



Challenges of Village Poultry Production and Marketing System in Eastern and South-eastern Zones of Tigray, Ethiopia

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

A survey was done aiming to assess the village chicken production and marketing system challenges in eastern and southeastern zone of Tigray region. Two peasant associations were selected from each district and 178 households having more than two chickens were interviewed. In the study districts, 50% of farmers assured the presence of an economically important disease, the Newcastle disease confirmed a major killer by 73.9% farmers and 75% of them approved its occurrence during dry season. Farmers treat their sick chicken (50.8%), while 14.4% took to the clinic but 10.8% farmers slaughter sick chickens for home consumption. About 60.8% of farmers have no access to veterinary services though 58.6% of them got advisory services from the extension agents. Similarly, based on the study, the major cause of loss of chickens were disease,

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predator and accidents. In addition, the rank of major chicken production system constraints were feed shortage followed by predator and lack of capital and the major predators were eagles, wild cat and honey burger. Farmers sell their chicken at the local market (94.2%) and in the nearby areas (2.9%) transporting on foot (94.2%) and by car (5.2%). The major criteria of farmers to buy chickens were hand weighing (54.5%), plumage color (9.1%), hand weighing and shank color (9.1%), and hand weighing, plumage color and age (27.3%), and transport their chickens to the market by embracing by hand (41.7%), hanging upside down (49.7%), by coop and car (2.9%) and by basket (1.1%). Similarly, eggs were sold in the local market (86.3%) and local market and neighborhood (6.3%) and transported mixing eggs with straw (56.1%), eggs with grain (19.9%), in plastic container (16.4%), and eggs with grain and straw (7.6%). The major chicken and egg marketing problems were price fluctuation with season, lack of capital and price depend on plumage color. Farmers rear chickens for income generation followed by consumption and hatching, while, eggs were used for income generation and hatching. Therefore, there is a need to strategically construct separate house for chickens, improve their husbandry practices, and create access to veterinary services and provide vaccination.

Keywords: Chicken; egg; market; plumage color; new castle disease; trait.

1. INTRODUCTION

The poultry industry contributes to the socio-economic status of households in low and middle-income, including the most vulnerable groups like women, the disabled, and the unemployed, and plays for food and nutrition security in the fastest-growing agricultural sub-sector, especially in developing countries like Ethiopia [1-3]. In Ethiopia, chicken plays a significant role in poverty reduction and alleviation, nutrition and food security, growth of domestic products (GDP), and employment opportunities [4]. Currently, the nation has 57 million chickens with 44.94 million indigenous (78.86%), 6.85 million hybrid (12.02%), and 5.19 million exotic breeds (9.12%) which are mainly kept by smallholder rural farmers under a scavenging production system that supplies above 85% of egg and meat production in the country [5]. The [5] added that the Tigray region state-owned 7 million chickens with 4.9 million indigenous (70.24%), 718,703 hybrids (10.27%), and 1.3 million exotic (19.49%). Similarly, in Sub-Saharan African countries, indigenous chickens play a significant role as sources of cash income and excellent sources of animal protein in rural poor communities [6].

Indigenous chickens in Ethiopia have high genetic variation and local adaptation ability that is the basis for selective breeding and genetic improvement strategies [7]. However, these indigenous chickens have given little attention for their efficient and sustainable utilization, conservation and improve programs by the government institutions and other relevant organizations, without considering their

production performance and important traits. In addition to that, chicken provides a great opportunity to increase protein production and income for smallholder farmers [8]. So, food security at the household level can be improved by promoting poultry production [9]. However, many constraints faced by small-holder poultry producers include poultry diseases, predators, inadequate availability and poor quality of feed resources, lack of proper health care, and poor marketing information [10,11]. Therefore, the objective of this study was to identify the major challenges of poultry production and marketing system and put way forward for the betterment of the sector to maximize its contribution in poverty alleviation, improve food security, enable employment in the region in particular and the country Ethiopia in general.

2. MATERIALS AND METHODS

2.1 Study Area

The three study districts were located in two zones (eastern and southeastern) of the Tigray regional state, northern Ethiopia. A total of six villages (two villages from each district) were selected. Hawzen district (Hayelom and Debrehiwot Peasant Associations (PAs)) is located at 14000'0.00"N and 39019'60.00"E and both villages represent midland agroecology. Similarly, Degua-tembien and Hintalo-wajerat districts are found at a latitude and longitude of (13029'59.99" N and 39014'60.00"E and 13009'60.00"N and 39039'59.99 E, respectively. Seret and Melfa PAs from Degua-tembien and Senale from Hintalo-wajerat represented the highland agroecology whereas Mesanu PAs from

Hintalo-wajerat represented the midland agroecology.

2.2 Sample Determination and Selection of Participants

Multi-stage sampling technique was employed to select the peasant associations (PA) which is the smallest administration unit, and the respondents. Six sample PAs were purposively selected to represent midland and highland (three PAs from midland and three PAs from highland agro ecology) based on chicken population number and access to roads. A stratified sampling technique was employed to stratify the PA of the midland (1500-2500 meters above sea level) and highland (>2500 masl) [12] agro ecology. A total of 178 chicken owners (approximately sixty farmers from each study district) who own three or more chickens were interviewed. A rapid field survey was conducted before the main study to validate the geographical distribution of the chicken concentration, and population number of the indigenous chicken ecotypes and to obtain a representative sample from the district; a sampling framework was developed and used for the process.

2.3 Methods of Data Collection

The household survey was used to gather data on poultry disease availability, cause of mortality, types of predators, constraints of the chicken production system, marketing of chicken and eggs, marketing problems, and purpose of keeping chickens and eggs.

2.4 Ranking Methods

The ranking was used to determine the major types of chicken predators, chicken production constraints, problems related to chicken and egg marketing, and the purpose of keeping chickens and eggs. Participants were asked to rank their first to fifth in each of the above-listed parameters, and the most important reasons listed from the first to third were considered.

Index=Sum (n × number of HHs ranked first) + (n-1) × number of HHs ranked second + (n-2) × number of HHs ranked third +... + 1×number of HHs ranked last) for one factor divided by the sum of (n × number of HHs ranked first+ (n-1) × number of HHs ranked second+.... +1 × number of HHs ranked last) for all factors and n=number of factors under consideration. The variable with

the highest index value is the most economically important [13].

2.5 Data Analysis

The collected data were analyzed using the Statistical Package for Social Sciences (SPSS) software version 20 [14], and descriptive statistics were used to compare the mean.

The following model was used:

$$Y_i = \mu + A_i + e_i$$

Where Y_i = response of variables

μ : overall population mean for the corresponding chicken age groups across districts

A_i : effect of i^{th} districts (1, 2, 3)

e_i : residual error

3. RESULTS AND DISCUSSION

3.1 Availability of Chicken Disease, Treatment and Access to Veterinary Services

3.1.1 Availability of poultry disease

The availability of chicken disease, treatments, and access to veterinary services are presented in Table 1. In the study districts, 50% of the respondents assured that there is chicken disease and 73.9% of them confirmed that Newcastle disease is the economically important disease of village chicken production in the areas. About 75.5% of the respondents replied that Newcastle disease occurred during the dry season more frequently than in the wet season. The current finding was lower than the report of Moreda et al. [15-18] in which 97.6%, 99.0%, 97.6%, and 93.8% of respondents experience the presence of disease in their localities respectively. However, it was in line with the report of Letebrhan et al [19]. Concerning the major disease, it was in line with the report of Moreda et al [15, 17], 89.5% of the farmers said the disease was Newcastle disease.

3.1.2 Treatment of sick chickens

Based on the study, 50.8% of the respondents, treat sick chickens themselves, while, some of them took the sick chickens to the clinic (14.4%) and 10.8% them also slaughtered sick chickens

for their home consumption. Similarly, the major actions taken when chickens were sick were similar to the findings of [20] in the Jimma zone, southwest Ethiopia, Emebet [17], and Mearg [18] in the central zone of Tigray, where farmers treat themselves. There is poor access to veterinary services and awareness of farmers on the consumption of sick chickens in the study areas. Generally, poor attention is given to the village poultry production and health services system in the study areas and the region.

3.1.3 Access to veterinary and advisory services

Concerning access to veterinary services, 38.6% of the respondents have access, whereas, 60.8% of them have no access to veterinary services when their chicken got sick. On the contrary, 58.6% of the respondents have got advisory service from extension experts in their localities but 41.4% of them did not get.

3.1.4 Causes of mortality of chicken based on their age

Disease is the major cause of mortality of chicks in Hawzen (46.4%), D/temben (27.1%) and

H/wajerat (49.1%) which is followed by predator in Hawzen (33.3%), D/temben (20.3%) and H/wajerat (40.4%) and accident which is 27.1% in Hawzen, 13.6% D/temben and 28.1% in H/wajerat districts (Fig. 1).

Similarly, disease is the major cause of mortality of grower which is 53.4% (Hawzen), 40.4% (H/wajerat) and 24.1% in D/temben followed by predator that is 29.8% (Hawzen), 23.7% D/temben and 22.8% in H/wajerat and accident 12.1% (Hawzen), 8.8% in H/wajerat and 1.7% in D/temben districts (Fig. 1).

The major cause of mortality of matured chicken or layers and cocks were disease, predator and accident across the study districts. In Hawzen (55.2%) and H/wajerat (50.9%) districts disease is the main causes of mortality of matured chicken whereas, in D/temben the main cause of mortality was (27.1%) predator followed by (25.4%) disease (Fig. 1). This implied that free grazing chickens were poorly managed and exposed to disease and predator. This finding was in line with the report of Mamoet al [21], the major cause of chicken mortality in north Gondar, northwestern Ethiopia was disease (47%).

Table 1. Availability of chicken diseases and treatments, access to veterinary and advisory services

Parameters (%)	Study Districts			Overall mean
	Hawzen	D/temben	H/wajirat	
N	60	60	58	
Poultry disease in the area				
Yes	51.7	35	64.3	50
No	48.3	65	35.7	50
New castle				
Yes	49.2	8.3	21.1	26.1
No	50.8	91.7	78.9	73.9
New castle occurrence				
Wet season	19.2	20	33.3	21.6
Dry season	80.8	80	50	75.7
Measures taken for sick chicken				
Taken to vet	31.3	2.4	8	14.4
Treat by my self	47.9	63.4	60	56.8
Sell to market	2.1			0.7
No action	12.5		16	10.1
Branding	4.2	2.4	6	4.3
Throw		4.9	2	2.2
Slaughter for home consumption		26.8	8	10.8
Access to veterinary service				
Yes	95.1	6.7	31.6	38.6
No	4.9	93.3	68.4	60.8
Advisory service from extension				
Yes	86.4	45.8	42.9	58.6
No	13.6	54.2	57.1	41.4

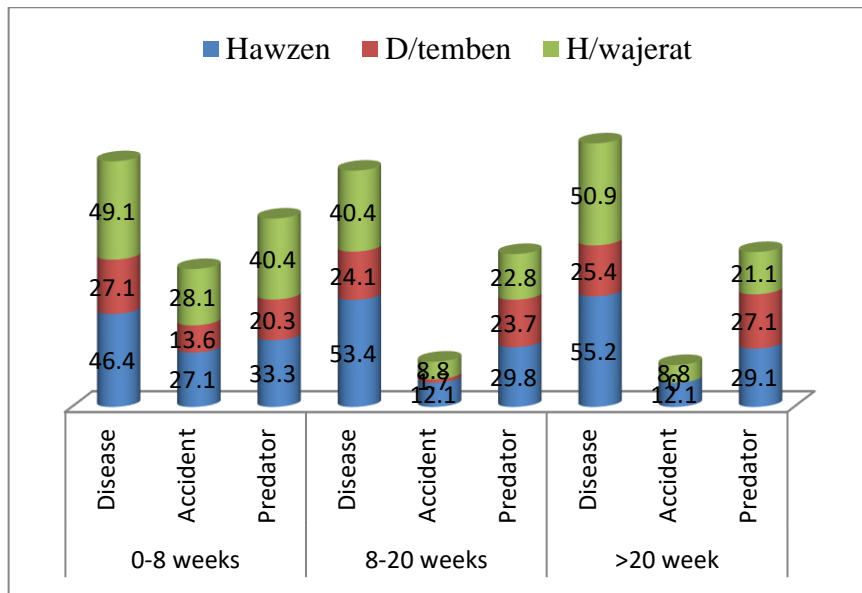


Fig. 1. Main causes of mortality of chicken by age

3.2 Types of Predators

The ranks of the common chicken predators are presented in Table 2. The major predators in the study areas were an eagle, wild cat, and Titgi in the Hawzen and D/temben districts whereas an eagle, domestic cat, and a wild cat in the H/wajerat district. The major predators across the districts were eagle (0.36), wild cat (0.30), and Titgi or (honey burger) (0.24). Therefore, this study indicated that housing chickens can protect from the available major predators across the study areas.

3.3 Constraints of Chicken Production System

The rank of chicken production system constraints are presented in Table 3. The major chicken production system constraints were feed shortage, lack of capital, disease, and lack of labor in Hawzen, whereas, predator, feed shortage, disease, and lack of capital in

D/temben and similarly, disease, predator, feed shortage and lack of capital in H/wajerat districts. The major constraints of chicken production across the study districts were feed shortages followed by predators and lack of capital. This is due to the competitive nature of the food feed of poultry and humans and poor access to credit by farmers in the study areas. This finding was different from the report of [22-25] who reported that the major constraint of poultry production was disease. However, it was similar to all the reports on the second major constraint of chicken production that is the predator. Yirgu et al [9], also reported that the major constraints of the poultry production system for smallholder farmers of Benshangul-Gumuz were disease, predators, lack of proper health care, and feed shortage. In addition to this, Sufiyan [26] also reported that the major constraints of village poultry production were poor management practices (housing and nutrition), disease and parasites, low extension services, and poor access to credits.

Table 2. Type of predators

Type of Predators	Study Districts							Overall	
	Hawzen		D/Temben		H/Wajerat				
	Index	Rank	Index	Rank	Index	Rank	index	Rank	
Wild Cat	0.23	2	0.16	3	0.22	3	0.3	2	
Eagle	0.45	1	0.41	1	0.37	1	0.36	1	
Titgi (honey burger)	0.16	3	0.19	2	0.07	5	0.24	3	
Snake	0.04	5	0.06	6	0.03	6	0.02	6	
Dog	0.01	6	0.1	4	0.08	4	0.05	5	
Domestic Cat	0.12	4	0.07	5	0.24	2	0.08	4	
Gedigedey (wild Egyptian vulture)			0.02	7					

Table 3. Rank index of major constraints of chicken production system in the study districts

Constraints	Study Districts							
	Hawzen		D/Temben		H/Wajerat		Overall	
	Index	Rank	Index	Rank	Index	Rank	Index	Rank
Disease	0.19	3	0.18	2	0.26	1	0.02	6
Lack of labor	0.12	4	0.00		0.02	6	0.05	4
Lack of capital	0.24	2	0.17	3	0.18	4	0.20	3
Thieves	0.04	5	0.1	4	0.02	6	0.05	4
Predator	0.12	4	0.32	1	0.2	2	0.21	2
Feed shortage	0.27	1	0.18	2	0.19	3	0.26	1
Shortage of land	0.01	6	0.04	5	0.08	5	0.04	5

3.4 Marketing of Chicken and Eggs

Selling of chicken, marketplace, means of transportation, and buyer quality parameters of chicken and eggs are presented in Table 4. Based on the study report, there was no systematic marketing of chickens and eggs in the study districts. Therefore, about 98.9% of the respondents sell their chickens at the local market (94.2%) and in the nearby areas (2.9%). The respondents sell their chickens and eggs by transporting them on foot (94.2%) and by car (5.2%) which indicates most of the communities were found far from the main market of their districts. This report was similar to the findings of Ngongolo [27], chickens were sold in retail, whereas, they also sell their products in the nearby market and to restaurants or hotels in Tanzania.

It was known that buyers have their criteria for buying chickens. Hence, the main criteria were hand weighing (54.5%), based on plumage color (9.1%), by hand weighing and shank color (9.1%), and hand weighing, plumage color, and age (27.3%) across the study districts. The means of transportation of chicken to the market were embraced by hand (41.7%), hanging upside down (49.7%), in the coop and by car (2.9%), and in the basket (1.1%). This was similar to the findings of Hailu et al [28], in which 41.85% of buyers in North Wollo use the hand weighing or body weight measurement of chickens at the market, and Feyera [25] also reported that 60.8% of farmers in western Oromia transport chickens by hand and 68.8% of them use the local market to sell their chickens.

Similarly, eggs were sold in the local market (86.3%), local market and neighborhood (6.3%) transporting their eggs with straw (56.1%), with grain (19.9%), in plastic containers (16.4%) and with grain and straw (7.6%). This was similar to the findings of Mearg [18], 72.5% of farmers in

the central zone of Tigray sell their eggs at the local market and transport them mixed with straw (74.6%).

3.5 Chickens and Eggs Marketing Problems

Marketing problems of chickens and eggs are presented in Table 5. The major marketing problems of chickens and eggs were lack of capital, price depending on plumage color, seasonal fluctuation of price, and disease outbreaks in Hawzen, D/temben, and H/wajerat districts. Similarly, low prices, a far reliable market, lack of buyers, market information gap, limited market outlets, and low market output were also problems related to the marketing of chickens and eggs in the study districts. The overall marketing problems of chickens and eggs across the study districts were price fluctuation with season (0.31), lack of capital (0.20), and price depending on plumage color (0.16). This result indicated that chicken production is highly affected by the Orthodox Christian religious belief and should be associated with festivity time. In addition, it is also indicated that creating access to credit, selecting and producing preferred traits (plumage color) of chickens by research organizations or higher institutions in the region is the best option. This was similar to the findings of Hailu et al [28], there were instable chicken prices and seasonal demand.

3.6 Purpose of Keeping Chickens and Eggs

3.6.1 Purpose of keeping chickens

The purposes of keeping chickens are given in Table 6. Therefore, the main purposes of keeping chickens were income generation through the sale of chickens followed by egg/meat consumption and replacement in the study districts. Similarly, spiritual, cultural, ceremonial, and hatching were the other purposes of keeping

chickens. This result was similar to the findings of Justus et al., (2013) in which the main purposes of Indigenous chickens were (89.2%) commercial, (11.7%) for celebration, and (11.7%) for spiritual. Similarly, Hailemichael et al [29] also reported that, the main purpose of keeping chickens of farmers in the southern zone of Tigray was for eggs to hatching, cash, and home consumption and Getachew et al [30] also reported that the purpose of keeping chickens in Gambella region is for egg production followed by income generation.

3.6.2 Purpose of keeping eggs

The main purposes of keeping eggs were for income generation or cash, consumption, and hatching. Similarly spiritual and ceremonial were the main use of eggs by the respondents (Table 7). This finding was similar to the report of Getachew et al [30], farmers in Gambella, western Ethiopia use eggs for income generation and hatching purposes which agrees with the report of Fisseha et al [31] and Getachew et al [32].

Table 4. Chickens and eggs marketing system

Parameters (%)	Districts			Overall mean
	Hawzen	D'temben	H/wajirat	
N	60	60	58	178
Sell chicken				
Yes	100	96.6	100	98.9
No		3.4		1.1
chicken selling place				
Local market	100	96.5	86	94.2
Neighborhood		1.8	3.5	1.7
In nearby areas		1.8	7	2.9
All			3.5	1.2
Means of transportation				
On foot	98.3	100	84.2	94.2
On foot and by car	1.7			0.6
By car			15.8	5.2
Buyers quality parameter				
Yes	100	96.6	100	98.9
No		3.4		1.1
Quality parameters of buyers				
By hand weighing	60			54.5
Plumage color	10			9.1
Hand weighing and shank	10			9.1
Hand weighing and plumage color, age	20		1.7	27.3
Transportation of chicken to market				
Embracing by hand	33.3	50.8	41.1	41.7
Hanging by hand upside down	61.7	44.1	42.9	49.7
In coop	1.7	5.1	1.8	2.9
By car	3.3		10.6	2.9
In basket			3.6	1.1
Eggs selling place				
Local market	96.7	86.2	75.4	86.3
Neighborhood	1.7	3.4	1.8	1.7
Nearby areas		3.4	3.5	2.9
All	1.7	3.4	3.5	2.9
Local market and neighborhood		3.4	15.8	6.3
Transportation of eggs				
Egg with grain	32.2	17.9	8.9	19.9
Egg with straw	42.4	71.4	55.4	56.1
In plastic container	22	5.4	21.4	16.4
With grain and straw	3.4	5.4	14.3	7.6

Table 5. Major problems related to marketing of poultry and its products

Market constraints	Study Districts							
	Hawzen		D/Temben		H/Wajerat		Overall	
	Index	Rank	Index	Rank	Index	Rank	Index	Rank
Low prices	0.08	5	0.01	5	0.06	5	0.05	5
Seasonality of price	0.22	3	0.37	1	0.33	1	0.31	1
Far reliable market	0.04	6			0.14	3	0.05	5
Lack of buyers	0.03	7			0.01	7	0.01	7
Disease outbreak	0.11	4	0.17	4	0.17	2	0.15	4
Lack of capital	0.27	1	0.22	2	0.11	4	0.20	2
Price depend on plumage	0.24	2	0.18	3	0.06	5	0.16	3
Market information gap	0.01	8	0.01	5	0.1	7	0.03	6
Limited market outlet					0.02	6	0.01	7
Low market output			0.01	5	0.01	7	0.01	7

Table 6. Purpose of keeping chickens

Purpose	Study Districts							
	Hawzen		D/temben		H/wajerat		Overall	
	Index	Rank	Index	Rank	Index	Rank	Index	Rank
Cash from sale	0.24	1	0.27	1	0.27	1	0.31	1
Egg consumption	0.24	1	0.26	2	0.21	2	0.28	2
Meat consumption	0.22	2	0.2	3	0.18	3	0.22	3
Replacement	0.19	3	0.13	4	0.1	4	0.14	4
Spiritual/religious	0.05	4	0.02	5	0.05	5	0.03	5
Cultural	0.03	5	0.01	6	0.01	6	0.01	6
Ceremony	0.03	5	0.02	5	0.01	6	0.01	6
Hatching			0.02	5	0.01	6	0.01	6

Table 7. Purpose of keeping eggs

Purposes	Study Districts							
	Hawzen		D/temben		H/wajerat		Overall	
	Index	Rank	Index	Rank	Index	Rank	Index	Rank
Cash	0.35	1	0.38	1	0.33	1	0.39	1
Consumption	0.34	2	0.35	2	0.27	2	0.34	2
Hatching	0.18	3	0.16	3	0.17	3	0.18	3
Spiritual	0.1	4	0.05	4	0.06	4	0.07	4
Ceremonial	0.03	5	0.03	5	0.02	5	0.02	5

4. CONCLUSION

Fifty percent of the respondents indicated that disease was the main challenge of chicken production followed by feed shortage, predators, and lack of capital in the study districts and 73.9% of them confirmed that Newcastle disease was the only known disease that occurred during dry season. The main objectives of chicken production of the respondents was cash from the sale, egg consumption, meat consumption and replacement, whereas, eggs were used for cash, consumption, and hatchability.

5. RECOMMENDATIONS

Since disease and predator are the major challenges of chicken production in the study districts, there is a need to strategically construct separate houses for chickens, improve their husbandry practices, create access to veterinary services, and provide vaccination. In addition, creating awareness and strong linkage and enabling access to credit is mandatory for all actors across the poultry value chain.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models

(ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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