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Research Article

Performances, Breeding Practices and Trait Preferences of Local Chicken Ecotypes in Southern Zone of Tigray, Northern Ethiopia

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Abstract

Background: Indigenous chickens in Ethiopia are found in large numbers distributed across different agro-ecologies under traditional scavenging management system and are reared as a source of animal protein and income to many of the rural populations. Identifying farmer's selection practices, traits of economic importance as perceived by farmers, market value and consumers preference and investigate the existence of genotypes raised and their attributes. This study was carried out in Southern zone of Tigray region to generate information on performances, breeding practice and trait preferences of indigenous chicken. **Methodology:** From randomly selected three districts 210 chicken producers were interviewed and focus group discussions were conducted to gather valuable information. Descriptive statistics and PROC GLM of SAS, version 9.2 was employed to analyse data. Figure and tables were used to present results. **Results:** Broody hens were the sole means of egg incubation and chick brooding method in the study area. The average age of male at first mating and female at first egg were 6.23 ± 0.06 and 6.74 ± 0.05 months, respectively. The number of clutch per hen per year, eggs per clutch and total eggs produced per hen per year were 4.25 ± 0.07 , 14.9 ± 0.32 and 63.2 ± 1.75 eggs, respectively. The hatchability and survival rate of chicks were 84.22 and 58.71%, respectively. Most chicken keepers in the study area had the tradition of selecting chicken for breeding stock. Body size, plumage color, body conformation, comb type, egg production performance and responsiveness to predators were the major means of selection. **Conclusion:** The survey indicated that performances in terms of egg production and fertility traits of indigenous chickens are low, producers local chicken trait preferences are subjective and breeding practices are traditional. Therefore, appropriate interventions particularly on the improvement of breed and breeding management are required to enhance overall productivity.

Key words: Local chicken, performance, breeding practices, trait preferences, survey

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Animal production in general and chickens in particular play important socioeconomic roles in developing countries^{1,2}. Provision of animal protein, generation of extra cash incomes and religious/cultural considerations are amongst the major reasons for keeping village chickens by rural communities³.

Indigenous chickens in Ethiopia are found in large numbers distributed across different agro-ecologies under traditional scavenging management system indicating that they are important avian resources reared as a source of animal protein and income to many of the rural populations⁴. Thus, their widespread distribution indicates their adaptive potential to the prevailing environment, disease and other stresses. According to CSA⁵, the total chicken population in the country is estimated to be 44.89 million of which 43.3 million (96.46%) are indigenous chickens, indicating the significance of local chickens as potential resource of the country. The total chicken egg and meat production in Ethiopia is also estimated to be about 78,000 and 72,300 metric tons, respectively⁴ from which more than 90% of the national chicken meat and egg output is contributed by local chickens⁶. However, the economic contribution of the sector is not still proportional to the huge chicken numbers, attributed to the presence of many productions, reproduction and infrastructural constraints⁷.

Furthermore, the indigenous chickens are good scavengers and foragers, well adapted to harsh environmental conditions and their minimal space requirements make chicken rearing a suitable activity and an alternative income source for the rural Ethiopian farmers^{8,9}. The indigenous chicken is also considered as gene reservoirs, particularly of those genes (naked neck) that have adaptive values in tropical conditions¹⁰. In addition, the local chicken sector constitutes a significant contribution to human livelihood and contributes significantly to food security of poor households.

To unlock the potential of indigenous chicken to improve household livelihoods, high producing and adapted indigenous chicken genotypes that meet market demands should be identified and sustainable genetic improvement programs that account for producer multiple objectives, market requirements and production circumstances developed⁹. Developing appropriate breeding programs for village conditions requires characterization of production circumstances and identification of breeding practices and trait of economic importance to farmers¹¹. Identifying farmer's selection practices, traits of economic importance as perceived by farmers, marketers and consumers and investigate the existence of genotypes raised and their attributes¹². Therefore,

the objective of the study was to generate base line information on performances, breeding practice and trait preferences of indigenous chicken production under smallholder producers.

MATERIALS AND METHODS

Study area: The study was conducted from 2012-2013 in Southern zone of Tigray, Northern Ethiopia. Randomly selected districts namely; Raya Azebo, Endamehoni and Ofla were considered (Fig. 1). These areas are situated at the range of 12°15'N to 13°00'N and 39°10'E to 39°50'. They have altitude ranges from 930-3925 m a.s.l. The mean annual temperature varies from 9 -28°C and the mean annual rainfall ranges¹³ from 400-912 mm.

Study design: Questionnaire survey and focal group discussions on local chicken performances, breeding practice and trait preferences were conducted in three selected districts. A total of 210 households rearing indigenous chicken were randomly selected and interviewed using structured questionnaire. Huge chicken production potential, indigenous skills of producers on chicken rearing and no previous study conducted in areas were base for selecting the research sites. Group discussions were made with focus group established at each PAs with group comprising 5-8 members. Members of the focal groups include elder people believed to be knowledgeable about past and present chicken keeping trends, women, children and extension agents.

Statistical analysis: Descriptive statistics such as mean, frequency and percentage were used to analyze the data using SAS version 9.2¹⁴. General linear model procedures (PROC GLM) of the SAS were employed for performance traits to detect statistical differences among sampled indigenous chickens in the three districts. Indexes were calculated to provide ranking according to a formula; $\text{Index} = \frac{\sum \text{of (3 for rank 1+2 for rank 2+1 for rank 3)}}{\sum \text{of (3 for rank 1+2 for rank 2+1 for rank 3)}}$ for overall attribute (reasons).

RESULTS AND DISCUSSION

Purpose of keeping local chickens in the study districts:

Chicken farming is commonly practiced as a sideline activity and none of the respondents specialized with it. However, advantages and uses of chicken farming in the context of

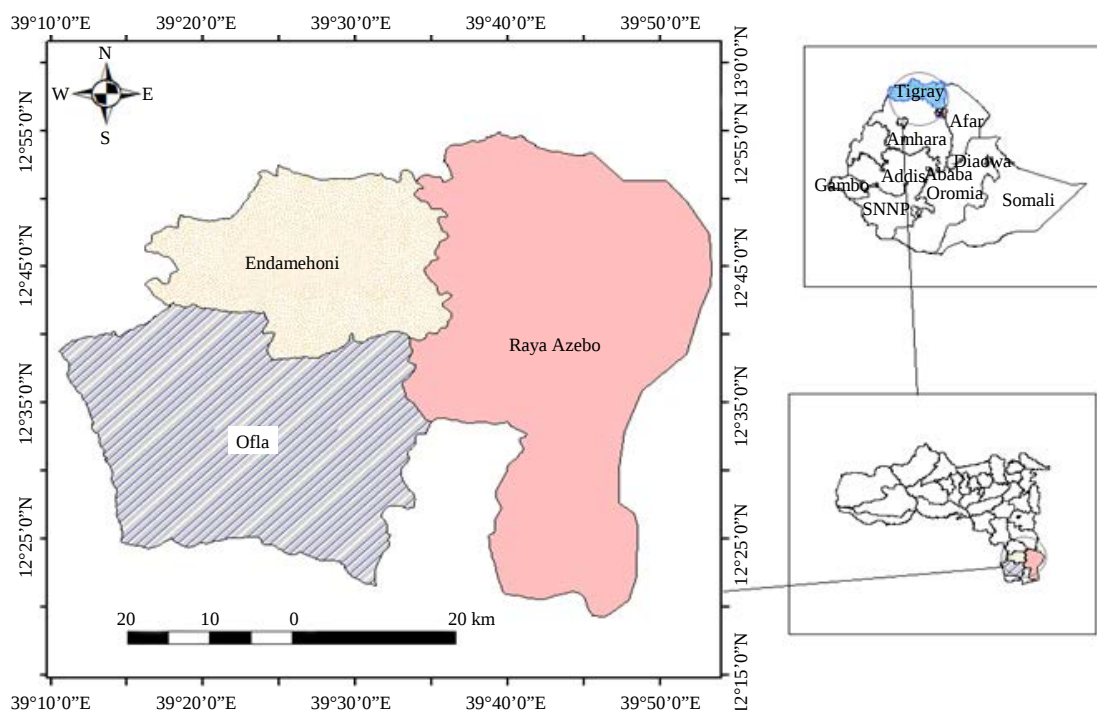


Fig. 1: Map of the study area in the Tigray region

Table 1: Purpose of village chicken rearing and eggs in the study districts

Districts	Purpose of chickens					Purpose of egg produced		
	Income	Breeding	Consumption	Egg production	Cultural/religious ceremonies	Hatching	Income	Consumption
Endamehoni								
Rank1	50	16	3	1	-	31	34	4
Rank2	6	21	30	13	-	28	15	11
Rank3	-	9	20	25	16	9	7	25
Index	0.39	0.23	0.21	0.13	0.04	0.44	0.39	0.17
Oflla								
Rank1	52	12	4	2	-	36	30	3
Rank2	13	22	20	12	3	19	36	9
Rank3	1	6	20	10	33	2	0	28
Index	0.44	0.20	0.17	0.10	0.09	0.41	0.44	0.15
Raya Azebo								
Rank1	41	7	17	5	-	42	16	11
Rank2	7	38	9	7	9	23	27	16
Rank3	5	12	22	11	20	0	0	32
Index	0.34	0.25	0.22	0.10	0.09	0.46	0.27	0.26

smallholder farmers were multi-faceted (Table 1). The results of rankings from all districts had shown that sale of live birds as source of cash income was the first most important function of rearing chicken followed by egg hatching for breeding stock and home consumption, egg production and use of chicken for cultural and/or religious ceremonies. Similarly, Moges *et al.*⁴ reported that the major purposes of chicken rearing in Bure district were: Sale for cash income (51%), egg hatching for breeding/replacement stock (45%), home

consumption (44%), egg production (40.7%) and use of chicken for cultural and/or religious ceremonies (36.4%) in the order of importance.

According to Endamehoni and Raya Azebo village chicken owners uses of eggs for hatching was ranked first followed by sale for cash income and home consumption. This is similar to Moges *et al.*⁴ reported that use of eggs for hatching (71.7%) was the first function of eggs in Bure woreda of Northwest Amhara followed by sale for cash income (58%) and home

consumption (68.6%). However, the present study revealed that the sale of eggs for cash income was the most important function of eggs in Ofra district followed by use for hatching and home consumption.

Traditional broodiness breaking methods: The survey indicated that broodiness characteristics were common and about 77.1, 65.7 and 58.6% of the households in Raya Azebo, Endamehoni and Ofra practice the traditional methods of breaking broodiness respectively. Respondents revealed as a hen resumes laying of eggs there is an increase in the number of eggs obtained from a single bird in a certain period of time. This is in agreement with Duressa¹⁵ and Tadelles¹⁶ who reported that traditionally households attempted to break broodiness to resume egg laying with the final goal of increasing egg productivity. According to the report of respondents in Raya Azebo (28.57%), Endamehoni (27.14%) and Ofra (18.57%) taking to neighborhood villages was the

main methods to break broodiness followed by tying wings (12.86%) in both Raya Azebo and Endamehoni and tying legs (17.14%) in Ofra (Fig. 2).

Incubation, hatching and chick survival: From the survey, it is observed that exclusively natural incubation and hatching is practiced. About 79.05% of the respondents incubate chicken eggs at dry season while 20.95% of the respondents incubate chicken eggs at any time. This might be because at this seasons the availability of scavenging and feed supplements are abundant and hot climate is conducive to provide good temperature for hatching eggs. The average number of eggs incubated using a broody hen was 12.6 out of the average 14.9 eggs laid per clutch per hen. On an average relatively high number (10.5 chicks) were hatched. However, the average survival rate of chicks to 8 weeks age was 6.23 chicks which is low indicating high mortality of chicks (Table 2). This was because of the fact that artificial chick

Table 2: Production and reproduction performances (Mean $\pm$ SE) of indigenous chickens

	Districts			
Traits	Endamehoni	Ofa	Raya Azebo	Overall mean
Reproductive traits				
Average age of cockerels at 1st mating (month)	6.43±0.10 ^a	6.37±0.09 ^a	5.90±0.10 ^b	6.23±0.06
Average age of pullets at 1st egg (month)	6.97±0.10 ^a	6.89±0.09 ^a	6.37±0.09 ^b	6.74±0.05
Number of clutches per hen per year	3.97±0.10 ^b	4.11±0.13 ^b	4.66±0.12 ^a	4.25±0.07
Average number of eggs per clutch	14.10±0.47 ^b	14.30±0.49 ^b	16.30±0.64 ^a	14.90±0.32
Estimated total egg production per hen per year	55.98±2.50 ^b	58.77±2.74 ^b	75.96±3.35 ^a	63.20±1.75
Productive traits				
Frequency of egg set to broody hen per year	2.47±0.06 ^{ab}	2.34±0.06 ^b	2.59±0.06 ^a	2.47±0.03
Average number of eggs set to broody hen	12.00±0.30	12.60±0.35	13.40±0.34	12.60±0.19
Average hatch rate	10.00±0.26	10.60±0.28	10.90±0.31	10.50±0.16
Percentage of hatchability (%)	84.09	86.37	82.21	84.22
Survival rate of chicks to 8 weeks age	6.17±0.25	6.09±0.27	6.43±0.35	6.23±0.17
Percentage of survival rate of chicks to 8 weeks age (%)	60.68	57.06	58.40	58.71

^{a,b}Means in the same row with different superscripts are significantly different ($p < 0.05$), SE: Standard error

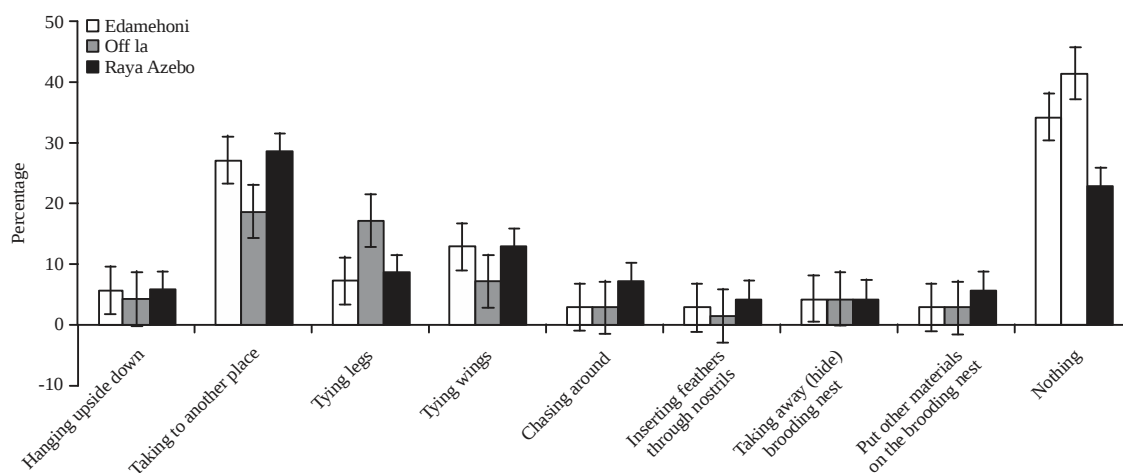


Fig. 2: Traditional methods in breaking broodiness of indigenous chickens

rearing was not widely practiced and hens were left to roam with chicks, exposing chicks to cold weather, predators and diseases. This shows that there is a need to put effort on reducing chick mortality of the local ecotypes.

Production and reproduction performance: According to the survey finding chickens from Endamehoni and Ofra had significantly higher mean values for age at first lay 6.97 and 6.89 months and 6.43 and 6.37 months for mean age at first mating, respectively, whereas Raya Azebo had lower values which is 6.37 months for mean age at first lay and 5.9 months for age at first mating (Table 2). This shows pullets and cockerels found in Raya Azebo relatively mature faster than of the other districts. The overall mean age at first lay (6.74 months) recorded in this study was similar with Tadelle *et al.*¹⁷ who reported 6.8 months of mean age at first lay and longer than 5.35 and 5.5 months reported by Mengesha¹⁸ and Halima¹⁹, respectively, for village chickens. Similarly, the number of eggs per clutch per hen was significantly higher (16.3) in Raya Azebo than both Ofra and Endamehoni. Generally, the number of eggs per clutch per hen found in this survey agreed well with the reported 15.7 and 14.9 eggs in Bure and Dale woredas, respectively Moges *et al.*⁴ and lower than Tadelle¹⁶ who reported 17.7

average eggs per clutch per hen for five regions in Ethiopia. The survey indicated variation in local chicken performance which might be associated with many factors, mainly variations in management practices between producers, availability of feed resources for scavenging and supplementation or genotype difference.

Chicken trait preference: The survey indicated that majority of farmers were selecting breeding hens for traits, such as egg production, good sitter and brooder (mothering ability), hatchability, large body size, plumage color and comb type (Table 3). The results in ranking of trait preference in hens revealed that farmers in all districts gave more emphasis to reproductive traits than qualitative traits and adaptive traits. Consequently, all farmers gave highest emphasis to egg production and good sitter and brooder (mothering ability) rather than large body size, body plumage color and comb type. Egg production appeared to be the most preferable trait because of the obvious benefits of selling eggs, consumption and hatching for replacement stock. This result is in agreement with Kibret²⁰ who indicated that most of the respondents (66.7%) selected hens based on egg production in Fogera. Dana *et al.*⁹ also reported egg production as the most important selection criterion in different parts of Ethiopia.

Table 3: Ranks of trait preference of farmers for breeding hens and cocks in the study districts

Traits										
Districts	Sex	Rank	Egg production	Good brooder	Hatchability	Plumage color	Body size	Double comb	Body conformation	Responsive to predator
Endamehoni	Female	1	37	15	5	4	9	-	-	-
		2	13	15	12	7	19	3	-	-
		3	-	8	12	16	7	19	-	-
		Index	0.33	0.20	0.13	0.10	0.18	0.06	-	-
	Male	1	-	-	-	34	34	2	-	-
		2	-	-	-	9	16	27	4	2
		3	-	-	-	3	6	4	9	7
		Index	-	-	-	0.35	0.39	0.18	0.05	0.03
Ofra	Female	1	39	10	7	9	5	-	-	-
		2	6	17	10	11	13	13	-	-
		3	6	20	10	5	-	8	-	-
		Index	0.34	0.21	0.13	0.14	0.10	0.08	-	-
	Male	1	-	-	-	28	29	17	3	3
		2	-	-	-	17	16	29	5	3
		3	-	-	-	5	4	4	7	13
		Index	-	-	-	0.32	0.24	0.30	0.07	0.07
Raya Azebo	Female	1	33	11	9	8	7	2	-	-
		2	11	19	13	10	9	8	-	-
		3	3	10	8	22	10	17	-	-
		Index	0.30	0.18	0.15	0.16	0.12	0.09	-	-
	Male	1	-	-	-	31	26	12	1	-
		2	-	-	-	13	7	36	9	4
		3	-	-	-	10	-	6	10	12
		Index	-	-	-	0.33	0.24	0.30	0.08	0.05

Table 4: Body plumage color preference in the study districts

Districts	Sex	Ranks	Body plumage color								
			Ambesuma ¹	Black	Brown	Gebsima ¹	Libework ¹	Kuarichama ¹	Red	Teteruma ¹	White
Endamehoni	Female	1	-	4	13	-	2	-	29	-	22
		2	-	9	17	-	7	-	15	5	17
		3	-	14	15	-	14	-	5	13	9
		Index	-	0.10	0.21	-	0.08	-	0.30	0.05	0.26
	Male	1	-	-	-	3	-	-	64	-	3
		2	3	-	-	12	-	-	5	-	49
		3	3	-	-	43	-	3	0	-	5
		Index	0.02	-	-	0.19	-	0.01	0.50	-	0.29
Ofa	Female	1	-	12	5	-	-	-	25	7	23
		2	-	9	3	-	2	-	17	25	16
		3	-	12	9	-	12	-	10	10	12
		Index	-	0.16	0.07	-	0.04	-	0.28	0.20	0.25
	Male	1	-	-	-	-	-	-	65	5	-
		2	5	-	-	-	-	3	5	21	36
		3	15	-	-	15	-	5	-	-	15
		Index	0.06	-	-	0.04	-	0.03	0.51	0.14	0.22
Raya Azebo	Female	1	-	17	10	-	3	-	21	-	19
		2	-	12	8	-	21	-	16	-	13
		3	-	12	20	-	17	-	7	-	14
		Index	-	0.21	0.16	-	0.16	-	0.24	-	0.23
	Male	1	-	-	-	-	-	-	66	-	-
		2	-	-	-	22	-	9	-	-	35
		3	-	-	-	27	-	13	-	-	17
		Index	-	-	-	0.18	-	0.08	0.51	-	0.23

Ambesuma: Grayish yellow with varying mixture, Gebesima: Grayish with varying mixture, Kuarichama: White with red strips, Libework: White with golden breast color, Teteruma: Red with white or black spots or white with black or red spots or black with white or red spots, ¹Names of plumage colors are in Amharic, Official Working Language of Ethiopia

Trait preference for cocks: Similar to hens farmers practiced selection on breeding cocks for five trait categories; plumage colour, large body size, comb type, response to predator and appearance/'qumena' (Table 3). Farmers in Raya Azebo and Ofla districts gave the highest emphasis for plumage color and double comb while large body size was the most preferable trait in Endamehoni district. This shows farmers in Raya Azebo and Ofla district traditionally attached their preference to plumage color and comb type. Generally, the survey showed that trait preference for cocks were mainly limited to trait categories which influenced consumer and market preference. Due to this reproductive traits like libido and early maturing were not considered by the respondents in both districts, even though this has an implication in the future production performance of chickens.

Body plumage color and comb type preference: The survey indicated that morphological traits such as body plumage color and comb type were also found to have significant aesthetic and economic values as well as cultural values, such as sacrifices and/or healing ceremonies beside other quantitative traits related to growth and egg production. Results of the rankings (Table 4) showed that red and white

body plumage color in both sexes were identified as the first and second most preferable body plumage, respectively. Respondents of the study area recognized only two types of combs, comb type: "Netela" meaning single and "Dirib" that actually comprised all comb types other than "Single" (i.e., rose, pea walnut, duplex and cushion combs). Accordingly all respondents preferred "Dirib" comb type and they confirm that double combed chicken are better in egg production (for both egg size and number).

CONCLUSION

Local chickens play an important role in supplying high quality protein to the family food balance and providing small disposable cash income in addition to the socio-religious functions for people of the study area. However, the performance in terms of egg production and reproduction is low. The breeding practices and trait preferences were mainly traditional and subjective. As result the present performance level is considered as low. Therefore, attention should be given to an overall improvement of the ecotypes to maintain sustainable utilization of the huge and diversified local chicken genetic resource of the study area.

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