

Review Article

Poultry Production and Marketing Systems in Ethiopia: A Review

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Abstract

Chickens are widely kept and make up the largest share in terms of numbers compared to other farm animal genetic resources. The total number of poultry in Ethiopia is estimated to be more than 60.04 million, but its production and productivity are limited. Therefore, this review aims to analyze and summarize data on Ethiopia's poultry production and marketing system for future improvement. The majority of the Ethiopian poultry farming system was extensive or traditional, with little supplementary feeding practice. Local chickens produce 18 to 60 eggs/year/hen, while exotic breeds produce an average of 250 eggs/year/hen with an average weight of 60 grams of eggs. Chickens and their products are used for income, home expenditure, and consumption. Extension service for the improvement of livestock production in general and poultry production, in particular, found to be weak. There was a higher price of chicken and eggs during the festival than other times. The major problems in poultry production in the country are disease and lack of animal health services, predators, shortage of supplementary feed, and lack of improved poultry housing systems. A better understanding of those constraints and worthy prospects about village chicken production and marketing is an important aspect of improving chicken production.

Keywords: Chicken; Ethiopia; Marketing; Production system

Introduction

In Ethiopia chickens (*Gallus domesticus*) are widely kept and make up the largest share in terms of numbers compared to other farm animals' genetic resources [1]. From the total number of chickens estimated at 60.04 million, the contribution of the local, exotic, and hybrid chicken breed was about 88.5%, 6.25% and 5.25% respectively [2]. In most cases, village chickens represent a significant component of the rural household livelihood as a source of cash income and nutrition [3].

Knowledge and understanding of the chicken production systems, opportunities, and constraints are important in the design and implementation of the indigenous chicken-based-development program, which can benefit rural societies [4]. Therefore, the objective of this review was to collect, analyze and summarize information on the chicken production and marketing system in Ethiopia for future improvement.

Poultry Population and Regional Distribution

Ethiopia has a huge number of indigenous chickens distributed in different agro-ecologies and regional states. Indigenous chickens that live in different geographical regional areas of the country have varieties of ecotype. Chicken population distribution varies with regional states, higher in Oromia followed by Amhara Regional State. Harari Regional State has a lower chicken population [2,5] (Table 1).

Exotic and Hybrid Chicken Population and Production

The chicken population in the country is increasing manner

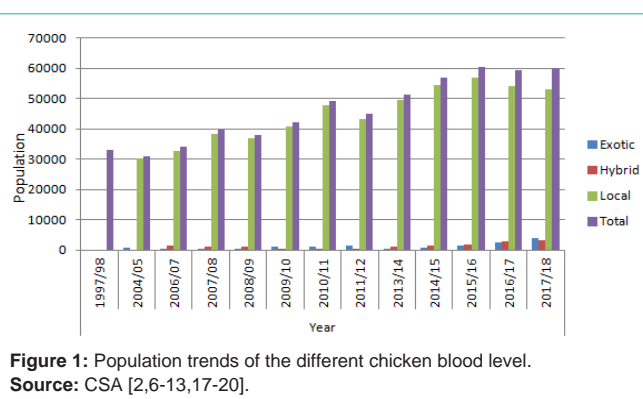


Figure 1: Population trends of the different chicken blood level. **Source:** CSA [2,6-13,17-20].

(Figure 1). The share of exotic and hybrid chickens was increasing over time. The contribution of exotic and hybrid chicken was raised about 6.2% and 5.3% respectively; have 11.5% shares [2]. The chicken is the largest constituent of the poultry population [14]. The traditional practices continue to dominate domestic poultry production in Ethiopia; industrial poultry production contributes only an insignificant proportion. About 99% of the annual poultry meat and egg production comes from the indigenous chickens kept under the traditional systems [15]. According to Alganesh et al. [16], the egg production potential of exotic breeds was around 250 eggs/year/hen with an average weight of 60 grams.

The average number of egg-laying periods/hen/year (clutch) was about 4, 4 and 1 for the local, hybrid and exotic breeds, respectively. The average length of a single egg-laying period per hen was estimated to be about 21, 45, and 169 days for local, hybrid and exotic breeds,

Table 1: Poultry population distribution of the country and regional states.

Region	2008/09	2009/10	2010/11	2011/12	2013/14	2014/15	2015/16	2016/17	2017/18
Tigray	3,829,788	4,266,077	4,308,595	5,003,126	5,287,790	6,189,848	6,329,501	5,735,973	6,190,640
Afar	26,519	29,369	67,319	57,993	124,489	132,215	106,355	5,735,973	215,768
Amhara	12,755,956	12,739,620	14,048,486	14,116,725	14,524,806	18,031,121	19,958,894	19,961,861	19,809,915
Oromia	13,673,006	15,336,939	18,762,281	16,345,099	19,313,874	20,076,129	21,201,122	20,408,299	20,894,742
Somale	77,367	55,752	106,114	113,004	196,396	162,884	177,300	161,265	250,418
B. Gumz	774,112	820,994	1,149,069	1,140,816	1,041,557	1,375,326	1,363,061	1,249,578	1,672,084
SNNP	6,707,186	8,503,564	10,407,807	7,690,931	10,353,805	10,433,773	10,851,155	11,197,124	10,491,131
Gambela	202,105	210,332	303,019	301,735	344,043	307,387	358,288	385,768	301,531
Harari	33,362	39,185	53,277	43,235	71,697	71,419	74,332	94,371	97,690
Dire dawa	48,102	51,431	80,963	80,345	92,283	86,617	85,318	102,963	118,376
Ethiopia	38,127,504	42,053,263	49,286,932	44,893,009	51,350,738	56,866,719	60,505,327	59,495,026	60,042,295

Source: CSA [2,6-13].

Key: B. Gumz: Benishangul Gumz; SNNP: South Nation Nationality People.

respectively. The average number of eggs/hen/laying period in the country was about 12, 38, and 133 eggs, correspondingly [2]. However, local chicken genetic resources are becoming seriously endangered owing to the high rate of genetic erosion resulting from disease and predation. Furthermore, the extensive and random distribution of exotic chicken breeds has resulted in the dilution of the indigenous genetic stock. If this trend continues, the gene pool of the indigenous chickens could be lost in the near future [1].

Flock Size and Structure

Different research outputs indicated that the average flock size of the chicken was different from a different area of the country (Table 2). The recommended cock to hen ratio in modern light and heavy breeds is 1:10 and 1:8 respectively [21]. The overall male to female ratio of village flocks was 1:2.5 in Tilili, Jarso, Horro, Chefe and Tepi [22], 3.7:1 in Bure [23,24] and 1:3.3, 1:3.2 and 1:2.2 in Bure, Fogera and Dale, respectively [21].

Use Pattern

The use pattern of chicken and chicken products is varied [36]. Village chicken keepers in the rift valley of the Oromia area use chickens and chicken by-products as a source of income/cash or for home expenditure (44%), home consumption (24%), ceremony and/or sacrifice (22%), and a deposit (10%). On the other hand, eggs from village chickens in the study area are used for hatching for replacement stock, sale for cash income, and home consumption [37]. In Tilili, Jarso, Horro, Chefe, and Tepi in order of importance, eggs were used for hatching, sale and home consumption, while chicks produced were used for sale, replacement, and home consumption. About 50, 27, and 23% of the eggs produced were reported to be used for hatching, sale, and home consumption, respectively [36].

In North-Bench and Sheko districts, chickens are used as a source of egg production. The egg used for hatching was the first most important use pattern [25]. The sale of live chicken for cash income is the first important function of rearing chicken in Fogera (77.8%) and Dale (43.7%) districts. In Bure, egg hatching for production of replacement chicks (51%) and sale for income (43.5%) are found to be important [21]. According to Fisseha et al. [23], the use of eggs for

hatching (71.7%) was the first function of eggs in the Bure district of northwest Amhara.

The two most important reasons for engaging in poultry production were income generation and improve family nutrition in Fogera district [38]. Most of the respondents (82%) indicated that the main objectives of keeping poultry were for home consumption and income generation in North Gondar [30]. According to Fisseha et al. [23] in the Bure district, about 78% of interviewed village chicken owners consumed chicken only during religious/cultural holidays, 20.3% whenever needed/available and only 0.7% reported that they never eat chicken. The importance of eggs for hatching was the first (71.7%) function of eggs.

According to Habtamu et al. [33] in the Chagni district, 70% of the respondents were keeping domestic chickens for generating income as a priority, while 23% reared them for their consumption. Another 7% were keeping these either for cultural reasons or simply for leisure. In Tsegede district producing egg and meat for income generation 51.3%, household consumption 46.7% and hatching and rearing of chickens for replacement of flock 2% [34]. At the same time in East Gojam Zone egg and meat are used for household consumption, income generation, hatching, and rearing of chicks for replacement of flock [35].

Gender Aspect of Poultry Management

In most developing countries, chicken production is mainly based on scavenging systems and rural women and children are traditionally believed to play an important role [39]. Studies revealed that women were responsible for the major poultry production activities. According to Mengesha et al. [40], at Jamma district there has been a work division among family members in poultry productions. The overall care-taking of chickens, feeding of chickens, cleaning of chickens-quarter, treating of sick chickens, the decision for off-take of poultry products with 72.5, 84.5, 82.2, 48.6, 56.6% were responsibilities of women in the family, respectively. However, poultry house construction and slaughtering of chicken was the responsibility of men in households.

According to Bradley [41]; family poultry could be easily managed

Table 2: Flock size per household in a different area of the country.

Study area	Regional state	Flock size/hh	References
Bench Maji Zone of South-bench	SNNP	9.58	Getachew et al. [25]
Bench Maji Zone of North-bench	SNNP	11.62	Getachew et al. [25]
Sheko	SNNP	6.1	Getachew et al. [25]
Central Highlands of Ethiopia	-	7.1	Tadelle and Ogle [26]
Awassa Zuria	SNNP	8.8	Asefa [27]
Bure	Amhara	13	Fisseha et al. [21]
Fogera	Amhara	12	Fisseha et al. [21]
Dale	SNNP	9	Fisseha et al. [21]
north-west Ethiopia	Amhara	7.13	Halima et al. [1]
Tiilli	Amhara	9.8	Tadelle et al. [22]
Jarso	Oromia	7.7	Tadelle et al. [22]
Horro	Oromia	6.9	Tadelle et al. [22]
Chefe	Oromia	6.6	Tadelle et al. [22]
Tepi	SNNP	5.8	Tadelle et al. [22]
Bure	Amhara	13.1	Fisseha [24]
Dale, Wonsho and Lokaabaya	SNNP	9.2	Mekonnen, 2007 [28]
Goma District	Oromia	6.23	Meseret [29]
North Gondar	Amhara	10.44	Mamo et al. [30]
North Gondar	Amhara	16.43	Getu and Birhan [31]
Kambata Tambaro and Wolaita	SNNP	8.6	Getiso et al. [32]
Bure district	SNNP	13	Fisseha et al. [23]
Chagni	Amhara	7.76	Habtamu et al. [33]
Tsegede, North Gondar	Amhara	17.9	Worku [34]
East Gojam Zone	Amhara	13	Nigatu and Bezabih [35]
Average		9.86	-

Key: SNNP: South Nation Nationality of People; hh: household.

within homesteads and the management has been associated with women for various historical and social factors. In the rift valley of Oromia, according to Dinka [37], 92.4% of village chickens were owned by children and women and they played a role in providing supplementary feeding and watering 60% and 15%, respectively. This implies that housing, feeding, and general management of village chickens are the responsibility of women and children while men are responsible for other off-farm activities. The role of men in poultry production was in the construction of poultry shelters (57.5%). Mekonnen [28] also reported that chicken house construction in SNNP was the responsibility of men (53.1%) and male youth (9.4%) while women take the lion share in accomplishing other perspectives of poultry management activities including the cleaned house (74.4%), provided supplementary feeding (65%) and watering (73.8%).

According to Fisseha [24], at Bure district men were responsible for activities like the construction of shelter (97.5%) and taking sick chickens for treatment (89.3%). However, women were highly responsible for many activities like cleaning chicken's house (38.6%), provision of supplementary feed to chickens (80.7%), selling chicken (46.8%) & selling eggs (54.6%) women and children were the major members of the household involved in the marketing of live chickens. Regarding decision making, both men & women together

were decision-makers in various village chicken production and marketing activities including selling eggs (78.2%), selling chicken (69.3%), consumption of eggs (93.2%), and consumption of chicken (92.9%). However, men alone were found to be decision-makers of the household: to buy drugs for sick chickens (88.6%) and to buy replacement stock (67.9%).

In another study also in Bure, women were used to shouldering most of the responsibilities in chicken production. About 59.72% of the responsibility of feeding and providing water, 62.5% of the responsibility of cleaning the houses and 56.95% of the responsibility for selling the chicken, and 63.89% of the responsibility for selling the eggs is the responsibility of women. On the other hand, men were primarily responsible for the construction of poultry houses [38]. The ownership pattern was usually related to decision-making in the selling and consumption of chicken and eggs. About 96.7% of the ownership of chicken was held by women in the Goma district. About 90% of house construction was covered by the men. However, women were highly responsible for many activities like the provision of water and supplementary feed to chicken 100%, selling of chicken 94% & cleaning chicken's waste in their nighttime resting areas 91% [29].

Poultry Production and Feeding Systems

These include the free-range system or traditional village system,

Table 3: Production and reproductive performance of village chickens in different studies.

Study area	MAFL	MAFM	NE/C	NC/Y	TE/Y	References
North-west Ethiopia	5.5	5.5	19-Sep	Na	57	Halima et al. [1]
South-west Ethiopia	5.75	5.74	na	3.65	53.33	Getachew et al. [25]
Five regional states	6.8	Na	17.7	2.6	46.4	Tadelle et al. [22]
Fogera District	5.9	5.87	na	Na	Na	Bogale [38]
North Wollo	6.4	6	12.64	3.62	49.51	Addisu et al. [46]
North Gondar for Gse	5.43	4.76	na	3.97	55.87	Getu and Birhan [31]
North Gondar for Nne	5.43	4.76	na	3.52	60.2	Getu and Birhan [31]
Gomma District	6.33	na	na	Na	43.8	Meseret [29]
Hawasa District	na	na	na	Na	36-42	Fikere [52]
North Gondar	na	na	11.53	Na	Na	Mamo et al. [30]
SNNP	na	na	12.92	4.05	Na	Getiso et al. [32]
Bure District	6.87	6.15	15.7	3.8	60	Fisseha et al. [23]
Tsegede	6.3	na	14.7	4	58.7	Worku [34]
East Gojam Zone	Na	na	18	6-Apr	Na	Nigatu and Bezabih [35]
Average	6.1	5.54	14.65	3.8	52.4	-

Keys: MAFL: Mean Age at First Lay (months); MAFM: Mean Age at First Mating for Cockerels (months); NE/C: Number of Eggs/Clutches; NC/Y: Number of Clutch/ Years; TE/Y: Total Egg Laying per Year; SNNP: South Nation Nationality of People Regional State; Nne: Necked Neck Ecotypes; Gse: Gasgie Ecotypes; na: not available.

Table 4: The total egg production of the country across years by Indigenous, Exotic, and Hybrid.

Production year	Indigenous chicken		Exotic chicken		Hybrid chicken		Total	
	Laying Population	Egg production	Laying Population	Egg production	Laying Population	Egg production	Total Laying chicken	Total Egg production
2004/05	9,969,634	97,458,301	235,903	5,325,790	Na	Na	10,205,537	97,694,204
2006/07	10,451,793	60,856,546	141,338	12,475,624	543,957	7,921,587	11,137,088	81,253,757
2007/08	12,346,856	68,240,818	78,637	792,157	508,764	6,250,801	12,934,257	75,283,776
2008/09	11,961,544	71,748,172	108,561	1,348,071	462,893	5,992,483	12,532,998	79,088,726
2009/10	13,458,202	78,065,930	116,145	Na	512,059	Na	14,086,406	79,088,726
2010/11	15,372,372	89,724,654	90,087	804,935	430,883	7,771,463	15,893,342	98,301,052
2011/12	14,158,795	78,894,848	123,086	936,107	532,169	14,844,827	14,814,050	94,675,782
2013/14	16,419,521	89,560,144	192,853	1,703,269	499,186	9,578,051	17,111,560	100,841,464
2014/15	17,769,868	93,801,389	463,200	5,164,479	588,579	7,604,939	18,821,647	106,570,807
2015/16	18,007,343	95,767,222	767,819	10,771,696	723,564	8,097,156	19,498,726	114,636,074
2016/17	17,352,213	92,692,202	1,515,251	22,126,477	1,044,820	12,747,424	19,912,284	127,566,103
2017/18	16,689,127	89,404,786	2,295,289	35,897,211	1,330,371	16,506,463	20,314,787	141,808,460

Key: Na: not available.

Source: CSA [6-13,18-20].

backyard, or subsistence system; semi-intensive system, and small-scale intensive system [42]. Much of the Ethiopian poultry production system was extensive or traditional poultry management practiced with little supplementary feeding practice, various studies confirm this fact. Even though the owners provide supplementary feed to their chicken, it is not enough in size and quality because they provide the feedstuffs without measuring [32].

In North Gondar, chickens are 100% widely grown in traditional production systems [31]; 98.1% in Dale district [28]; 99.28% in Northwestern Ethiopia [43]; 96.3% supplementary food provided in central Ethiopia [44]; in Goma district, 97.8% practiced scavenging system with supplementary feed [29]. Inadequate supplementary feed supply is one of the characteristics of a free-ranging backyard poultry

production system [45]. In Bure woreda, the most significant (82.9%) poultry production method was identified for their scavenging type of production, where the majority of breeds (96.8%) are local chicken ecotypes, with only seasonal/conditional feed supplementation [24].

All chicken owners in North Wollo kept their chickens in free-range/scavenging type of production system with occasional supplementary feeds 89.87% [46]. About 98, 93, and 98% of respondents in Bure, Fogera and, Dale, respectively, offer supplementary feeds to their chicken. According to 87% of the respondents, the main supplement is made up of a mixture of different crops grown on their farm [21]. Very few respondents (6.9%) reported as they didn't give any supplementary feed, while the majority (88.9%) reported that they gave supplementary feed for the scavenging chicken in Bure [38].

Chickens scavenge in the vicinity of the homestead during the daytime where they may be received cereal grains, cereal bran, crushed grains, and other house waste products as supplementary feed [3]. Village chickens are often left to search their food, scratching and picking on the ground while only small amounts of grains or kitchen leftovers were supplemented, mainly during feed shortage seasons [24]. In Dale, Wonsho, and Loka Abaya districts, Mekonnen [28] states that 98.1% of the respondents practiced a scavenging system with supplementary feeding. Another study by Asefa [27] in Awassa Zuria also indicated that 95% of the households offer supplementary feed.

In the rift valley of Oromia, 98% of households were engaged in village chicken production and partially provided supplementary feeding to their chickens of various ages. The owners do partial supplementation mostly once per day (64%), feedstuffs such as maize, wheat, sorghum, and household waste products are used as the main sources of village chicken supplementary feed [37]. According to Halima [1], 99.28% of farmers in Northwestern Ethiopia provide supplementary feeding to their chickens of different age groups together mostly once a day with maize, barley, wheat, finger millet, and household waste products. In Bench Maji Zone, 100% of the respondents practiced a scavenging system with supplementary feeding [25].

In the Gondar Zuria district, 86% of respondents provide supplementary feed and 14% of respondents didn't provide supplementary feed. Although most of the respondents provide supplementary feed, it wasn't enough for better poultry production, and also it is not providing purposively. About 56% of respondents were offered once a day early in the morning, while 28% and 16% of respondents were offered two and three times a day, respectively. About 86% of respondents depended on supplementing grains; maize (42.63%), sorghum (14.73%), barley and wheat (10.85%), kitchen waste 16.28%, others (9.3%), and chicken leftovers were provided by only 6.2% of respondents [47].

Chickens in North Gondar were getting their feed resources through scavenging. About 55% of households were involved in scavenging chicken production system and 33% were scavenging plus grain supplementation. Scavenging was the major feed resource for chickens in the study area. Chickens were scavenged around homes with little feed supplementation by the households. Whole households (100%) provided supplementary feeds [30]. Scavenging was the major feeding system in Kambata Tambaro and Wolaita Zones. In addition, the farmers rarely feed their chickens with leftovers and grains [32]. In Bure district, 82.9% of the production system is based on scavenging, where the majority (96.8%) of the chickens is local chicken ecotypes, with only seasonal/conditional feed supplement [23]. Supplementary feed was provided by the majority (97.5%) of chicken owners, while 84.3% of them did this between July to September in Bure [23].

In Tsegede Woreda, the dominant poultry production system was an extensive type (83.3%). Chickens were managed mainly on free-ranging, utilizing various feed sources searching by their own in the field, with conditional feed supplementation. However, only (16.7%) of the respondent farmers practice a semi-intensive type of chicken management using fences around their homestead [34]. In East Gojam, 100% of the respondent farmers practiced providing

supplementary feed to their chicken, which is usually offered (56.7%) once a day, (34.4%) twice a day and the remaining (8.9 %) provide supplementary feed more than twice per day [35].

Poultry Watering Practice

Water plays an important role in the digestion and metabolism of the fowl, additionally, it serves as a media to administer some important vaccines. At SNNP about 75% of the respondents provided water for their chicken twice a day usually in the morning and evening, while 25% of the respondents provide water once a day at any time [28]. In rift valley Oromia village chicken producers provided water for village chickens at different times of the day; *ad-libitum* 47%, once a day 14%, twice a day 18%, three times 16% and four times a day 5% from tap water 66%, river water 15%, borehole 6% and other sources 13% [37]. In the Alfa district, 19.8% of the respondents provide water to their chickens only during the dry season, and the remaining 79.2% offered throughout the year, 100% from the Quara and Tache Armacheho district provided water for their chicken both in dry and wet season [31].

In South-Western Ethiopia, 57.78% of owners provide water *ad-libitum* [25]. According to Halima [1], 99.5% of chicken owners in northwest Amhara provided water to village chickens. The source of water, the water given to chickens was drawn from rivers (72.22%), and hand-operated (27.78%). In the Bure district, the chicken owners provided water to their chicken, 85.4% only during the dry season and 14.3% throughout the year. Most of the owners 78.9% used *ad libitum* water supplementation [24].

About 68% of the respondents had locally made watering and feeding trough made of wood and broken material, while 32% of respondents were had not any watering and feeding trough. In the Gondar Zuria district, watering and feeding troughs were washing depending on the availability of time [47]. All village chicken owners in the Bure district provided water to their chicken, about 85.4% only during the dry season and 14.3% throughout the year. Most chicken owners (78.9%) used *ad libitum* water supply [23]. In East Gojam Zone, 27% and 62% of the respondent were filling the varying types of watering troughs twice and more than two times per day, respectively for unlimited access [35].

Poultry Housing Practice

Housing is essential for chickens because it protects them from predators, theft, inclement weather (rain, sun, cold wind, low night temperatures) and provide shelter for egg-laying and broody hens. In the rural community, mostly chickens shared a common room with a human with a specific separate place (such as perch), and some of the owners had a separate house for their chickens. In the Oromia Rift valley, only 14% of the respondents have separate sheds for chickens. The common housing facilities for chickens were cartoons and baskets made of bamboo or a round stick placed in the main house 58% and perch 26.6% [37].

Fisseha [24] reported that only 22.1% of farmers provide separate overnight houses for village chickens. In the Alefa district, about 97.6% of the respondents kept their chicken at night sheltering places within the family house and placed it on the floor, and covered it with materials made from bamboo that allows ventilation. Due to lack of awareness and risk of predators, they used shared rooms with

humans. Similarly, 100% in the Quara district, and more than 90% at Tache Armacheho districts, respondents were constructed separate perches for the presence of predators and suffocations [31].

According to Halima [1] in northwest Ethiopia, almost all farmers provided night shelter for their chickens either in part of the kitchen (1.36%) or in the main house (39.07%), in hand-woven baskets (7.29%), in bamboo cages (1.51%) or separate sheds purpose-made for chickens (50.77%). Bogale [38] evidenced that, majority of the rural households 59.7% of Fogera district had separate sheds for their chickens. According to Fisseha [24], 22.1% of the respondent prepared separate overnight houses for village chicken, 45.7% use perches inside the house, 27.1% use the floor covered by bamboo made materials, 3.6% use ceilings of the house, and 1.4% of the respondent use locally constructed sitting place from mud and stone called 'medeb'.

In North Wollo areas the abundant chicken house type was a room inside the main house 56.86%. Only 15.36% of respondents prepared separate chicken houses. About 37.25% of the respondents cleaned their chicken houses twice per week. Besides, farmers also have indigenous knowledge in preventing chickens from external parasites by smoking (75.82%) or spraying chemicals (12.09%) in the chicken house and also by sweeping the chicken house with locally made alcohol "Arekie" (7.84%) [46]. In the Bure district, most of the respondents (59.7%) used separate houses constructed exclusively for poultry. On the other hand, 37.5% were kept their chickens in the main house [38]. In Dale, Wonsho, and Loka Abaya districts, about 95% of the cases share the main house to spend the night. In some cases, 5%, the chickens were allowed to roost in enclosed baskets hanging in the kitchen [28]. According to Halima [1] in Northwest Ethiopia, farmers confine chickens only during the night, 51% of them had separate sheds for their chickens, and that 74.02% of the household's clean chickens' houses once a day while 11.66% twice a day. Meseret [29] states that 94.4% in Gomma district and Eskinder [48] reported 92.06% in both Horro and Jarso had separate sheds for their chickens.

In Gondar Zuria, about 59.3% of the respondents keep poultry in the same room with human during nighttime. On the other side, 12% of households reported having separated partition at night time enclosure for poultry within family dwelling. The remaining respondents reported having separate poultry house [47]. Similarly, in Gondar Zuria, the majority of farmers (58%) housed their chickens by sharing the same room with perch. The rest 30% and 12% of respondents were used different shelters in the same room with the families and separate building houses, respectively [49]. Almost all of the respondents in the study area provided overnight shelters for their chickens. In North Gondar, about 63% of the households constructed a separated confined chicken house [30]. Only 14% of the respondents constructed separate houses for their chickens; the other 79.1% dwelling with their owners (perches in the house), 6% perches in the kitchen, and 1.7% in the livestock house in Kambata Tambaro and Wolaita Zones [32].

About 22.1% of owners prepared separate overnight houses for village chickens. However, the majority (77.9%) of village chicken owners kept chickens on a various night sheltering places including; perches inside the house (45.7%), on the floor covered by bamboo

made materials (27.1%), on ceilings of the house (3.6%) and under locally constructed sitting place in Bure (1.4%) [23]. Farmers provided night shelter for their chickens either in part of the kitchen 8.53% (n=6) or in the main house 67.7% (n=49) in separate sheds, while purpose-made for chickens were 23.77% (n=17) in Chagni [33]. The majority of farmers have housed their chickens by sharing the same room with perch (59%). The rest 30% and 11% of respondents were used different shelters in the same room with the families and separate building houses, respectively in Tsegede [34]. Almost all farmers provided night shelter for their chickens like in separate sheds purpose-made for chickens 41.1%, using perch 24.4%, using basket 15.6%, in the main house at one of the rooms 11.1% and the remaining 7.8% use either part of the kitchen in East Gojam [35].

Poultry Health Management

The chicken owners experienced the highest chicken death rate during the rainy season. The major causes of death were seasonal outbreaks of chicken diseases, particularly Newcastle disease (locally known as 'fengele'), followed by predation. However, there was a problem in identifying the real causes and the type of diseases that led to chicken deaths since most of the veterinary services given to the farmers were not supported with laboratory investigation. Only 6.66% of the farmers have extension services relating to chicken diseases and health management. In northwest Ethiopia, the majority of chicken mortalities (72.43%) were not properly examined and no health management services provided. Getachew et al. [25], indicated that 68.33% in North-bench, 63.33% in Sheko, and 48.33% in South Bench village chicken owners were experienced chicken disease outbreaks, and the major diseases and parasites easily recognized by the villagers were Newcastle disease and lice infestation. The report also indicated that a traditional treatment (ethnoveterinary) was the major type of treatment used by the majority of village chicken owners.

Newcastle disease was the most prevalent and economically important in North Wollo [46] and Bure districts [23]. Newcastle disease was 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 any time of the year in central Ethiopia [50]. The report of Fisseha [24] and Fisseha et al. [23] indicated that 97.5% of village chicken owners in Bure were faced chicken disease problems in their locality. Newcastle disease was the most prevalent (98.2%) and economically important disease affecting village chicken production in North Gondar [31]. Similarly, in Kambata Tambaro and Wolaita Zone, 84.4% of respondents were experienced disease outbreaks. Generally, the disease was one of the most important constraints impairing the chicken production system under farmer's management condition because there was a lack of veterinary health service [32].

Production and Reproductive Performance of Village Chickens

The production and reproductive performance (mean age at first lay, mean age at first mating for cockerels, number of laid eggs/clutches, number of clutch/years, total egg laying per year) of village chicken in studies were summarized in Table 3. The overall productivity was very low. For example, according to Tadelles [51] and Tadelles et al. [22], between forty to fifty eggs, were laid/year and about 12 chicks could get annually per hen. Meseret [29] reported

that the mean age at a slaughter weight of 1.5kg of the male chickens in the Gomma district was reached at 8.62 months. Similarly, the hatchability percentage of eggs in the Tsegede district was 82.7% in 34 and 83% in East Gojam Zone [35]. Meanwhile, to increase the laying performance of chicken, farmers in the Rift valley of Oromia usually stimulated broody hens to lay eggs by changing their house (30%), hanging their leg up down to fixed objects (21%), and providing additional feed (13%).

Culling Practice and Determinant Factors for Culling

In most parts of the country, farmers have experienced the culling of chicken for a different reason. According to Getachew et al. [25], most of the respondents in North-bench (66.67%), Sheko (65%), and South-bench (56.67%) had their indigenous knowledge of culling chicken for the reason of poor productivity, old age, and illness. According to Halima1 in northwest Ethiopia, culling of chicken due to home consumption or as a source of income was 53.3%, 19.22% of the chickens were sold because of fear of disease and 21.81% were sold to generate income.

Additionally, Addisu et al. [46] reported the means of culling less productive chickens in North Wollo; i.e slaughtering (53.27%), selling (41.18%), and devour or sell eggs of unwanted hens (5.56%). In the Bure district, different factors were reported that led farmers to cull their chicken. The respondents cull chickens due to poor productivity (46.5%), old age and poor productivity (25%), and due to sickness (5.65%) [38]. In Kambata Tambaro and Wolaita Zone, the basic reasons for the culling of chicken includes less productivity (8.8%), old age (5.4%), and old age and low production (59.5%) with an average culling age of 4.3 years, and old age, low production, and illness (25.7%). Most of the farmers (82.2%) sold the culled chicken for income generation purpose [32].

A study in Bure by Fisseha et al. [23], reported about 93.9% of chicken owners had their indigenous knowledge of culling chickens purposely. The major type of chickens culled from the flock were; old aged chickens 51.4%, lower producers 23.6%, sick chickens 16.8 and chicken more than need, mainly cockerels 8.2%. The average culling age of local cocks was 2.7 years. In the East Gojam zone, 91% of the respondents are experienced in the culling of unwanted or less productive chickens from their flock. The basic reasons for the culling of chicken include less productivity (57.8%), old age with an average culling age of 3.5 years (28.9%), and infection with disease (13.3%). Most of the farmers (90%) sold the culled chicken for income generation purpose [35]. On the other hand, farmers practicing a selection of productive hen based on their body size (68%), finger accommodation between the pelvic bones (12%), and pedigree (20%) [37].

Flock Replacement

Chickens are also kept for a variety of purposes such as to provide parent stock and for sacrifice. In Northwest Ethiopia, about 61.6%, 5.3%, and 33.2% of the replacement stocks for layer chickens were obtained in the form of purchase, gift, and hatched eggs using broody hens in the home, respectively [1]. According to Tadelles et al. [22], about 70% of breeding females in different regions of country households originated from hatching at home and the remaining 30%

were purchased. Additionally, Habtamu et al. [33] stated that about 21.2, 5.2 and 72.6% of the replacement stocks for layer chickens were obtained in the form of purchase, gift, and hatched eggs, respectively in the Chagni district.

Egg Production and Productivity

The largest egg production comes from the local chicken breed, but the exotic and hybrid chicken has a contribution (Table 4). Productive hens have on average 9-19 eggs per clutch, while the total number of eggs produced from local chicken ranges from 18 to 57 eggs/year/hen, which is very low [1].

Egg Incubation Practice and Chick Survival

Artificial incubation is not practiced by the owners of indigenous chickens in Ethiopia. For the hatching of chicken eggs, farmers depended on broody hens. The total number of eggs incubated per clutch under a broody hen varied from 7 to 18 and a comparatively high number of chicks were hatched (7-15) from the number of eggs set. Out of the total number of the hatched chicks, 6-12 chicks survived to adulthood [1]. The mean number of eggs set per chicken was 13.5 ± 2 . The hatching rate was $70.5 \pm 11\%$ ranging from 30-90% (n=250) [22].

The frequency of egg set to broody hen/year was 1.95 in north-bench, 1.98 in Sheko and 2.10 in south-bench, and the average number of eggs set to broody hens was 12.1 in North-bench, 11.72 in Sheko, and 11.27 in South-bench of which the average percentage of hatchability was 78%, 75.5%, and 81%, respectively [25]. 80% hatchability of eggs by a broody hen is normal, but a range of 75% to 80% is considered to be satisfactory [25]. According to Fisseha et al. [23] a higher hatchability performance of local chickens (82.6%) was reported in the Bure district.

In North Wollo, 88.23% of respondents had a practice of egg and broody hen selection. Egg selection was also performed based on size (larger sized) and exotic blood content. Broody hen selection was conducted based on body size (26.83%) and broodiness ability history (73.16%) [47]. In the Bure district, the largest proportion of respondents (81.9%) reported doing incubation during the dry season [38]. The chicken mortality rate was found to be generally high. The overall mortality rate reached up to 49% before the chicks reached two months of age [22].

Extension Services

The ministry of agriculture and rural development has given due attention to improving agricultural productivity and thus assigned 3 development agents for each kebeles. However, only 37.5% of chicken owner farmers of the Bure district have been getting proper agricultural extension services related to village chicken production. Inaccessibility to extension agents was the main reason (31.8%) identified for the absence of proper extension service concerning village chicken production [24]. Unlikely, in northwest Ethiopia, about 70.6% of the chicken growers obtained information about improved chicken production systems from market places, neighbors, and extension agents [1].

Approximately 81% of respondents were not accessed credit facility and remaining 19% of respondents were availed credit facility for village chicken production and about 56% of respondents were

had not access to training service, this result indicates that training and credit service are one constraint for poultry production in Gondar Zuria district [48].

In East Gojam Zone the extension service for the improvement of poultry production was found to be weak. Little emphasis has been given to livestock and poultry production activities. Only some of the respondents (13.3%) utilize the service to a limited extent. The majority (86.7%) of the respondents do not find extension services from any stakeholders, mainly from development agents. This was due to various reasons; specifically, lack of awareness about the importance (56.7%), not need the service (18.9%), and lack of availability of the service (12.2%) [35].

Marketing System

The poultry marketing structure has not been well studied in Ethiopia. The market outlets or channels available to producers are diverse at all markets, although their importance differs across markets. The major channels through which producers/farmers sell their chicken in the markets are directly sold to consumers and/or small retailers that take the chicken to large urban centers [53]. However, the farmers do have little knowledge on how the market works and why the price fluctuates and have virtually no information on market conditions [54]. Thus, most farmers sell chickens within their vicinity. This can attribute to the small number of chickens offered for sale, long distance to the high-demanding urban and peri-urban markets, and that the selling of chickens is occasional and based on prevalent pressing needs of the family [53].

Although local consumers generally prefer the indigenous chicken, the high consumption is associated only with holy days. Resulted in the largest off-take rates of the flock occur particularly during holidays and festivals and the onset of disease outbreaks [55]. In such circumstances, prices fall dramatically due to the high supply compared to demand. Ultimately, affect the producers. In most cases, traders use public transportation (buses and minibuses) or hire space in private trucks to transport chicken to terminal markets. During transportation, the chickens may be kept along with other bags sacks of grain bundles of firewood by binding their legs together that can result in considerable loss due to stress [56]. The traditional chicken and egg collectors from the villages can facilitate the marketing of smallholders, however, such marketing structure is overlooked, or criticized, as it is not sustainable.

In developing countries like Ethiopia, village poultry represents a significant component of the rural household livelihood as a source of income and nutrition, and as a gift to strengthen social relationships [4,57,58]. There was a higher variation in the price of chicken and egg, due to festivals based on the coat color of the chicken and the size of the eggs [47]. There were fluctuations across the months of the year in sales as well as in consumption of both chicken and eggs. The highest chicken sales and consumption overlapped with the major social and religious festivals of the year. These are Ethiopian new year (September 11), Ethiopian Christmas (January 5), Ethiopian Epiphany (January 19), Ethiopian Easter (April), and St. Mary's day (August). The periods of low chicken sales and consumption coincided with the pre-Easter fasting period which lasts about two months, from February to March [24,59].

Additionally, chicken prices were fluctuated during the year, generally low in the rainy season and high in the dry season. Regarding the marketing channel, most chicken owners (37.9%) sold their chicken directly to consumers & middlemen (chicken collectors), who are involved in chicken marketing. The rest of the chickens were usually sold to other urban and rural chicken producers and retailers [24].

Live chicken and eggs are usually sold in local markets to civil servants and occasionally to middlemen for retail in the larger towns and cities of the market sheds. The estimated distance of the marketplace from the villages varies from 1-7 km with an average of 2.8km. According to farm households, the largest off-take rates from the flock occur particularly during holidays and festivals and during the onset of disease outbreaks. The latter is meant to prevent or minimize expected financial losses from high morbidity and mortality. In such circumstances, prices fall dramatically due to the high supply compared to the demand. At times, nearly all chickens brought to a market should be sold at an available price in order not to return chickens to home. This is mainly exercised as part of a precautionary measure to prevent the introduction of disease(s) to flocks at farm sites from markets. Farmers also sell chickens and eggs to meet their cash requirement for small household expenditures [36].

The price of live chicken was determined based on body weight (41.83%), the combination of comb-type and plumage color (32.35%), and plumage color (25.82%) during buying and selling [45]. Farmers sell their chicken mostly when there is an instant cash need in the house (65.6%) when there were disease outbreaks (24.4%) and during the major crop planting seasons (10%) usually occurred from the beginning of the main rainy season [28].

Challenges for Village Chicken Production and Marketing System in Ethiopia

Disease and predator were the major and economically important problems for poultry production in South Western Ethiopia [25]. Fluctuation (seasonality) in prices of chicken products was the most and prevailing chicken and egg marketing constraint of Bure district [24]. According to Fisseha [24], the main challenges of village chicken production are the prevalence of disease and inadequate health care, predators, poor productivity of local chicken ecotypes, and poor chicken management (feeding, housing, and health care).

In North Wollo, chicken diseases (60.13%), feed shortage (20.59%), and predator or thefts (19.28%) were the major constraints of chicken production [45]. Bogale [38] stated that disease (48.6%) and shortage of supplementary feed (19.4%) was the major constraint in Fogera district. Among the reported constraints of chicken production prioritized by the respondents in North Gondar were disease, predators, market problems, lack of water, and lack of extension and veterinary services. Most respondents have frequently mentioned diseases as the first ranked chicken production constraint. Similarly, in the Alefa district, the main bottlenecks that challenge chicken production were poor veterinary and extension services, and lack of market facilities including access to the main road [31].

The most five important constraints of poultry production in Northern Gondar were diseases, predators, shortage of supplementary

feeds, poultry housing problem, and lack of veterinary health services, in descending order [30]. In the Chagni district, the disease was reported to be the major constraint (58%) of the farmers, while inadequate veterinary and extension service and high feed costs were constraints by 17% and 13% of the farmers, respectively [33]. In East Gojam the major constraints of chicken production were a disease, lack of veterinary service, a traditional management system with limited feed supply, poor housing, and lack of access to improved breeds with limitation of extension service [35].

Conclusion

In the country, the chicken population has a contribution as a source of income and protein food source. However, chickens are raised under traditional management practices with poor husbandry practices such as lower levels of feeding, watering, veterinary service, housing and, breeding practice. Hence, it implies the lower productivity of chicken and its products for example an individual local chicken laid in a range of 35 to 60 eggs per year. The majority of the chicken population was local genotype with low production potential. The egg and meat of poultry come mainly from indigenous chicken breeds. But the population of exotic and hybrid chickens has risen over the last fifteen years. Relatively exotic and hybrid chicken has the potential to produce more eggs with the risk of dilution of the more adaptable indigenous chicken. Almost all of the chickens were managed with an extensive management system and more or less the management of the chicken was carried out by women. The marketing value of chickens depended on time, higher on religious festivals.

Chicken production in Ethiopia has faced many problems such as disease, low production performance, feed shortage, and predation. On the other hand; poor market system, lack of credit service for farmers, inadequate training and extension service, etc are another bottleneck. A better understanding of these constraints and good prospects of village chicken production is important to improve chicken production and improves the standard of the living condition of the farmers. The agricultural extension and agricultural research system of the country has a big responsibility to address all those listed problems.

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