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ASSESSMENT OF PRODUCTION PERFORMANCE OF IMPROVED CHICKENS UNDER RURAL MANAGEMENT PRACTICES IN DUGDA WOREDA, EAST- SHEWA ZONE, OROMIA REGION, ETHIOPIA.

MSc. Thesis

By

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Department of Animal Production Studies

October, 2015

Bishoftu, Ethiopia

ASSESSMENT OF PRODUCTION PERFORMANCE OF IMPROVED CHICKENS UNDER RURAL MANAGEMENT PRACTICES IN DUGDA WOREDA, EAST- SHEWA ZONE, OROMIA REGION, ETHIOPIA.

A Thesis Submitted to the College of Veterinary Medicine and Agriculture of Addis Ababa University in partial fulfillment of the requirements for the degree of Master of Science in Tropical Animal production and Health

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As members of the Examining Board of the final MSc open defence, we certify that we have read and evaluated the Thesis prepared by Almaz Abebe, titled "Assessment of Production Performance of Improved Chickens under Rural Management Practices in Dugda Woreda, East- Shewa Zone, Oromia Region, Ethiopia" and recommend that it be accepted as fulfilling the thesis requirement for the degree of Masters of Science in Tropical Animal Production and Health.

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DEDICATION

I dedicate this thesis to my beloved families, my Father Ato Abebe Hirpo, my Mother w/ro Zenebech Jimma and especially my beloved Sister Birtukan Abebe, you all deserve my appreciations for your encouragement.

STATEMENT OF AUTHOR

First, I declare that this thesis is my *bona fide* work and all sources of material used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for an advanced (MSc) degree at Addis Ababa University, College of Veterinary Medicine and Agriculture and is deposited at the University/College library to be made available to borrowers under rules of the Library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate

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LIST OF ABBREVATIONS

AH	Albumin Height
ANRS-BoARD	Amhara National Regional State Bureau of Agriculture and Rural Development
ANOVA	Analysis of Variance
CSA	Central Statistical Agency
DAs	Development Agents
DZARC	Debre Zeit Agricultural Research Center
EW	Egg Weight
FAO	Food and Agriculture Organization
HU	Haugh Unit
IB	Isabrown
ILRI	International Livestock Research Institute
NCD	Newcastle Disease
PAs	Peasant Associations
SD	Standard Deviation
SE	Standard Error
SFRB	Scavenging feed resource base
SI	Shape index
SPSS	Statistical Package for Social Sciences
SNNPR	Southern Nations and Nationalities people Region
TSS	Technical Services and Supplies
UK	United Kingdom
WLH	White-Leg Horn chicken breeds

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ABSTRACT

A cross sectional study was conducted with the objectives of assessing management practices, evaluate egg productive and reproductive performance and egg quality traits of Isa Brown, white leghorn and Fayoumi under rural management, from February 2015 to September 2015 in Dugda woreda of East Shewa,Zone, Ethiopia. Totally, 160 randomly selected respondents were included in the study from five purposively selected Peasant Associations (PAs) from the district. The data collected were analyzed using SPSS version 17. Major poultry production activities in the area were managed by women in the district, 68.7% respondents provide house to chicken, 92.5% of the respondents provided additional supplement. About 91.2% of the respondents used maize and wheat as additional supplements, mostly three times a day about 66.9% and Provision of water 99.9% with 95% free access in the district . In the district 81.9% and 94.6% respondents had good market access to sell eggs and chicken. Collectively, 50% of chicken owner respondent vaccinate their chickens for prevention and control of different disease and using dewormer and anti ecto-parasite about 25% and 25%, respectively. Extension services were used by 33.1% respondents in the district. Under rural chicken production system all family members participate in different activities and Women were highly responsible for many activities. Diseases, lack of knowledge about scientific poultry management practices, lack of time due to farming activities, shortage of feed from the study area, lack of market, predators were listed as major constraints to improved chicken production in the district. Getting improved quality chicks by affordable price, having good market access of improved chicken breed and egg with high price compared to local breed,, having marketing in cooperatives, awareness creation, training on health management and chicken production, provision of credit facility for chicken producer, attentions on overall management system, supply of electricity were mentioned as option to improve chicken productivity and marketing in the study areas. The average eggs laid/year/bird was 248.82, 256.21, and 253.33 eggs for Isa brown, White leghorn and Fayoumi breeds respectively. Average age at first laying was 165, 165 and 174 days for Isa brown, White leghorn and Fayoumi respectively. Isa brown was superior for egg weight, average shell thickness, shell weight, dried shell

weight, yolk height, yolk weight, albumin weight and Haugh Unit than White leghorn and Fayoumi, Isa brown and Fayoumi were superior than White leghorn by egg shape index percent, White leghorn was superior in albumin height than Isabrwon and Fayoumi whereas, Fayoumi was superior to Isabrwon and White leghorn by yolk colour. Generally in the study district poor attention was given on modern poultry production and management system and can be improved through continuous awareness creation and training and provision of good access to market and obtain better price.

***Key words**: Egg Production, Egg Quality Trait, Improved Chicken Production Performances, Village Chicken Management Practices.*

1. INTRODUCTION

In Ethiopia, chicken production plays a great role as a prime supplier of eggs and meat in rural and urban area and as a source of income, especially to women. Chicken production also used for poverty alleviation and efficient transforming feed protein and energy in to consumable human diets. In Ethiopia, chicken production categorized into traditional, small and large -scale oriented sectors based on the type of inputs used, number and type of chicken kept (Alemu, 1995) and the rural sector constitutes about 99% of the total chicken population managed under traditional village poultry production system (Halima, 2007). According to ILRI (2004) and MoA (1997) annual egg production potential of Ethiopian indigenous village chicken is 36 eggs with a single egg weighing between 39 and 46 g. These birds are exposed to natural selection from the environment for hardness, running and flight skills and good mothering but they are poor layers. With this potential of indigenous chicken, the demand of egg and chicken meat of Ethiopian populations cannot be satisfied. Yet with large poultry population, Ethiopian poultry industry remain highly undeveloped, unorganized and the country export almost no poultry meat (ILRI, 2004). Attempts have been made to introduce different exotic poultry breeds to small holder farming systems of Ethiopia because of low performance of indigenous chicken as mentioned above.

1.1. Background

Animal production in general and chickens in particular play important socioeconomic roles in developing countries (Alders, 2004; Salam, 2005). Provision of animal protein, generation of extra cash incomes and religious/cultural considerations are amongst the major reasons for keeping village chickens by rural communities (Alders *et al.*, 2009). Nearly all rural and peri-urban families in developing countries keep a small flock of free range chickens (Jens *et al.,* 2004). According to Sonaiya (2005) small farming families, land-less laborers and people with incomes below the poverty line were able to raise village birds with low inputs and harvested the benefits of eggs and meat via scavenging

feed resources. However; most rural communities lack the required husbandry skills, training and opportunity to effectively improve their chicken production (Mlozi *et al.*, 2003).

In Ethiopia chickens are the most widespread and almost every rural family owns chickens, which provide a valuable source of family protein and income (Tadelle *et al.*, 2003). The total chicken population in the country is estimated to be 44.89 million (CSA, 2012). The most dominant chicken types reared in Ethiopia are local ecotypes, which show a large variation in body position, plumage color, comb type and productivity (Halima *et al.*, 2007). However; the economic contribution of the sector is not still proportional to the huge chicken numbers, attributed to the presence of many productions, reproduction and infrastructural constraints (Aberra, 2000). Similar to the national system; the major proportion of chicken production (98%) in Amhara region (ANRS) is a traditional sector, at small holder level, from which almost the whole annual meat and egg production is produced (ANRSBoARD, 2006).

According to Ministry of Agriculture, in Ethiopia, like many African countries, attempts have been made at various times to improve local chicken production through introduction of exotic chicken breeds. Distribution of pullets, cockerels, day old chicks and fertile eggs, layers and duals breeds, has been one of the poultry extension packages accomplished by the Regional Office of Agriculture, since the last 20 years, aiming at improving chicken production and productivity. Despite this huge distribution of exotic chicken breeds, the contribution of improved chicken breeds in the current production system of the region is very low (<5%). A study by Tekelewold *et al.*, (2006), on the adoption of poultry technology in the highlands of Ethiopia (East shewa and Welayta) indicated that adoption has been limited by a set of factors such as lack of knowledge on chicken husbandry (feeding, housing, health care, etc), lack of complimentary inputs (feed, alternative breeds, etc), lack of strong extension follow up, high disease prevalence and predation, unavailability of credit services and market problems.

Poultry production is deeply embedded in Ethiopian society kept by all strata of society from the landless rural poor to the well off in the cities (Wilson, 2010; Tadelle *et al.,* 2003b). In the Ethiopian context poultry effectively means domestic chickens. Out of a total of 44.89 million chickens in Ethiopia, the small-scale family poultry production accounts for about 98% mainly indigenous birds (96.6%) (CSA, 2012), and contributes to more than 90% of the national chicken meat and egg output (Dana *et al.,* 2010). A major comparative advantage of family poultry for poorer, more remote, rural communities is the conversion of labor into cash in a shorter time, with less capital requirement and with less risk than is the case with other livestock species. Though family poultry is not seen as a primary occupation by the producers, it is a source of significant income to rural families throughout Ethiopia.

The study area is favorable climate for chicken production that makes the country to have a substantial potential for chicken production development. Considering such a potential, investing in development interventions to the chicken production sector contribute to poverty alleviation in the country by increasing the income of smallholder chicken producers and creating employment and transforming the existing extensive chicken production system to intensive production system. In view of such a large number of chickens and the important number of producers engaged in the chicken production sector, the development efforts have not a significant impact on the growth of the sector. The problems associated in rural chicken production undertaken especially in management aspects and their gaps does not studies the impact of chicken management practice on reproductive and productive performance and egg quality trait of improved chickens in the study area.

General Objective

- To assess/ evaluate egg production, reproduction performance and egg quality traits of improved chicken and the role of gender under rural chicken management practices in Dugda woreda.

Specific Objectives

- To study the rural chicken management practices in the =;[pstudy area.
- To evaluate the egg productive, reproductive performance and egg quality traits of improved chickens in study area.
- To identify the challenges to improved chicken production in the study area.
- To assess the work distribution in family members under rural chicken management/production practice.

2. LITERATURE REVIEW

2.1. Purposes of Keeping Family Chicken

The report of Moges *et al.* (2010) indicated primary reasons of raising chicken were breeding for replacement and sale for income. Tadelle *et al.* (2003b) have also reported that 50% of eggs used to produce replacement birds and 27% sold for income generation while 30.6% of mature birds were kept as replacements and 44.4% were sold for income generation.

2.2. Production Performance of Chicken under Rural Production System

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

Desalew *et al. (*2013) studied the productive performances of three exotic chicken breed under village production systems in Lume and Ada'a of East Shewa Zone of Ethiopia reported average egg production of 276.1, 266.32 and 187.04 eggs from Isa Brown, Bovan Brown and Potchefstroom Koekoek, respectively. The average age at sexual maturity (first egg laying) for the three breeds were reported is 160.5, 165.5 and 153.3 days, respectively.

Poultry production is affected by factors such as breed and strain of chicken used, environmental conditions in poultry house, management practices and feed and feeding management (Bell and Weaver, 2002). The knowledge of performance of economic traits in chicken is important for the formulation of breeding plans for further improvement in production traits. Growth and production traits of a bird indicate its genetic constitution and adaptation with respect to the specific environment (Ahmed and Singh, 2007).

The laying cycle of a chicken flock usually covers a span of about 12 months. Egg production begins when the birds reach about 18-22 weeks of age, depending on the breed and season. Flock production rises sharply and reaches a peak of about 90%, 6-8 weeks later, production then gradually declines to about 65% after 12 months of lay. There are many factors that can adversely affect egg production. Unraveling the cause of a sudden drop in egg production requires a thorough investigation into the history of the flock. Egg production can be affected by feed consumption (quality and quantity), water intake, intensity and duration of light received, parasite infestation, diseases, management and environmental factors (Jacob *et. al*., 1998).

Different authors reported the effect of breed on egg production; Duduyemi (2005) found no significant effect of breed on egg production, while Majaro (2001) and Yakubu *et al*. (2007) reported significant effect of breed on egg production and mortality rate. Moreover, Gwaza and Egahi (2009) reported significant effect of breed on age at peak egg production in a farm consisting of four strains of layers. Abdel-Rahman (2000) reported that naked neck genotype was superior to full feathered mates in egg production, sexual maturity, mortality rate and feed efficiency.

2.3. Village Chicken Husbandry/Management

2.3.1. Housing and feeding management

According to Moges *et al.* (2010) reported that only 22.1% of farmers provide separate overnight houses for village chickens. Lack of knowledge and awareness and poor attention to village chicken were some of the reasons for not constructing separate chicken house. Proper housing does not only provide an environment that moderates environmental impact but also provides adequate ventilation for the birds to lay eggs in next boxes, as well as to feed and sleep in comfort and for security purposes (Yakubu, 2010). The farmers in north western part of Ethiopia provided 99% supplementary feed and drinking water throughout the year depending on the availability of feed commonly before birds leave for scavenging in the morning and in the evening to gather back home. Feedstuffs such maize, wheat, sorghum and household waste products were used as the main sources of chicken feed Halima *et al.* (2007).

Improvement of productivity of scavenging chicken through improved feeding

Assuming that chemical analysis of crop contents accurately reflects the feeds consumed the nutritional status of laying village hens in the highlands of Ethiopia would satisfy maintenance needs only and production of about 40 eggs/hen per year (Tadelle and Ogle, 2000). According to Tadelle, 1996, it was possible to attain hen-day production of about 30% from local chickens by supplementing a combination of 15g maize and 15g Noug (*Guizotia abyssinica*) cake/bird/day in the short rainy and dry seasons. Supplementing 30g maize alone resulted in 28% production while about 20% production was attained with supplementation of 30g Noug Seed Cake/ bird/day during this period. On the other hand, non-supplemented local birds under a similar environment produced only about 14% from scavenging only.

Under these conditions, supplementation of 30g/head/day of a mixture of equal proportions of maize and Noug cake increased annual egg production of local hens by about 100%. Even more remarkable success was attained with higher levels of supplementation using improved breeds. In villages around the southwestern part of the country, scavenging White Leghorn layers offered 90g/hen/day of a commercial layer ration produced 200 eggs/hen/year (Solomon, 1997) indicating a tremendous potential for improvement in the village systems. However, supplementary feeding of local and Rhode Island Red chickens was uneconomical during the main rainy season implying that the scavenging feed resource available during this season would be sufficient to support economical egg production (Negussie, 1999).

2.3.2. Chicken Health

Halima (2007) reported that the major causes of death for local birds in North West Amhara were seasonal outbreaks of diseases, specifically Newcastle disease. Newcastle disease (NCD) is well known by most chicken keeping farmers. It was presented as the major cause of poultry loss by most of the owners that wipes out the whole flock when there is an outbreak. This situation prevails in many parts of Ethiopia (Zeleke *et al*., 2005; Serkalem *et al.*, 2005), on rural poultry, which supports the argument that NCD is the most devastating disease of village chickens. Typically, there is an annual passage of NCD in rural poultry, and the survivors have a high level of antibodies, which are initially passed on to the next generation in the form of maternal antibodies. These gradually decline, and at the next viral challenge the antibody levels of those with some antibodies are boosted, whereas those with no protection succumb, and so the cycle is repeated every one or two years (Gueye 2002).

2.3.3. Causes of chicken mortality and losses

According to Dessie and Ogle (2001) about 40-60% of the chicken die during the first 8 weeks of life mainly as a result of disease and predation. Predators were also noted to be

a threat to family chicken production. Gueye (2002) also reported that mortality of backyard chicken was high and could reach up to 53% until four weeks of age in tropical Africa.

2.3.4. Knowledge of Medication and Vaccination

Farmers were asked to disclose means of treating NCD. Their responses were that they did not have a treatment regime specific for NCD but rather for most poultry diseases. Some of these local or traditional methods of treatment were mixing of various home remedies with drinking water. The dosages of these types of treatments are not controlled and their effectiveness still remains debatable. Very occasionally owners treat their chicken using antibiotics originally intended for human use. Village poultry keeping farmers tend to start dealing with disease control once the symptoms appear in their flocks. They therefore treat symptoms instead of diseases and link specific therapeutic preparations to specific disease symptoms (Gueye 2002).

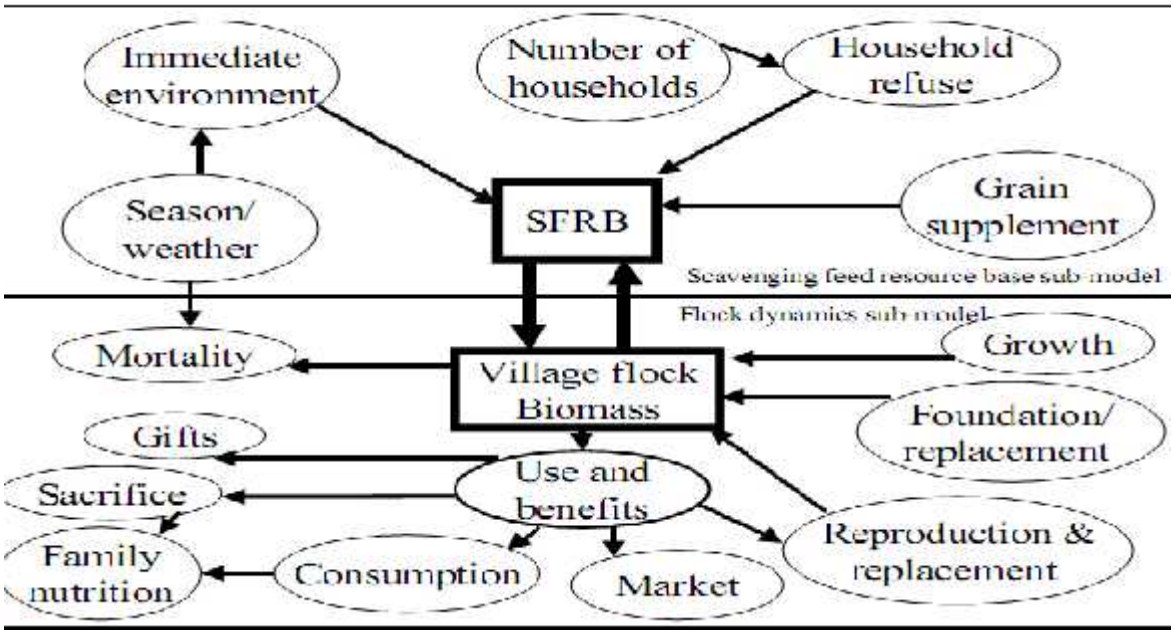
2.4. Challenges of Village Chicken Production System

According to Halima (2007) also reported that predation was one of the major village chicken production constraint in North West Ethiopia. Newcastle disease (NCD) is believed to be the most devastating chicken disease in free-range systems and the main cause of the high chicken mortality irrespective of age and sex, which occurs almost any time of the year (Serkalem *et al.,* 2005 and Nwanta *et al.,* 2008). Among the infectious diseases NCD, salmonelloses, coccidioses and fowl pox are considered to be the most important causes of mortality to local chickens while predators are an additional causes of loss (Eshetu *et al.,* 2001).

2.5. Classification of Poultry Production Systems on The Basis of Biosecurity Level

- Sector-1: Industrial integrated system with a high level of biosecurity and birds or products that are marketed commercially.
- Sector-2: Commercial poultry production system with a moderate to high level of biosecurity and birds or products that are sold through slaughter house or live-bird markets.
- Sector-3: Smallholder commercial poultry production including waterfowl, generally with low levels of biosecurity and birds or products that are usually sold through live-bird markets.
- Sector-4: Village or backyard production with minimal biosecurity and birds or products that are consumed locally. *Source:* FAO/OIE (2007).

Figure 1. A pictorial model of the scavenging village chicken production system in the Central highland of Ethiopia is presented by Tadelle and Ogle (2001) in Fgure1.



2.6. Marketing

Households attempt to produce more birds that can be sold at festival time to command high prices but, conversely, forced sales at periods of high disease risk or actual disease cause prices to fall. The chicken farmers determine the price of chicken by weight, sex and plumage color. Chicken owners sale birds when they are in need of cash and when birds are sick. Consumers overwhelmingly prefer local to exotic birds and eggs. The premium for local birds is attributed to better meat flavor and more deeply colored egg yolks (Wilson, 2010).

2.7. Egg Quality Traits

It is obvious that beneficial egg quality traits are of immense importance to poultry breeding industries (Bain, 2005). In addition, embryonic development of hen's egg is dependent on traits like egg weight, yolk and albumen weights, genetic line and age of the hen (Onagbesan *et al*., 2007). Strains of Leghorn that lay brown eggs in addition to strains that lay white eggs were developed. The brown strains were developed because there was an apparent demand for consumption of brown eggs. Thus, there was interest to use strains of laying hens that lay better quality eggs. The different strains vary in the different criteria of egg production and quality (Bell and Weaver, 2002).

Egg weight influences the weight of components of eggs especially egg albumen and yolk (Zhang *et al.,* 2005; Aygun and Yetisir, 2010). The relationship between weight, length and width of eggs has been reported by Danilov (2000) who also noted the proportion of yolk, albumen and shell that contribute to the egg weight increases with hen's age, reaching a plateau by the end of the laying cycle. Thus, egg weight is one of the important phenotypic traits that influence egg quality and reproductive fitness of the chicken parents (Islam *et al*., 2001; Farooq *et al*., 2001). Anderson (2002) provided detailed information on the differences in egg production and quality between different white and brown egg strains and reported the egg weight from brown hens (61.1g) was more than that of white hens (58.3g). Tixier-Boichard *et al.* (2006) recorded weight of

42.8 g for Fayoumi eggs and 58.8 g for IB eggs. Higher weight of egg from commercial strains is not a surprise since such strains submitted to important breeding pressure for egg weight improvement (Hocking *et al*., 2003). Further, under smallholder farmers condition in northern Ethiopia, egg weight was recorded as 52.5g, 52.1g and 43 g for Rohde island Red, White leghorn and Fayoumi, respectively (Lemlem and Tesfaye, 2010).

Hen age has also been shown to increase yolk weight (Van den Brand *et al.*, 2004) albumen weight (Suk and Park, 2001). Yolk color is a key factor in any consumer survey relating to egg quality (Okeudo *et al.*, 2003). Consumer preferences for yolk colour are highly subjective and vary widely from country to country. The determinant of yolk color is the xanthophyl (plant pigment) content of the diet consumed (Silverside *et al.*, 2006). Green grass during scavenging might be responsible for carotenoids deposits in the yolk, which improves the yolk color. Among feed ingredients, only supplemented maize contributes to improved color intensity of the yolk. Thus, if a hen has access to green grass or supplemented feed ingredients containing carotenoids/xanthophylls, it will be enough to give the yolk the color preferred by consumer (Zaman *et al*., 2004). Ethiopian consumers have a strong preference for eggs with deep yellow yolk color. Very small sized eggs from the scavenging local chicken with deep yellow yolk colour fetch much higher prices compared to larger eggs of improved strains with pale yolk (Tadelle *et al.*, 2003a).

The Haugh Unit (HU) proposed by Haugh (1937), is calculated from the height of the inner thick albumen and the weight of an egg and it is considered to be a typical measure of albumen quality. It is generally accepted that the higher the Haugh unit value, the better the quality of the egg. It is also important that all eggs being evaluated at the same internal temperature. Age of the hen and season of the year can also affect Haugh unit values. Rajkumar *et al*. (2009) reported that brown egg layers produced eggs with higher HU. Research has shown in UK that there is consumer resistant to purchase eggs which have HU's below 60, the actual HU figure where resistance to the product determined

later by market researchers. Some of the large supermarkets chains in the UK set minimum acceptable level of 70 HU on regular documented tests (TSS, 1999).

The eggshell thickness is an important trait for hatchability. For best result of hatchability egg shell thickness should be between 0.33 and 0.35 mm and few eggs with a shell thickness less than 0.27mm will hatch (Khan *et al*., 2004). One of the main concerns is a decrease in eggshell quality as the hen ages, due to an increase in egg weight without an increase in the amount of calcium carbonate deposited in the shells. For this reason, the incidence of cracked eggs could even exceed 20% at the end of the laying period (Nys, 2001).The egg shell quality is given through the weight and the percentage of shell, thickness and the strength. The differences in eggshell quality depend on the environmental conditions and the feed quality and also of strain of layers (Zita *et al.*, 2009). On the other hand, Khan *et al.* (2004) reported no significant effect of breed on eggshell thickness under semi scavenging condition.

In comparison, strains used for production of white and brown eggs, Silversides and Scott (2001) reported that eggs from IB hens had better percentage of shell than those form Isa-White hens. Several authors reported variable results about the influence of the rearing systems on shell thickness. Leyendecker *et al.* (2001, 2005) reported thicker shells in free range eggs when compared to conventional cage systems (Leyendecker *et al.*, 2001), and to conventional and furnished cages (Leyendecker *et al.*, 2005). On the other hand, Tumova and Ebeid (2003) noticed thicker shells in battery cage compared to barn system, while Van de Brand *et al.* (2004) did not find differences between free range and battery cage.

2.8. Gender Aspects of Smallholder chicken Production

Despite all the regional differences in smallholder poultry production, one observation seems to remain the same, whether talking of smallholder households in Africa, Asia or Latin America – namely that the day-to-day management of poultry is undertaken by women, often with assistance from their children. Whereas men may assist in the

construction of housing (night shelters for the animals) and in some localities in bringing birds and eggs to the market, women and children are, as a general rule, the ones who feed and water the birds, clean the housing and apply treatments (Mathias, 2006; Tadelle *et al.,* 2003; Tung, 2005; Ibrahim and Sibanda, 2005).

2.8.1. Role of rural Family members in village chicken production system

Chicken production in most developing countries is based mainly on scavenging systems and rural women and children are traditionally believed to play an important role (John, 1995). They are generally in charge of most chicken husbandry practices, since small-scale animal production does not require heavy manual labor (Riise *et al.*, 2004). A Survey result in four African countries; Ethiopia, Gambia, Tanzania and Zimbabwe, showed that women dominated on most activities of village chicken husbandry except for shelter construction and marketing. The result also showed that various gender based constraints such as; poor access to information and heavy workloads on women should be addressed to meet the needs and opportunities of this gender category in this sector (Kitalyi, 1998).

According to Abubakar *et al.* (2007) in a study conducted on village chicken production in some parts of Nigeria and Cameroon; all gender categories were involved in village chicken management, with children having the highest responsibility of shutting down the birds at night and let them out in the morning. Based on the result of the study; women owned the majority of birds (52.7%) followed by children (26.9%) and lastly men (20.4%) in the Province of Cameroon; unlike the situation in Borno state, Nigeria, where majority of the birds are owned by men (55.6%) followed by women (38.9%) and lastly children (11.1%). Halima (2007) also reported that rural women, in either male-headed or female headed households of North-West Amhara, were more responsible for chicken rearing, while the men were responsible for crop cultivation and other off-farm activities According to Mcainsh *et al.* (2004) and Gueye (1998) approximately 80% of the chicken flocks in a number of African countries were owned and largely controlled by rural women. In the male-headed households the wife and husband were co-owners of the

chickens but sometimes children owned some birds in the flock and were allowed to use their chickens for expenses at school or to purchase clothes.

Women are involved in smallholder poultry production for three main reasons. These are: **First**, when compared to larger livestock, poultry do not require much investment. As they are usually left to scavenge for their feed during daytime, they only require a little supplementary feeding (depending on the season of the year), a night shelter and, occasionally, some veterinary treatment and vaccination. Moreover, in contrast to larger animals, poultry are not highly valued in terms of social capital, i.e. the prestige the animal brings to its owner. Depending on the locality and its livestock-keeping traditions and cultural norms, men usually prefer keeping larger animals such as goats, sheep or, better even, cattle. Although women smallholders may keep a few goats, it is usually the man who creates the conditions for investing in buffalos, cattle and large flocks of goats and sheep (Villareal, 2001; Joensen, 2002; Thomsen, 2005).

Poultry, on the other hand, requires little initial investment and generates quick and frequent returns, something which fits well with the types of day-to-day expenditures – food stuff, schoolbooks etc. – that women smallholders face as the main household caretakers (Todd, 1998; Thomsen, 2005). Also, the size of any potential economic loss in the event of theft, predation or disease among the animals is less with chickens (although poultry, due to their small size, are of course more easily taken by predators or stolen than are cows or goats). For all these reasons, poultry are generally accepted as women's capital (Villareal, 2001).

As an example, Altamirano (2005) reports that women of the Bolivian highlands prefer chickens to other, larger, animals. Although they are also the ones to take care of the family sheep, goats and pigs, they have to consult their husbands with respect to decisions about the use of these animals. In the case of chickens, the women themselves may make decisions about consumption and sales.

Second, poultry are kept at the homestead. Poultry keeping is, thus, an activity that the women can undertake without having to leave the household, where they will usually be occupied by domestic duties such as cooking, cleaning and caring for children. As such, they do not have to allocate a lot of extra time to managing the poultry (the daily cleaning of the poultry house, feeding, etc.) as compared to other income-generating activities, such as day labouring or petty commerce, which require them to leave their homes for many consecutive hours (Bush, 2006; ACI, 2007).

Third, in places where religious beliefs or societal norms require that women do not leave their household compound or village, at least not without being accompanied by a male relative, poultry keeping is a suitable income-generating activity. This is because, as mentioned above, the tasks related to poultry keeping can be carried out without leaving the home. However, in such cases the women will still depend on male relatives or intermediaries for the marketing of their poultry products (Seeberg, 2003; FAO 2003b).

3. MATERIALS AND METHODS

3.1. Description of the Study Area

Dugda is one of the woredas in East Shewa Zone of Oromia Region located in the Great Rift Valley. Dugda woreda is bordered by Adami Tullu Jido Kombolcha in the south, on the west by the Southern Nations, Nationalities and Peoples Region, on the NorthWest by the South West Shewa Zone, on the North by Bora Woreda and on the East by the Arsi Zone. The administrative center of Dugda is Meki. On the other hand it is located 90km from the zonal capital Adama to the West and 130km from Addis Ababa to South. (Socio-economic profile of East Shewa 2006).

The altitude of this woreda ranges from 1600 to 2007 meters above sea level; Mount Bora Mariam (2007 meters) is the highest point. The annual rainfall is about 750mm, Mean monthly temperature is 26^{o}C. Soil type 41% sandy loam and clay loam. A survey of the land in this woreda shows that 63.3% is arable or cultivable, 8.3% pasture, 3.6% forest, 12.5% water body, 0.3% mountain and stone, 11.9% swampy and the remaining, 10.6% is degraded. (70%) Farmers income from crop, fruits and vegetables 30% from livestock production, also the total livestock population found in woreda is estimated to be 223,279 cattle, 43,978 sheep, 46,126 goats, 103,380 local chickens and 6,368 are improved chickens. survey of Agriculture office in the district (2014).

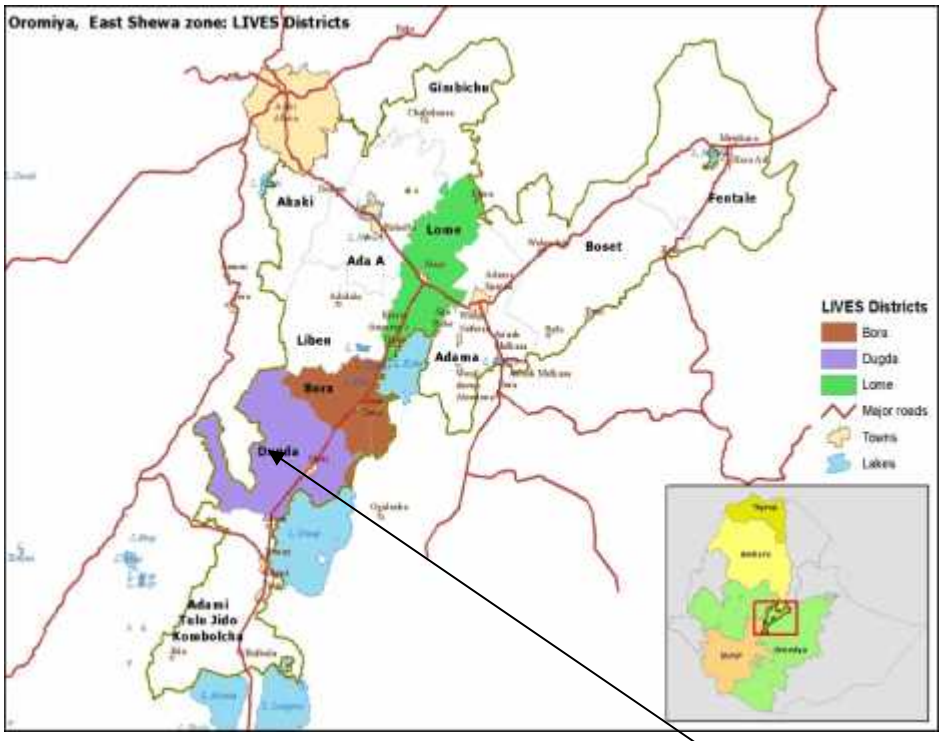


Figure 2. Biophysical characteristics of East Shewa Zone

Source: (ILRI 2013)

3.2. Study Design

A cross-sectional study design was employed from February 2015 to September 2015 to assess/ evaluate egg production, reproduction performance and egg quality traits of improved chicken under rural chicken management practices in Dugda woreda.

3.3. Study Population

The populations studied were three different improved chicken (IB, WLH and Fayoumi) adopted by households in the study woreda

3.4. Sample size determination

The total number of respondents sampled for the questionnaire survey was determined as $N=0.25/SE^2$ according the formula given by Arsham (20052), where, N = Sample size, SE =Standard error. Thus, using the standard error of 0.04 with 95% confidence level, 160 households were included in the study.

3.5. Selection of the study area and sampling techniques

A Multi-stage sampling procedure (purposive and random) was applied. Study Woreda was selected purposively based on chicken potentiality of the area and improved chicken population. Out of total 36 rural kebele found in the woreda, 5 representative kebeles were selected purposively based on, chicken production potential and road accessibility. The development agents and livestock experts of Dugda woreda agriculture & rural development office actively participated in selection of representative kebeles. All village chicken owner households which adopted improved layer chicken in the selected five kebeles (Walda, Darara Dalecha, Wadesha Orgocho, Shumi Gamo, Majaf lalo) were registered as sampling frame. From the total of 213 households improved chicken owners simple random sampling technique was applied to select 32 chicken owner respondents in each of the selected kebeles. A total of 160 village chicken owner households were interviewed using structured questionnaires, pre-tested before the actual data collection.

3.2. Data Collection and Evaluation

A cross sectional survey was carried out for each household to collect information focusing on status of keeping improved chicken, egg production, reproduction performance of improved chicken along with chicken management practices and its constraints from member(s) of the households directly responsible for management and care of chickens. The quantitative data like chicken weight in kg, egg weight(g) were measured and registered by researcher by using structured questionnaire interview from sampling respondents and

qualitative information's like better chicken producers, improved chickens breed and chicken potential PAs was gathered through focus group discussions with selected key informants (DAs and PA administrators). Combining data sources and type would help in generating reliable and complete evidence that support decision-making in chicken management practice of the study area.

3.2.1. Questionnaire survey

Questionnaire interview is one of the components of this research work. Smallholder farmers having at least 5 chickens in selected PAs were included in the survey. Structured questionnaire was prepared for the interview from sampling respondent. The interview questionnaire was focusing mainly on chicken production, smallholder chicken management practice and limitations, major chicken production problems and associated risk factors and other husbandry practices

3.2.2. Direct Observation

Chicken population in selected PA was observed during their chicken feed, feeding and housing practice for the occurrence of any management problem. A transect walk was used during observation and involving 5 households in each of the five selected farmers PA.

3.2.3. Variables Measured

Mature body weight

Live weight recoding of laying hens was carried out with weighing balance to evaluate body weight performance under rural village conditions.

Evaluation of internal and external egg quality

A total of 20 fresh eggs were collected from adult laying hens of each of the three improved breeds (Total 60 eggs) used in Dugda districts during the survey for evaluating egg quality traits. The egg quality traits were evaluated at Haramaya University Animal science laboratory. External egg quality traits such as egg weight, shell weight and dried shell weight (using drying oven) was measured in gm using electronic sensitive balance, egg length and width (cm) were measured using Varnier caliper, shell thickness (mm) using an Electronic Digital Caliper (Mitutoyo, Japan). Egg shape index using formula = (egg width/egg length) x 100. The shell thickness was measured at three different points in the equatorial shell and the calculated average of the three was used as a trait. To determine the internal egg quality traits, eggs were broken on a flat glass sheet. The thick albumen height (AH) was measured at its widest part at a position half way between the yolk and the outer margin. Yolk height was measured using Tripod Micrometer (TSS, England) and yolk diameter in cm using Varnier caliper, yolk index using formula = yolk height/Average yolk diameter. The yolk was carefully separated from the albumen. Albumen and yolk weight was determined by weighing with electronic sensitive balance separately. The yolk color was determined using the Roche Color Fan (Printed in Switzerland); a standard colorimetric system ranged 1-15. Individual Haugh Units (HU) were calculated from the two parameters; height of albumen (AH) and egg weight (EW) using the formula: $HU=100\log (AH–1.7\ EW^{0.37} + 7.6)$ (Haugh, 1937), where HU=Haugh Unit, AH=Albumen height and EW=Egg weight.

3.3. Data Analysis

The data collected were entered in to MS- excel and were analyzed using SPSS Software version 17. Descriptive statistics was used to describe management practices in each selected kebele and ANOVA was used to compare the differences in egg productive, reproductive performance and egg quality traits of improved chicken in the study area.

4. RESULTS

4.1. Household Characteristics

The household characteristics of interviewed village chicken owners are presented in Table1. Accordingly, from the total of 160 interviewed rural chicken owners, 102 (63.8%) were male and 58 (36.3%) were female. The average age of respondents was 38.3 years (ranging from 18-74 years). Regarding the educational level of respondents; 33.8% were illiterate, 23.8% had basic education (Reading & writing), 33.1% had primary education, and 5.6% had secondary and 3.8% College / University education.

Table 1. Household characteristics of respondents in Dugda district

Household characteristics	(N=160)
Sex of respondents (%)	
Male	63.8
Female	36.2
Average age of the respondents (years)	38.3
Educational status of respondents (%)	
Illiterate	33.8
Read and write	23.8
Elementary school	33.1
High school	5.6
College/ University	3.8
Average family size/household	4.94
Av Land holding/household (ha)	2.2±1.98
Landless households (%)	24.4

The average family size per household of the study woreda was 4.94 (ranging from 1-15 person). The average land holding per household of the study area, used for different farming activities, was 2.2 ha (ranging from 0.5-9 ha), with a SD of 1.98 ha and 24.4% of respondents were landless in the study area.

4.2. Rural Chicken Management Practices

4.2.1. Poultry housing and facilities

The results obtained on chicken housing management system and facilities are given in Table 2. Accordingly, a total of 68.7% of the respondents provide house to their chicken in the study district. Out of which 43.1% of respondents provide night shelter to their chicken while 22.5% of respondents construct separate poultry house and provide litter as bedding.

Table 2. Rural Chicken management practices in Dugda district

Management practices	N=160	
	Freq	%
Poultry housing system and facilities:		
Provide house to their chicken	110	68.7
Provide a night shelter for chicken	69	43.1
Separate house entirely constructed for chicken	36	22.5
Separate house with ventilation and electric facility	5	3.1
Share the same house with people	48	30
Share the same house with other animals	2	1.3
Litter material used	36	22.5
Constructed based on recommended plan	24	15.0
Reasons of not constructing the chicken house :		
Lack of extension services	3	1.9
Lack of knowledge	8	5
Financial problem	12	7.5
There is no need	17	10.6
Lack of space	10	6.3

material, 30% of the respondents share the same house between chicken and people and 1.3 % respondent's house their chicken with other animals, whereas from total respondents who constructed separate poultry house only 15% constructed based on recommended plan, 3.1% respondents provided with adequate ventilation and electricity facility. The reasons indicated by respondents for not constructing/ providing chicken house were lack of extension services (1.9%) , lack of knowledge (5%), financial problems (7.5%), there is no need (10.6%) and lack of space (6.3%) in the area of study.

4.2.2. Feed and feeding system

The results obtained on poultry feeds and feeding system used in the study area are given in Table 3. The major poultry feeding system was scavenging with additional supplements (92.5%) and 7.5% used only scavenging with no additional feed supplements for chicken.

Table 3. Poultry feeds and feeding practices in Dugda district

Feeds and feeding practices	N=160	
Feeding system	Freq	%
Only scavenging	12	7.5
Scavenging with additional supplement	148	92.5
Homemade feed (readymade feed)	4	2.5
Purchased balanced feed	4	2.5
Additional feed type: Wheat and maize	76	47.5
Wheat bran	2	1.3
Maize, wheat and wheat bran	52	32.5
Maize, wheat and kitchens waste	8	5
Maize, wheat, kitchen waste and meat	2	1.3
Frequency of feeding: Three times a day	107	66.9
Two times a day	41	25.6

Out of the respondents who provide feed supplements, 2.5% used homemade feed and 2.5% were using purchased commercial balanced chicken feed. About 47.5% of the respondents provide maize and wheat, 1.3% uses wheat bran, 32.5% maize, wheat and wheat bran, 5% maize, wheat and kitchens waste and 1.3% maize, wheat kitchen waste and meat/carcass, as additional feed supplements, Provision of mineral supplement was not practiced in districts. Regarding frequency of feeding, out of 92.5% of the respondents in districts, 66.9% respondents feed their chicken three times a day and 25.6 % provide twice a day supplement to their chicken in the area of study.

4.2.3. Watering

The information recorded for water sources and frequency of watering to the chicken (Table 4) shows that major source of water for chicken in the study area was borehole water (32.5%) followed by river water (25.6%), tap water (23.1%) and pond water(18.1%) in Dugda district. Regarding frequency of watering, 95% of respondents provide water with free access, 2.5% provide water in twice a day in morning and evening and only 1.9% provides water once in morning and 0.1% does not provide any water to their chicken.

Table 4. Source and frequency of watering to chicken in Dugda district

Source and frequency of watering	Frequency	%
Source of water:		
Borehole water	52	32.5
River water	41	25.6
Tap water	37	23.4
Pond water	29	18.4
Frequency of watering:		
Free access	152	95
Morning and evening	4	2.5
Morning only	3	1.9
Does not provide water	1	0.01

4.2.4. Chicken health management

The observations on chicken health management (Table 5) revealed that 50% of the respondents vaccinate their birds to prevent and control infectious diseases while others 50% of the chicken owners in the study area do not vaccinate their chicken. Majority of the total respondents prevents diseases, vaccinate their chicken for New castle disease (31.2%) and New castle and Fowl typhoid (12.5%) only and a few respondents vaccinate their birds against New castle disease, Fowl typhoid and Marek's diseases (3.8%) and New castle disease, Fowl typhoid and Marek's diseases and Infectious Bronchitis (2.5%).

Table 5. Management practices to prevent and control poultry diseases in Dugda district

	N= 160	
Management practice	**Freq**	**%**
Uses of Vaccination :	**80**	**50.0**
New castle Disease	50	31.2
New castle Disease, Fowl typhoid and Mareks Disease	6	3.8
New castle Disease, Fowl thiphoid, Marekes Disease and Infectious bronchitis	4	2.5
New castle Disease and Fowl typhoid	20	12.5
Do not vaccinate for any disease	80	50.0
Use of anti- parasites:		
Use of anti-ectoparasite	40	25
Does not use anti-ectoparasite	120	75
Use of dewormig	40	25
Did not use of deworming	120	75

Further, about 25% of the respondents used anti – ectoparasites to control external parasitic infestation and 25% uses deworming to control the internal parasites of their

chicken and 75% of chicken owner in the study area do not used any anti-ectoparasites and dewormer.

4.2.5. Culling practice and reasons for culling chickens in the district.

The information recorded for culling of chicken are presented in Table 6. Most of the respondents (87.5 %) cull chicken due to different reasons. The main reasons for culling recorded were old age (38.1%), old age and sickness (20 %,) poor productivity (16.3%), old age with poor productivity and sickness (8.1%) and old age with poor productivity (5%). From the total 12.5% of the respondents were not culling their chickens by any means.

Table 6. Culling practice and reason of culling chickens in Dugda district.

	N=160	
Culling practice	Freq.	%
Culling time:-		
Old age	61	38.1
Old age and sickness	32	20.0
Poor productivity	26	16.3
Old age, poor productivity and sickness	13	8.1
Old age and poor productivity	8	5.0
Have no culling practice	20	12.5

4.4. Type and Source of Improved Chicks Adopted

The results observed on type and source of improved chicks (Table 7) showed that majority of the respondents in the Dugda district used IB chicken (63.8%), followed by Fayoumi (24.4%) and a small number of the respondents used White leghorn (11.9%). Regarding source of the chicks, it was revealed that about 80.6% of the respondents

purchased chicks from private hatcheries and 16.3% respondents hatched fertile eggs naturally at home, while 3.1% of the respondent's received their chickens from NGO.

Table 7. Types and sources of improved chicks used in Dugda district

Sources and breed of chickens	Frequency	%
Type of Improved chicks		
Isa Brown (IB)	102	63.8
Fayoumi	39	24.4
White leghorn	19	11.9
Sources of chicks		
Purchased from private hatcheries	129	80.6
Naturally hatched at home	26	16.3
Provided from NGO	5	3.1

4.5. Marketing

4.5.1. Market access for poultry products and production inputs

The results obtained for market access to buy production inputs and sale of poultry products (Table 8) indicated that 81.9 % of the respondents for procurement of production input and 94.6% for marketing of eggs and chicken in study district had good market access. However, 18.1% respondents for procurement of production input and 5.4% respondents to sell eggs and chicken had poor market access.

Table 8. Market access for poultry products and production inputs in Dugda district

Market access	**Production inputs**	**Eggs and Chicken**
Good access	131(81.9%)	151(94.6%)
Poor access	29(18.1%)	9 (5.4%)

4.5.2. Practice of selling of eggs and chicken

The observation recorded on practice of selling of eggs and chicken (Table 9) indicated that most of the respondents (91.9%) in the area of study were selling their eggs and chicken in village market, and only 3.8% of the respondents were selling their eggs and chicken at their own doorstep, 1.9% to retailers and about 1.3% each to whole sellers and local shopkeepers in the area of study.

Table 9. Practice of selling eggs and chickens in Dugda district.

Practice of selling Eggs and chickens	Freq.	%
Village market	147	91.9
Selling at own doorstep	6	3.8
Retailer	3	1.9
Whole sellers	2	1.3
Local shopkeepers	2	1.3

4.5.3. Selling time and consumer preference

The results obtained for selling time and consumer preference (Table 10) showed that for majority of respondents (51.2%) selling time was according to their personal money requirement followed by holidays and festivals (34.4%) in the district. However, about 12.5% respondents sold their chicken after a specified weight gain and age of chickens. A small number (1.9%) of respondents in districts were selling their chickens due to decrease in egg production of the chickens. Consumer preference of the respondents for eggs and meats obtained from local, improved and both local and improved chicken were (36.2% and 80%), (25% and 3.1%) and (38.8% and16.3) respectively. The respondent preference for eggs and meat of chickens from local has sweet taste than egg and meat obtained from improved breeds which is not adopted by society.

Table 10. Time of selling and consumer meat and egg preference in Dugda district

	N=160	
Selling time and consumer preference	**Freq**	**%**
Time of selling		
Weight and age of chickens	20	12.5
Personal money requirement	82	51.2
Holyday and festivals	55	34.4
Decrease production	3	1.9
Consumer meat and egg preference		
Eggs from improved chicken	40	25
Eggs from local chicken	58	36.2
Equally preferred	62	38.8
Meat from improved chicken	5	3.1
Meat from local chicken	129	80.7
Equally preferred	26	16.3

4.6. Access to Agricultural Extension Services

The information obtained on access to agriculture extension services to respondents for the improvement of poultry production in the study area (Table 11) shows that only 33.1% of the

Table 11. Practice of agricultural extension services in district

Practice of agricultural extension service	N=160	
	frequency	%
Access to extension service	53	33.1
Have not access to extension service	107	66.9
Reason- Have no heard of them	38	23.8
Cannot easily reach them	59	36.9
There is no need	10	6.3

respondents had access to extension services while majority of the respondents (66.9%) had no access to the extension service on poultry production. Reasons of not using extention service indicated were as respondents have not heard of extension service (23.8%), cannot easily reach extension people (36.9%) and did not feel any need of the service (6.3%).

4.6.1. Training and credit service on Poultry production

Provision of training for chicken owner on improved chicken production practices is given in Table 12. Accordingly, majority of the respondents (61.9%) did not get any training on improved chicken production management practices and only 38.1%, respondents got training on improved poultry production practices. Out of which 20%, respondents got training before starting chicken production, 6.9% after starting of chicken production and 11.1%, of respondents got training twice before and after starting of chicken production. There was no provision of credit facility to the chicken owners for use of improved poultry production in the district.

Table 12. Provision of training credit service on improved poultry production in district.

Provision of training	frequency	%
Provision of training to respondents	61	38.1
Before starting chicken production	32	20
After starting chicken production	11	6.9
Before and after chicken production	18	11.1
No provision of training	99	61.9
No provision of credit facility to chicken owner	160	100

4.7. Work Distribution to Family Members in Rural Chicken Production System

The participation of family members in different rural poultry production activities (Table 13) shows that women were involved in more poultry production activities than other family members. Mostly women were responsible for selling of egg (83.8%), selling of chickens (55.6%), cleaning of chicken house (31.8%), and supplementary feed

to chicken (25%). However, Family was responsible mostly for providing water, providing feed (23.8%) and taking sick chicken for treatment (12.5%) while the men were mostly (75.6%) responsible for construction of chicken house and treatment of sick birds (33.1%), Children also participated, alone and together with other family members, in various village chicken husbandry activities like cleaning of house, providing supplementary feed and watering to their chicken.

Table 13. Family members work distribution under rural chicken production system in Dugda district.

	Gender participation in percent (%)						
Activity	Men	Women	Children	Family	Men and women	Children and women	Children and men
Cleaning chicken house	1.3	31.3	1.9	47.5	3.8	13.1	1.3
Shelter construction	75.6	3.8	6.3	7.5	1.9	2.5	2.5
Supplementary feeding	0.6	25.0	0.0	56.3	3.1	13.8	1.3
Providing water	1.3	23.8	0.0	57.1	4.4	11.3	1.3
Selling egg	2.5	83.8	0.0	1.9	11.3	0.0	1.3
Selling chicken	5.6	55.6	0.6	21.3	11.3	5.6	0.0
Treatment of sick chicken	33.1	12.5	0.0	41.9	10.6	1.9	0.0

4.8. Challenges to Improved Chickens Production

The information on challenges to improved chicken rearing reported by chicken owners in the study district was shown in Table 14. About 41.3% of respondents reported disease as the biggest problem to improved chicken under rural chicken production system followed by lack of scientific knowledge about poultry management practices (20%), lack of time due to other farm activities (12.5%), shortage of feed in the area (10%), lack of marketing facilities (7.5%), attack of predators (6.9%), financial problems (1.3%), and

thieves (0.01%).Those mentioned problems were the reasons for chicken owners in rural chicken production.

Table 14. Challenges of improved chickens breed rearing in the study district

Challenges	Frequency	%
Disease	66	41.3
Lack of scientific knowledge	32	20
Lack of time due to farming activities	20	12.5
Shortage of feeds	16	10
Lack of market	12	7.5
Attacks of predators	11	6.9
Financial problem	2	1.3
Thieves	1	0.01

4.9. Respondents Suggestion for Improving Rural Poultry Production

The different suggestions for improving the rural poultry production as indicated by respondents are given in Table 15. According to interviewed chickens owners the suggestions to improve chickens production includes provision of technical guidance (15%), supply of improved breeds in affordable price (12.5%), provision of credit facility (10.7), provision of health management (disease and vaccines) services (10.6%), provision of shelter construction and preparing balanced ration (9.5%), provision of training to poultry owners (9.5%), supply of improved replacement chicks (7.6%), Supply of fertile egg for hatching at home (7.6%) attention on overall management system (6.9%) and provision of expert advise (4.4%) along with some more suggestions from small number of respondents.

Table 15. Suggestions for improving poultry production in Dugda district

Suggestions	Frequency	%
Provision of technical support and monitoring		
Provision of technical guidance	24	15.0
Supply of improved breeds in affordable price	20	12.5
Provision of credit facility for chicken producer	18	10.7
Provision of health management (disease and vaccines)	17	10.6
Provision of shelter construction and preparing balanced ration	15	9.5
Provision of training to poultry owners	15	9.5
Supply of improved quality replacement chicks	12	7.6
Supply of fertile egg for hatching at home	12	7.6
Attention on overall management system	11	6.9
Provision of expert advising	7	4.4
Disease resistant breeds will be used	4	2.5
Rear one day chicken and distribute to the farmer	3	1.9
Awareness creation before making of need assessment	2	1.3
Total	160	100

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4.10. Respondents Suggestion for Improving Egg and Chicken Marketing

The respondent's suggestion for improving egg and chicken marketing (Table 16) indicated of having good market access to improved breeds of chicken and egg (27.5%), higher selling price of improved breeds of egg and chicken compared to local breeds (26.9%), affordable purchasing price of improved chicks (10.6%), easy access to improved breed chicks (16.2%), separate market area for sale of products from improved chicken (6.3%), training on marketing for farmers (6.3%), cooperative marketing (4.4%) and supply of improved chicken on demand (2.5%). All this idea was suggested by farmers for the improvement of chicken and egg marketing in the study area.

Table 16. Respondent's suggestion for improving egg and chicken marketing

Suggestions given by farmers	frequency	%
Good market access to improved breed chicken and egg	44	27.5
Higher price of egg and chicken of improved breeds than local	43	26.9
Affordable purchasing price of improved chicken	17	10.6
Easy access to improved breed chicks	26	16.2
Separate market for sale of eggs and chicken of improved breeds	10	6.3
Training on marketing for farmers	9	5.6
Cooperative marketing	7	4.4
Supply of improved chicken on demand	4	2.5

4.11. Reproduction and Production Performances

4.11.1. Age of first egg laying hen and mature hen body weight

The mean ±SD for age at first egg and mature body weight of laying hen of three improved chicken breeds under rural poultry production system are given in Table 17.

Table 17. Age at first egg and mature body weight of improved chickens in Dugda district.

Breed		Age at first egg laying	Mature body weight
	N	Mean±SD (days)	Mean±SD (kg)
Isa brown	102	165± 23	1.49±0.168
White leghorn	19	165±19	1.48±0.212
Fayoumi	39	174±18	1.47±0.204

The average age at first egg laying for IB, Fayoumi and White leghorn were 165± 23, 165±19 and 174±18 days, respectively. However, there was no significant difference among three breeds ($p>0.05$) for age at first egg. The average body weight of mature egg laying hen were observed as 1.49±0.168kg for IB, 1.48±0.212 kg for WLH and

1.47±0.204 kg for Fayoumi breed of chickens. There was no statistically significant difference among the three layer breeds for mature body weight.

4.11.2. Egg production performance

Egg production performance of different improved chicken breed under rural management system are shown in Table 18. The average number of egg laid/hen/year of Isa brown, White leghorn and Fayoumi breeds were 248.82±33.211, 256.21±40.364 and 253.33±31.920 eggs, respectively in Dugda district. There was no significant difference (P>0.05) between three breeds of chicken.

Table 18. Egg production performance of improved chicken breeds in the study district.

Chicken type	N	Mean ± SD
Isa brown	102	248.82 ± 33.211
White leghorn	19	256.21 ± 40.3364
Fayoumi	39	253.33 ± 31.920

4.11.3. Egg quality trait of improved chicken breeds

Different parameters were used for evaluation of internal and external egg quality traits including egg weight, shape index, shell thickness, Shell weight, dried shell weight, albumen height, albumen weight, yolk height, yolk weight, yolk width, yolk color, yolk index and Hough unit. The results on egg quality traits observed in this study are presented in Table 19.

Table 19. Egg quality traits of improved chickens in Dugda district

Egg quality traits	Improved chicken breed		
	Isa brown Mean±SD	White leghorn Mean±SD	Fayoumi Mean±SD
Egg weight (g)	56.40±5.924[a]	49.5±4.032[b]	45.35±2.007[c]
Egg shape index (%)	77.85±3.545[a]	74.7±3818[b]	75.85±2.603[a]
Egg shell weight (g)	6.60±0.995[a]	5.65±0.813[b]	5.30±0.470[b]
Dried shell weight (g)	5.27±0.992[a]	4.04±0.600[b]	3.69±0.412[b]
Average shell thickness (mm)	0.34±0.042[a]	0.30±0.045[b]	0.27±0.014[c]
Albumen height (mm)	5.70±0912[a]	5.89±0.729[a]	3.69±0.316[b]
Albumen weight (g)	34.55±4.395[a]	29.30±2.536[b]	25.85±1.387[c]
Yolk height (mm)	16.10±0.560[a]	15.74±0.452[a]	15.24±0.473[b]
Yolk weight (g)	15.30±1.455	14.50±1.318	14.05±0.887
Yolk color (1-15)	8.75±1.410[a]	5.05±0.605[b]	9.75±2.954[a]
Yolk index	0.40±0.013	0.40±0.026	0.40±0.012
Haugh unit	74.74±7.27[a]	66.24±3.747[b]	64.50±2.233[b]

The value with different superscript differ significantly from each other ($p<0.05$)

Mean±SD of egg weight of IB, WLH and Fayoumi breeds were 56.40±5.924g, 49.5±4.032g, 45.35±2.007g respectively. The results also revealed that there was a significant difference in average egg weight of IB, WLH and Fayoumi ($p<0.05$). The average egg SI for IB, WLH and Fayoumi breeds were observed as 77.85±3.545, 74.7±3818 and 75.85±2.603 percent. Egg SI of IB and Fayoumi were significantly different from egg SI of WLH breed ($p<0.05$). The mean egg shell weight (g) for IB, WLH and Fayoumi breeds were 6.60±0.995g, 5.65±0.813g and 5.30±0.470g, respectively. The mean egg shell weight of IB was statically significantly different with WLH and Fayoumi breeds ($p<0.05$). Dry shell weight of egg was estimated as 5.27±0.992g, 4.04±0.600g and 3.69±0.412g for IB, WLH and Fayoumi breeds, respectively. The dry shell of eggs from IB was statistically significantly higher than WLH and Fayoumi breeds ($p<0.05$). The average shell thickness results were 0.34±0.042,

0.30±0.045 and 0.27±0.014mm for IB, WLH and Fayoumi breeds, respectively and the difference between three breeds were statistically significant ($p<0.05$).

Average albumin heights were observed as 5.70±0912 mm, 5.89±0.729 mm and 3.69±0.316 mm for IB, WL and Fayoumi breeds, respectively. The average albumin heights of IB and WLH were statistically significantly higher than Fayoumi breed ($p<0.05$). Average albumin weight was 34.55±4.395g, 29.30±2.536g and 25.85±1.387g for IB, WLH and Fayoumi, respectively and there was statically significant difference among three breed ($p<0.05$). The recorded results on Yolk height were 16.10±0.56mm, 15.74±0.452mm and 15.24±0.473mm, for IB, WLH and Fayoumi breeds, respectively. WLH and IB were statistically significantly different ($p<0.05$) from Fayoumi for average yolk height. The average yolk weights for IB, WLH and Fayoumi were observed as 15.30±1.455g, 14.50±1.318g and 14.05±0.887g, respectively. There was not statistically significant ($p>0.05$) difference among three chickens breed. The recorded yolk color result for IB, WLH and Fayoumi were 8.75±1.410, 5.05±0.605 and 9.75±2.954. The egg yolk color of Fayoumi and IB were significantly ($p<0.05$) higher than egg yolk color of WLH. Average yolk index were observed as 0.40±0.013, 0.40±0.026 and 0.40±0.026 for IB, WLH and Fayoumi breeds, respectively. There was no significant difference among three breeds for egg yolk index. The mean Haugh units were74.74±7.27, 66.24±3.747 and 64.50±2.233 for IB, WLH and Fayoumi breeds, respectively, and IB was statistically significantly different ($p<0.05$) from WL and Fayoumi on Haugh units.

5. DISCUSSION

The household characteristics (Table1) of 160 of interviewed village chicken owners indicated that 63.8% of respondents were male and 36.3% were female in Dugda district. The average age of respondents was 38.3 years (ranging from 18-74 years). This average age of respondents in Dugda district were similar to those reported by Desalew *et al*. (2013) in East Shewa Zone and by Moges *et al*. (2010) in North West Ethiopia. The average family size identified in the area of study was similar to the national average of 5.2 persons (CSA 2003) and the reported 5.4 for North-West Amhara (Halima, 2007).

Educational status of households under current study revealed that number of illiterates was lower (33.8%) than 82.1% reported for North-West Ethiopia (Halima, 2007). The landholding per household in Dugda woreda was (2.2±1.98ha) which was higher than reported by Desalew *et al*. (2013) in East Shewa Zone. The proportion of the landless chicken owner respondents were 24.4% in the district which is higher than reported by Desalew *et al* (2013). Chicken can be a source of eggs and meat with low inputs for landless chicken owners (Sonaiya and Swan, 2005). According to Moreki *et al.* (2001), family chicken are rarely the sole means of livelihood for the family.

The results obtained on rural chicken management practices in Dugda district (Table 2) revealed that 68.7% of the respondents provide house to their birds, which is lower than 91.11% in Ada'a and 95.6% in Lume districts, as reported by Desalew *et al.* (2013) and Khandait *et al.* (2011) in Bhandara district of India, reported 90% of backyard chicken owners provided separate poultry house.. Further it was indicated that 43.1% of respondents provide night shelter to their chicken and only 22.5% of respondents constructed separate poultry house which was in agreed with the reports of Moges *et al.* (2010a) and Mengesha *et al.* (2011 who have reported 22.1% and 21.2% respondents respectively, constructed separate poultry house entirely for poultry but did not agree with Desalew *et al* (2013) who has reported higher proportion of respondents, 35.6% in Ada'a and 25.6% in Lume districts constructed separate poultry house. However, in the present study, out of 68.7% in the district 15% of the respondents constructed chicken

house based on recommended extension package for improved chicken. Generally, it was also observed that few households (3.1%) residing near the town and main road provide adequate ventilation and electricity and litter material in poultry house. About 30% of the respondents share the same house between chicken and people and 1.3 % respondent's house their chicken with other animals, This variation in observations might be due to different farmers' awareness to the importance of poultry housing in different districts studied by different workers.

Study of Table 3 revealed that major poultry feeding system in Dugda district was scavenging with additional feed supplements (92.5%). This value was lower than Halima *et al*.(2007) reported 99.28 % in Northwest Ethiopia, Moges *et al.* (2010) reported that 98, 93 and 98% of respondents in three districts of Bure, Fogera and Dale, respectively and Meseret Molla, (2010) reported 97.8% of the farmers in Gomma Woreda of Jimma Zone, provided additional supplementary feed to their chickens. The major feed ingredients used as additional poultry feed supplements in the area of study were maize and wheat (47.5%). Other farmers used maize and wheat with other ingredients like furshika, kitchen wastes and meat (43.7). Majority of respondents (66.9%) give additional feed supplements three times a day while 25.6% of respondents provide supplementary feed two times a day to their chicken in Dugda district under present study. These observations agree with Desalew *et al* (2013) reporting that maize and wheat were used as feed supplements, mostly at frequency of three times/day. As scavenging laying hen can find approximately 60 to 70% of their feed requirement Rahman *et al.* (1997); providing supplementary feeds three times/day could help to express the laying potential of chickens at village level.

Almost all rural chicken owners (99.9%) of Dugda woreda under this study Table 4, provided water to their chicken; throughout the year and most of the respondents (95%) provided free access to the water, similar with Halima (2007), reported that 99.5% of chicken owners in North-West Amhara provided water to village chicken. The major source of water to the rural chicken in Dugda district were borehole was the major water source in district were borehole water (32.5%) followed by river water (25.6%), tap water (23.4%) and pond water (18.4%) in Dugda district. Moges *et al. (*2010) and Mengesha *et al.*

(2011) reported similar, watering practices in Bure district of North West Zone of Amahra region and Jamma district of South Wollo respectively.

The observations recorded on poultry health management practices in Dugda districts (Table 5) revealed that 50% of the respondents vaccinate their bird to prevent and control of chicken diseases. Majority of respondents (31.2%) were vaccinating their birds against New castle disease, which was most prevalent disease in the area of study. Serkalem *et al.* (2005) also reported that NCD was one of the major infectious diseases affecting productivity and survival of village chickens in central high lands of Ethiopia. Similarly, Kusina *et al.* (2000) reported that NCD was identified and accepted as the greatest danger to the expansion of chicken production in Zimbabwe. Regarding the control of parasitic infestation/ infection about 25% of the respondents uses anti – ectoparasites to control external parasitic infestation and 25% of the respondents uses deworming to control the internal parasites of their chicken. These proportions of respondents using anti ectoparasites were lower than those reported by Desalew *et al*. (2013) for Ada'a and Lume districts on cumulative basis. None of the chicken owner practiced vaccination and prophylactic measures against poultry diseases in studies conducted by Leta and Endalew (2010); Mengesha *et al. (*2011) and Takele and Oli (2011).

The results for culling of chicken (Table 6) revealed that most of the respondents (87.5 %) use culling due to various reasons. The main reasons for culling were old age (38.1%), old age and sickness (20%) poor productivity (16.3%), old age with poor productivity and sickness (8.1%) and old age with poor productivity (5%). Similar culling practice was reported by Moges *et al.* (2010a).

The information on type and source of improved chicks to chicken owners (Table 7) showed that majority of the respondents (63.8%) in the Dugda district used IB chicken, indicating the popularity of the breed among farmers in the area of study. Regarding source of the chicks it is revealed that about 80.6% of the respondents purchased chicks from private hatcheries and 16.3% respondents hatched fertile eggs naturally at home,

while 3.1% of the respondent's received their chickens from NGO. This means that government hatcheries are not supplying any improved chicks to the farmers in Dugda district.

Results obtained for market access to sale chicken and eggs (Table 8) indicated that 94.6% of the respondents had good market access to sale eggs and chicken in district this result higher than reported by Desalew *et al*. (2013) in East Shewa, Ethiopia.

Selling trend of eggs and chicken (Table 9) indicated that higher proportion of the respondents, 91.9% in district was selling their eggs and chicken to village market, and 3.8% of the respondents in district were selling their eggs and chicken at village market and at their own doorstep. Similar selling practice of eggs and chicken has been reported by Tadelle *et al.* (2003c) and Khandait *et al.* (2011).

The information on selling time and consumer preference (Table 10) showed that majority of respondents (51.2%) sell their chicken according to their personal money requirement This sales are decided by women, which provide her with an immediate income to meet household expenses, Next preferred time for selling chicken was during holiday and festival (34.4%) in the district. The fact that respondents preferred to sale at higher prices, as the price of eggs and chicken is highly related to holidays and agreed to the report of Halima (2007); Wilson (2010) and Dinka *et al.* (2010). However, about 12.5% respondents sold their chicken after a specified weight gain and age of chicken. Consumer preference of the respondents for eggs and meats obtained from local, were 36.2% and 80% respectively which were higher than the preference for egg (25%) and meat (3.1%) from improved chicken. The premium for local birds is attributed to better meat flavor and more deeply colored egg yolks (Dessie and Ogle, 2001). However, at village level, significant difference in egg yolk color may not be expected between local and improved chicken, thus such difference might be for flavor and taste of the egg from local chicken. About 25% of the respondents in Dugda districts prefer eggs from commercial chicken for their larger egg size as egg from local chicken is considerably smaller than commercial layers, usually weighing 50 to 66 percent (Sonaiya, 2004).

The survey results on access to the agriculture extension services to respondents for the improvement of poultry production in the study area (Table 11) revealed that only 33.1% of the respondents had access to extension services while majority of the respondents (66.9%) had no access to the extension service on poultry production. Major reasons of not using extension service were as respondents cannot easily reach extension people (36.9%), have not heard of extension service (23.8%), and did not feel any need of the extension service (6.3%).

Provision of training for chicken owner on improved chicken production and lack of relevant technical extension package seems to be a limiting gap in the area of rural household poultry production. This is agreed with Meseret Molla (2010) and Mengesha *et al.* (2011). However, Desalew *et al* (2013) reported better extension services (47.2%) on collective basis in Ada'a and Lume districts. A similar picture about the extension services provision in Ada'a district was also reported by ILRI (2005). Majority of the respondents did not use agricultural extension services; this might be due to drawback fear of farmers to the technology disseminated as it is also reported by Dana *et al*. (2006).

Credit service for improved poultry production was not provided in the district (Table12), this observation agreed with Aklilu *et a*l. (2007); Moges *et al. (*2010a) and Takele and Oli (2011).

The results on work distribution to different family members (Table 13) revealed that all family members participated in different rural chicken production activities. However, Women were highly responsible for many activities and agreed with Gueye (1998) reported that women and children were generally in charge of village chicken husbandry practices in developing countries. Abubakar (2007) also reported that women and children involvement was by far the highest on village flocks management labor profile activities included; sheltering birds, cleaning bird's house, feeding and watering of birds in some parts of Nigeria and Cameroon. Mapiye *et al.* (2005) also reported that women in Zimbabwe were dominated in most village chicken production activities like; feeding

(37.7%), watering (51.2%) and cleaning of bird's house (37.2%) whereas men were dominant in shelter constructions (60%) and treatment of birds (40%).

The major challenge to chicken production in the study district (Table 14) were prevalence of disease, lack of knowledge about scientific poultry management practices, lack of time due to farming activities, shortage of feed in the study area, lack of market, attacks of predators, financial problem and thieves, as indicated by respondents during survey. According to Solomon (2007) who reported that the bio-security of the backyard poultry production system is very poor and risky, since scavenging birds live together with people and other species of livestock. Poultry movement and droppings are very difficult to control and chickens freely roam in the compounds used by households and children and to Solomon (2007), full day scavenging chickens are vulnerable to predation and disease. A survey conducted in Southern Ethiopia identified Fowl cholera followed by New Castle Disease, Coccidiosis, Fowl influenza [Infectious Bronchitis], Fowl pox, Fowl typhoid and Salmonella to be the major poultry diseases respectively (Aberra, 2007).

The respondents suggestion for sustainable development of poultry production and marketing in Dugda district (Table15 and 16) includes; provision of technical support and monitoring, supply of improved breeds in affordable price, credit facility for improved chicken production , training on vaccination and disease control and marketing, supply of day old quality chicks to the farmers, regular electricity supply to avoid high chick mortality, good market for chicken and eggs of improved breeds, higher selling price of egg and chicken from improved breeds compared to local breeds, The chicks of improved breeds that replace itself should be available in market on competitive price, creation of cooperatives for marketing, and supply of improved chicken according to needs of farmers. These observations were almost similar to Dessie and Ogale (2001) and Desalew *et al*. (2013).

Average age at first egg and mature body weight of laying hen of three improved chicken breeds under rural poultry production system (Table 17). The average age at first egg

laying for IB, White leghorn and Fayoumi were 165± 23, 165±19 and 174±18 days, respectively. However, there was no significant difference among three breeds ($p>0.05$) for age at first egg. These results indicate that IB and WLH are early maturing breeds than Fayoumi under rural management practices. The average age at first egg in all the three breeds under present study were slightly higher than age at first egg in IB and PK reported by Desalew *et al*. (2013) but age at first egg observed for three breeds was lower than the age at first egg (6.5months) reported by Dessie and Ogle (2001). The difference in observations could be attributed to the genetic and environmental reasons, which is in agreement with the reports of Demeke (2004), Fasil *et al* (2010) and Lem Lem and Tesfaye (2010).

The average body weight of mature egg laying hen (Table17) were 1.49±0.168kg for IB, 1.48±0.212 kg for WLH and 1.47±0.204 kg for Fayoumi breed of chickens. There was no statistically significant difference among the three layer breeds for mature body weight. The body weights of all the three breeds under present study were lower than body weights of IB, BB and PK breeds reported by Desalew *et al*. (2013) under rural management practices. The difference in observations could be due to difference in genotype and environments. As the laying hen body weight increased, egg production decreased and egg weight and feed consumption increased, because heavy birds consume more feed and lay larger eggs with large egg yolk than light hens (Leeson *et al*., 1997).

Results on egg production performance under rural management practices (Table 18) revealed that average number of egg laid/hen/year of Isa brown, White leghorn and Fayoumi breeds were 248.82±33.211, 256.21±40.364 and 253.33±31.920 eggs, respectively in Dugda district and there was no significant difference ($P>0.05$) between three breeds for egg laying. These results indicated that WLH laid more eggs than Fayoumi and IB, indicating superiority of WHL over other breeds for egg production even under rural management condition. This result was similar with the average daily egg production/ head of the Isa Brown breed of chickens is 0.70 reported by Meseret Molla (2010). The average number of eggs/year/hen reported in this study was lower than those reported by Desalew *et al.* (2013) for IB(276.1)and BB(266.3) but higher than PK

(187.04) and than those reported by Lemlem and Tesfaye (2010) for White Leghorn, Rhode Island Red and Fayoumi chicken under village household condition. The variation in observations might be attributed to the differences in genotype of the bird and feeding management used. In addition, present egg production was significantly higher than local chickens, which lay 55 to 80 eggs/year (Dessie and Ogle, 2001). This good performance of improved layers with supplementation of maize and wheat is in agreement with the findings of Vries (1993) and Altamirano (2005).

Regarding egg weight (Table18), the result of the current study showed that the average weight of eggs collected from different sources of the study woreda was 56g for IB, 49g for WLH and for Fayoumi 45g and there were statistically significant difference ($p<0.05$) in average eggs weight of three breed. The egg weight recorded for IB was relatively much higher than WLH and Fayoumi breeds. This difference could be expected since IB developed for egg weight improvement (Hocking *et al.,* 2003). The present findings agreed with the observations of Tixier-Boichard *et al*. (2006). The egg weights under current study were lower than egg weights observed by Desalew *et al.* (2013), for IB (58.75g) and BB (60.27g) but higher than PK (48.84g). Also egg weight of WLH and Fayoumi were lower than 53.4g reported by Halima (2007) for RIR chicken breed eggs but higher than 42.9g by Hallima (2007), observed for eggs collected from seven chicken ecotypes of North-West Amhara. The observed egg weight of Fayoumi breed agreed with 45.91g reported by Akhtar *et al* (2007). The present egg weights were higher than 35-39g, reported by Ahmed (1994) for Banladesh indigenous chicken eggs the difference observations on egg weight among different strains of chicken in the present study could be genetic differences.

The average egg SI (Table19) for IB, WLH and Fayoumi breeds were 77.85±3.545, 74.7±3818 and 75.85±2.603 percent, respectively and the difference of IB and WLH with Fayoumi were statistically significant ($p<0.05$) for egg SI, The egg shape index from this study was higher than 66.9% reported for eggs of Nigerian Fulani chicken ecotypes (Fayeye *et al.,* 2005). Eggs with higher shape index percentages are more circular in shape than that of eggs with lower shape index percentages. The "normal" chicken eggs

are supposed to be elliptical (oval)in shape and eggs that are unusual in shape such as; long/ narrow, round and flat-sided could not be placed in grades AA or A in developed world (Silversides, 1994).

The mean egg shell weight (Table19) for IB, WLH and Fayoumi breeds were 6.60±0.995, 5.65±0.813 and 5.30±0.470g, respectively The mean egg shell weight of IB was statistically significantly different from WLH and Fayoumi breeds ($p<0.05$). Higher egg shell weight in egg of IB were expected because of higher egg weight as egg shell weight is proportional to egg weight. The present egg shell weights were higher than 4.32g reported by Sreenivas *et al* (2013) in White leghorn. Dry shell weight of egg was estimated as 5.27±0.992g, 4.04±0.600g and 3.69±0.412g for IB, WLH and Fayoumi breeds, respectively. The dry shell of eggs from IB was statistically significantly higher than WLH and Fayoumi breeds ($p<0.05$). Similar average dry egg shell weight of 3.95g and 5.7g were reported by Halima (2007) for eggs collected from intensively managed local hens of North-West Amhara and RIR chicken breeds, respectively. This variable was in complete accordance of egg shell weight.

The average shell thickness measured were 0.34±0.042, 0.30±0.045 and 0.27±0.014mm for IB, WLH and Fayoumi breeds, respectively and the difference between three breeds were statistically significant ($p<0.05$). These observations agreed with Desalew *et al.* (2013), reported egg shell thickness 0.31 ± 0.05, 0.33 ± 0.037, and 0.29 ± 0.026mm for IB, BB and PK, respectively. Similarly, Teketel (1986) reported an average egg shell thickness of 0.35 mm for Ethiopian local breed chicken eggs. Asuquo *et al.* (1992) also reported an average egg shell thickness of 0.30 mm and 0.35 mm for Nigerian local breeds and Isa-Brown breed chicken eggs, respectively. However, the average egg shell thickness of improved chicken under this study was lower than 0.71 mm & 0.69 mm reported by Halima (2007) for eggs collected from intensively managed local chicken ecotypes of North-West Amhara and RIR chicken breeds, respectively. Ashraf *et al.* (2003) reported no difference in egg shell thickness of commercial and traditional breeds. Rajkumar *et al (*2009) who reported the effect of layer type difference, environmental conditions and feed quality on eggshell thickness. The difference in eggshell thickness in

the present study could be layer strain difference; this is in agreement with Khan *et al.* (2004) and Zita *et al*. *(*2009) who reported the effect of layer type difference, environmental conditions and feed quality on eggshell thickness.

Average albumin heights were observed as 5.70±0912, 5.89±0.729 and 3.69±0.316 mm for IB, WL and Fayoumi breeds, respectively. The average albumin heights of IB and WLH were statistically significantly higher than Fayoumi breed ($p<0.05$). The reason could be attributed to the observed difference in egg size of above breeds. These results agreed with Niranjan *et a*l **(**2008**)** who reported significant difference on albumin height for chicken under backyard management. On the other hand, the current result of albumin height was lower than recorded result of improve chicken reported by Desalew *et al*. (2013) in East Shewa, Zone, Ethiopia.

Average albumin weight was 34.55±4.395, 29.30±2.536 and 25.85±1.387g for IB, WLH and Fayoumi breeds, respectively and there was statically significant difference among three breed ($p<0.05$). Significant differences might be due to difference in egg weight indicating that size of eggs affect the weight of egg components. The present albumin weights agreed with Desalew *et al.* (2013) who reported similar albumin weights for three exotic breeds of chicken under rural condition and agreed with the findings of Zhang *et al* (2005), Aygun and Yetisir (2010).

Average Yolk height was 16.10±0.56mm, 15.74±0.452mm and 15.24±0.473mm, for IB, WLH and Fayoumi breeds, respectively. WLH and IB were statistically significantly different ($p<0.05$) from Fayoumi for average yolk height. The smaller yolk heights in Fayoumi could be due to lower egg weight. These yolk heights were higher than those reported by Moges *et al* (2010) but lower than Desalew *et al*. (2013).

The average yolk weights for IB, WLH and Fayoumi were observed as 15.30±1.455g, 14.50±1.318g and 14.05±0.887g, respectively. There was not statistically significant ($p>0.05$) difference among three chickens breed. These findings agreed with Silversides and Scott (2001) and Silversides *et al.* (2006), Tulin and Ahmed (2009) and Desalew *et al.* (2013), who observed that yolk weight of different strains differed significantly.

The yolk color result for IB, WLH and Fayoumi were 8.75±1.410, 5.05±0.605 and 9.75±2.954. The egg yolk color of Fayoumi and IB were significantly ($p<0.05$) higher than egg yolk color of WLH. The lower yolk color value for WLH compared to Fayoumi and IB could be due to higher egg production, non feeding of yellow and lack of green leafy material in the scavenging area of WLH layers. However, this result was higher than the egg yolk color reported as 3.48 and 4.0 by Halima (2007) for eggs collected from intensively managed local hens of North-West Amhara and RIR chicken breed hens, respectively. Hunton, (1995) also reported that Yolk color is used as a quality determination factor but is nearly entirely dependent on the diet and is easily manipulated.

The observed values for yolk index were 0.40±0.013, 0.40±0.026 and 0.40±0.012 in IB, WLH and Fayoumi, respectively and showed no difference between three breeds under study. These yolk index values were lower than those reported by Akhtar *et al* (2007) but agreed with Khalid (2001) who observed that yolk index of different experimental breeds did not show any difference among them.

Haugh unit determines the albumen quality; higher Haugh unit means better albumen quality The mean Haugh units were74.74±7.27, 66.24±3.747 and 64.50±2.233 for IB, WLH and Fayoumi breeds, respectively, and IB was statistically significantly different ($p<0.05$) from WL and Fayoumi on Haugh units and disagreed with the reported by Khalid (2001) and Ashraf *et al.* (2003) also found that Haugh unit of all the experimental breeds was the same.

6. CONCLUSION AND RECOMMENDATIONS

The study was conducted with the objectives of assessing/ evaluating egg production, reproduction performances and egg quality traits of improved chicken under rural chicken management practices in Dugda woreda. In the study area awareness about the modern chicken production system was poor and most of village chicken production activities are managed by women. There was no credit facility designed for rural poultry production and also there is a problem of supplying of improved chicken breed in time, Limitation of governmental and private poultry farm for purchasing improved chicken. Generally in the study district poor attention was given for poultry production and management system.

Egg production performance of improved chicken breeds of white leghorn and Fayoumi were slightly higher than Isa brown and egg weight of Isa brown was higher than white leghorn and Fayoumi and yolk color of Fayoumi and isa brown higher than white leghorn. The mean Haugh units of Isa brown higher than white leghorn and Fayoumi.

Based on the result of this study, the following recommendations are drawn:

- Provision of frequent trainings on modern chicken husbandry practices to women would be essential for the improvement of rural chicken production.
- Training should be given for farmers to increase awareness regarding the benefits of exotic breeds, and their management activities.
- Awareness creation on internal and external egg quality.
- Diseases and predators that affect productivity of chicken need to be controlled.
- improve chickens replace itself should be widely distribute to the farmers
- The adaptability of improved breed to the local area should be assessed to maximize the productivity of birds.
- Provision of credit facilities to chicken owners and linking the production with marketing should be done to encourage chicken owners.
- Chicken owners need to work in cooperatives for better outcome and to avoid market fluctuation.
- Egg need to be stored properly in order to maintain the internal quality for a long period.

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8. ANNEXES

8.1. Questionnaire Format

Remainder to enumerators

1. Make brief introduction to each farmer before starting any question, get introduced to the farmers (greet them the local way) get his name, tell him yours, the institution you are working for, and make clear the purpose and objectives of your question.
2. Please ask each question so clearly and patiently until the farmer understands.
3. Please fill up the questionnaire according to the farmers replay (do not put your opinion).
4. Please try not to use technical terms while discussing with farmers and do not forget the local unit.

Enumerator's Name_____Date_____Code no_____

A. Demographic characteristics of the households in the study area.

1. Name of village/Peasant Association _____
2. Name of household head_____Sex_____Age_____
3. Family size? 1. Male_____2.Female_____3.Total_____
4. Level of education of the household head?
   1. Illiterate 2. Read and write 3. Elementary School 4. High School
   5. College and University education

5. Land size? Please indicate the available land in the following table.

NO	Land type	Land unit	
		Hectares (ha)	**Local measurement**
1.	Arable land		
2.	Grazing land		
3.	Unutilized land		
	Total		

B. Chicken Breeds Adopted

1. Source of chicken 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 provide housing for chickens, 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 Material do you use?

1. *Teff* straw 2. Wheat straw

3. If others (specify) _____

D. Feeding and Watering

1. How do you feed your chicken?

1. Scavenging only 2. Scavenging with supplement

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

2. When do you feed your chicken?

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?

1. Maize and wheat 2. Furshika 3. Others

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. Free access 2. Morning only 3. Morning and evening only

4. If other (specify) _____

E. Work Distribution to Family Members in Rural Chicken Production Practice

1. Describe the family members activities for chicken

No	Activity type	Responsible family members (Rank)			
		Children	Women	Men	Family
I	Chicken management and marketing				
	Shelter construction				
2	Cleaning chicken house				
3	Supplementary feeding				
4	Providing water				
5	Selling chicken				
6	Selling eggs				
7	Treatment of sick birds, if any				

F. Egg production and reproduction performance

No	Parameter	Chicken types adopted
1 2 3	Pullets age at first egg (weeks) Laying hen mature weight (gm/kg) Total number of eggs laid per hen/year	

1. Do you practice culling of birds? 1. Yes 2. No

2. If yes, reasons for culling? 1. Poor productivity 2. Old age 3. Sickness

3. Specify (if others)_____,_____, _____

G. Marketing (Products and production input)

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

6. If others (specify)_____

6. Which breed type meat is most preferred by consumers?

1. Meat from improved breed

2. Meat from local chicken

3. Equally preferred by consumers

7. Write your reasons for

Q.7. resonses? _____

8. Which breed type egg is most preferred by consumers?

1. Eggs from improved breeds 2. Eggs from local chicken 3. Equally preferred

9. Write your reasons for Q.8 responses?_____

H. Poultry Health

1. Do you practice annual vaccination of your chicken? 1. Yes 2. No

2. Against which diseases vaccinate your chicken?

1. Newcastle diseases 2. Marek's Disease

3. Fowl thiphoid 4. Gumboro (infectious bursa disease)

5. Infectious bronchitis

3. Do you use anti-ectoparasites? 1. Yes 2. No

4. Do you practice deworming? 1. Yes 2. No

I. Extension service

1. Do you have access to the extension service? 1. Yes 2. No

2. If you say No for Q.1, state the reasons?

1. Have no heard of them 2. Cannot easily reach them

3. There is no need 4. If others (specify) _____

3. How frequently do you see the extension agent?

1. Once in a week 2. Once in two weeks

3. Once in a month 4. Not Seen

4. Do you discuss your production problems with extension agents?

1. Yes 2. No

5. Have you ever got any training on poultry production? 1. Yes 2. No

6. If yes, for Q. 5. When?

1. Before starting the business 2. After the business started

7. Did you get credit service when you start poultry business? 1. Yes 2. No

8. If yes, for what purpose did use the credit?

1. Day old chicks 2. Poultry feed 3. Poultry equipment

4. If others (specify) _____

J. List major constraints

A. What are constraints in adoption of improved breeds? (Rank)

1. Presence of disease
2. Shortage of feed from surrounding
3. Attacks of predators (which age group is affected)_____
4. Thieves
5. Lack of market
6. Lack of time due to farm work activities
7. Improper service of veterinary doctors at village level
8. Lack of knowledge about scientific poultry management practices
9. Any other, if any_____

K. What do you recommend to improve poultry production in your area?

1. _____

2. _____

3. _____

4. _____

5. _____

L. What do you recommend to improve chicken and egg marketing in your area?

1. _____

2. _____

3. _____

4. _____

5. _____

Figure 3. Chicken breed of Fayoumi and WLH found in the area.

8.2. Performance Parameters Recording Format

Live weight at various ages

Age category	**Live weight (Kg) according to breed type**		
Laying hen (8-18) months) (Kg)			

Laboratory egg quality recording

format Egg quality traits	Chicken breed types			
Egg weight (g)				
Yolk height, (mm)				
Albumin height (mm)				
Yolk weight (g)				
Yolk colour				
Albumin weight (g)				
Haugh Unit				
Shell thickness (mm)				

8.3. Types of equipments to be used for internal and external egg quality trait assessment study.

I. External egg quality parameters identified in the study

1. Egg weight (g), (using digital balance)
2. Shell thickness (mm), (using digital caliper)
3. Dried Shell weight (g), (using drying oven)
4. Egg shape index (%), (calculated as: (egg width/egg length)*100)
5. Egg shell color (visual observation)
6. yolk index (yolk height/Average yolk diameter)

II. Internal egg quality parameters

1. Yolk height (mm), (using tripod micrometer)
2. Albumen height (mm), (using tripod micrometer)
3. Yolk color (measured using color fun, ranged 1-15),
4. Hough Unit (HU), (calculated using albumen height and egg weight calculated using the formula: $HU = 100\log (AH - 1.7EW^{0.37} + 7.6)$ (Haugh, 1937). where; HU = Haugh unit, AH = Albumen height and EW = Egg weight

Figure 4. Materials used for egg quality study

Weighing egg shell by using digital balance

measuring shell thickness by using digital caliper

Measured yolk weight by using tripod micrometer

measures yolk color by using Roche Color fan

Weighing egg by digital balance

measuring egg yolk width by using varnier caliper