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Assessment of Village Chicken Production System and Constraints in Gena Bossa District of Dawro Zone, Ethiopia

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ABSTRACT

This study was conducted in Gena Bossa district with the objective of assessing village chicken production system and constraints of chicken production system. Multistage stratified purposive and random sampling methods were used and a total of 138 households were participated for the interview. 15, 54 and 69 farmers selected for interview from highland, midland and lowland agro-ecologies, respectively. From the interviewed farmers 47, 47 and 44 farmers were poor, medium and rich wealth leveled, respectively. Farmers were categorized to their education level and 34, 34, 35 and 35 respondents were interviewed from illiterate, reading and writing, primary first and primary second cycle education level, respectively. The overall flock size of chickens was 10.86 per household. About 92.2% of the respondents practice scavenging with supplementary feeding system. Only 10.4% of the respondents constructed separate house for chickens. Newcastle disease was the main disease which affects the flock and only 31.42% of the respondents practice vaccination. Predators and diseases were the main constraints for production, and feed accesses and veterinary service were opportunities to increase performance of chickens. Lowest production performance of indigenous chickens were recorded under farmer management condition which needs further improvement from the government by organizing trainings for farmers on disease control, housing and feeding of chickens to improve productivity.

Keywords: Agro-ecology, Education level, Wealth status, Constraints, Gena Bossa

INTRODUCTION

Agriculture dominates the Ethiopian economy and contributes 45% of Gross Domestic Product (GDP) and provides more than 80% of employment. Ethiopia has the highest livestock populations in Africa and accounts for 17%, 20%, 13% and 55% of cattle, sheep, goats and equines, respectively [1]. Livestock production accounts for about 32% of agricultural GDP and 61% agricultural total export [2-4].

The global poultry population has been estimated to be about 16.2 billion, of which 71.6% is found in developing countries [5]. In Africa, village poultry contributes over 70% of poultry products and 20% of animal protein intake [6]. In East Africa over 80% of human population live in rural areas and over 75% of these households keep indigenous chickens. The Ethiopian poultry population is estimated to be about 60.5 million, of which 94.33%, 2.47% and 3.21% is indigenous, exotic and hybrid chickens, respectively [1]. According to CSA report 83.5%, 7.1% and 9.4% meat and egg product comes from indigenous, hybrid and exotic breeds of chickens in Ethiopia, respectively.

The Ethiopian indigenous chickens are known to possess desirable characters such as thermo tolerant, resistance to some disease, good egg and meat flavor, hard egg shells, high fertility and hatchability as well as high dressing percentage [7]. According to Abubakar [8] the impact of the Ethiopian village chicken in the national economy and its role in improving the nutritional status, family income, food security and livelihood of many smallholders is significant

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owing to its low cost of production. The diverse agro-ecology and agronomic practice prevailing in the country together with the huge population of livestock in general and poultry in particular, could be a promising attribute to boost up the sector and increase its contribution to the total agricultural output as well as to improve the living standards of the poor livestock keepers [9,10]. Poultry production, as one segment of livestock production, has a peculiar privilege to contribute to the sector. Poultry is small in size and rapid in human food production due to its short reproductive cycle compared to other domestic animals kept in Ethiopia. It fits well with the concept of small-scale agricultural development. Moreover, it goes eco-friendly and does not compete for scarce land resources [11,12].

In Ethiopia, the contribution of indigenous chickens to farm household and rural economies is not proportional to their large numbers. The production systems are affected by different constraints which cause low productive and reproductive performance of chickens. These constraints which affect chicken production include diseases, poor management practices, predation and lack of organized markets from which the most important in the village chicken are disease and improper housing conditions which expose birds for predation [7,13-15].

There are numerous chickens existing in the study area but still now producers got little products from their chickens. However, the productivity of indigenous chicken and the production system has not been studied extensively in Gena Bossa district of SNNPR. Cognizant of this, this research was designed with the objectives of assessing village chicken production system and constraints of chicken production in the Gena Bossa district of SNNPR.

MATERIALS AND METHOD

Description of the study area

This study was conducted at Gena Bossa district. The district is found in Dawro zone of South Nation Nationalities and Peoples Region State (SNNPRS). Karawo is the town of the district which is located at about 508 km south west of Addis Ababa across Shashemene and Wolayita, 303 km from Hawassa Town of SNNPRS. The total surface area of the district is 90,122 hectare. The total population of Gena Bossa district is about 109,401 and from this 54,870 is male and 54,531 is female.

Selection of study households

Multistage stratified purposive and random sampling methods were used to study population that produces indigenous chickens. Based on the number of chicken population and the potential of each *kebeles* and its representativeness to the district, three *kebeles* from lowland, two *kebeles* from midland and one *kebele* from highland were selected to collect data. Farmers were categorized to different wealth levels poor, medium and rich. Then, those farmers which separated by wealth status were re-categorized by education level. Finally, 138 respondents randomly selected from different agro-ecologies which was categorized based on wealth and education level. 15, 54 and 69 farmers were selected from highland, midland and lowland agro-ecologies, respectively to determine the effect of agro-ecology on chicken production. This also divided to wealth status and 47, 47 and 44 farmers selected from poor, medium and rich wealth leveled farmers, respectively to determine the effect of wealth on chicken production. Finally; 34, 34, 35 and 35 farmers from illiterate, reading and writing, primary first cycle and primary second cycle education level, respectively were selected from those farmers classified by wealth status to determine the effect of education level of respondents on chicken production.

Sample size determination

The total size for household was determined by using probability proportional size-sampling technique Cochran's (1977).

$$no = \frac{Z^2 * (P)(q)}{d^2}$$

Where;

n_o=Desired sample size according to Cochran's (1977) when population greater than 10,000

Z=Standard normal deviation (1.96 for 95% confidence level)

P=0.10 (proportion of population to be included in sample, i.e., 10%)

q=is 1-P, i.e., (0.90)

d=is degree of accuracy desired (0.05)

Data collection methods

Questionnaire survey: The data were collected by using both primary and secondary source of data. The primary data were collected by using semi-structured questionnaire. The parameters like flock composition, types of breed, productive and reproductive performances, feeding and watering, housing and health control systems, breeding, socio-economic contribution, constraints and opportunities of traditional chicken production system were gathered by using questionnaire. The secondary data were collected from written document of Gena Bossa Agricultural and Natural Resource Development Office, Animal and Fisher Development Office of the district and other sources.

Data management and analysis: Descriptive statistics such as percentage, mean and frequency were calculated and all survey data were analyzed by using SPSS Version 20 [16]. Descriptive statistics were employed for describing data gathered by questionnaires for management practices.

Respondents gave ranks to constraints and opportunities of chicken production. Then priority index was used to rank the constraints and opportunities of traditional chicken production according to their severity and based on their relative importance, respectively.

Priority 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 + (n-2) × number of HHs ranked third +.... + 1 × number of HHs ranked last) for all factors

Where,

n=number of factors under consideration and HH=Households. The variable with the highest index value is the highest economically important.

RESULTS AND DISCUSSION

Demographic characteristics, land size and livestock number of households

Demographic structures, land size and livestock numbers of the study area were shown in **Table 1**. According to the data collected 57.2% were males and the rest 42.8% were females. The average ages of respondents were 37.66 years and the mean family size per household were 6.8. About 63.8% of respondents were the followers of protestant followed by Orthodox and Catholic religious followers. Regarding to marital statuses of respondents 73.2% were married and the rest were divorced and widows.

Table 1. Demographic structures, land size and livestock number of the respondents.

Household profile	Frequency	Percentage
Sex of respondents		
Male	79	57.2
Female	59	42.8
Marital status		
Married	101	73.2
Divorced	15	10.9
Widows	22	15.9
Farming system		
Mixed farming system (crop-livestock)	138	100
Total land and livestock	Mean ± SE	
Total land per household (hec.)	2.02 ± 0.16	
Livestock per household (No)	13.22 ± 0.45	

hec.=hectare; No=number

Flock size and structures of chickens

According to this study average chickens per household in Gena Bossa district were 10.86 ± 1.52 and from this cocks, hens, pullets, cockerels and chicks were 1.67 ± 0.14, 4.06 ± 0.38, 1.62 ± 0.28, 0.95 ± 0.26 and 2.56 ± 0.46, respectively **(Table 2)**.

Table 2. Flock size and structure of indigenous chickens in the study area (Mean ± SE).

Variables	Cocks	Hen	Pullets	Cockerels	Chicks	Overall
Agro-eco.						
Highland	1.62 ± 0.19^{ab}	4.12 ± 0.52^{ab}	2.16 ± 0.39^{a}	1.42 ± 0.36^{a}	2.79 ± 0.64	12.11 ± 2.1^{a}
Midland	1.95 ± 0.10^{a}	4.58 ± 0.27^{a}	1.49 ± 0.20^{ab}	0.98 ± 0.18^{ab}	2.95 ± 0.33	11.95 ± 1.08^{a}
Lowland	1.44 ± 0.08^{b}	3.46 ± 0.23^{b}	1.18 ± 0.17^{b}	0.45 ± 0.16^{b}	1.94 ± 0.28	8.47 ± 0.92^{b}
P-value	0.002	0.003	0.030	0.020	0.171	0.001
Wealth						
Poor	1.52 ± 0.13	4.15 ± 0.36	2.00 ± 0.27	1.31 ± 0.25	2.85 ± 0.44	11.83 ± 1.45
Medium	1.68 ± 0.13	3.55 ± 0.35	1.31 ± 0.26	0.53 ± 0.24	2.06 ± 0.43	9.13 ± 1.41
Rich	1.79 ± 0.14	4.47 ± 0.38	1.54 ± 0.28	1.01 ± 0.26	2.77 ± 0.47	11.58 ± 1.53
P-value	0.701	0.504	0.105	0.101	0.852	0.291
Edu. Level						
Illiterate	1.83 ± 0.15	4.29 ± 0.42	2.03 ± 0.32	1.62 ± 0.29	2.53 ± 0.51	12.3 ± 1.69
R&W	1.66 ± 0.16	3.75 ± 0.44	1.11 ± 0.33	0.41 ± 0.30	2.65 ± 0.54	9.58 ± 1.77
Grade 1-4	1.59 ± 0.16	3.93 ± 0.44	1.56 ± 0.33	0.83 ± 0.30	1.89 ± 0.54	9.8 ± 1.77
Grade 5-8	1.58 ± 0.14	4.27 ± 0.39	1.77 ± 0.29	0.93 ± 0.27	3.17 ± 0.47	11.72 ± 1.56
P-value	0.104	0.587	0.836	0.104	0.105	0.622
Overall district	1.67 ± 0.14	4.06 ± 0.38	1.62 ± 0.28	0.95 ± 0.26	2.56 ± 0.46	10.86 ± 1.52

a, b, ab: Least square means with different superscript within a column are significantly different (P<0.05)
N.B: Chicks (0-8 week age), Pullets and cockerel (8-20 weeks), Cocks and Hens>20 weeks
Agro-eco.: Agro-Ecology, Edu. Level: Education Level, R&W: Reading and Writing, SE: Standard Error

The mean number of chickens obtained in this study was comparable to the reported mean flock size of 7-10 mature chickens/households in Ethiopia and in South Ethiopia 9.22 chickens/household. This result was similar with Endale et al. [17] who reported that the flock size in south western zone was 11.22 per household. In contrary, this result was higher than Bikila [18] report in which the flock sizes per household were 3.81 in Chelliya district of Western Shewa. But this result was lower than Gebremariam et al. [19] report in which the flock size was 24 chickens per household and flock structure per household were 13.29, 1.72, 4.84, 0.46 and 3.7 for hens, cocks, pullets, cockerels and chicks in the Southern zone of Tigray, respectively. There were highest numbers of hens followed by chicks in the flock. This variation in hen number might be the farmers' interest to increase egg production for selling, consuming and hatching purposes. Also it might be there were no strong culling practice of unproductive old aged hens which increases the number of hens in the flock and most of chicks were lost by predators at brooding age when they scavenging feed and water.

The mean number of chickens per household was significantly (p<0.01) different at different agro-ecology. Significantly lowest (8.47 ± 0.92) chicken number was recorded from lowland of the study area. Comparably this result was higher at highland and midland but similar at lowland agro-ecologies to Aberra [20] result in which mean number of indigenous chickens reared at different agro-ecological zones of Ethiopia were 8.5, 7.4 and 8.4 at highland, midland and lowland agro-ecologies, respectively. According to Zemene [21] finding lowest numbers of chickens were obtained from highland (8.5) and midland (7.4) of Western Amhara and similar chicken flock size obtained from lowland (8.4) agro-ecologies with present finding. Highest number of chickens were reported by Ahimedin and Mangistu [22] in Gorogutu district of Eastern Hararghe, the mean number of chickens were 16.69, 17.76 and 18.79 at highland, midland and lowland agro-ecologies, respectively.

The mean number of cocks, hens, pullets and cockerels were significantly different (P<0.05) at different agro-ecologies **(Table 2)**. There were significantly (p<0.05) lowest numbers of cocks (1.44 ± 0.08), pullets (1.18 ± 0.17), cockerels (0.45

± 0.16) and hens (3.46 ± 0.23) at lowland. Significantly ($p<0.05$) highest number of cocks (1.95 ± 0.10) and hens (4.58 ± 0.27) were recorded in midland. This difference might be due to midland farmers' interest to increase egg production and to sell cocks by highest price. Cockerels (1.42 ± 0.36) and pullets (2.16 ± 0.39) were significantly highest at highland agro-ecology. This might be due to highland farmers want to replace parent and unproductive stocks by pullets and cockerels. Chicks were the second highest in flock which accounts 2.79 ± 0.64, 2.95 ± 0.33 and 1.97 ± 0.28 at highland, midland and lowland agro-ecologies, respectively. This might be some farmers at different agro-ecology control their chicks from predators at brooding age by incarcerating mother hens by skip, and provides feed and water. In this study there were no significant difference ($P>0.05$) in flock size at different wealth status, educational levels and at different interaction points **(Table 2)**.

Management systems of chickens

Feeding and watering systems: Feed and water are the basic necessity for growth, production and health of chickens. In rural area chickens search their feed by scavenging in almost all part of Ethiopia. According to the result of this study, 92.2% of the respondent uses scavenging with supplementary feeding system and 7.8% uses only scavenging system of feeding **(Table 3)**. This study is in line with that of Meseret [23] in Gomma wereda (97.8%), Addisu et al. [24] in North Wollo (89.87%), Emebet et al. [25] in Dawo and Seden Sodo district (96.3%) and Fisseha et al. [26] in Bure district (97.5%) practice scavenging system with supplementary feeding. In this study the respondents provide supplementary feed to their poultry to increase egg production (79.81%), to improve meat yield (7.37%) and for brooding hen (12.82%) to improve hatchability of eggs. About 52.24%, 45.39% and 2.37% of respondents were provide maize and wheat, maize and sorghum, and other (*theff*, barely, etc.) for chickens as a supplementary feed, respectively. This result was in agreement with Addisu et al. [24] in North Wollo of Amhara region 36.27%, 36.27% and 23.53% provides wheat, sorghum and maize for their chickens as a supplementary feed, respectively.

In this study, 80.8% of respondents provided supplementary feed for the whole groups of chickens together but only 19.2% give feed separately to different age class. Regarding to ways of feeding chickens, 74.91% provide feed throw on the ground for collective feeding, 24.31% provide on locally made feeding trough and 0.78% put feed in any container to fed chickens. This result shows highest percent of producers gave feed by locally made feeding trough and separately to different class than reported by Meseret [23] in Gomma wereda only 2.8% of producers provide supplementary feeds separately in different class and 100% give feeds throw on the ground. Almost 97.95% of the respondent in the study area provides water for chickens. This result was similar with Fisseha et al. [26] report 100% of the respondent provides water in Bure district of North West Ethiopia. Concerning the frequency (83.51%) free access, (6.08%) morning and evening, (1.39%) afternoon and evening and 9.02% of respondents provide water only at afternoon. Comparing to present result, highest percent of respondents (96%) in Ada'a and Lume district provides water free access to their chickens [27].

About 100%, 85.2% and 95.7% of the interviewed respondents practiced scavenging with supplementary feeding systems as a major feeding system in highland, midland and lowland areas, respectively **(Table 3)**. This result agrees with the report of Addisu et al. [24] in north Wollo of Amhara region who reported 80%, 97.17% and 89.87% of respondents provided supplementary feed in highland, midland and lowland altitudes, respectively. In this study, the major reason of farmers for supplementing chickens was to increase egg production and it accounts 93.3%, 72.3% and 80.6% at highland, midland and lowland, respectively **(Table 3)**. This result agrees with Ahimedin and Mangistu [22] report in which 86.7%, 86.7% and 90% of farmers in Gorogutu district provides supplementary feed to increase egg production at highland, midland and lowland, respectively.

Regarding to provision of water for chickens, 100%, 96.3% and 98.6% of respondents provides water at highland, midland and lowland areas, respectively. There were differences on watering frequency at different agro-ecologies of the study area. These differences might be due to access of water and farmers' awareness on providing water for chickens. The majority of the respondents 93.3% in highland, 78.8% in midland and 83.9% in lowland provided water in free access. According to Ahimedin and Mangistu [22] in Gorogutu district of Eastern Hararghe 50%, 66.7% and 50% of farmers at highland, midland and lowland provide water ad libitum for chickens, respectively.

Majority of chicken owners practice scavenging with supplementary feeding systems at different wealth status of producers **(Table 3)**. According to this study 91.5%, 93.6% and 90.9% of poor, medium and rich wealth leveled farmers provide supplementary feed to their chickens, respectively. The reason for supplementation at different wealth status was to increase egg production, to improve growth rate and for brooding. Most of farmers provide water free access to their chickens at different wealth levels which account 89.1%, 80.9% and 78.6% at poor, medium and rich wealth status, respectively. This result indicates poor and medium wealth farmers provide great emphasizes to care their chickens in terms of feed and water provisions and this might be due to the interest to get more money from this sector.

Table 3. Feeding and watering practice of chickens in Gena Bossa district.

Parameters	Agro-ecologies (%)			Wealth status (%)			Education level (%)				Overall
	HL	ML	LL	Poor	Medium	Rich	Illiterate	R&W	PFC	PSC	
Ways of Feeding											
Scavenging only		14.8	4.3	8.5	6.4	9.1	11.8	11.8	2.9	8.6	7.8
Scavenging with sup.	100	85.2	95.7	91.5	93.6	90.9	88.3	88.3	97.1	91.4	92.2
Supplementing time											
Morning	33.3	23.4	32.8	18.6	42.2	26.8	33.3	26.7	29.4	28.6	29.51
Morning and Evening	66.7	48.9	55.2	67.4	42.2	53.7	46.7	56.7	47.1	65.7	55.03
Supplementary feeds											
Maize and Wheat	86.7	55.3	37.3	41.9	62.2	43.9	60	36.7	44.1	54.3	52.24
Maize and Sorghum	13.3	38.3	62.7	58.1	37.8	48.8	33.3	60	55.9	45.7	45.39
Reason of supplementation											
To increase egg production	93.3	72.3	80.6	81.4	75.6	80.5	86.7	56.7	82.4	88.6	79.81
To improve meat yield	6.7	14.9	3	2.3	11.1	7.3	3.3	13.3	5.9	5.9	7.37
For brooding	-	12.8	16.4	16.3	13.3	12.2	10	30	11.8	5.7	12.82
Supplementing ways											
Separately	13.4	34	6.7	14	20	26.8	13.3	23.3	17.6	22.9	19.2
Together to all class	86.6	66	93.3	86	80	73.2	86.7	76.7	82.4	77.1	80.8
Ways of feeding systems											
Throw on the ground	100	68.1	68.7	72.1	73.3	70.7	100	83.3	52.9	60	74.91
Locally made trough	-	29.8	31.3	27.9	26.7	26.8	-	13.3	47.1	40	24.31
Frequency of watering											
Free access	93.3	78.8	83.9	89.1	80.9	78.6	90.9	71	80	88.6	83.51
Morning and Evening	-	-	13.2	4.5	6.4	9.5	3	6.5	8.6	8.6	6.08
Afternoon and Evening	-	-	2.9	-	2.1	2.4	-	6.5	-	-	1.39
Afternoon only	6.7	20.4	-	6.5	10.6	9.5	6.1	16.1	11.4	2.9	9.02

HL: Highland; ML: Midland; LL: Lowland; PFC: Primary First Cycle; PSC: Primary Second Cycle; R&W: Reading and Writing; Sup.: Supplementary

Regarding to farmers with different education level 88.3%, 88.3%, 97.1% and 91.4% of illiterate, reading and writing, primary first and second cycle educated farmers follows scavenging with supplementary feeding systems, respectively **(Table 3)**. This result indicates most of educated farmers gave care and provide supplementary feed to improve production performance of chickens. Most of farmers provide supplementary feed to their chickens together to the whole group but few farmers provide separately to different age classes. When level of education increases, farmers understanding on usage of providing water and other cares given for chickens also increased. The probability of practicing proper feeding and water provision for chicken was significantly and positively influenced by education level of producers [28]. Most of respondents those were illiterate (90%), reading and writing (71%), primary first cycle (80%) and primary second cycle (88.6%) educated farmers provide water free access to chickens and the rest of farmers provide at different times **(Table 3)**.

Housing systems of chickens: Based on this study, only 10.4% of the respondents constructed separate house for their chickens **(Table 4)**. This study agrees with that of Tarekegn et al. [29] who reported 13.5% of the producers provided separate houses for chickens. This result also agrees with the report of Addisu et al. [24] in which only 15.36% of respondents in North Wollo of Amhara region constructed separate chicken house. This result was higher than those reported by Meseret [23] for chickens in Goma district which was 3.6%. In contrary, this result was lower than Solomon et al. [15] reports in Metekel zone of North West Ethiopia 48% of respondents constructed separate house and Desalew [27] 91.11% in Ada'a and 95.6% in Lume districts constructed separate house for chickens. About 96.12% of the respondent cleaned poultry houses daily (58.66%) and weekly (32.95%). Majority (89.6%) of the farmers had no separate chicken house, even if, they had no separate house they clean chickens bedding place in which they shelter for night. This result was comparable to the report of Fisseha et al. [30] for Fogera majority of respondent's clean chicken house/shelter daily and the remaining 20.8% clean weekly.

Table 4. Housing system of indigenous chickens in the study area.

Parameters	Agro-ecology (%)			Wealth status (%)			Education level (%)				Overall
	HL	ML	LL	Poor	Medium	Rich	Illit.	R&W	PFC	PSC	
Separate house											
Yes	-	3.7	20.3	4.3	19.1	11.4	8.8	5.9	14.3	17.1	10.4
No	100	96.3	79.7	95.7	80.9	88.6	91.2	94.1	85.7	82.9	89.6
Cleaning house											
Yes	93.3	96.3	97.1	95.7	95.7	97.7	91.2	97.1	97.1	100	96.12
No	6.7	3.7	2.9	4.3	4.3	2.3	8.8	2.9	2.9	-	3.88
Cleaning frequency											
Daily	71.4	61.5	52.2	71.1	71.1	30.2	41.9	45.5	58.8	82.9	58.66
Weekly	21.4	25	43.3	24.4	24.4	53.5	48.4	42.4	35.3	11.4	32.95
Control movement											
Yes	25	40	51.6	33	46	37.6	30.3	32.9	43.1	49.1	38.8
No	75	60	48.4	67	54	62.4	69.7	67.1	56.9	50.9	61.2
Why control											
Protect disease transmission	33.8	77.8	24.4	40	51.6	39.1	33.3	44.4	45	50	43.94
Protect predator losses	22.2	22.2	75.6	60	48.4	60.9	66.7	55.6	55	50	56.06

PFC: Primary First Cycle; PSC: Primary Second Cycle; R&W: Reading and Writing; HL: Highland; ML: Midland; LL: Lowland; Illit.: Illiterate

Majority of the respondents' clean poultry houses at highland (93.3%), midland (96.3%) and lowland (97.1%) agro-ecologies. Regarding to the frequency of cleaning chicken houses, about 71.4%, 61.5% and 52% of the farmers clean chicken house daily at highland, midland and lowland agro-ecologies, respectively **(Table 4)**.

Housing system of chickens at different wealth status of the respondents was shown in **Table 4**. Only few farmers constructed separate house for their chickens which accounts 4.3%, 19.1% and 11.4% of poor, medium and rich wealth status of respondents, respectively. This difference might be due to high cost of building house, lack of training and knowledge about the importance of constructing separate house for chickens. As the annual income of the farmers increased, the likelihood of farmer's decision to adopt improved chicken housing systems increased [28]. Cleaning poultry house prevents the occurrence of diseases and about 95.7%, 95.7% and 97.7% of poor, medium and rich wealth leveled respondents clean chicken houses at different time, respectively. About 33% poor, 46% medium and 37.6% rich farmers control free movement of chickens to protect disease transmission and losses by predators.

Comparably highest percent of primary first (14.3%) and second cycle (17.3%) educated farmer constructed separate house for chickens. But illiterate and reading and writing leveled farmers also constructed separate house but lower

than educated farmers **(Table 4)**. Hundred percent of primary second cycle educated farmers clean poultry house which implies when education level increases level of understanding about the importance of separate house and cleaning poultry house also increases. About 49.1% of primary second cycle, 43.1% of primary first cycle, 32.9% of reading and writing and 30.3% of illiterate farmers' controls free movement of chickens to protect disease transmission and losses by predators. So, educated farmers control free movement of chickens and provide great emphasizes for their chickens to improve flock productivity.

Breeding and culling practices of indigenous chickens: There were no controlled and systematic breeding practice in the study area and most of the time aggressive cocks mate hens that reared at home as well as neighbor that might had high or low egg production performance and growth rate. In this study, 57.4% of producers select chickens for breeding based on egg production (83.09%) followed by growth rate and feather color of the parent stocks **(Table 5)**. This result agrees with that of Solomon et al. [15] in which 63.1% of farmers trying to improve genetic potential of local chickens based on egg production (59.4%), body weight (44.3%) and feather color in Metekel zone. This kind of selection was not scientifically sound way but farmers' choice hens from a flock which produce highest number of eggs.

Table 5. Breeding and culling practice of chickens in the study area.

Parameters	Agro-ecology (%)			Wealth status (%)			Education level (%)				Overall
	Highland	Midland	Lowland	Poor	Med.	Rich	Illiterate	R&W	PFC	PSC	
Selection practice											
Yes	66.7	64.8	47.8	46.8	66	56.8	35.3	41.2	65.7	82.9	57.4
No	33.3	35.2	52.2	53.2	34	43.2	64.7	58.8	34.3	17.1	42.6
Feather color	-	14.3	9.1	22.7	6.4	4	-	14.3	13	10.3	9.41
Egg production	90	80	81.8	72.8	87.2	84	91.7	85.7	78.3	79.4	83.09
Growth rate	10	5.7	9.1	4.5	6.4	12	8.3	-	8.7	10.3	7.5
Culling practice											
Yes	46.7	38.9	55.1	36.2	61.7	45.5	32.4	35.3	57.1	65.7	47.46
No	53.3	61.1	44.9	63.8	38.3	54.5	67.6	64.7	42.9	34.3	52.54
Ways of culling											
By selling	85.7	14.3	36.8	47.1	24.1	40	36.4	25	35	39.3	38.37
By giving gift	14.3	-	13.2	5.9	6.9	15	9.1	8.3	10	8.7	9.14
By consuming	-	85.7	50	47.1	69	45	54.5	66.7	55	52.2	52.49

PFC: Primary First Cycle; PSC: Primary Second Cycle; R&W: Reading and Writing; Med.: Medium

Breeding practice varies at different agro-ecologies of the study area **(Table 5)**. Comparatively lowest numbers of farmers practice selecting indigenous chicken for breeding at lowland (47.8%) than midland (64.8%) and highland (66.7%) agro-ecologies. Egg production performance was the main criteria for selection at highland, midland and lowland agro-ecologies which accounts 90%, 80% and 81.8%, respectively. This result agrees with Ahimedin and Mangistu [22] report egg production was the primary criteria for selecting chickens for breeding at highland (96.7%), midland (76.6%) and lowland (86.7%) agro-ecologies of Gorogutu district. Depending on egg production performance, growth rate and feather color 100%, 82.9% and 75.8% of farmers at highland, midland and lowland choice both sexes of chickens for selection, respectively. Regarding feather color, most of farmers select chickens with golden color in highland and lowland which accounts 46.7% and 55.1%, respectively. But at midland farmers selects both red and golden feather colors which account 37% and 35.2%, respectively. Concerning culling 46.7%, 38.9% and 55.1% of respondents cull their chickens by selling, giving gift and consuming chickens at highland, midland and lowland agro-ecologies, respectively **(Table 5)**.

Lowest percent of poor (46.8%) farmers practice selection for breeding comparing to medium (66%) and rich (56.8%) respondents **(Table 5)**. This difference might be due to poor farmers have low income to select and buy chickens with high production performance and growth rate to improve parent stock in the flock. Most of poor, medium and rich farmers select both males and females at the same time for

breeding that accounts 86.4%, 90.3% and 68%, respectively. Egg production was the main criteria to select chickens for poor, medium and rich wealth level farmers which account 72.8%, 87.2% and 84%, respectively. The most dominant color preferred by medium and rich farmers were golden which accounts 61.7% and 40.9%, respectively but poor farmers mostly interested on both red (44.7%) and golden (36.2) feather colored chickens. Highest percent (61.7%) of medium economic leveled farmers cull their chickens which was comparably more than poor (36.2%) and rich (45.5%) wealth status of farmers. Those farmers cull sick, unproductive and unwanted feather colored chickens by selling, giving gift and consuming at home.

Most of primary first (65.7%) and primary second (82.9%) cycle educated farmers practice selection for breeding. This difference indicates when education level increases selection for breeding to improve production performance of the flock also increases. Educated farmers may be likely to be contacted by agricultural extension workers looking for model farmers to test innovations which improve productivity [31]. The main criterion for selection was egg production which accounts 91.7%, 85.7%, 78.3% and 79.4% of illiterate, reading and writing, primary first and second cycle educated farmers, respectively **(Table 5)**. Regarding to culling of chickens 32.4% illiterate, 35.3% reading and writing, 57.1% primary first cycle and 65.7% primary second cycle educated farmers practices culling sick, old aged unproductive and unwanted feather colored chickens by selling, giving gift and consuming at home.

Health control mechanism: Health is the main factor that affects production performance of chickens at village as well as commercial production levels. Disease affects the flocks of indigenous chickens in the study area. Most affecting disease in this study was Newcastle disease (ND) (locally "*fengile*") (79.77%) and rest of flocks affected by Coccidiosis (locally "*Tekimat"*) and chronic respiratory disease (CRD) (locally "*gunfan*"). This result agrees with Addisu et al. [24] report in North Wollo, ND was the most prevalent and economically important disease affecting village chicken production (85.91%). This finding was also in agreement with the reports that major causes of village chicken death is ND outbreak in Bure district [26], in Gomma district [23], in four region of Ethiopia (Oromia, Amhara, SNNP and Tigray) [32] and in north Gonder zone [33].

Most of respondents could not use vaccination (68.58%) but only 31.42% vaccinated chickens to protect chickens from different diseases **(Table 6)**. Mostly affected classes in the flock were chicks (76.40%) followed by layers, pullets and cockerels, and cocks. This might be scavenging systems of feeding and watering exposes the chicken to different disease causing organisms and chicks are the most susceptible group than the older ones. Also it might be due to lack of full package vaccination and lack of practicing vaccination. This result agrees with Bosenu and Takele [34] reports 91.67% chicks were affected by diseases in Haramaya district. Only 11.8% of the respondents use modern medicine to treat their chickens but 88.2% uses traditional medicines like lemon juice, ginger and onion to treat diseases.

Table 6. Health care practices and common diseases of chickens at different agro-ecology, wealth and education level of respondents.

Parameters	Agro-ecology			Wealth status			Education level				Overall
	HL	ML	LL	Poor	Med.	Rich	Illiterate	R&W	PFC	PSC	
Annual vac.											
Yes	26.7	33.3	31.9	29.8	40.4	25	11.8	38.2	31.4	45.7	31.42
No	73.3	66.7	68.1	70.2	59.6	75	88.2	61.8	68.6	54.3	68.58
Common disease											
Coccidiosis	13.3	9.3	14.5	12.8	19.1	4.5	14.7	8.8	11.4	14.3	12.27
CRD	6.7	11.1	5.8	12.8	-	11.4	8.8	8.8	5.7	8.6	7.96
ND	80	79.6	79.7	74.5	80.9	84.1	76.5	82.4	82.9	77.1	79.77
Treatments											
Traditional	85.8	88.2	90.6	92.1	88.9	83.6	94.1	90.3	87.5	80.9	88.2
Modern	14.2	11.8	9.4	7.9	11.1	16.4	5.9	9.7	12.5	19.1	11.8

HL: Highland; ML: Midland; LL: Lowland; Med.: Medium; PFC: Primary First Cycle; PSC: Primary Second Cycle; R&W: Reading and Writing; vac.: Vaccination

Prevalence of disease was comparable at different agro-ecological zones in the study area. Newcastle disease was highly prevalent diseases in highland (80%), midland (79.6%) and lowland (79.7%) agro-ecologies **(Table 6)**. Farmers could not differentiate type of disease but they knew the symptoms of diseases like bloody diarrhea, nasal discharge, sneezing, torticollis, dropping wings, inability to drink and eat properly and deaths within few days. According to veterinarian these symptoms are referring ND. This result contradicts to Bikila [18] report at Chelliya district of Western Shewa highest prevalence of ND occurs at highland agro-ecologies (96.7%) than midland (73.3%) but in this study there were comparably similar occurrences of ND at different agro-ecologies of the district. About 85.8%, 88.2% and 90.6% of chicken producers use traditional medicines like lemon juice, ginger and onion to treat diseases locally to treat chickens affected by different diseases at highland, midland and lowland, respectively.

Only few respondents practice vaccinations in highland (26.7%), midland (33.3%) and lowland (31.9%) agro-ecologies. This result agrees with Ahimedin and Mangistu [22] in Gorogutu district 13.3%, 10% and 16.7% of farmers practice vaccination for chickens at highland, midland and lowland areas, respectively. This might be due to lack of medicine for vaccination and lack of awareness given to protect chickens from disease through vaccination. This result agrees with N'Goran et al. [35] report in Kohogo area of Côte d'Ivoire, only 34.5% of village chicken producers vaccinated their chickens against ND and the main reasons of producers those could not practice vaccination were lack of knowledge of the existence of vaccination as a mean of prevention of ND and lack of financial source. In this finding mostly affected class in the flock was chicks at highland (66.7%), midland (64.8%) and lowland (91.3%). This might be due to lack of proper and clean house, scavenging system of feeding and lack of health care given to chicks. According to Addisu et al. [24] report about 84%, 83% and 83.02% of chicks were highly sensitive and susceptible for disease than younger and elder at highland, midland and lowland areas of north Wollo, respectively.

The prevalence of ND at different wealth level was 74.5%, 80.9% and 84.1% at poor, medium and rich wealth status of respondents, respectively. Regarding to annual vaccination; only 29.8%, 40.4% and 25% of poor, medium and rich wealth leveled farmers practice annual vaccination for chickens, respectively **(Table 6)**. Since the lowest number of rich farmers use vaccination, the prevalence of ND was highest in this group and this might be due to low attention is given to the sector because of the low contribution of money to the household.

Comparably highest percent of primary second cycle (45.7%) educated farmers practice annual vaccination that was highest than that of illiterate (11.8%), reading and writing (38.2%) and primary first cycle (31.4%) educated farmers **(Table 6)**. This result shows educated farmers gave care and took awareness for their chickens to improve flock size as well as productivity by vaccinating their chickens. Highest percent of illiterate (84.1%) farmer chickens were affected by ND. Mostly affect classes of chickens in the flock was chicks which accounts 73.5%, 79.4%, 77.1% and 75.4% at illiterate, reading and writing, primary first and second cycle educated respondents, respectively.

Constraints of village chicken production

There were different challenges that reduce indigenous chickens in traditional/scavenging extensive production systems in Ethiopia. Based on the result of this study predators (1^{st}), disease (2^{nd}), feed shortage (3^{rd}), market access (4^{th}), thieves (5^{th}), lack of veterinary service (6^{th}), lack of knowledge about scientific management practice (6^{th}) and lack of time for farm activities (8^{th}) were the major constraints which affects chicken production **(Table 7)**. All of the constraints listed in **Table 7** hinder village chicken production systems at different agro-ecologies, wealth status and education levels of the producers in the study area. Predator, disease and feed were the most common bottleneck of village chicken production but the rest challenges varies in the severity rank at different agro-ecology, wealth status and education level of the farmers.

The most important constraint that reduces chicken production performance in this study that ranked first was predator with index value of 0.209. The predator loss might be due to improper housing system and extensive scavenging production system of feeding and watering. Diseases and feed shortage were also challenges in present study that hinder chicken production and this might be due to lack of vaccination, lack of clean feeders and waterier, and absence of sufficient supplementing feeds. This result agrees with Feleke et al. [36] in which predator (1^{st}), flock mortality (2^{nd}), disease (3^{rd}), low production (4^{th}), feed shortage (5^{th}), breed (6^{th}) and market access (7^{th}) were the major constraints in Arbegona Woreda at Sidama Zone. Also it agrees with report which says disease (1^{st}), predators (2^{nd}), shortage of supplementary feeds (3^{rd}), poultry housing problem (4^{th}), and lack of veterinary and extension services (5^{th}) are the most important constraints which affect village poultry production in Northern Godar of Amhara region.

Table 7. Constraints of traditional chicken production systems in Gena Bossa district.

Constraints	Disease	Feed	Predator	Thieves	Market	Time	Veterinary Service	Knowledge
Agro.								
HL	0.176 (2)	0.135 (4)	0.213 (1)	0.117 (5)	0.104 (6)	0.044 (8)	0.070 (7)	0.141 (3)
ML	0.199 (2)	0.168 (3)	0.218 (1)	0.059 (7)	0.141 (4)	0.059 (7)	0.076 (5)	0.076 (5)
LL	0.197 (2)	0.168 (3)	0.208 (1)	0.082 (5)	0.125 (4)	0.077 (7)	0.078 (6)	0.063 (8)
Wealth								
Poor	0.196 (2)	0.160 (3)	0.210 (1)	0.082 (5)	0.131 (4)	0.069 (8)	0.074 (7)	0.076 (6)
Med.	0.195 (2)	0.163 (3)	0.210 (1)	0.088 (5)	0.119 (4)	0.072 (8)	0.078 (6)	0.073 (7)
Rich	0.188 (2)	0.165 (3)	0.205 (1)	0.082 (5)	0.131 (4)	0.075 (7)	0.074 (8)	0.078 (6)
Edu.								
Illit.	0.188 (2)	0.159 (3)	0.208 (1)	0.073 (7)	0.127 (4)	0.099 (5)	0.069 (8)	0.077 (6)
R&W	0.194 (2)	0.162 (3)	0.209 (1)	0.091 (5)	0.131 (4)	0.069 (7)	0.069 (7)	0.076 (6)
PFC	0.194 (2)	0.157 (3)	0.205 (1)	0.094 (5)	0.125 (4)	0.073 (8)	0.076 (6)	0.076 (6)
PSC	0.189 (2)	0.166 (3)	0.208 (1)	0.083 (6)	0.120 (4)	0.078 (7)	0.085 (5)	0.068 (8)
Overall	0.193 (2)	0.162 (3)	0.209 (1)	0.086 (5)	0.127 (4)	0.073 (8)	0.075 (6)	0.075 (6)

Agro.: Agro-Ecology; Edu.: Education; HL: Highland; ML: Midland; LL: Lowland; Med.: Medium; Illit.: Illiterate; R&W: Reading and Writing; PFC: Primary First Cycle; PSC: Primary Second Cycle; Numbers in the Bracket: Rank; Numbers out of Bracket: Index Value

Opportunity of village chicken production

There were highest numbers of challenges that affects chicken production and causes chicken losses in the study area. On the other hand, there were opportunities to improve chicken production in the study area which was show in **Table 8**. The major opportunity of chicken production in the study area was feed access with the index value of 0.298. This implies majority of farmers cultivate crop for home consumption and for source of income. So, farmers provide cereal grain produced for other purposes to their chickens to increase egg production and to improve growth rate of chickens. Also they got additional feed from market and mill leftover to their chickens. The second, third, fourth and fifth opportunities of chicken production were veterinary and extension service, market access, training and credit service with index values of 0.217, 0.176, 0.171 and 0.138, respectively. This result was comparable to Shishay et al. [37] funding in which feed access, market access, drinking water access and ease management of village chickens were the main opportunities in Western Zone of Tigray at Northern Ethiopia. It also agrees with the result of Feleke et al. [36] in which market access, feed access, credit service and extension service were the main opportunities of chicken production in Arbegona Woreda of Sidama Zone in Southern Ethiopia. Market access, credit service, feed access and training and extension were the major opportunities of chicken production in the Debsan Tikara of Gonder Zuria woreda at North Gonder [38].

Table 8. Opportunity of traditional chicken production systems in Gena Bossa district.

Opportunities	Market access	Feed access	Veterinary service	Training	Credit service
Agro-ecology					
Highland	0.184 (3)	0.300 (1)	0.224 (2)	0.170 (4)	0.121 (5)
Midland	0.173 (3)	0.308 (1)	0.212 (2)	0.167 (4)	0.139 (5)
Lowland	0.172 (3)	0.306 (1)	0.2139 (2)	0.171 (4)	0.138 (5)
Wealth					
Poor	0.168 (3)	0.304 (1)	0.219 (2)	0.170 (4)	0.138 (5)
Medium	0.171 (3)	0.312 (1)	0.205 (2)	0.164 (4)	0.148 (5)
Rich	0.181 (3)	0.303 (1)	0.218 (2)	0.174 (4)	0.123 (5)
Education					
Illiterate	0.169 (3)	0.314 (1)	0.213 (2)	0.155 (4)	0.148 (5)
R&W	0.186 (3)	0.298 (1)	0.218 (2)	0.170 (4)	0.128 (5)
PFC	0.158 (3)	0.304 (1)	0.209 (2)	0.189 (4)	0.140 (5)
PSC	0.165 (3)	0.316 (1)	0.220 (2)	0.165 (3)	0.132 (5)
Overall (District)	0.176 (3)	0.298 (1)	0.217 (2)	0.171 (4)	0.138 (5)

R&W: Reading and Writing; PFC: Primary First Cycle; PSC: Primary Second Cycle; Numbers in the Bracket: Rank; Numbers out of Bracket: Index

CONCLUSION AND RECOMMENDATION

This result shows that average flock size per household was 10.86 and about 92.2% of village chicken producers follow scavenging feeding system with occasional supplementation. Only 10.4% of the respondents constructed separate house for chickens. Highest numbers of chickens were affected by ND and only 31.42% of farmers use annual vaccination to prevent chickens from diseases. The following recommendations are suggested based on the result of the current study [39,40]:

- Full package vaccination reduces the outbreak of different diseases which hinder chicken production and it also increases survival rate of chickens. So, government should provide vaccination for chickens to prevent loss of chickens by disease out breaking especially ND.
- Training improves farmer's awareness in order to improve ways of feeding, housing and vaccinating chickens to increase chicken production performance. So, government should organize training for farmers on disease control, housing and feeding of chickens to improve chicken productivity.
- Farmers should protect chickens from predators by constructing shelter from locally available materials.
- Provision of credit service to traditional chicken producers and linking the production system with marketing will encourage chicken owners to boost up production.

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