease outbreak has been controlled (Butcher, 2003). The disease problem is further aggravated by the fact that the veterinary service has remained irregular, unevenly distributed and poorly organized at village level (Takele and Oli, 2011). There are many factors that influence the health of smallholder chicken and it is very difficult to design improvement strategies to overcome health constraints (Mapiye *etal.,* 2008). It has been reported that Effective health coverage and vaccination programmes could significantly improve productivity of rural chicken (Javed *etal.,* 2003). There has been no effective vaccination program in different part of rural Ethiopia as reported by Moges *etal.,* (2010a); Leta and Endalew (2010); Takele and Oli (2011) and Mengesha et al., (2011).

2.6.3 Lack of Adequate Extension Services

In Ethiopia, the national poultry extension service is provided almost solely by the Ministry of Agriculture (ILRI, 2005). A holistic and multi-disciplinary support including the provision of training, veterinary service and credit are critical in supporting village chicken improvement programs (Moge et al., 2010b). The Ethiopian poultry extension coverage varies from region to regions. Mengesha et al., (2011) reported that 50% of chicken owners of Jamma district of South Wello have access to the regional poultry extension packages. Rural women are given priority in extension service and contribute significantly in almost all activities related to poultry production (JICA, 1999). The general tendency is that provision of training for both farmers and extension staff on disease control, improved housing, feeding, marketing and entrepreneurship could significantly help to improve productivity of local chicken (Moges *etal.,* 2010b).

2.7 Internal and External Egg Quality

Egg quality has been defined as the characteristics of an egg that affect its acceptability to the consumers and is important market price determinant factor in both table and hatching eggs (Parmar et al., 2006). Quality factors for eggs may be divided into two general group's i.e. external and internal egg qualities. Evaluation of the external and internal qualities of eggs is important because of consumer preferences for better egg quality. The total numbers of good quality eggs produced and some of the other practices such as packaging, transportation and storage of produced eggs are therefore vital in achieving economic success in poultry farming (Niranjan et al., 2008). It is generally agreed that all the characteristics of egg quality have a genetic basis and quality of chicken eggs may also vary due to several other factors like breed, strain, variety, rearing practices, temperature, relative humidity and season (Parmar et al., 2006 and Niranjan et al., 2008).

2.7.1 Internal egg quality

Internal egg quality involves functional, aesthetic and microbiological properties of the egg yolk and albumen. The proportions of these components for fresh egg are 32 % yolk, 58 % albumen and 10 % shell (Leeson, 2006).The egg white comprises of four structures. The chalaziferous layer or chalazae immediately surround the yolk, accounting for 3% of the total egg white. The inner thin layer, which surrounds the chalazae accounts for 17% of the total egg white. The third structure is the firm or thick layer, which provides an envelope or jacket that holds the inner thin white and the yolk. The albumen structure that adheres to the shell membrane at each end of the egg accounts for 57 % of the albumen (Parmar et al., 2006 and Niranjan et al., 2008). The fourth structure, the outer thin layer lies just inside the shell membranes and accounts for 23% of the egg white (USDA, 2000). Yolk of newly laid egg is round and firm. As the egg gets older, the yolk absorbs water from the egg white and increasing in size. The increase in size of the yolk produces an enlargement and weakness of the Vitelline membrane as a result of which the yolk looks flat and shows spots. Internal egg

quality decreases with advancement of storage period. The longer the storage time, the more the internal quality deteriorates. However, the chemical composition of the egg (yolk and white) does not change much. The pH of albumen of fresh eggs lies between 7.6 and 8.5. During storage, the albumen pH increases at a temperature dependent rate to a maximum value of about 9.7 (Heath, 1977). After 3 days of storage at 3 °C, Sharp and Powell (1931) reported an albumen pH of 9.18. After 21 days of storage, the albumen had a pH close to 9.4, regardless of storage temperature (Li-Chan etal, 1995).

Heath (1977) observed that when loss of carbon dioxide was prevented by the oiling of the shell, the albumen pH of 8.3 did not change over 7-days of storage period at 22 °C. In oiled eggs stored at 7 °C, albumen pH dropped from 8.3 to 8.1 in seven days (Li-Chan etal., 1995). Increases in albumen pH are due to CO2 loss through the shell pores, and depend on dissolved CO2, bicarbonate and carbonate ions and protein equilibrium. Bicarbonate and carbonate ion concentration is affected by the partial CO2 pressure in the external environment. In newly laid eggs, the yolk pH is close to 6.0 and gradually increases to reach 6.4 to 6.9 during storage. Egg quality preservation through handling and distribution is dependent on constant care from all personnel involved in these activities. The quality of the egg once it is laid cannot be improved, so efforts to maintain its quality must start right at this moment. The decrease in internal egg quality once the egg is laid is due to the loss of water and CO2. In consequence, the egg pH is altered, resulting in watery albumen due to the loss of the thick albumen protein structure. The cloudy appearance of the albumen is also due to the CO2. When the egg ages, the CO2 loss causes the albumen to become transparent, compared with fresh eggs. To minimize egg quality problems two things are important. These are the frequent egg collection, mainly in the hot months, and rapid storage in the cool room. The best results are obtained at a temperature of 10 °C. There are six main factors affecting internal egg quality: disease, age of the egg, temperature, humidity, handling, and storage conditions. Egg stored at above 15.5 °C increases loss of moisture (low humidity). On the contrary, high relative humidity helps to decrease water losses from the eggs. Egg storage at relative humidity of above 70 % helps to reduce egg weight losses and keeps the albumen fresh for longer periods of time. Rough handling of the eggs not only increases the

risk of breakage, but also may cause internal egg quality problems. Eggs are very prone to take on the odors of other products stored with them indicating the need of separate storage. The variables mentioned above are particularly important to ensure that a 1-week-old egg, properly handled, can be as fresh as a day-old egg kept at room temperature. If the egg is properly handled during shipment and distribution, it will reach the consumer's table with adequate freshness (http://www.thepoultrysite.com/publications/1/egg-quality-handbook/5/internal-and-external-e).

2.7.2 External Egg Quality

Poor egg shell quality has been the major economic concern to commercial egg producers, with estimated annual losses in the USA of around 478 million US dollars (Roland 1988). In Australia in 1998, the impact was of the order of 10 million dollars per year. Information obtained from egg grading facilities indicates that 10 % of eggs are downgraded due to egg shell quality problems. Based on values for the UK, Germany and the USA, it has been estimated that the incidence of broken eggs ranges between 6 and 8 % (Washburn, 1982). In Mexico in 2005 it was estimated that the egg industry lost between 30 and 35 million US dollars, based on average figures of 2.5 % broken eggs and 4% weak shells. These losses occur only between laying and packing, not taking into account losses in transit to the end consumer (DSM Mexico, 2005, unpublished data). To maintain consistently good shell quality throughout the life of the hen, it is necessary to implement a total quality management programmes throughout the egg production cycle. It has been always recognized that the hen has the most extra ordinary method of obtaining and depositing calcium in the entire animal kingdom. An egg has an average of 2.3 g of calcium in the shell, and almost 25 mg in the yolk (Etches, 1987). A modern hen laying 330 eggs per cycle will deposit 767 g of calcium; assuming a 50% calcium retention rate from the diet, the hen will consume 1.53 kg of calcium per cycle.

Exterior egg quality is judged on the basis of texture, color, shape, soundness and cleanliness. According to USDA (2000) standards, the shell of each egg should be smooth, clean and free of cracks. The eggs should be uniform in color, size and shape. There are five major types of

shell problems in the egg industry. These are cracks due to excess pressure, cracks due to thin shells, body-checks, pimpled or toe holes and shell-less eggs. When a producer complains about an increase in downgrade eggs, the first thing required is to determine which types of these problems have increased. In a processing plant with 97% A-quality eggs, a typical distribution of the different types of shell problems (downgrade) might be 2.13% stains, 0.85% blood spots, 0.85% meat spots, 61% pressure cracks, 9.8% thin shell cracks, 6.8% body-checks, 13.6% pimpled and 5.1% toe holes. If the percentage of any type of shell problem is abnormally high, then that is the problem needing attention.

3. MATERIALS AND METHODS

3.1 Description of the Study Areas

This study was conducted in Dedo Woreda of Jimma Zone of Oromia Regional State, located at 18 km South of Jimma town and comprises of a total area of 1459.1 Km^2. Dedo is bordered on the south by the Gojeb River which separates it from the SNNP Region, on the west by Gera, on the north by Kersa, and on the east by Omo Nada. Topographically Dedo is mountainous with an altitude ranging between 880 and 2400 m.a.s.l. Agro-ecologically Dedo Woreda consists of 18 % highlands, 48 % midlands and 34 % lowlands. The poultry and human population of the Woreda is estimated at 0.056 and 0.29 million, respectively (National Census, 2007). The farming practices are characterized by crop -livestock mixed system. Cereal grains are the major food crops cultivated whereas; livestock, chat and coffee are the major cash crops of the Woreda.

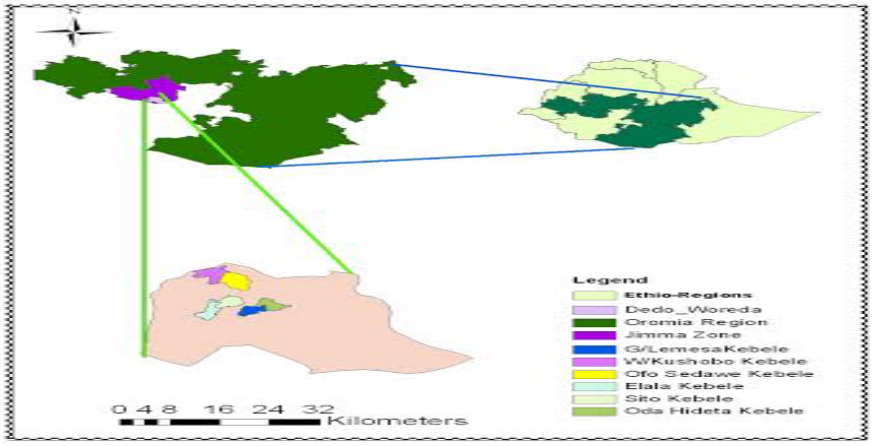


Figure 1 Map of Dedo Woreda with selected PA

3.2 Selections of the Participating Households

Three different agro- ecologies (, highland, mid-altitude and lowland) of the Woreda were purposively selected based on their poultry population and accessibility as shown in Table1. Stratified probability random sampling (purposive and random) method was followed to select two peasant associations (PA) from each agro-ecology of the Woreda and a total of 30 households were randomly selected from each of the Peasant Association. Thus a total of 180 (6x30) households were used to carry out the survey on management practices, marketing system and production performance of village chickens.

Table 1 Sampling frame of households in each Kebele

Poultry Population	PA	Number of HH	Agro ecology
4652	Sito	30	Midland
	Ofole	30	
1053	Waro Kolobo	30	Highland
	Odo Hideta	30	
609	Elala	30	Lowland
	Garema Lamesa	30	
Total		180	

PA- Peasant association HH- House holds

3.3 Data Collection

Structured questionnaire was used to collect data from primary source which mainly included households, development agents and key informants followed by review of the available secondary data source. A visit to physical facility of live bird and egg markets and open discussion with poultry farmers and live bird and egg sellers, buyers and intermediaries were also made. Finally data on poultry population and flock structure, management practices, marketing system and production performance (number of clutches, age at first egg *etc*) were collected using the questionnaires prepared to collect the data (Annex D).

3.4 Determination of Internal and External Egg Quality

A total of 240 fresh eggs (80 from each agro ecology) were purchased from selected farmers on contractual bases at household level. The eggs were collected from all the three agro-ecologies and transported to JUCAVM animal nutrition laboratory. Each egg was individually weighed using a two digit sensitive balance and the following egg quality parameters were recorded: Average Egg Shell Thickness, Yolk Color, using Roche color fan scale (1-15), Albumen Height, Yolk Height, and Haugh Unit. For the albumen and yolk height measurements, the eggs were broken out on a flat glass and then the maximum albumen and yolk heights were measured with a tripod micrometer. Individual Haugh Unit was calculated using formula cited by Tulin and Ahmet (2009).

$$HU = 100 \log (AH + 7.57 - 1.7EW0.37)$$

Where, AH = observed albumen height in mm and

EW = egg weight in grams.

3. 5 Fertility and Hatchability measurement

Fresh eggs (stored for 3-7 days) were purchased (334 eggs from each agro ecology)) on contractual basis for comparative external and internal egg quality evaluation. These were (total of 1000 eggs) selected against undesirable size, shapes and abnormal shell structures. The selected eggs (200 from each agro ecology and total of 600) were incubated using JUCAVM hatcheries. The empty incubator and all the fixtures were fumigated in advance using 70ml of formalin plus 35g potassium permanganate (Altman *etal.*, 1997). The incubation temperature, humidity and turning devices were adjusted in advance of incubation according to the recommendations of the manufacturer. The experimental eggs incubated were candled on the 7^{th} and 14^{th} day of incubation to remove infertile eggs and early and late dead embryo. The hatched chicks were transferred to the electric brooder house of JUCAVM as soon as they dried. Finally fertility and hatchability were calculated as;

% Fertility = Number of fertile eggs x 100

Number of total eggs set

% Hatchability = Number of chicks hatched x 100

Number of fertile eggs

3.6 Chicken Growth measurement

After hatching, the chicken were collected, counted, and weighed and grouped according to their origin of agro ecology and level of dryness and transferred to electric brooder house which were cleaned, disinfected and well prepared in advance. All the chicks were placed on commercial starters ration purchased from Addis Ababa and clean water were made available all the times. Feed consumption was measured daily whereas body weight were taken weekly for 0-8 weeks.

Growth rate was calculated as;

Percent growth rate = (V present-V past)/ V past*100

In this formula,

V present = present value (weight)

V past = past value (weight)

3.7 Statistical Analysis

All the data Collected were analyzed using both statistical package for social science (SPSS) and SAS (1999). The data was analyzed by the same program using descriptive statistics i.e. mean, frequency and percentage. Data collected from laboratory analysis was analyzed using the General Linear Models (GLM) procedure of SAS (1999) based on the following model.
Yijk =μ + Ith + Jth+ Єijk.

Where: Yijk= the value of the respective variable mentioned above

μ = overall mean of the respective variable

Ith= the effect of ith agro ecology (i= 1--3, Highland, Midland and Lowland)

Jth = the jth production and reproduction performance

Єijk= random error term.

5% significance will be used.

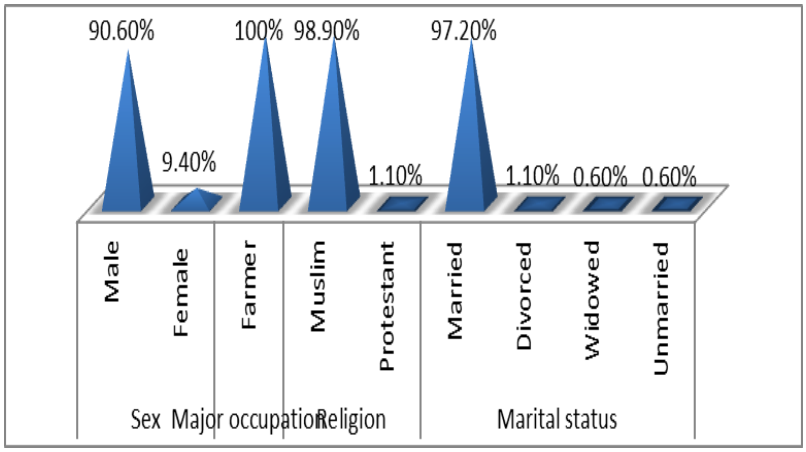
4. RESULTS AND DISCUSSION

4.1 Socio- Economic Characteristics of the Respondents

The occupation, sex, marital status, religion, land holding and other relevant characteristics of the respondents are shown in Figure 2. The results obtained indicated that about 91% of the respondents were male headed households. All the respondents reported to have fully involved in farming activities as means of supporting their livelihood. The overall average land holding of the respondents in Dedo Woreda was reported to be about 1.72 h/hh. This is higher than the mean land holding of 1.1 and 1.4 ha/hh reported from Ada'a and Lume districts of East Shewa. The results of this study also showed that the land holding of Dedo Woreda is higher than that of the national average of 1.02 ha/hh (EEA 2002).

The mean family size of all the respondents was calculated to be 7.1 persons/ hh, the result of which is higher than the mean family size of 6.2 and 6.9 persons/hh recorded from Bure of Amhara regional state and Dale district of SNNP regional state, both of which are higher than the national average of 5.2 persons/hh (CSA 2003). The result of the current study (7.1person/hh) is also higher than, the Amhara and SNNP regional states (5.4 and 5.1 persons/hh respectively) as reported by Halima (2007) and CSA (2003) respectively. As indicated in the present study (Table2), the average land holding (1.72h/hh) is very small from the point of view of the average family size (7.1pearsons/hh) of the study area. The majority of the respondents (97 %) were married. About 98.9% of the respondents were reported to be Muslim and the remaining 1.1% was Protestants. The overall mean age of the respondents was found to be about 42 years. About 23.0% of the respondents reported to be within the age group of 30- 60 years; whereas; about 34.4% of the respondents reported to belong to the age group of 15-30years .Thus the results of this study showed that the majority of the respondents are in the economically active age group. About 66 % of the respondents reported to have more than 15 years of experience in poultry rearing. The results of the current study showed that the respondents of the Midland agro ecology (38%) had longer experience in rearing poultry as compared to the respondents of highland and lowland agro-

ecologies. The results of this study also showed that about 25% of the respondents were illiterate. About 25.6 %, 23.9%, 19.4% and 6.1% of the literate respondents were reported to have gone through primary first cycle (1-4), primary second cycle (5-8), high school (9-10) and above secondary high school as shown in Figure 2 . Socio- economic role of Chicken production in Dedo Woreda provide major opportunities for better nutritional value and source of incomes for smallholder farmers because of short generation interval and medium rate of productivity. According to Alders, (2004); Salam, (2005) Animal production in general and chickens in particular play important socio economic roles in developing countries. Educational back ground of the respondent was a major opportunity for village chicken production in the study area, so should reduce these challenges to exotic chicken production and management of village productivity.



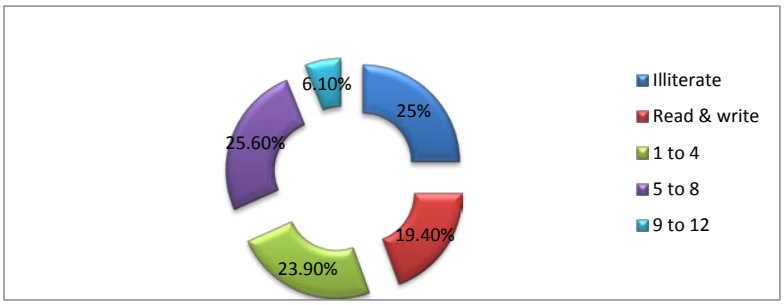


Figure 2 Profile and educational level of the respondents

Table 2: Land holding, Family Size and Flock Size of the Respondent (Mean ±SD).

Variables	NHH	Highland	Midland	Lowland	Overall Mean
Land holding(ha/hh)	60	1.54±1.3	2.21±1.1	1.40±.60	1.72±1.1
Family size (persons/hh)	60	6.8±1.8	7.1±1.9	7.3±2.2	7.13±1.9
Flock size (chickens/hh)	60	10.5±2.6	11.72±5.1	10.47±3.9	10.91±4.0

NHH-Number of House Hold SD-Standard deviation

4.2. Flock Size and Structure

Flock structure is described in terms of the number and proportion of the different age groups and sex in a flock. The plumage colors of the local chicken found in Dedo Woreda are mixed (black, white, red, grey *etc.*). The flock size and structure of chickens and the mean number of chicken/hh in each agro ecology are shown in Table 3. The flock size ranged between 2 and 12 chicken/hh in the lowland, 5 and 30 chickens/hh in the midland and 2 and 22 chickens/hh in the highland respectively showen (Table3). Mean flock size of 10.11 and 10.5 chickens/hh was calculated for the lowland, midland and highland agro ecologies respectively. The overall mean flock size of 10.5 chickens/hh was recorded from the study

Woreda, the value of which is higher than that of the flock size of Oromia Regional state (3.6) and the national average (4.1) as reported by CSA (2003), but lower than (13 chickens/hh) that reported by Fisseha *etal.,* (2010) from Bure district of the Amhara regional state. Melese Gashu Nigatu *etal.,(* 2014) reported mean flock size of 13 and 5 chickens/hh for local and crossbred chickens respectively from Eastern Gojam Zone of Amhara regional state. An average flock size of 16 chickens/hh was also reported from the central highland of Ethiopia (Tadelle *et al.,* 2003b). The result of this study showed that the average number of chickens/hh of the Dedo Woreda (10.5 chickens/hh) was higher than that of Tigray regional state (7.2) as reported by Solomon (2008) and that of North west Ethiopia (7.1) as reported by Halima *etal.,* (2007). On the other side the mean flock size recorded from the current study was slightly higher than that of (9.22 chickens/hh) South Ethiopia as reported by (Mekonen 2007).

Mean flock size of 16 and 26 chickens/hh was calculated for the rural area of Tanzania (Mwalusanya *et al.,* 2004) and, Pakistan respectively as reported by Javed *etal.,* (2003) and Farooq *etal* .,(2004) .The general indication is that the national average for the indigenous chicken flock size reported from Ethiopia (4.1) is significantly lower than that reported from other developing countries such as Philippines (19), Uganda (18) and Sudan (22) (Eugene 2004; Sewannyana *etal* .,2004 and Khalafalla 2000). The variation in flock size within Ethiopia and the lower flock size average for Ethiopia has been attributed to the farming systems practiced and prevalence of local factors such as diseases and predators (Kuit *etal*., 1986). The results of this study tends to indicate that the Flock size variation in the study are could partially be attributed the variation in land holding and prevalence of disease situation. The relatively higher mean flock size calculated for the study area is perhaps due to purposive selection of sampled farmers raising chickens. The mean flock size of the study areas was found to be dominated by chicks of 0-8 weeks of age (3.90 chicks/hh) followed by hens (3.27 hens/hh), pullets (2.95), cocks (2.08) and cockerels (1.72) as shown Table 3.

The high proportion of the chicks (0-8 weeks of age) might be attributed to high chick mortality while the higher proportion of hens in the population is an indication of strong

desire for egg and chick production (Wilson *etal*., 1987; Abdou and Bell 1992). The relatively large proportion of hens per household in the study area might purposively complete by the farmers' to increase egg production and securing the sources of replacement flocks. It might as well be attributed to lack of strong selection and culling against the hens and buildup of old and unproductive hens in the flocks. The mean male to female ratio was calculated to be 1:1, 1:2, 1:3, 1:5, 1:8 and 1:10 in midland, highland and lowland agro ecology of the study area respectively. As shown in Table 3 the mean value of cocks/hh is higher for lowland. The recommended cock to hen ratio in modern light and heavy breeds' are1:10 and 1:8, respectively indicating that there are surplus males in the flock in the case of midland and high land agro ecology of the study areas. The results of the male to female ratio obtained from these three agro ecology was in agreement with that of Fisseha Moges, *etal*., (2010) who reported, similar male to female ratio from the study conducted on the indigenous chicken of Bure, Fogera and Dale districts respectively. However, a cock to hen ratio of 1:4 was reported in Sudan by Khalafalla *etal*., (2001).

Table 3 : Flock Size and Structure of Chickens in the Study Sites

Item	High Land	PV	Mid-Altitude	PV	Lowlands	PV
Mean number of chicks (0-8wks) /hh	2.81±0.80	0.00	3.30±0.91	0.00	2.41±0.70	0.9
Mean number of Pullets (8-20wks) /hh	2.60±0.68	0.27	2.86±0.74	0.27	2.0±0.68	0.01
Mean number of cockerels (8-20 wks) /hh	1.5±0.49	0.00	1.60±0.64	0.00	1.40±0.42	0.24
Mean number of adult cocks (>20wks) /hh	1.10±0.60	0.62	1.10±0.64	0.62	2.05±0.50	0.74
Mean number of laying hens (> 20wks) /hh	2.5±0.52	0.28	2.2±0.67	0.28	2.13±0.52	0.41
Range (minimum-maximum) of	2-22		5-30		2–12	

chickens/hh

* The mean difference is significant at the 0.05 level.

4.3 Labor Dynamics

Under the traditional management practiced of the study area, about 5% of the respondents reported that the males (men) are responsible for the care of chickens in the area of construction of poultry houses. About 95% of the respondents indicated that women and children are responsible for the management and marketing of chickens. The result of this study was in agreement with that of Aklilu *etal.,* (2007) who reported that, in Ethiopia, poultry is a source of self-reliance for women, since poultry and egg sales are decided by women and provide women with an immediate income to meet household expenses such as food.

4.3 Village Chicken Husbandry Practice

4.3 .1 Feeds and Feeding

The available feed ingredients and feeding practice of Dedo Woreda are summarized in Table 4. The major supplementary feed in the surveyed area comprise of cereal grains (88.3%), of which maize, sorghum, teff, barley, mixture of maize and sorghum, mixture of maize and wheat and mixture of maize and barley accounted for 60, 13,11, 1.6, 1.6 and 1.1 % of the total cereal grains used for supplementation (Table4). The remaining 11.7% supplementary feed materials consisted of household leftovers such as sugar beet, "*Kocho"* (Baked Enset), and "*Amicho*" (cooked and non-cooked enset). About 92.2 % of the respondents indicated that supplementary feeding were highly required during the big (June to August) and small rainy (March to May) seasons than during the dry season (September to February) mainly attributed to the shortage of grain during the rainy season. It seems that the amount of supplementation provided depends on the availability of resources at the household level. In most cases, provision of feeds to chicken was seasonal as reported by

Fisseha *etal.,* (2010) from a survey conducted on indigenous chicken productions and marketing systems of Bure and Fogera of the Amhara regional state and Dale Woreda of the SNNP regional state.

According to the results of this study, the respondents reported that supplementations are aimed at improving health status and overall productivity of their chickens and young chicks are given priority in supplementary feeding because of the fact that the young chicks could not adequately scavenge and might be attacked by predators. Laying hens are given the second priority in terms of supplementary feeding aimed at increasing egg productivity. The result of this study was in agreement with that of Fisseha Moges *etal*.,(2010) who reported that young chicks are given priority in supplementary feeding in all the study location of Bure Woreda of the Amhara regional state because they could not scavenge. The results of this study showed that the respondent practiced supplementary feeding of their chicken, which is usually offered in the morning (18.3 %), in the afternoon (2.2 %), in the afternoon and evening (1.1 %), in the morning and afternoon (51.7 %). About 26.7 % the respondents reported to have provided supplementary feed more than twice per day (Table 4). This result implied that although the supplementary feed is not satisfactory in terms of quality and quantity. The majority of the respondents (82.8 %) provide supplementary feed by throwing on bare ground to feed in groups without age separation, while 9.4 % reported to have provided in a feeder. The remaining 7.8 % of the respondents provide the supplementary feed either in a feeder or on bare ground.

Table 4: Chickens Feeding Practice of Dedo Woreda

Feeding Practices		Frequency	Percentage
Nutrient source	Scavenging	179	99.4
	Purposeful feeding	1	0.6
Source of feeding	From the house	163	90.6
	Purchased	17	9.4

Feeding practice	In a feeder	17	9.4
	On bare ground	149	82.8
	Both	14	7.8
Way of supplementation	Separate feeding of different classes of chickens	80	44.4
	Collective group feeding	100	55.6
Time of supplementation	In the morning	33	18.3
	In the afternoon	4	2.2
	In the afternoon and evening	2	1.1
	In the morning and afternoon	93	51.7
	In the morning, afternoon and evening	48	26.7
Type of feed supplemented	Grains	159	88.3
	Others	21	11.7
Types of grains supplemented by chicken	Wheat	5	2.7
	Maize	110	61.5
	Sorghum	34	12.4
	Barely	3	1.6
	Maize and sorghum	20	11.1
	Maize and wheat	3	1.6
	Maize and barley	2	1.1
	Teff	3	1.6

4.3.2 Provision of Water

The results of this study revealed that there were seasonal variations in the source and practice of offering water for village chickens. About 56 % and 44 % of the respondents reported to offer water to their chickens throughout the year and during the dry period respectively. About 71.19, and 10% of the respondents reported to have offered river water, spring water, both rain and river water to their chicken respectively. The result of this study

was in agreement with that of Fisseha Moges *eta*l., (2010) who reported that, the major sources of water for chicken in the Bure Woreda of the Amhara regional state is river (30.4%), spring (28.5%), locally made underground water (21.4%) and pipe water (19.7%). The overuse, of river water during the dry period is reported to have become heavily contaminated with disease causing pathogenic organisms. The contamination seems to be severing since the same river water could be used for human and wild life consumption as reported by the respondents of the current study. Birds of any age can be affected, although young ones are more susceptible. The result of this study also showed that about 78.3% of respondents reported to have regular watering troughs made up of plastic material. About 7.2%, 0.6%, 4.4 and 0.6% of the respondents reported to have used watering through made up of metal, wood and broken pot and stone respectively. About 8.9% of the respondents use any locally available materials as watering trough. About 26.7% of the respondents clean the watering through once a day, while 57.8 % and 10.6% reported to have cleaned twice per day and three times a day respectively. The remaining 4.9 % never clean watering troughs. Unclean watering troughs are one of the major sources of contamination of the drinking water by pathogenic disease causing organisms in Dedo Woreda.

4.3.3 Housing

About 70.6 % of the respondents said to have provided separate poultry house during night times. On the other side the remaining 29.4% of the respondents keeps their chicken in family dwelling together with human being during night times. About 88.3 % of the respondents strongly believe that there are significant advantages of constructing separate poultry house and the remaining 11.7% seems to be in-different pertaining the advantages and purpose of separate poultry houses. The problem of separate chicken house construction in the study area was reported to be lack of knowledge about feeds and feeding practice (86.1%), shortage of construction material (9.4%) and disease prevalence (2.2).

Table 5 : Housing system of the study area

Village chicken housing system	Frequency	Percent
In the kitchen	20	11.1
Perches' on trees	24	13.3
Homemade cage	2	1.1
Perch inside the house	9	5.01
Family dwelling	101	56.1
Dwelling other livestock	24	13.3
Cleaning shelter		
Once per day	159	88.3
Every two to three day	21	11.7
Per week	0	0
Never clean	0	0

The majority of the respondents in the study area reported to have used different materials in the construction of poultry house. About 5.6, 66.1, 23.9, 4.4 % of the respondents reported to have used mad blocks, iron sheet, wood and grass as poultry house construction materials respectively. The result of this study seems to be in agreement with that of Halima (2007), who reported that significant size of the rural households (51%) of Northern Ethiopia had separate poultry houses for their chickens. In contrast Mekonnen (2007) reported that there are no separate poultry houses in Dale Woreda located in Sidama Zone of SNNP regional state. Most of the published reports suggest that, whenever poultry houses are provided, the houses are made up of different locally available construction materials such as wood, mud bricks; sugarcane stems, bamboo and cereal Stover's. The other African countries are not exception to this situation. In Botswana 35.8 % of the indigenous chicken farmers provided

housing of some kind (Badubi *etal*., 2006). According to the results of this study, about 88.3% of the respondents, clean their chicken house once a week, while the remaining 11.7% clean 2-3 days a week. Lack of frequent cleaning of poultry houses is likely to be infested by infectious disease and different external parasites both of which cause high mortality of village chickens. The result of this study was in agreement with that of Fisseha Moges *etal*., (2010) who reported that lack of frequent cleaning of poultry shelter can easily cause diseases and increase morbidity and mortality rates of chicken. Thus it is suggested that awareness creation within the farming community concerning the importance of regular cleaning of poultry shelters (Fisseha Moges *etal*., 2010)

4.2.4 Diseases Conditions and Health Care

According to the results of this study, there are several poultry diseases characterized by seasonal outbreaks in the study area. Based on the observations of the respondents, serious outbreak usually occurs during the rainy seasons. About 45, 23.3, 15, 12.8, 2.6 and 1.1% of the respondents indicated that Coccidiosis, Cholera, Infectious bronchitis, Newcastle disease, Fowl pox and External parasite as economically important poultry disease in the study area shown (figure 3).

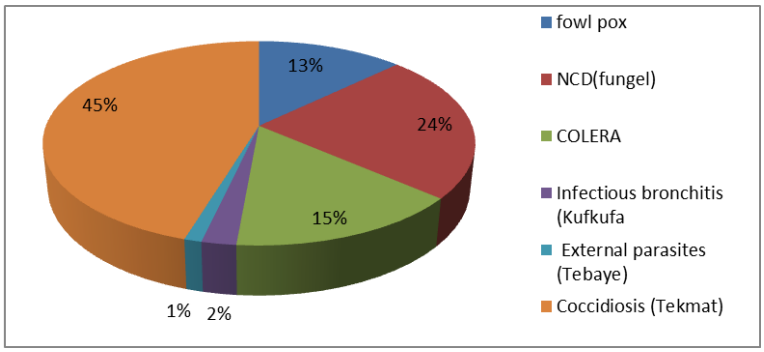


Figure 3 Proportion of Common poultry disease of Dedo Woreda as reported by the respondents.

Moreover, it is revealed that, these diseases could horizontally be transmitted by contact between flocks of different households. This study result is in agreement with the results of other studies indicated the severity of Newcastle disease during the rainy season in Kenya (Anonymous 1990) and Ethiopia (Sonaiya 1999), while in the West and Central African countries, (Mukiibi-Muka 1992; Gueye 1998). Additionally, predator and accidents caused by humans and domestic animals are the causes of high chick mortality in Dedo Woreda. The result of this study seems to be in agreement with that of (Aberra, 2007), Poultry Production and Management in the Tropic. 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 of economic importance. Moreover, the health status in many of the small scale intensive poultry farms is extremely poor (Abebe, 2006).According to the results of this study, 55% of the respondent's revealed that farmers usually treat sick chickens using traditional medicine. They uses Garlic, tobacco leaf, local alcohol, paper powder, butter, lemon, orange, "*Feto*" (Lipdum sativum) seed powder, "*Endod*" (Phytolacca dodecandra) leaf juice and onion *etc.* as soaking, nasal use and smoking against external parasite. However about 13% of the respondents are reported to consult veterinarians when their chickens get sick, even if there is no adequate and efficient veterinary and extension service in the study area. About 84.6 and 10% of the respondents reported lack of awareness about the availability of vaccines, lack of attention to village chicken and inaccessibility and shortage of vaccines as the major health problems of in the study area.

4.3.5 Predators

Predators are reported to be one of the major constraints to village chicken production system of Dedo Woreda. About 49.2% of the respondents indicated that wild Egyptian Vulture (locally called 'Chulule') was reported to be a dangerous predator attacking young chicks while about 25 % and 25.8 % of the respondents reported wild cats and domestic dogs to be economically important predator of young chicks respectively. The result of this study was

in agreement with that of Halima (2007) who reported that predation was one of the major constraints under the village chicken production system in Northwest Ethiopia. Provision of supplementary feeding, watering and construction of 'predator proof' chicken houses has been suggested to reduce losses of birds due to disease conditions and predations (Fisseha Moges *etal.,* 2010). Young chicks could also be protected from predators with the use of appropriate technology such as hay-box brooder.

Table 6 :Cause of Chicken Mortality in the Study Area

Variable	Level	Sex	Percent
Age group with highest mortality of chicks	Chickens(0-8) weeks of age	Male	18.4
		Female	21.5
	Chickens(8-20) weeks of age	Male	16.1
		Female	21.8
	Cocks	⩾20 weeks of age	12.5
	Layers	⩾20weeks of age	9.7
	Diseases		50.8
Causes of mortality	Predators		49.2
Season of mortality	Dry season		51.5
	Rainy season		48.5

4.3.6 Breeds and Breeding

About 96.1% of the chicken found in the study area belongs to the Ethiopian non-descriptive indigenous breeds of chickens. The remaining 3.9% are exotic and cross breeds (Table7).

The result of this study seems to follow the general national tendency in terms of breed, since it had been reported that about 96.9, 0.54, and 2.56% of the total national poultry population are reported to be indigenous, hybrid and exotic, respectively (CSA, 2012).

Table 7 :Distribution of chicken breeds in the study area

Chickens breeds	Frequency (No)	Percent (%)
Indigenous	172	96.1
Exotic	1	0.6
Cross	7	3.9

About 97.8 % of the respondents reported to incubate eggs using mature broody hen (2nd and 3rd clutch) during the dry seasons after a careful selection of thoroughly broody hen based on their own selection parameters. About 56.1% of the respondents reported to select the broody hen on the basis of its previous hatching history. About 24.4, 9.4 and 4, 4% of the respondents select broody hen to be used for incubation on the basis of body size, plumage cover and the appearance of the broodiness. The remaining 5.7% reported to have used no selection criteria. About 97.8% of the respondents reported to have placed the incubation boxes in a protected and dark corner of the family dwellings with the use of cereal straws as bedding materials either on clay pot or on bare ground.

About 87.8% of the respondents do not mind for egg incubation position. The majority of the respondent (99%) incubates home laid eggs. About 80.4 % of the respondents reported not to practice any special management of the broody hen during incubation such as putting feed and water near to the brooding nest and avoiding disturbance. According to the results of this study, chickens are acquired through purchase from the local market (85%), purchase from agricultural office (10 %) (Some farmers keep the exotic Rhode Island Red (RIR and WLH) breed and as a gift and/or exchange (5%). The result of this study was in agreement with that of Kugonza *et al*. (2007) who reported that most of the households in Uganda, acquire chickens through a combination of two or more ways which include purchase (65.6%), gift (26.3%) or exchanged for labor (8.1%). According to Fisseha Moges *etal., (*2010), the majority of the replacement stock (76–87%) originates from the household flock and the rest

are purchased from the local market. Some farmers keep the Rhode Island Red breed of chickens distributed through the government extension system. These have been crossed with indigenous chickens in some instances. The non-monetary (gift) method of acquiring chicken represents one of the most important socio-cultural roles of chicken in Dedo Woreda. Relatively better economic gains might be appreciated from chicken if the proportion of gifts and slaughtering of chickens for guests are reduced and positive response on management is provided. The broody hen management practices employed in the study area was reported to be traditional. Most of the respondents reported to have attempted increasing egg production by stimulating the broody hens to resume lying. Disturbing the broody hen in the nest (6.1%), hanging the birds upside down (92.2 %) and moving to neighbors (1.7%) are some of the methods practiced to stimulating broody hen to resume lying. Sickness and frequent broodiness are the two major factors of culling chickens from the flock in the study area Table 8.

Table 8: The determinant factors of culling chicken in the Dedo Woreda

Causes of culling	Frequency	Percent
Poor productivity	28	15.6
Sickness	28	15.6
Old age	22	12.2
Frequency of broodiness	84	46.7
All	18	9.9

4.3.7 Marketing System

The results of this study showed that sale of chicken and egg are an important source of family income in the study area (Table 9). Although chicken are sold in various places, the Woreda towns are the major urban markets of poultry. The annual income from the sale of

poultry and poultry products in the study area was calculated to be Birr 335.44.. The result of this study was in agreement with the mean annual income of Birr 300/hh reported by Bush (2006) from the study conducted in the SNNP regional state. According to Bush (2006), this income represents 25% of the typical annual income of poor families.

Table 9 : Market Price of Live Birds and Eggs in Dedo Woreda

Item	High Land	Mid-Altitude	Lowlands	P Value
Price of adult cock during rainy season (birr/h)	121±17.5[ab]	124.50±17.63[a]	119±19.70[ab]	0.18
Price of adult cock during dry seasons (birr/h)	131.00±25.23[a]	132.83±27.027[a]	127.66±19.72[ab]	0.01
Price of adult hen during rainy season (birr/h)	68.12±13.20[a]	65.5±14.25[ab]	67.7±13.20[a]	0.39
Price of adult hen during dry season (birr/h)	72±15.17[a]	68.55±16.50[ab]	71.8±13.30[a]	0.10
Price of pullets and cockerels in rainy season (birr)	54.21±15.23[a]	50.31±15.20[ab]	50.31±15.20[ab]	0.26
Price of pullets & cockerels in dry seasons (birr)	56.23±17.30[a]	52.4±18.50[ab]	51.65±13[ab]	0.26
Price of eggs during rainy seasons (birr)	1.75.0±0.2[c]	185.0±0.12[ab]	1.92±0.1[a]	0.01
Price of eggs during dry seasons (birr)	1.88±0.13[a]	1.80±0.12[ab]	1.88±0.14[a]	0.00

The major reasons of selling live birds and eggs in the Dedo Woreda were reported to be the occurrence of disease outbreak, the beginning of the big rainy season, need of cash for buying children cloth and purchase of feed and other household constructional materials. Both women and men are involved in chicken marketing in the study area. The result of this study was in agreement with that of Assefa (2007) and Halima (2007), who reported that chicken owners found in different parts of the country sell chicken and eggs to purchase food items, cover school fees, get cash for grain milling services, purchase improved seeds and to adjust flock size. Eggs from local chicken are often favored because of their deep yellow colored yolks, as a result of which free ranging local chicken are higher in market demand and fetch higher prices in urban markets (ILRI 1995). The cause of variation in chicken and egg market price in Dedo Woreda were reported to be diseases outbreak (3.9%), holiday (11.1%), egg size (15%) and combinations of disease and holiday (70%). The result of this study was in agreement with that of Halima (2007),who reported that the market price of chicken and eggs is highly related to holy days, non-fasting season for the Orthodox Christians, plumage color, comb type, body size, age, sex, market site and health status of chicken. It is also in agreement with that of ILRI (1995), which indicated that in Ethiopia, village chicken and egg marketing channels are informal and poorly developed. Chicken and eggs are sold to consumers within the villages, on road sides and in local and urban markets.

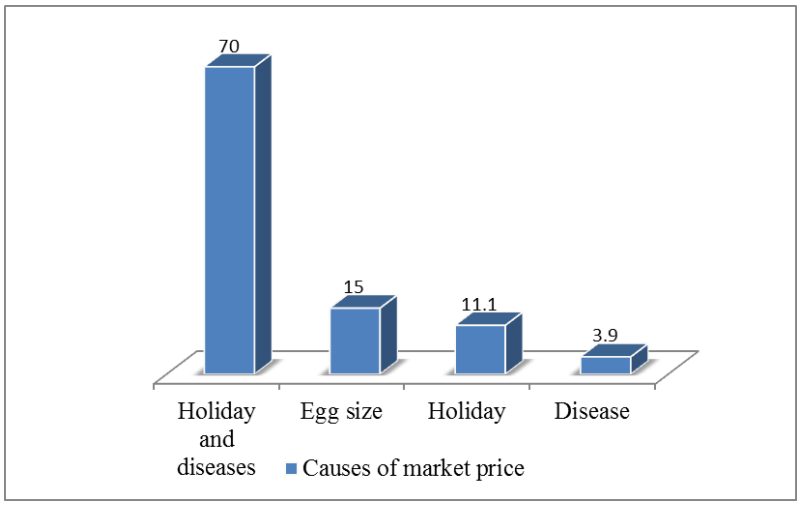


Figure 4 Determinant of market price in Dedo Woreda.

There is seasonal variation in market price of live birds and eggs and market price showed decrease with the onset of the big rainy season (June to August) as shown in Table 9. The results of this study showed that white, red and mixture of white and red plumage colors are more preferred for consumption in the Dedo Woreda. Black, mixture of black and white, mixture of red, white and black and mixture of red and black plumage colors are less favored. This result is in agreement with that of Fisseha Moges *etal.*, (2010), who reported the same tendency in consumer and market color preference from a survey conducted on indigenous chicken productions and marketing systems of Bure and Fogera of the Amhara regional state and Dale Woreda of the SNNP regional state.

4.3.8 Extension Service in the Study Area

Little emphasis has been given to livestock and poultry production activities in the Dedo Woreda. The result of this study indicated that 47.8 % of the respondents reported to have received national poultry technical extension packages and services offered by development

agent. About 52.2% of the respondents have no access to the Woreda poultry extension services attributed to the low extension coverage and lack of awareness about the usefulness of the extension services. Similar to the results of this study, Melese Gashu Nigatu *etal.*, *(*2014) and Alemu and Tadelle (1997) reported extremely weak extension linkage between the research output and the ministry of agriculture which in turn resulted in lack of consistent feed back to the research centers. Fisseha *etal.*, (2007) also reported lack of access to poultry extension packages in Bure district of Amhara regional state.

4.3. 9. Production and Reproduction Performance of Village Chicken

Indigenous chickens are generally known to lay fewer eggs as compared to exotic chickens. About 78 % of the respondents in this study reported that their chickens laid 4-5 clutches of eggs per year and each clutch was estimated to contain 10– 16 eggs showing annual egg production/hen to range 35 - 62 eggs, the value of which is similar to 43.8 eggs/year/hen as reported by Meseret (2010) from an attempts made in characterization of village poultry production and marketing system in Gomma Woreda of Jimma Zone. The results of the current study are similar to that of Moges *etal.*, (2010) who estimated annual egg production of indigenous hens at about 60 eggs. Mean age at the first egg of pullets and age at slaughtering of the male in the study area was found to be 5.5 and 6 months respectively. This result is higher than the value reported by Fisseha Moges *etal.*, (2010) from an assessment of village chicken production system and evaluation of the productive and reproductive performance of local chicken ecotype in Bure district, North West Ethiopia. The average number of eggs incubated at a time was reported to be 12 eggs. About 22% of the respondents said that they have no idea of how many eggs are laid by the hen on yearly basis, since there is lack of recording among the rural communities as to the exact number of eggs and clutches per hen per year. Eggs are not stored over a long period because of the fact that both live birds and eggs are an immediate source of income at household level in Dedo Woreda.

The flock size and structure of the Woreda is dominated by indigenous chickens. It has been found that the number of exotic chickens and their crosses are low in all the Agro ecologies studied as compared to the number of indigenous chickens, mainly attributed to the low adaptability of improved breeds of chickens to the local conditions. The majority of the respondents reported to have no interest in keeping exotic breeds of chickens, because they lack mothering ability required for incubation, hatching and brooding of the resulting chicks. More over exotic breeds of chickens are poor in scavenging and their concentrate feed requirement is high. Exotic breeds of chickens could also be easily attacked by predators. Lemlem *etal.*, *(*2010) reported the highest mortality attributed to disease condition and predation from Fayoumi and White Leghorn breeds of chickens kept under the management of smallholder farmers in Northern Ethiopia as compared to the indigenous chickens. About 80% of the respondents indicated that local chickens performed better than exotic chickens and their crosses in terms of survivability, disease résistance and alertness against predators.

The majority of the respondents reported that the risk of disease, predation, lack of supplementary feeding, unavailability of vaccine and lack of proper housing are the major limitations to the productivity of exotic chickens and their crosses under rural household conditions in Dedo Woreda. In agreement with the result of the current study, Mwalusanya *etal*., (2004) reported that the low productivity of local chickens is partly due to poor management practices, in particular the lack of proper health care, poor nutrition and poor housing

4.3.10 Fertility and Hatchability of Eggs Incubated

Fertility and hatchability are the major economically important parameters of reproduction performance in poultry production. The results of fertility and hatchability of the eggs collected from the studied Agro ecologies and incubated with the use of JUCAVM hatchery are shown in Table10. The mean percent total hatchability of eggs of Dedo Woreda was calculated to be 20.8 % the value of which was slightly lower than that (22 %) reported by Meseret (2010),Brännänng and Pearson (1990); Mekonnen (2007) and Tadelle and Ogle

(1996a). The results of this study clearly showed that hatchability seems to be one of the detrimental factors limiting poultry production in Dedo Woreda. About 88 % of the respondents believed that there was seasonal variation in hatchability. They reported to have the lowest hatchability during the rainy seasons. All the respondents reported to have had about 20-30 % hatchability during the rainy seasons and > 73.3 % hatchability during the early dry period ranging from September to December.

Table 10 : Fertility and Hatchability of Eggs incubated from the Experimental Sites

Item	Highland (N=200)		Midland (N=200)		Lowland (N=200)		Total (N=600)	
	N	%	N	%	N	%	N	%
Infertile eggs removed on the 7th day of incubation	83	42	82	41	77	39	242	40.3
Early dead embryo removed on the 7th day of incubation	17	8.5	9	4.5	18	46	44	7.3
Late dead embryo removed on 14th day of incubation	11	7.5	21	10.5	21	10.5	13	6.5
Percent fertility of the eggs	58	29	58.5	29.25	61	30.5	118	19.6
Percent hatchability of the fertile eggs incubated	39	33.62	40	34.18	46	37.7	125	35.21
Percent hatchability of the total eggs incubated	39	19.5	40	20	46	23	125	20.83

4.3.11 External and Internal Egg Quality Characteristic

The results of the study conducted on the internal and external quality characteristics of the eggs collected from the study sites are given in Table 11. The results showed that about 89 and 4.4% of the eggs were medium white and pale in shell color respectively. About 3.3, 2.2 and 1.1% of the eggs collected were characterized medium, white, cream and pale brown

shell color respectively. The result of this study was in agreement to that of Halima (2007) who reported that the shell color of eggs collected from local hens of Northwest Ethiopia is mixture of white, light brown and cream colors. The mean weight of the eggs collected from all the studied Agro ecologies ranged between 40.75 and 44.29 grams. There was no statistically significant difference ($P<0.05$) between all the study areas in mean egg weight. Egg weight was largely affected by factors such as environment, feed, breed of chicken,, age, genetic make-up and number of egg laid (Msoffe *et al*., 2002 and Yakubu et al., 2008). Teketel (1986) also reported an average egg weight of 46 gm for Ethiopian local chicken. This result of the current study is also similar to the result of Aberra *etal.*, (2007), who reported an average egg weight of 42g and 49g for the Ethiopian naked neck chicken and their F1 crosses with New Hampshire breeds, respectively both of which were reared under improved management conditions. The mean egg weight of Dedo Woreda was calculated to be 42.42g, the value of which is in agreement with that of Fisseha Moges *etal*., (2010)) who reported average weight of eggs from local hens to be 43 and 47gm in Bure and Fogera Woredas of the Amhara regional state, respectively. According to Zhang *etal*., (2005) and Aygun and Yetisir (2010), egg weight influences the weight of the individual components of an egg especially that of egg albumen and yolk.

Table 11 : Internal and External Qualities of Eggs Collected from the Study Sites

Item	Highland (N=80)	Midland (N=80)	Lowland (N=80)	Total mean	P value	CV
Mean egg weight (g)	40.75^{b}	44.29^{a}	42.23^{b}	42.42	0.001	9.73
Mean albumen weight (g)	21.46^{b}	22.86^{a}	21.58^{b}	21.97	0.04	12.58
Mean yolk weight (g)	14.06^{b}	15.25^{a}	15.00^{a}	14.77	0.00	12.00
Mean shell weight (g)	4.95^{b}	5.35^{a}	5.18^{ab}	5.16	0.03	13.09
Mean albumen height (mm)	1.78^{b}	2.09^{a}	2.18^{a}	2.01	0.00	29.31
Mean yolk height (mm)	11.28^{ab}	11.44^{a}	10.26^{b}	10.9	0.07	22.75
Average yolk color fun(1-15)	9.60^{a}	9.40^{a}	9.92^{a}	9.64	0.3	16.55

Mean shell thickness(mm)	4.31[b]	4.76[a]	4.73[a]	4.60	0.05	20.03
Average Haugh Unit	44.42[b]	46.37[a]	45.59[ab]	45.46	0.001	20.21

* Means with the same letter are not significantly different (P<0.05).

The overall mean shell weight of eggs without membrane collected from local hens in Dedo Woreda was 5.16g. The result of this study was in agreement with that of Fisseha Moges *etal.*, (2010) who reported the average dry shell weight of 2.3 and 5.5 gm from eggs collected from local hens of Bure and Fogera Woredas of Amhara regional state respectively. Halima (2007) reported a relatively higher average dry shell weight of 3.95 gm and 5.7 gm for eggs collected from intensively managed local and RIR hens of Northwest Amhara regional state respectively. The overall mean shell thickness recorded from eggs collected from the study area was 4.60 mm, the value of which is higher than that reported (0.71 mm and 0.69 mm) by Halima (2007) for eggs collected from intensively managed local and RIR chickens of Northwest Amhara regional state. Teketel (1986) reported an average egg shell thickness of 0.35 mm for the Ethiopian local chicken while; Asuquo *et al.,* (1992) reported an average egg shell thickness of 0.30 mm and 0.35 mm for Nigerian local and Isa-Brown chickens respectively. The higher average shell thickness (4.60mm) recorded in the current study might be attributed to the high calcium and phosphorous contents of the supplementary and scavenging feed resources of the Dedo Woreda. The average yolk and albumen height of eggs collected from the selected Agro ecologies of Dedo Woreda was 10.99 and 2.01mm respectively the values of which are lower than that of Fisseha Moges *etal* .,(2010), who reported mean yolk and albumen height of 15.1 and 4.1mm respectively for eggs collected from Bure Woreda of the Amhara regional state.

The mean yolk weight of eggs collected from the study area was 14.77g the result of which is similar to the mean yolk weight of eggs collected from Gomma Woreda (15.02g) as reported by Meseret (2010). It is accepted that, embryonic development of hen's egg is dependent on traits like egg weight, yolk and albumen heights, genetic line and age of the hen. The mean albumen weight of eggs collected from the study areas was 22gm and this is higher than that of Fisseha Moges *etal*., (2010),who reported average albumen weight of 19.6 and 22gm

for local eggs collected from Bure and Fogera Woredas of the Amhara regional state respectively. The other most important internal egg quality traits considered in this study was yolk Color, estimated using roach color fun (range 1–15) .The result showed that the average yolk color of eggs from local hens were 9.64 in the study area. This is higher than that reported by Fisseha Moges *etal*., (2010) for local eggs (8.6 and 9.06) collected from Bure and Fogera Woredas respectively. Halima (2007), reported average yolk color of 3.5 and 4.0 respectively for eggs collected from intensively managed local and RIR hens in Northwest Amhara regional state. Pavlovski *et al.*, (1981) also reported that the yolk color score of free range local hens is higher compared to yolk color score of eggs collected from hens managed under intensive management condition. Hence ,the higher yolk color score obtained from the current study indicates that scavenging feed resource base of Dedo Woreda is rich in xanthophyll's', which is responsible for deep yellow color collected from scavenging indigenous chickens. The average mean value of Haugh unit of the eggs collected from the study area was 45.46, the value of which is lower than that (66.5) reported by Fisseha Moges *etal*., (2010) for Bure and Fogera Woredas and then that (61 and 81) reported by Halima (2007) for eggs collected from local and RIR chicken kept under intensive management condition of Northwest Amhara regional state. Asuquo *etal*., (1992) reported higher Haugh unit values of 79.8 and 89.9 for eggs collected from Nigerian local and Isa-Brown chickens respectively. The lower mean Haugh unit obtained from ($\leq$ 72) in the current study might be attributed to the poor handling and storage of the eggs, since egg Haugh unit is highly correlated with storage period and condition of eggs.

4.4 Performance and Survival of the Experimental Chicks Hatched

4.4.1 Performance of the Experimental Chicks

The results of the feeding trials conducted on the experimental chicks hatched (the number of chicks hatched, initial hatching weight, final body weight, feed intake, feed conversion ratio and the corresponding survival rate to an age of 4 and 8 weeks) are shown in Table 12.

Table 12: Performance and Survival rate of the Experimental Chicks

Item	High land	Mid land	Lowland	Average
Total chicks hatched %	40	54	31	125
Initial body weight gain(g)	36.69	37.37	39.86	37.97
Body weight at an age of 8 weeks (g)	366.06	394.42	374.34	378.27
Daily Weight gain(g)/bird	6.10	6.57	6.23	6.3
Total Feed intake /bird/day (g)	3311.02	3367.09	3172.39	3283.5
Mean daily feed intake/bird (g)	55.18	56.12	52.9	54.7
Feed conversion ratio (FCR)	9.05	8.53	8.47	8.68
Mortality to an age of 8 weeks	53	56	57	55.3

As shown in Table 12, there was no statistically significant ($P<0.05$) difference between all the groups of the experimental chicks in mean hatching (initial) and mean body weight at an age of 8 weeks. The mean hatching weight (39.86 g/chick) of the groups of chicks hatched from eggs collected from the lowland area tended to be slightly higher than the others. On the contrary, the mean body weight (394.42 g/chick) attained at an age of 8 weeks by the groups of chicks hatched from eggs collected from midland areas tended to be higher than the others. Growth is defined as an increase in entire body, body parts or individual organ size per unit time (Yang *etal*., 2006). Growth is influenced by genotype nutrition, type of tissue, specific regulatory factors, as well as other aspects of the feed (Car1son, 1969). Low protein reduces growth as a consequence of depressed appetite and thus reduces intake of nutrients (Campel and Taverner, 1988).The depression in feed intake is regarded as responsible for the retarded growth in chickens (Kingori *et al*., 2003). The results of this study showed that, there was no significant difference ($P<0.05$) between all the groups of chicken in growth rate as measured by mean daily body weight gain (Table 12)

4.4.2 Daily feed intake

The results obtained showed that there were no statistically significant difference ($P<0.05$) between all the groups both in mean daily feed consumption and total feed consumed over the 8 weeks of the feeding trial. The mean total feed consumed from hatching to an age of 8 weeks (3172.39 g/chick) and the mean daily feed consumption (52 g/chick) of the groups hatched from eggs collected from the lowland tended to be lower than the others.

4.4.3 Feed conversion ratio

The results of feed conversion ratio of the experimental chicks are presented in Table 12. There was no statistically significant difference ($P>0.05$) between the all the groups of chicks in feed conversion ratio as measured by the amount of feed consumed per unit of body weight gain. Feed conversion ratio of 9.05, 8.5 and 8.4 was calculated for the groups hatched from eggs collected from the highland, midland and lowland area respectively. The results indicate that the groups hatched from eggs collected from highlands seemed to have consumed more feed (9.05g) per g of body weight gain compared to those hatched from eggs collected from midlands (8.5g) and lowland (8.4g). The feed conversion ratio calculated from the current study were higher than that (4.9 -5.2g of feed per g of gain) reported by Tadelle *etal* 2003, from Tepi, Horro, and Tilili indigenous chicks. Feed conversion ratio is a complex process and a highly aggregated traits which is the result of the interaction of behavior, level of production, appetite and other factors Halima *etal.,* 2006. Moreover, frequent disease outbreaks were encountered during the conduct of the feeding trial which might have confounded the performance of the experimental chicks.

4.4.4 Mortality

There was no statistically significant difference between all the groups of the experimental chicks in mortality. Reasonably low and comparable rate of mortality was recorded from all

the groups during the early phase of brooding. There was increase in rate of mortality of the experimental chicks gradually with time. The overall mean mortality to an age of 8 weeks of all the experimental chicks was calculated to be 53%, the value of which is high by any standard for chicks kept in confinement. About 55% of the total mortality to an age of 8 weeks occurred during the 7-8 weeks of the feeding trial which was attributed to the occurrence of serious disease outbreaks. The result of this study seemed to be in agreement with that of Solomon Demeke(2004) who reported that percent mortality from hatchling to maturity was higher ($P<0.05$) in local chicken (24%) compared to the leghorn (7.3%) chicken Higher mortalities, have also been reported earlier for local birds raised under intensive management conditions in Awassa (26%) (Teketel Forsido 1986), and Arsi (34%) (Brannang and Persson, 1990). The reason for the high mortality of local birds under intensive management system is not clear. On the contrary, the survival rate (% mortality) encountered in this study seems to be similar to those recorded from scavenging indigenous chicken in different parts of the country. The results of mortality obtained in the current study were higher than that (41%) reported by Meseret (2010), from the indigenous chickens of Gomma Woreda. Mekonnen (2007) reported 55% mortality to an age of 8 weeks from Dale Woreda of Southern Ethiopia. Tadelle and Ogle (1996a), reported mean mortality of 61% from young stocks kept under traditional management system in central highland of Ethiopia.

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Village Chicken production is an essential part of livestock production system in the study area. Poultry production in the study area is affected by a wide range of factors such as traditional management practice, lack of knowledge of modern husbandry, lack of access to improved breeds and limitation in extension and veterinary service Moreover, very less emphasis has been given to the livestock production sector in general and to chicken production in particular at the national level. The results of this study clearly showed that mortality as high as 55-60% could be encountered during the first 8 weeks of chick brooding.

On the other side, the available high demand towards chicken and eggs in the study area could be considered as good opportunity to the farmers involved in household poultry. These being the causes, the following recommendations could be suggested based on the results of the current study

5.2 Recommendations

(1) Appropriate intervention in health care and control of predators

(2) Provision of better extension service, credit schemes and training opportunities.

(3) Further investigation in to the constraints and potential of indigenous chicken based village poultry

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7. APPENDICES

Appendix A: Picture of chickens Egg market

Appendix B: Picture of Egg Candling

Appendix C: Picture of Egg Quality determination

Appendix D: Questionnaires Format

Farmer's Name----------Region---------- District----------Kebele------

Enumerator's Name---------- Date of interview----------

Agro-ecology a. Lowland b. Mid-altitude c. Highland

A. Socio-economic characteristics

1. Sex and age of the respondent 1.1.Male ----------1. 2. Female--------1.3. Age--

2. Major occupation----------

3. Educational level of the respondent

1. Illiterate 2. Read & write 3.1st –4th 4. 5th –8th 5. 9th-12th

4. Religion---------- 5. Marital status ----------

5. Economic status of the family (low, medium or high income) ----------

6. Land size (ha) ----------

7. Family size----------

Male Female Total----------

a) Ages under 14 years ---------- ---------- ----------

b) Ages between 15 to 30 years ---------- ---------- ----------

c) Ages between 31 to 60 years ---------- ---------- ----------

d) Ages above 60 years ---------- ---------- ----------

e) Total number ---------- ---------- ----------

B. Breeds Breeding

Source of breed: ----------

1. Purchased from Govt. /Pvt. Hatchery

2. Provided from agriculture research center

3. Provided from NGO's

4. Hatching of eggs naturally at home

C. Housing condition

1. Management system used?

1. Backyard

2. Semi-intensive

3. Others

2. Available housing condition?

1. Share the same house with people

2. Provision of night shelter only

3. Separate house entirely constructed for poultry

4. Separate house with other animals

5. Provision of electricity

6. Ventilation facility

3. Did you construct poultry house based on recommended extension packages? 1. Yes 2. No 4. If no in Q.3, specify the reasons_____,

5. Do you provide litter material in the poultry house? 1. Yes 2. No 6. If yes Q.5. What type litter martial do you use? 1. Teff straw 2. Wheat straw 3. If others (specify) _____

D. Feeding and Watering

1. How do you feed your birds? ----------

1. Scavenging only 2. Scavenging with supplement

3. Purchased feed 4. Homemade feed (readymade feed)

2. When do you feed your chickens? ----------

1. Morning and evening 2. Morning and afternoon

3. Morning, afternoon and evening 4. Only scavenging

3. Do you provide supplementary feed? ----------

1. Yes 2. No

4. If yes in Q.3., specify the type of supplement? ----------

5. Do you provide water for your bird? ----------

1. Yes 2. No

6. If yes Q.5. What is the source of water?----------

1. Whole water 2. River 3. Tap water 4. Pond water 5. If others (specify) ----------

7. How frequent do you provide water? ----------

1. Morning only 2. Afternoon

3. Morning and evening only 4. If other (s) _____

E. production and reproduction Performance of chickens

1. Total number of eggs laid per hen/year----------

2. Total number of eggs laid per hen/year----------

1. Do you practice culling of birds? ----------

1. 1 Yes 2. No 2. If yes, reasons for culling? ----------

1. Poor productivity 2. Old age 3. Sickness 3. Specify (if others) _____

G. Marketing of chickens

1. Do you have market access to buy poultry production inputs? ----------

1. Yes ----------2. No ----------

2. Where do you buy poultry production inputs? ----------

1. NGO 2. Government 3. Private companies 4. If others (Specify) ----------

3. Do you have market access for your poultry products? ----------

1. Yes 2. No

4. When do you sell your poultry products? (Time of selling)----------

1. Specific wt. gain/age of birds 2. Personal money requirement 3. During holydays and festivals 4. If others (specify)----------

5. To whom are you selling your poultry products? ----------

1. Village market 2. Local shopkeepers 3. Selling at own doorstep 4. Retailer

5. Whole sellers.

H. Health and disease control

1. Do you experience serious disease outbreaks?----------

Yes . ----------No----------

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

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

4. What do you do when birds are sick?----------

(a) Treat them myself (b) Call in veterinarian (c) Call in development agents

(d) Cull/kill them all immediately (e) Slaughter them all immediately for home

Consumption (f) Sell them all immediately (g) 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?----------

a) To protect from predators attack b) To avoid risk of contagious diseases

c) To protect from mixing with the village flock

d) To protect birds from picking and destroying crops/ vegetables

7. Do you control the free movement of chickens at a time of disease outbreak? ----------

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

8. Do your chickens scavenge mixed with that of your neighbors?

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

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

10. Describe the common diseases you have experienced in your flock. ----------

I. Extension contact and services

1. Have you ever discussed your poultry production & related problems with extension agents? ----------

1. Yes---------- 2.No----------

2. If yes how frequently do you contact the agent (days in a month) ----------

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

(a) Have no idea about the extension in poultry (b) Could not easily reach them

(c) There is no need to contact the agent (d) Other, specify----------

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

1. Yes---------- 2.No----------

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

(a)Extension agents (b) Relatives (c) Other farmers (d) Newspaper

e) Market (f) Radio g) Neigh bores (h) Television (i) Co-operative leader J) Other specify----

J. Breed/Breeding

1) Do you select chicken for breeding? ----------Yes ---------No----------

2) If yes, on which sex do you practice selection? ---------- Male------- Female ---- Both----------

3) Selection criteria for breeding----------

a. Feather color b. Body weight c.Heavy Medium

d .Small Egg production e. Broody behaviour

f. Frequent brooder g. slow brooder h. not brooder at all Mothering ability

Good ability of sitting during hatching 2) good feeder of the chickens after hatching 3) Good hatching history 4) Good protector from predator/aggressive weaning the bird

Comb type Yes No Single Double others, specify----------

4). Specific considerations during selections of hens for brooding/incubation

a) Select hens with larger body size b) Select hens with ample plumage feather cover

c) Select on the basis of previous hatching d) Broodiness e) other criteria

5) Are you interested to have exotic chickens? Yes No

6) If you have the opportunity to buy exotic chickens, which breed do you like to have?

(a) WLH (b) RIR (c) Both (d) Other (Specify)

7) Why did you choose the above breed?

1st ____ 2nd ____ 3rd ___ 4th __

K. Incubation, brooding and rearing

1. Incubation of eggs 1) broody hens 2) Artificial 3) Any other--------

2. Do you have your own breeding cock? Yes No

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

4. If your answer to question 2 is yes:

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

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

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

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

6. What do you use as egg setting material? ----------

a) clay pot & straw bedding b) clay pot only/without bedding

c) Teff straw d) wheat straw e) other (Specify)_____

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

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

9. What do you use as hatching eggs storage materials? ----------

10. Do you select eggs at a time or before incubation? Yes No

11. If yes to question 10 state the criterion of selecting eggs for incubation

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

12. Do you select any specific color of eggs for incubation? Yes No

13. If yes which color do you prefer? Brown White Others --------

14. Do you practice any special treatments of eggs before incubation? Yes No

15. If yes, how do you treat?

i. Wash with cold water ii. Wash with warm water iii. Test fertility

iv. Clean using cloths or other materials v. Other_____

16. Do you select size of hens for brooding? a) Yes b) No c) Do not consider

the size since any hen that manifested broody behaviour is allowed to bath

17. If yes, which one do you prefer? 1) Bigger 2) Medium size 3) Smaller

18. Do you select the mother hen incubating the eggs? Yes No

19. How many eggs do you incubate under a single hen at a time? ----------

20. How many normal chicks do you collect from a single incubation? ----------

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

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

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

23. Sources of eggs for incubation

i. Purchased from market ii. Purchased from neighbor

iii. Laid at home iv. Other

24. Do you incubate eggs purchased from market? Yes No

25. Do you test eggs for fertility? Yes No

26. If yes to question 25 how do you test? ----------

If yes to question 25 when do you test? ----------

A) Before incubation B) after incubation (at what days----------)

27. How do you position the eggs while incubating?

i. Pointed end downwards ii. Pointed end upwards

iii. Position on inside iv. Do not mind position

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

i. In dark and protected corner ii. In light and protected corner iii. Anywhere in the house

29. Practices to avoid broody behaviour

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

c) Disturbing in the nest d) Moving to neighbors e) Others_____

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

a. In cold room b. Inside cold container c. Any place d. Other practices----------

31. When do you usually incubate eggs (indicate season of incubation)? ---------

32. Is there seasonal variability on hatchability? Yes No

33. If yes, at which season did you have the worst (lowest) hatchability? ---------

34. When do you achieve the best results (indicate season)? ----------

35. Do you use the mother hen in raising the chicks? Yes No

36. If yes how long the hen spends weaning the chicks (in weeks)? ____

37. What do you feed them? ----------

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

a) The1st week b) The2nd week c) The 3rd week d) The4th week

e) The5th week f) The6th week g) The7th week h) The8th week

39. How many chicks survive to an age of 2 months? ----------

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

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

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

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

43. Placement of the eggs in the brooder hen

a) Eggs positions side ways b) Eggs positions pointed end down

c) Eggs positions blunt end down d) Do not mind about positioned eggs

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

a) Visual examination through the sun light c) Eggs will be cleaned before incubation

b) Floating eggs in a bucketed filled with water Other (Specify)