

# Productive and Reproductive Performance of Indigenous Chickens in Ethiopia

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## ABSTRACT

This study reviews the productive and reproductive performance of indigenous chickens in Ethiopia with the aim of delivering summarized and synthesized information for the beneficiaries and producers. Chicken production encompasses into traditional scavenging, small and large-scale market orientated systems based on the objective of the producer, the type of inputs used and the number and types of chickens kept. In Ethiopia, indigenous chickens produce 10-20 eggs per clutch and 30-65 small eggs per hen per year in 3-4 clutches. Local chickens reach slaughter/market age at 8 to 12 months with 0.6-2.5kg average weight at farmer management system. Indigenous chickens require long time to reach sexual maturity and take the longest time to recover reproductive cycle by local broody hen. The average mortality rate was highest and which affects both productive and reproductive performance of indigenous chickens by reducing survival rate. There were huge numbers of indigenous chickens existing in Ethiopia but productivity was disproportional to the number of chickens. The major constraint which affects productive and reproductive performance of indigenous chickens are diseases and predators, feed shortages, lack of training and extension services, and lack of proper marketing systems. In conclusion, lowest productive and reproductive performance was recorded which needs further improvement by adjusting training and extension service for farmers.

**Keywords:** Indigenous Chickens, Reproductive Performance, Productive Performance, Ethiopia.

## I. INTRODUCTION

Poultry production is an important sector in Ethiopia where chickens and their products are important sources for income generation for rural peoples and important source for high quality protein for developing countries. Poultry in Ethiopia is similar with chicken and total chicken population were 60.5 million, from this 94.33%, 2.47% and 3.21% were indigenous, exotic and hybrid chickens, respectively (CSA, 2016). Backyard poultry production in Ethiopia represents a significant part of the national economy in general and the rural economy in particular, and contributes 83.5% of the national egg and meat products (CSA, 2016).

Chicken production encompasses into traditional scavenging, small and large-scale market orientated sectors which is based on the objective of the producer, the type of inputs used and the number and types of chickens kept (Halima, 2007). The rural poultry sector constitutes about 98% of the total chicken population (FAO, 2007) and are largely consists of the indigenous or native domestic fowl. The traditional back yard systems are characterized by mainly low-input and small-scale with 4-10 mature birds per household, reared in the back yards with inadequate housing, feeding and health care. Scavenging is the most important component of the poultry diet (Fisseha et al., 2010, Meseret, 2010).

The Ethiopian indigenous chickens are known to possess desirable characters such as thermo tolerant, resistance to some disease, good egg and meat flavor, hard egg shells, high fertility and hatchability as well as high dressing percentage (Aberra, 2000). According to Abubakar et al. (2007) the impact of the Ethiopian village chicken in the national economy and its role in improving the nutritional status, family income, food security and livelihood of many smallholders is significant owing to its low cost of production. The diverse agro-ecology and agronomic practice prevailing in the country together with the huge population of livestock in general and poultry in particular, could be a promising attribute to boost up the sector and increase its contribution to the total agricultural output as well as to improve the living standards of the poor livestock keepers (Aleme and Mitiku, 2015; Hunduma et al., 2010).

The Ethiopian indigenous chickens are none descriptive breeds closely related to the jungle fowl and vary in color, comb type, body conformation, weight and may or may not possess shank feather and broodiness is pronounced (Demeke, 2008). The mean annual egg production of indigenous chickens is estimated to be 60 small-size eggs per year with a thick shell and deep yellow yolk color. Indigenous chickens are poor in productive and reproductive performance which are characterized by small sized eggs, slow growth rate, late maturity, slow age at first mating, small clutch size, a natural learning to broodiness and high mortality of chicks among the flock. Low productivity of indigenous chickens is due to low hatchability and high mortality of chicks (Fissaha et al., 2010; Getachew et al., 2016).

There were huge number of indigenous chickens in Ethiopia but its productive and reproductive performance were low and varies in different area, and are not reviewed and well documented for users and producers. There is a need for reviewing the productive and reproductive performance of village chickens to improve the indigenous chicken

productivity and to save the indigenous genotype from distinction or replacement by exotic chickens. This being the cases, the objective of this review is to review the productive and reproductive performance of indigenous chickens in Ethiopia with the following specific objectives:

- ✓ To review the productive performance of indigenous chickens in Ethiopia
- ✓ To review the reproductive performance of indigenous chickens in Ethiopia
- ✓ To review the constraints that affects productive and reproductive performance of indigenous chicken in Ethiopia

## II. REVIEW

### 2.1 Productive Performance of Village chickens

The productive performance of indigenous chickens are low and which includes clutch number, average number of eggs laid per clutch, average days per clutch, average number of eggs per hen per year, slaughter age and weight of chickens.

#### 2.1.1 Clutch number

Clutch numbers of Ethiopian indigenous chicken is different at different production and management systems. According to CSA (2016) report the national average clutch number of Ethiopia indigenous chicken was 4 per year. The number of clutch periods showed by local hens per year is 3.8, 2-6 and 3.7 in Bure, Fogéra and Dale, respectively (Fissaha et al., 2010). Melkamu and Wube (2013) in Debsan Tikara Kebele at Gonder Zuria Woreda the average clutch number were 3 per year. Alem (2014) reports in Central Tigray the average clutch number per year was 3.15 to 3.2 and 3.2 at lowland and midland agro-ecologies, respectively. The number of clutch periods recorded per year was  $4.29 \pm 0.17$  (range 3.38-6.11) in Metekel zone of Northwest Ethiopia, respectively (Solomon et al., 2013). The average number of clutches per year per hen was 3.2 for local hens ranged from 2 to 5 with an average clutch length of 21.6 days ranged from 15 to 28 days in lowland and

midland agro-ecological zones of Central Tigray (Alem, 2014). The average number of clutches per year recorded from the Gomma Wereda was 3.43 (Meseret, 2010). The overall average clutch number of chicken in North Wollo of Amhara region was 3.62 per year (Addisu et al., 2013). Mekonnen (2007) reported that the mean clutch number of indigenous chicken in three districts of SNNPRs was 3.8 per year.

### 2.1.2 Egg production

Indigenous chickens' produces lowest number of eggs and which is small in size. An indigenous chicken in Ethiopia produces 12 eggs per clutch (CSA, 2016). According to Yadessa et al. (2017) finding indigenous chickens produces 14.3 small eggs per clutch in Mezhenger, Sheka and Benchi -Maji zones of south western Ethiopia. Solomon et al. (2013) report under existing farmer management condition, number of eggs produced per clutch was  $13.56 \pm 0.26$  in Metekel zone of Northwest Ethiopia. Addisi et al. (2013) reported the average eggs laid/clutch/hens was 16.88, 14.23 and 11.9 eggs in Quara, Alefa and Tach Annachiho districts, respectively. Average number of eggs laid per hen per clutch was 13.6 for local hens ranged from 9 to 18 eggs in lowland and midland agro-ecological zones of Central Tigray (Alem, 2014). The average number of eggs per clutch of indigenous chickens reported from Gomma district was 12.92 (Meseret, 2010).

The egg production potential of local chicken is 30-60 eggs/year/hen with an average of 38g egg weight under village management conditions, while exotic breeds produce around 250 eggs/year/hen with around 60g egg weight in Ethiopia (Alganesh et al., 2003). Indigenous chickens produce 48 small eggs per hen per year at farmers' management conditions in Ethiopia (CSA, 2016). The average number of eggs produced per hen per year was 54.5 in Mezhenger, Sheka and Benchi -Maji zones of south western Ethiopia (Yadessa et al., 2017). According to Addisu et al. (2013) 49.51 eggs per hen per year was reported from North Wollo, Amhara Region, Ethiopia.

Solomon et al. (2013) also reported 59.5 eggs per hen per year in Metekel zone, Northwest Ethiopia. According to Fissaha et al. (2010) finding the total egg production/hen per year of local hens under farmer management condition is estimated to be 60, 53 and 55 in Bure, Fogéra and Dale woredas, respectively. Melkamu (2014) finding showed that an indigenous chicken produces average of 65 eggs per hen per year. Indigenous chickens produce  $59.51 \pm 2.66$  (range 45.38-93.19) per hen per year in Metekel zone of Northwest Ethiopia (Solomon et al., 2013). Mean annual egg production of the indigenous chickens of Gomma Wereda was 43.8 eggs (Meseret, 2010), mean annual number of eggs produced from Dale district was 55.2 eggs/year/hen (Mekonnen 2007) and average number of eggs per hen per year in Ambo was 36-42 ( Fikere, 2000). The mean annual egg production/hen in North Wollo of Amhara region was  $49.51 \pm 0.38$  (Addisu et al., 2013).

### 2.1.3 Slaughter weight of indigenous chickens

Bogale (2008) indicated that the meat production ability and growth performance of indigenous chicken are limited and local males may reach 1.5kg live weight at 6 months of age and females about 30% less. According to GAIN (2017) report in which local Ethiopian chickens weighs 1.25 kg at slaughter age in village management condition. The average weight of mature males (cocks) was significantly higher in midland (1.812) kg than in lowland (1.694) agro-ecology in Central Tigray. But similar body weight of hens (1.37 kg and 1.356 kg), cockerels (1.024 kg and 1.119 kg) and pullets (1.021 kg and 1.064 kg) was recorded in lowland and midland agro ecology, respectively. These significant differences in body weight of indigenous chickens were attributed to non-genetic factors like supplementary feeding, watering and health care in different agro-ecology of Central Tigray (Alem, 2014). According to Meseret (2010) finding the mean market weight of indigenous male chickens in Gomma wereda was 1.5kg at 8.62 months in village management condition. Mekonnen (2007) reported that the mature body weight of cocks

and hens at farmers management condition in Wonsho, Loka abaya and Dale districts of Southern Ethiopia were 1.58kg and 1.30kg, respectively. The average weight of local hens ranges from 0.6kg to 2.1kg and local cocks ranges from 0.6 to 2.5kg at selected districts of North Western Amhara region (Moges et al., 2014).

#### **2.1.4 Slaughter/Market age of indigenous chickens**

According to GAIN (2017) report Ethiopian indigenous chickens reach slaughter age at 8 to 12 months in village management system. Mean age at slaughter for indigenous male chickens of the Gomma Wereda was 8.62 months (Meseret, 2010). Getiso et al. (2017) report that in three agro-ecologies of SNNPR indigenous chickens reach slaughter age at 9.9 months. Also in western Tigray indigenous chickens reach slaughter age at 4.66 and 4.5 months for male and female chickens, respectively (Shishay et al., 2015). In other hand, indigenous male chickens of Wolaita zones in southern Ethiopia requires 8.6, 9.4 and 8.9 months to reach slaughter age at highland, midland and lowland areas, respectively (Zereu and Lijalem, 2016).

## **2.2 Reproductive performance of village chickens**

Reproductive cycle takes longest time for indigenous chickens because of they require long time to reach sexual maturity age and they replace parent stock by traditional broody hens which require long time to recover the reproductive cycle.

### **2.2.1 Age at sexual maturity of indigenous chickens**

The overall mean age of cock at first mating was 4.9 months in Mezhenger and Sheka but in benchi-Maji zone it requires 5.2 months (Yadessa et al., 2017). Meseret (2010) reported that the mean sexual maturity of indigenous chicken at Gomma district of Jimma zone were about 6.33 months. According to Aberra et al. (2013) report age at first egg of scavenging chickens in different agro-ecological zones of Amhara region was 6.6 months. The average age of indigenous pullets and cockerels at first mating

was  $5.2 \pm 1.16$  and  $5.44 \pm 1.3$  months in Metekel zone of Northwest Ethiopia, respectively (Solomon et al., 2013). Average age at first egg was 27.2 weeks for local breeds ranged from 24 to 28 weeks and average age at first mating of cockerels was 26 weeks for local chickens in lowland and midland agro-ecological zones of Central Tigray (Alem, 2014). Mekonnen (2007) reported that age at first egg was 7.07 months for indigenous pullets of Dale wereda. The overall mean age of sexual maturity was  $24.25 \pm 0.04$  and  $23.84 \pm 0.05$  weeks for indigenous male and female chickens in North Wollo of Amhara Region, respectively (Addisu et al., 2013). Bogale (2008) finding the mean age of sexual maturity of indigenous chicken in Fogera district was  $23.48 \pm 0.1$  and  $23.6 \pm 0.11$  weeks for male and female, respectively.

### **2.2.2 Hatchability of indigenous chickens**

Natural incubation is the most commonly used method for replacing and increasing the size of flocks by the help of broody hens. Incubating hens uses dark and quite place for laying and incubating eggs. Producers adjust appropriate place and makes nest for broody hens and uses clay pot and straw bedding (cartoons) but in some cases uses clay without bedding (broken pot). Farmers are very conscious and concerned for preparation of appropriate place and provide good feed resources and best environment for incubating by broody hens. Traditionally, farmers incubate at dry season and uses eggs which were laid within the houses (Bikila, 2013). The average number of eggs incubated per hen in different agro-ecological zones of Amhara region was 12.8 and out of the incubated eggs, only 10 chicks were hatched, giving an average hatchability of 79.1% (Aberra et al., 2013). According to Solomon et al. (2013) report the average number of eggs set per hen was  $14.74 \pm 0.25$  (range 12.40-16.91) with a hatchability of 84.7% in Metekel zone of Northwest Ethiopia. According to Fissaha et al. (2010) report 13 eggs (ranged 7-22) with hatchability percentage of 82.6 and 89.1 at Bure and Dale districts of Ethiopia,

respectively. According to Alem (2014) report in both agro-ecologies of the Central Tigray the average numbers of eggs set for incubation per broody hen were 10.2 eggs with hatchability of 85.8% for local eggs.

The number of eggs set per hen depends on availability of eggs, size of eggs and size of broody hen and the maternal instinct of the broody hen. However, the overall mean number of eggs incubated was 11.32 eggs with minimum of 6 and maximum 20 eggs per hen and the percent hatchability was 82.74% in Nole Kabba Woreda, Western Wollega, Ethiopia (Habte et al., 2013). The mean percent total hatchability calculated for the indigenous chickens of the Gomma Wereda was 22% (Meseret, 2010). The Average number of eggs set for incubation was 13 ranging from 10-20 per hen from which relatively fair number (83%) chicks were hatched in East Gojam zone of Amhara regional state (Melese and Melkamu, 2014). Samson and Endalew (2010) reported that productive indigenous hens lay on average 10-18 eggs per clutch and 7-15 eggs were incubated using a broody hen from the incubated eggs 5-10 chicks hatched per clutch.

### **2.2.3 Mortality and survival rate of indigenous chickens**

Scavenging system is characterized by high chick mortality in the first two weeks of life, caused mainly by predators and Newcastle disease in Southern region of Ethiopia (Melesse and Negesse, 2011). According to Alganesh et al. (2003) and Negussie et al. (2003) the low productivity of the local scavenging hens is not only because they are low producers of small sized eggs and slow growers but also the system is characterized by high chick mortality before they reach around 8 weeks of age. In different agro-ecological zones of Ethiopia at Amhara region 10 chicks were hatched and among these only 5.5 chicks reached market age, which implies 55.3 % survival rate suggesting high chick mortality during the growing period (Aberra et al., 2013). Chicks reached grower stage 8weeks (survival

rate) were 65.8% for local chickens in lowland and midland agro-ecological zones of Central Tigray (Alem, 2014). According to Tadelle *et al.* (2003b) finding average survival rate of chicks in Ethiopia was 51.3% and about 44.2 % mortality of chicks (55.8 % survived) reported by Abraham and Yayneshet (2010) from Northern Ethiopia. Mean chick mortality (to an age of 8 weeks) of the indigenous chickens of Gomma Wereda was 41% (Meseret, 2010). The mean number of chicks survives to market age in East Gojam zone of Amhara region was 65.91% (Melese and Melkamu, 2014).

## **2.3 Constraints of indigenous chicken production**

### **2.3.1 Disease and predators**

Disease and predator were the main constraints of indigenous chicken production at farmer management condition in Lemo district of Hadiya zone in southern Ethiopia (Salo et al., 2016). Halima (2007) reported that diseases and predator were major factor that causes loss of chicken in Northwest Ethiopia. Shishay et al. (2014) revealed that both diseases and predators are highly prevalent challenges which hinder indigenous chicken productivity. According to their report Newcastle disease (1<sup>st</sup>), fowl salmonella (2<sup>nd</sup>), coccidiosis (3<sup>rd</sup>), fowl typhoid (4<sup>th</sup>), fowl cholera (5<sup>th</sup>), fowl pox (6<sup>th</sup>) and fowl coryza (7<sup>th</sup>) were the major and economically important diseases that hinder the expansion of village chicken production in Western Zone of Tigray, Northern Ethiopia. Fentie et al. (2013) also recently reported that poor health care, incidence of predation, poor housing and feeding management were the major constraints of village chicken production of which poultry diseases (46.2%) and predation (27.1%) were the most predominant causes of chicken loss .New castle disease was the biggest constraints of family chicken production in North Gondar of Northwest Ethiopia. Diseases and predators were the first and second major constraints that cause loss of chickens in North West Ethiopia (Halima, 2007). A study conducted in Mekele zone of North West Ethiopia also revealed that seasonal

outbreak of diseases and predators were major factors that cause loss of chickens, and lack of credit services, limited skill of management practices and low productivity of local chickens were outlined as major constraints of chicken production (Solomon et al. 2013). The most serious constraint hindering poultry production is predator and poor housing system and the scavenging feeding system of poultry leads for this problem in Arbegona Woreda of Sidama Zone in Southern Ethiopia (Feleke, 2015). The most important constraints impairing the existing chicken production system under farmer's management condition in their order of significance were disease, lack of veterinary health service, traditional management system with limited feed supplementation, poor housing and no access of improved breeds with limitation of extension service (Melese and Melkamu, 2014).

### **2.3.2 Feed shortage**

Bogale (2007) reported that shortage of supplementary feed (19.4%) was the main constraint which hinders indigenous chicken productivity in Fogera district. There is no purposeful feeding of chickens under the village conditions in Ethiopia and scavenging is almost the only source of diet. Scavenging feed resource base for local birds are inadequate and the main constraints in Fogera district (Bogale, 2008). Scavenge feed resources are defined as the total amount of feed products available to all scavenging animals in a given area. It depends on the number of households, the type of crop grown and crop processing as well as climatic conditions (Sonaiya and Swan, 2004). The local birds in the farming community are allowed to wander freely inside and outside the house in search of the food. Anything in and around the house is used as the most important part of their diet. So, the important sources of the feed for the bird are household wastes, anything from the environment and small amount of grain thought to be useful sources of nutrition (Meseret, 2010). The local chickens in the farming community are allowed to wander freely inside and

outside the house in search of the food. Anything in and around the house is used as the most important part of their diet. So the important sources of the feed for the bird are household wastes, anything from the environment and small amount of grain thought to be useful sources of nutrition (Resource-Centre, 2005).

### **2.3.3 Marketing system**

There is no formal poultry and poultry product marketing channel and informal marketing of live birds and eggs involving open markets are common throughout the Woreda which affects production of indigenous chickens in Haramaya (Abera and Geta, 2014). Fluctuation (seasonality) in prices of chicken products was the most prevailing chicken and egg marketing constraint (Bikila, 2013). The major constraints in rural chicken marketing were identified as low price, low marketing output and long distance to reliable markets. As a result, the smallholder farmers are not in a position to get the expected return from the sale of chickens in North West Ethiopia (Awol, 2010). Seasonal fluctuation of chicken and eggs, low supply (output) of chickens and eggs due to disease and predation, presence of limited market outlets and lack of space for chicken marketing in urban area were market related constraints which affects poultry production (Moges et al., 2010b).

### **2.3.4 Lack of training and extension service**

There was low extension support from responsible bodies to improve indigenous chicken production in Eastern Ethiopia (Getachew et al., 2015). Bikila (2013) low supply of exotic breed and limited credit for poultry production, weak extension service, lack of appropriate chicken and egg marketing information to producer farmer and lack of enough space for chicken marketing in urban markets were the major challenges which hinders indigenous chicken productivity. The extension linkage between the

research output and the ministry of agriculture and the farmers are found to be extremely weak, thus in general there is no consistent feedback to the research. Fisseha et al. (2007) also reported that lack of access to extension agents for chicken farmers is one of the main reasons for the lower extension service in Burie district of Amhara region. Lack of access to get extension agents was the main reason (31.8%) for absence of extension service with regard to village chicken production. Lack of modern poultry rearing knowledge through extension service and training was the other constraint in both districts of Ethiopia (Fissaha et al., 2010). It is also reported that training for both farmers and extension staff focusing on disease control, improved housing, feeding, marketing and entrepreneurship could help to improve productivity of local chicken (Moges et al., 2010b).

### III. CONCLUSION AND RECOMMENDATION

Chicken production system is encompasses into traditional, small and large-scale market oriented production system based on the objectives of the producers, the type of inputs used and type and number of chickens reared. Traditional production system is characterized by low-input and small-scale with 4-10 mature birds per households with inadequate housing, feeding and health care practice. The productive performances of indigenous chickens are low in village management condition (inappropriate feeding, housing and health care practice). In Ethiopia, indigenous chickens produces 10-20 eggs per clutch and 30-65 small eggs per hen per year was laid in 3-4 clutches. Local chickens reach slaughter/market age at 8 to 12 months with 0.6-2.5kg average live weight at farmer management condition. Indigenous chickens require long time to reach sexual maturity and takes longest time to recover reproductive cycle by local broody hen. Chickens take 5-7.2 months to reach first mating and egg lying age. They reproduce by natural incubation system by broody hen with the average hatchability

of 75-85%. The average mortality rate was highest and which affects both productive and reproductive performance of indigenous chickens by reducing survival rate. There were huge number of indigenous chickens existing in Ethiopia but productivity was disproportional to the number of chickens. The major constraints which affects productive and reproductive performance of indigenous chickens includes diseases and predators, feed shortages, lack of training and extension services, and lack of proper marketing systems.

Depending on the above conclusions, the following recommendations were needed to improve productive and reproductive performance of indigenous chickens.

- ✓ Farmers should improve management conditions (feeding, housing and health care practice).
- ✓ Government should adjust training and extension service to improve this sector.
- ✓ Government should adjust proper market channel to solve input-output marketing challenges.

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