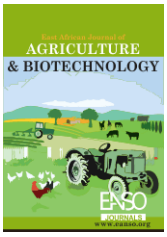

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Original Article

Review on Production and Reproduction Performance of Indigenous Chicken in Ethiopia

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ABSTRACT

The review summarizes the production and reproductive performance of indigenous chicken in Ethiopia. Even though the total population of indigenous chicken is high enough (98%) than other exotic and crossbreeds, the gain from the poultry sector is still low. Thus, production was encountered under free-range systems with low input for the sector, which limits the profit due to low egg production, small egg size, slow growth rate, late maturity, small clutch size, intensive inclination to broodiness, and high mortality of chickens. The reproductive performance of indigenous chickens includes hatchability and fertility of eggs in addition to the above, which depended on health, nutrition, genetics, storage, incubation condition, and seasonal fluctuation, as well as the number of eggs given to broody hens, was also another factor that causes variability. The hatchability of broody hen reaches up to 85.69%, which was higher than reports from a modern incubator in governmental poultry breed and multiplication centre in Ethiopia (69%) under standard breeding conditions. In terms of the egg and meat production, minimum values were recorded than other exotic and cross breeds because there was no identified productive breed in the country and still in classifications based on ecotypes/location/ and feather plumages of the chicken, even if they have good quality in terms of test for their products. They are also good scavenging as well as foragers and have a high level of disease tolerance, good maternal quality, adapt to harsh conditions and poor-quality feeds. However, there is a lack of knowledge about poultry production, limitation of feed resources, the prevalence of disease as well as institutional and socio-economic conditions are faced.

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INTRODUCTION

Ethiopia has one of the largest and most diverse livestock populations in Africa (CSA, 2011). The livestock sector contributes 20% to the total GDP, supports the livelihoods of 70% of the population, and generates about 11% of annual export earnings. The livestock sector has further potential to increase and contribute to the economic development of the country (CSA, 2011).

Poultry includes all domestic birds kept for the purpose of human food production (meat and eggs) such as chickens, turkeys, ducks, geese, ostrich, guinea fowl, doves, and pigeons. In Ethiopia, ostrich, ducks, guinea fowls, doves, and pigeons are found in their natural habitat whereas, geese and turkey are uncommon. Thus, poultry production is synonymous with chicken production under the present Ethiopian conditions (Solomon, 2007).

Most chickens in Ethiopia are Indigenous (49.3 million), distributed across different agro-ecological zones (CSA, 2011), and mostly under a traditional family-based scavenging management system (Alemu and Tadelle, 1997). This indicates that they are highly important farm animals kept as a good source of animal protein and income to most of the rural populations. Furthermore, their widespread distribution indicates their adaptive potential to the local environmental conditions, diseases, and other stresses (Halima, 2007). Although chicken has a significant contribution to the national economy, production per chicken is extremely low. The total chicken egg and meat production in Ethiopia is estimated to be about 78,000 and 72,300 metric tons, respectively (Fisseha et al., 2010). More than 90% of the national chicken meat and egg output is derived from indigenous chickens (Nigussie, 2011).

The productive performance of indigenous scavenging chickens of Ethiopia is low because of their low egg production potential, high chicken mortality, and longer reproductive cycle (slow growth rate, late sexual maturity, and broodiness for an extended period (Besbes, 2009). Even though the productivity of local chicken is very poor, they are very important to withstand certain harsh environmental conditions and can perform better under poor management than cross and exotic breeds; they are also well known to possess desirable characters such as ideal mother, good sister, hatch their own eggs, excellent foragers, resistance to common poultry disease and special meat and egg quality (flavour), hard eggshells (Abdelqader et al., 2007). However, little research and development works have been carried out on indigenous chicken, despite the fact that they are more numerous than commercial chicken in most developing countries and they have been marginalized by decision-makers.

In Ethiopia, Indigenous chickens are the most widespread, and almost every rural family owner of chickens, which provides a valuable source of

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family protein and income (Tadelle et al., 2003). Therefore, the objective of this paper is to review the Production and reproduction performance of the Ethiopian indigenous chicken.

LITERATURE REVIEW

Indigenous Chicken Population Dynamics of Ethiopia

The total poultry population at national level in 2003, 2009, 2010 and 2013 was estimated to be about 35,656,390 chickens (CSA, 2003/04), 42,053,263 chickens (CSA, 2009/10), 49,286,932 chickens (CSA, 2011) and 51,350,738 chickens (CSA, 2013), respectively. Regionally, Oromia, Amhara, SNNR, and Tigray stand first, second, third, and fourth rank in chicken population size, respectively, in the four years. With regard to population dynamics, there is an increasing trend in chicken population with 17.74% (6,396,873 chickens) and 17.2% (7,233,669 chickens) increment from 2003 to 2009 and 2009 to 2010, respectively. Similarly, there was a growth of 4.2 % (2,063,808 chickens) from 2010 to 2013 (Table 1). This could be due to the increase in poultry products and by-products demand. With respect to breed-wise dynamics, 40.6 million (96.61%), 1.19 million (2.84%), and 0.231 million (0.55%) of the total poultry were reported to be indigenous, hybrid, and exotic breeds, respectively, in 2009/10. Likewise, it was reported that 47.9 million (97.3%), 1.14 million (2.32%), and 0.188 million (0.38%) of the total national poultry were indigenous, hybrid, and exotic breeds, respectively in 2010 (CSA, 2011). 96.83 % (49.72 million), 2.37% (1.22 million), and 0.8% (0.411 million) of the total poultry are reported to be indigenous, hybrid, and exotic chickens, respectively (CSA, 2013).

Table 1: Regional and national indigenous chicken population dynamics and distribution in Ethiopia

Regional states	years		
	2009/10	2010/11	2013/14
Tigray	3867840	3998450	4717700
Afar	26510	66280	1120200
Amhara	12297020	13587400	14085100
Oromia	14880250	18347470	18870900
Somalia	55750	1059700	196300
B. Gumuz	819160	1144150	103600
SNNR	8386520	10276080	10217800
Gambella	209200	30280	342400
Harari	37820	52330	71200
D. Dawa	475100	74060	74300
Total	40627570	47954980	49799500
Comp (%)	96.61%	97.30%	96.83%

Source: CSA (2003/04¸ 2009/10, 2010/11 and 2013/14)

Indigenous Chicken Production in Ethiopia

A poultry production system is categorized 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 (Alemu, 1995; Halima, 2007). The rural poultry sector constitutes about 98 % of the total chicken population (FAO, 2007) and largely consists of the indigenous or native domestic fowl. The traditional

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backyard 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 and they are usually capable of finding feeds for their maintenance requirement plus the production of a few eggs (Tadelle, 1996).

In Ethiopia, poultry production systems show a clear distinction between the traditional, low input system on the one hand and the modern production system using relatively advanced technology on the other hand. Chicken can be reared in different management and production systems. Based on chicken breed type, input and output level, mortality rate, type of producer, the purpose of production, length of broodiness, growth rate, and the number of chickens reared.

Indigenous Chicken Ecotypes of Ethiopia

The indigenous chickens of Ethiopia are non-descriptive breeds with a wide range of morphologic or genetic diversity. Indigenous chickens are found in huge numbers distributed in different agro-ecology categories under traditional family-based scavenging management systems (Alemu & Tadelle, 1997). They have various names and are characterized on a different basis by different scholars. Teketel (1986) and Bogale (2008) characterized them based on plumage colour as *Gebsima* (greyish mixture), *Key* (red), *Netch* (white), *Tikur* (black), *Anbesma*, *Seran*, *Libework*, *Netch Teterma, Tikur Teterma*, *Key Teterma,* and Naked nack (*Angete Melata*). Tadelle (2003) characterized them based on the area of geographical origin or market shed name as *Chefe, Horro, Jarso, Tepi,* and *Tilili*. Similarly, Halima (2007) characterized them on the basis of the market shed names as *Gelila et al.* (2011) characterized them on a similar basis as Farta *et al.* (2012) recently characterized the indigenous chicken ecotypes of the North Wollo zone as low land, midland, and highland ecotypes based on agro-ecology distribution. As a result, there are more than 20 identified and characterized Ethiopian local chicken ecotypes.

Production Performance of Indigenous Chicken

The productivity in village chicken production systems in general and the free-range system, in particular, is low (Kondombo, 2005). This is due to low egg production and a high mortality rate (Nigussie *et al.,* 2003). Teketel (1986) and Aberra (2000) also characterized the low productivity of local chicken due to low egg production performance, production of small-sized eggs, slow growth rate, late maturity, small clutch size, an instinctive inclination to broodiness, and high mortality of chicks.

The productive performance of indigenous scavenging chickens of Ethiopia is low because of their low egg production potential, high chicken mortality, and longer reproductive cycle (slow growth rate, late sexual maturity, and broodiness for an extended period (Besbes, 2009). Pullets and cockerels reached sexual maturity at an average age of 6.4 months and 5.7 months, respectively. Even though the productivity of local chicken is very poor, they are very important to withstand certain harsh environmental conditions and can perform better under poor management than cross and exotic breeds; they are also well known to possess desirable characters such as ideal mother, good sister, hatch their own eggs, excellent foragers, resistance to common poultry disease and special meat and egg quality (flavour), hard eggshells (Abdelqader *et al*., 2007). The low productivity of the indigenous stock could also partially be attributed to the low management standard of the traditional household poultry production system. It has been seen that the provision of vaccination, improved feeding, clean water, and nighttime enclosure improve the performance of the indigenous chickens (Abebe, 1992; Solomon 2007).

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In Ethiopia, Indigenous chickens are the widest spread, and almost every rural family owners of chickens, which provides a valuable source of family protein and income (Tadelle *et al.,* 2003). Traditional free scavenging is the common production system (no adequate supply of feeding, housing, and health care). This production system results in poor productive performance of indigenous chickens (low egg production performance, small-sized egg, long sexual maturity of hens and cockerels, high chicken mortality, and chickens were exposed to predators). Because of non-genetic factors such as feeding, housing, and health care and other management practices have a much greater impact on production than genetics under a scavenging system of production.

Flock Performance

The indigenous chickens attain their sexual maturity of laying eggs at averages of 6.8 months (Abegaz & Gemechu, 2016) and 7-8 months which was reported by Mogesses (2007), and later than 6.33 months which was reported by Meseret (2010). The average body weight of 0.914 kg at first lay was 42% lower than the average body weight of 1.3 kg (Fisseha et al., 2010). This might be associated with differences in the breed of chicken and other factors related to the feeding and management of chicken. The delayed sexual maturity for laying an egg on local chickens might be a result of poor management and the Absence of an intensive management system and selection among local chickens (Abegaz & Gemechu, 2016**).** The productivity of birds was related to the agricultural calendar and age of birds. Higher egg production is always expected at the time of land preparation, sowing, and during and after harvesting. Pullets produce a higher number of eggs in their first year of production than in the subsequent year(s).

According to Endale *et al.* (2017) and Matawork *et al.* (2018), age at sexual maturity was 5.63 and 5.25 months for pullets and cockerels in south Western and Northern Ethiopia, respectively. Sexual maturity depends on the management and overall production systems of farmers, mainly on feeding, watering, and disease control mechanisms. This result indicated that sexual maturity earlier than that of Fisseha et al. (2010a) resulted in Bure district cockerels reaching sexual maturity at 5.8 months and pullets reach at 6.47 months (27.5 weeks) and Kugonza et al. (2008) in Eastern Uganda, the sexual maturity of cockerels, requires 5.5 months and pullets require 6.5 months.

The age at the first layer of local chicken in Halaba district was of 6.5 months *(Table 1)* (Nebiyu *et al*., 2013). Similarly, Halima (2007) reported that 77.4% of local cocks in northwest Ethiopia reach sexual maturity at 20–24 weeks of age, which is similar to the reported value of 6.10–8.16 months (Teketel 1986; Tadelle 1996; Aberra 2000).

Egg Production Performances

In Ethiopia, a local scavenging hen on average lays about 36–40 eggs/year (Tadelle et al. 2000; FAO 2004). The average egg weight of local hens around Arsi, Ethiopia, was reported to be 38 gm (Brannang and Persson, 1990).

Local chickens are appropriate under the traditional production system with low input levels, which makes the best use of locally available resources and hatch their eggs and brood chicks which are important traits under the present Ethiopian conditions (Yami and Dessie, 1997 and (Solomon, 2007). The total national annual poultry meat and eggs production were estimated at 72,300 and 78,000 metric tons, respectively, resulting in the per capita consumption of 57 eggs and 2.85 kg of poultry meat.

Annual egg production is 55-80 eggs per year in 5-6 clutches of 10-15 eggs with an average egg weight of 30 g (Dessie and Ogle, 2001). A study at Asela Livestock Farm showed that the average production of local birds was 34 eggs/ hen/ year with an average egg weight of 38 g (Brannang and Persson, 1990). In five areas of the highlands, a further study

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showed a somewhat higher production of 17 eggs in the first clutch, 21 in the second and 25 for the third and all other clutches with 2.6 clutches being laid per year (Tadelle et al., 2003b). Within a clutch, eggs are not laid every day, and a 10-egg clutch may be laid in 15-18 days, whereas a 15-egg clutch may take 25 days.

The egg production potential of local chicken is 30-60 eggs year/ hen with an average of 38 g egg weight under village management conditions in Ethiopia. With this potential of indigenous chicken, the demand for egg and chicken meat of Ethiopian populations cannot be satisfied (Geleta *et al*., 2013). According to the study by the Ministry of Agriculture (1980), the average annual egg production of the native chicken is estimated to be 30 to 40 eggs/ hen/year under village conditions and this could be increased to 80 eggs/ hen/ year with the provision of improved feeding, housing, and health care. Even though, Solomon (2003b) reported that the average annual egg production of the native chicken was 40-60 eggs under village conditions and this could be improved to 80-100 eggs on the station. Testing the response of indigenous chicken under good housing, feeding, and management help to increase the productive performance of indigenous chicken with improved environment and management but not to an economically acceptable level (Solomon, 2003b).

The average number of eggs/clutches of local hens in Burkina Faso was estimated to be 12 eggs (Kondombo, 2005), which is comparable to the range of 12–18 eggs reported by Gueye (1998), but higher than that of 10 eggs/clutch reported by Mourad et al. (1997) in Guinea and 9 eggs/clutch by Kuit *et al*. (1986) in Mali. Halima (2007) reported average productivity of 9–19 eggs/clutch with 2–3 clutch periods/hen per year and an average total egg production ranged from 18–57 eggs/year per hen for local hens in North-West Ethiopia. The average number of clutches/ hens per year and the number of eggs/clutches of local chicken in Sudan were 3 and 12 eggs, respectively (Khalafalla *et al.,* 2001).

According to Nebiyu *et al*. (2013), the average age at the first layer of village chickens is 6.5 months higher than the average age at the first lay of 6.33 months (Meseret, 2010). The average body weight of 0.914 kg at the first lay in the present study was 42% lower than the average body weight of 1.3 kg (Fisseha *et al*., 2010). This might be associated with differences in the breed of chicken and other factors related to the feeding and management of chicken. The mean egg weight of 39.4 g in the present study was 3.4% higher than the mean egg weight of 38.1 g (Njenga, 2005). On the other hand, the mean egg weight in the present study was 13.7% lower than the mean egg weight of 44.8 g (Bogale, 2008) and 8.6% lower than the mean egg weight of 42.9 g (Halima, 2007).

Indigenous flocks are considered to be very poor in egg production performance attributed to low genetic potential, poor management, and a long natural reproductive cycle. It is estimated that, under scavenging conditions, the reproductive cycle of indigenous hens consists of 20-days of laying phase, 21-days of incubation phase, and 56-days of brooding phase (Alemu and Tadelle, 1997). Also, From the report of CSA (2011), the average length of egg-laying period/hen was also determined in breeds and environmental management systems of which estimated numbers of indigenous chicken 21 days of incubation phases.

Egg production of local layers increased by 15% as a result of supplementation with a daily ration of 60 g/head. This result also agrees with Alemu and Tadelle (1997) who reported that there is an increase in the egg production performance of local hens with improvement in nutritional status but not to an economically acceptable level. The mean total egg mass of local layers kept under household conditions was 1.5 kg /hen. Thus, there seems to be no economic justification for supplementary feeding of scavenging local layers due to their poor feed utilization efficiencies.

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According to Sonaiya *et al*. (1998) and Gueye (2000), the annual egg production/hen of local hens in village conditions ranged from 20 to 100 eggs, with an average egg weight range of 30 to 50 gm. According to Gueye (2000), the adult male and female weight of African village chickens range from 1.2 to 3.2 kg and from 0.7 to 2.1 kg, respectively. The productivity of local chicken in Guinea (Mourad et al., 1997).

In the Halaba district of the SNNPRS, the average number of eggs laid by a local hen was 13.3 eggs/hen/clutch and the mean annual egg production was 50.8 eggs per year (Table 2). The average clutch length was 26.0 days. It was observed that all of the hens laid the eggs at more than one-day intervals. The average number of clutches per hen per year in the present study was 3.8, which ranged from 2 to 6 clutches. The way of breaking broodiness to increase the number of clutches practised by farmers in the study area was taking the bird to another place for more than a week, piercing the nostrils with feathers, hanging the bird upside down for 3 days consecutively for 2 to 3 h per day. (Nebiyu *et al*., 2013).

One of the expressions of the low productivity of indigenous chickens is their late sexual maturity. The average number of eggs/hens per clutch was 14.6, the number of clutch periods showed by local hens per year was 3.37; accordingly, the total egg production/hen per year of local hens, under existing farmer management conditions, is estimated to be 56 in Bure, Fogera and Dale *woredas* (*Table 2*).

Table 2: Summary of production performance of indigenous chicken

	References				
Production Parameters	**Mourad *et al.* (1997)**	**Fisseha *et al.* (2010)3**	**Nebiyu *et al*. (2013)8**	**Alem (2015)2**	***Adem & Teshome (2016)***
Average age of cockerels at 1st mating (months)	na	8.61	na	6.06	5.33
Average age of local pullets at 1st egg (months)	6	6.45	6.5	6.34	6.8
Average number of eggs/hens per clutch	10.05	14.45	13.3	13.6	14
Number of clutches/hens per year	3.78	3.23	3.8	3.2	
Average egg production/hen per year	na	56	50.8	43.43	56
Average Egg Weight(gm)	30.74	na	39.4	na	40

Na = not available

Meat Production Performance

The meat production ability of local stocks is also limited compared to the exotic birds. Local males may reach 1.5 kg live weight at 6 months of age and females about 30% less. The carcass weight of local stocks at 6 months of age was 550 grams which were significantly lower than that of White Leghorn (875gm). Tadelle (2003) reported that males are 36 per cent heavier than their female contemporaries at 18 weeks of age. According to Tadelle (1996), the overall mean live weight of local hens in three different altitudes of the central highlands of Ethiopia were 1129.8 + 59 (ranging from 999 to 1282), with birds at high altitude being heaviest which is probably related to increased availability of

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feed resources in the immediate environment as the villagers produce more cereals and grow two crops per year and smaller flock size. The chicken meat consumption in Ethiopia as pointed out by Sonaiya (1990), in recent years, rural poultry have assumed a much greater role as suppliers of animal protein for both rural and urban dwellers. This is because of the recurrent droughts, disease, and decreased grazing land, which has resulted in significantly reduced supplies of meat from cattle, sheep, and goats. Poultry is the only affordable species to be slaughtered at home by resource-poor farmers, as the prices of other species are too high and have increased substantially in recent years.

According to Gueye (2000), the adult male and female weight of African village chickens range from 1.2 to 3.2 kg and from 0.7 to 2.1 kg, respectively. Local chicks weigh about 28 g at hatching, 185 g at eight weeks, and 1.035 kg at 6.5 months which is point-of-lay (Dessie and Ogle, 2001). Mature body weights range from 1.0-1.2 kg for hens to 1.3-1.7 kg for cocks with carcass weights being around 800 g (*Table 2;* Shanawany and Banerjee, 1991).

Table 3: Meat production characteristics of indigenous chicken of Ethiopian

Product And Trait		**Genotype**				
		Tikur	**Melata**	**Kei**	**Gebsima**	**Netch**
mature weight	Male kg	1.3	1.7	1.6	1.5	1.4
	Female kg	1.0	1.2	1.2	1.1	1.1
	Feed intake	50.9	53.2	37.0	36.4	39.1
Carcass composition (%)	Meat	65.2	64.3	65.8	65.1	68
	Bon	23.0	25.0	24.2	21.3	21.3
	Skin	11.3	10.7	11.7	10.7	10.7

Source: (Wilson, 2010)

Reproductive Performance

Fertility and Hatchability

Fertility and hatchability are major parameters of reproductive performance which are most sensitive to environmental and genetic influences. Fertility refers to the percentage of incubated eggs that are fertile, while hatchability is the percentage of fertile eggs that hatch. The mean value for the fertility of indigenous chicken in the eastern Hararge Zone of Ethiopia showed a significantly higher percentage of fertile eggs (91.46%) (Abdurrahman *et al.*, 2016). For the best result of hatchability, the eggshell thickness should be between 0.33 and 0.35 mm, and few eggs with a shell thickness less than 0.27 mm will hatch.

According to Fisseha et al. (2010), egg size has a significant effect on the fertility of eggs. Infertility is highest for larger eggs than the smaller ones. The early and middle death of an embryo was not affected by egg size, but there was a significant difference in the late death of an embryo. Fertile eggs very quickly develop blood vessels, which may be seen against a sharp light from a torch. According to (Melaku and Getu, 2015), hatchability was calculated based on set and fertile eggs and the number of chicks hatched as depicted in the following formulas.

$$Fertility = \frac{Total\ fertileeggs}{Total\ eggs\ set}\ x\ 100\%$$

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$$Hatchability\ (\%) = \frac{Number\ of\ chicks\ hatched}{Number\ of\ fertile\ eggs\ placed\ in\ the\ incubator}\ x\ 100\%$$

$$Hatching\ yield\ (\%) = \frac{Number\ of\ chicks\ hatched}{Number\ of\ fertile\ eggs\ placed\ in\ the\ incubator}$$

The production potential of backyard chickens can only be increased when there are adequate numbers of viable chickens available for the replacement of the uneconomical birds. This is mainly a function of the quality of the eggs set for hatching (North, 1984). The higher the proportion of quality eggs, the better hatchability. Backyard chickens are scavengers, and there seems to be a wide variation in their hatching performance compared with commercial poultry. Fargo *et al*. (2000) reported hatchability variation ranging between 63.1 and 84.1% of eggs under backyard conditions. Hatchability is affected by several factors including nutritional and health status, genetic factors, and physical, storage, and incubation conditions of the eggs (Matiwos, 2012**)**. Seasonal fluctuations could also cause wide variability in hatchability. A prolonged egg holding period may cause deterioration in the interior egg quality and increase the risks of embryonic mortality (Prabakaran *et al*., 1984). The number of eggs set under a broody hen could also affect hatchability. It is suggested that incubation of a single egg beyond the capacity of a broody hen could result in a reduction of hatchability by 0.23% (Farooq *et al*., 2003).

Zeleke et al. (2005) reported that the average hatchability performance of modern incubators found in governmental poultry breeding and multiplication centres of the Amhara region, under standard breeding conditions, was 69%, which is lower than the hatchability performance of local broody hens. Similar hatchability performance results of village hens were reported by different researchers as follows; 50 -100% and 60 - 90% in the United Republic of Tanzania and Burkina Faso local chicken, respectively by Minga *et al.* (1989) and Bourzat *et al*. (1990), as sited by Aichi *et al*. (1998) and an average hatchability of 82% was reported in the communal area of Zimbabwe by Kusina *et al*. (2000). According to Kitalyi (1998), the reasons for the differences in hatchability performance of local hens might be attributed to the time/season of the year, since hatchability of eggs was affected by the season of incubation.

According to Alem (2015) and Fisseha *et al.* (2010) average number of eggs set for incubation per broody hen was 10.2 and 11.9 eggs, respectively, with hatchability of 85.69% and 83.5, 89.1% in Southern Ethiopia (Mekonnen, 2007) in addition, 90% of egg hatchability in Eastern Uganda (Kugonza *et al*., 2008), and 83.6% hatchability in Tanzania was reported by Mwalusanya *et al*. (2004) but higher than the reported 70.5% hatching rate (Tadelle *et al.*, 2003b) and 78.6 % hatchability of local eggs reported by Abraham and Yayneshet (2010) for Northern Ethiopia, 61.8% hatchability in Botswana (Aganga *et al*., 2000. The number of eggs set for natural incubation in Dale *woreda* is also in agreement with the 9.8 eggs reported by Asefa (2007) for Awassa Zuria *woreda* in southern Ethiopia.

According to Abegaz and Gemechu (2016), the hatchability percentage of local chicken was 80%. This result was higher as compared to the value of 70% reported by Solomon (2007) and 59.6% reported by Melkamu and Andarge (2013). The higher percentage was observed due to the small number of eggs sited per hen for hatching and preparation of good sitting material prior to incubation. This might be an indication of good fertility and brooding of indigenous chickens.

Table 4: Summary on reproduction performance of indigenous chicken

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Production Parameters	References				
	Mourad *et al.* (1997) Africa	**Fisseha *et al.* (2010)3**	**Nebiyu *et al.* (2013)8**	**Alem (2015)2**	**Adem & Teshome (2016)**
Average number of eggs set for hatching (No.)	na	11.9	12	10.2	10
Average number of chicks hatched from sited egg (No.)	na	9.3	10.1	na	8
Hatchability %	83	83.5	83.7	85.69	80
Survivability (%)	na	na	52.3	65.67	na

Na= not available

Constraints of Chicken Production

Indigenous chickens are good scavengers as well as foragers and have high levels of disease tolerance, possess good maternal qualities, and are adapted to harsh conditions and poor-quality feeds as compared to the exotic breeds. In Ethiopia, however, lack of knowledge about poultry production, limitation of feed resources, the prevalence of diseases (Newcastle, Coccidiosis, etc.) as well as institutional and socio-economic constraints remain to be the major challenges in village-based chicken productions. According to Tadelle and Ogle (2001), the primary problem cited by the village poultry farmers was the high mortality of chicks. The major causes of this problem as perceived by the community and in their order of importance were disease (63.8 %), predation (21.8 %), lack of feed (9.5 %), and lack of information (4.9%), as per the reports of (Tadelle, 2003). Insufficient water was also one of the causes of mortality in chicks and older birds and a contributing factor to low productivity. The major constraints of village indigenous chicken production were partly due to poor management of the chicken (prevailing diseases and predators, lack of proper health care, poor feeding, and poor marketing information). On the other hand, an attempt of replacing indigenous chickens with exotic chicken breeds was identified as a major threat in eroding and dilution of the indigenous chicken genetic resources (Dinka., 2010).

Inadequate Health Care and Poor Feed Source

The major problem impairing the existing production system in Ethiopia is the high incidence of Newcastle disease, which is named locally "fengel" (Alemu and Tadelle, 1997; Solomon 2004). Another report in Southern parts of the country by Aberra (2007) indicated that fowl cholera is a major problem followed by Newcastle disease. Next to disease, the major limiting factor of the production increase is the lack of feed. The nutritional status of local laying hens from chemical analysis of crop contents indicated that protein was below the requirement for optimum egg production; the deficiency is more serious during the short rainy season and dry seasons (Alemu and Tadelle, 1997). Newcastle disease (NCD) is highly infectious and causes more losses than any other disease in the tropics. The disease spreads rapidly through the flock and mortality could reach up to 100% (Nwanta *et al.*, 2008).

Among the infectious diseases, NCD, salmonelloses, coccidioses, and fowlpox are considered to be the most important causes of mortality in the local chicken, while predators are additional causes of loss (Eshetu et al., 2001). According to Tadelle (2001), the high mortality of chicks under village chicken production in the central highlands of Ethiopia is due to diseases, parasites, predation, lack of feed, poor housing, and insufficient water supply.

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Inadequate Emphasis on Research and Extension

Until recently, little emphasis has been given to livestock and poultry research. The extension linkage between the research output and the ministry of agriculture and the farmers is found to be extremely weak (Alemu and Tadelle, 1997) and in general, there is no consistent feedback to the research. Most of the poultry extension workers transfer their extension packages to the households expecting that the husband will pass the message to his wife (Abera, 2000). However, poultry keeping in most parts of Ethiopia is mainly the responsibility of women, as reported by Tadelle and Ogle (1996a). This indicated that there are no client-oriented extensions.

Lack of Organized Market and Poor Access to Main Market

Even though chicken meat is a relatively cheap and affordable source of animal protein (Alemu and Tadelle, 1997), lack of an organized marketing system and the seasonal fluctuation of price are the main constraints of the poultry market in Ethiopia. Price variation is mainly attributed to the high demand for chickens for Ethiopian New Year and holidays. It is also partly influenced by weight, age of chickens, and availability. The plumage colour, sex, combs types, feather covers are also very important for influencing price. According to Gausi *et al*. (2004), the major constraints in rural chicken marketing were identified as low price, low marketable 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. Likewise, poor marketing information system, poor access to terminal market, high price fluctuation, and exchange based on plumage colour, age, and sex are among the main constraints of the chicken market in the country (Kena, 2002).

Likewise, poor marketing information system, poor access to terminal market, high price fluctuation, and exchange based on plumage colour, age, and sex are among the main constraints of the chicken market in the country (Kena et al., 2002). Despite the benefits of village poultry keeping to poor households in most parts of the country, they face significant market constraints. The distance to the nearest market is a key factor; the nearer the market, the shorter the marketing chain and the higher the price received for both live birds and eggs. It is also clear that increased involvement of intermediaries leads to reduced prices for the producer. A price reduction of 68% for birds and 25% for eggs was observed in areas with poor market access in Tigray Regional State compared to those areas with better market access. Transaction costs may be reduced through improving access to information, infrastructure, and organization of the poultry producers. However, the costs of transport, credit and marketing risks should be carefully assessed. A further constraint to the marketing of traditional household poultry and products is the fact that there is no packaging and weight standardization of market eggs and that traditional storage methods can lead to deterioration of the quality of table eggs. According to Gausi et al. (2004), smallholder village chicken producers tend to ignore new technology even when it appears to be better than their current practices due to market limitations.

Social and Cultural Constraints

The socio-cultural constraints to poultry development are the value placed upon poultry for use at ceremonies and festivals or even as a source of income in times of need but neither as the source of daily food nor as a regular source of income. Some regard chickens as their pets or part of the family, thus rarely used as food for home consumption, although they can sell without regret and the money utilized. Another constraint is the social norm that determines the ownership of livestock. Typically, where crop farming is the main activity, keeping livestock is perceived as a peripheral activity neglected to women and children. Practical experience indicates that there were no regular watering and supplementing feed, and they do not clean the birds at night shelter and

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take care of the young chicks. Farmers are also reluctant to expand their poultry farms. The farmers' attitude to the sector makes the rural traditional poultry farming remain unchanged for a long time.

Breed Constraints

A breed of poultry is the main factor that is considered in chicken meat or broilers production. The meat production ability of indigenous chicken was limited in growth performance (Bogale, 2008). Day-old chickens of different populations of indigenous chicken measure a live weight of 27.3 g per chicken (Halima, 2007; Bogale, 2008).

Nigussie (2011) in adult live body weight of the different populations of local indigenous chickens also reported 1.6 kg for males and 1.3 kg for females. Solomon (2003) reported that there was no difference between White Leghorn and indigenous chickens raised under scavenging conditions in mean daily body weight gain at 2 months of age. He also reported that the indigenous chickens are sold for meat purposes starting from 6-8 months of age at a weight of around 0.7-1.4 kg.

The local chicken genetic resources in the Amhara region of Northwest Ethiopia were seriously endangered owing to the high rate of genetic erosion due to the extensive and random distribution of exotic breeds by both governmental and non-governmental organizations since they are believed to dilute the different take kinds of indigenous genetic stock. This threat is also in line with the food and agriculture organization (FAO) report. Replacement of indigenous chickens by exotic chicken, which states that animal genetic resources in developing countries, in general, are being eroded through the rapid transformation of the agricultural system, in which the main cause of the loss of indigenous animal genetic resources is the indiscriminate introduction of exotic genetic resources, before proper characterization utilization and conservation of indigenous genetic resources (FAO, 1999).

Replacement of indigenous chickens by exotic chicken breeds is also a major threat in eroding and dilution of the indigenous genetic resources. Establishing a constructive breeding program to address constraints related to poultry production is essential. However, the chicken genetic resources in the Amhara region of Northwest Ethiopia are becoming very sensitive due to the high rate of genetic erosion as a result of a high incidence of Newcastle disease (Dinka et al., 2010).

Predation

Predators were listed alongside diseases as the major cause of premature death. Predation is strongly associated with the rainy season. The predators include primarily birds of prey such as vultures, which prey only on chickens, and wild mammals such as cats and foxes, which prey on mature birds as well as chicks (Tadelle and Ogle, 2001). Predators such as birds of prey (locally known as "Culullee") (34%), cats and dogs (16.3%), and wild animals (15%) were identified as the major causes of village poultry in the rift valley of Oromia, Ethiopia (Dinka et al., 2010). Halima (2007) also reported that predation is one of the major constraints in village chicken production in northwest Ethiopia.

Another study from Benishangul-Gumuz, Western Ethiopia, done by Alemayehu et al. (2015) reported that wild cats (locally known as "shelemetmat"), eagles, and foxes were the common chicken predators identified by the chicken owners in the study areas. Eagle is a serious problem in the dry season, while the rest are commonly attacking chicken during the wet season. As reported by the chicken owners, in the wet season, the scavenging areas are covered by vegetation and this makes a conducive environment for wild cats and foxes to attack chickens. In dry seasons, the vegetation of scavenging areas is less dense, and chickens are vulnerable to the eagle.

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The most striking problem in village chicken production systems is the high mortality rate which could reach as high as 80–90% within the first few weeks after hatching due to diseases and predation (Wilson et al., 1987).

According to Fisseha *et al.* (2010), predation was not an important problem in the Fogera plains; it is identified as another economically important constraint in the village chicken production system in Bure and Dale *woredas*. Halima (2007) also reported that predation is one of the major constraints in village chicken production in northwest Ethiopia. In Bure *woreda*, 59.3% of the respondents indicated that wild Egyptian Vulture (locally called 'chilfit') is a dangerous predator, and attack on young chicks is higher (73.2%). In addition, mongoose (36.8%) and wild cats (3.9%) are the other important predators.

CONCLUSION AND RECOMMENDATION

Poultry in Ethiopia, especially indigenous chickens, are kept for a multiplicity of reasons. In addition to yielding animal protein and providing a surplus for sale to generate small amounts of cash, they are reared for sacrificial and cultural reasons. Small-scale scavenging production could be an effective means of transfer of wealth from higher-income urban consumers to poorer and poor rural and pre-urban members of the community. The traditional system makes effective use of local resources, but there are considerable opportunities for improvement. Village poultry development should concentrate on the rural and pre-urban areas where the majority of producers live and where most village poultry are found. There is much academic and emotional support for this pathway out of poverty but, unfortunately, little practical activity.

Even though the total population of indigenous chickens is high enough than other exotic and crossbreeds, the gain from the poultry sector is still low. Thus, production was encountered under free-range systems with low input for the sector, which limits the profit due to low egg production, small egg size, slow growth rate, late maturity, small clutch size, intensive inclination to broodiness, and high mortality of chickens. The reproductive performance of indigenous chickens includes hatchability and fertility of egg in addition to the above which depended on health, nutrition, genetic, storage, incubation condition, and seasonal fluctuation as well as the number of eggs given to broody hens was also another factor that causes variability

The following recommendations are suggested based on the current review: The oft-preferred route to higher output and productivity is to modify ('improve') the local genetics. Before this takes place, however, it would be preferable to encourage changes in management (e.g., provision of feed to newly hatched chicks, indoor management of chicks, and control of predators). Production potential can be increased by keeping an adequate number of viable chickens available for the replacement of uneconomical birds. So, the government should provide training in production and reproduction management and vaccination for chickens to prevent the loss of chickens by disease outbreaking. Training improves farmers' awareness in order to improve ways of feeding, housing, and vaccinating chickens to increase chicken production performance.

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