On-farm phenotypic characterization of indigenous chicken populations and their productive and reproductive performances in central Ethiopia

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Abstract

This study was conducted in Gibe and Ameka districts of Hadiya Zone to characterize and describe indigenous chicken populations and their production systems and, to determine the productive and reproductive performance of indigenous chicken populations. A total of 351 respondents from purposively identified districts were randomized to gather the information through semi-structured questionnaires. Phenotypic data were collected from a total of 224 (33 male and 191 female) matured indigenous chickens. The morphometric traits recorded were body weight, body length, breast circumference, wingspan, shank length, shank circumference, comb length, wattle length, earlobe length and beak length. Among the analyzed morphometric traits, the significant ($p<0.05$) difference in districts for both sexes of chickens was only body weight, but female chickens significantly ($p<0.05$) different for breast circumference, shank length, shank circumference, wattle length, wing span and comb length in the studied districts. Others analyzed phenotypic trait were comb type, plumage color, ear lope color, feather morphology and distribution, spurs, shank color, feather on shark, plumage pattern, eye color and skin color. The results showed that mean flock size of the study area was 9.63 chicken/household of which 44, 14, 12, 6 and 14% of the total indigenous chicken population structure were chicks, pullets, cockerels, cocks and hens chicken respectively. Reproductive traits showed significant difference ($p<0.05$) between Gibe and Ameka districts. Disease, lack of knowledge, predators and feed were the major chicken production constraints in studied area area. The variations in chickens for different sites and sexes considered as opportunities for selection and genetic improvement of indigenous chicken.

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Key words: Central Ethiopia; Characterization; Indigenous chicken; Performance

Introduction

In Ethiopia, the agricultural sector is a corner stone of the economic and social life of the people. The sector contributes about 37.57% of the gross domestic product, 90% of export earnings and 83% of employment opportunities (Davis et al. 2010). Livestock plays significant role in the country's economy through the provision of food, foreign exchange, draught power, transportation, manure, family income and social security in time of crop failure. Chicken is the largest group of domestic animal species contributing about 30% of all animal protein consumed at the global level. The word chicken in Ethiopia is synonymous with chicken and the country owns the largest chicken population in Africa. The total chicken population of the country was estimated at about 56.9 million of which 78.85, 9.11 and 12.03 % is indigenous, hybrid and exotic breeds of chicken, respectively (CSA, 2021).

Indigenous chicken contribute significantly to the worlds' meat and eggs production and represents about 80% of the total world chicken population. They play a key role in the home economy to improve food security, assist in poverty alleviation and mitigate the adverse economic impacts for rural people (Dutta et al. 2013). Moreover, the indigenous chicken populations are known for special features of good scavenging and better disease resistance.

Indigenous chickens were designated on the bases of their phenotypic variations in terms of plumage color, shank length, and comb type and growth performances. There are large variations in morphological appearances, conformation and body weights of the Ethiopian indigenous chicken (Moges et al. 2010a). Considering the high potential of the study sites for poultry production and the presence of diverse ecotypes, it is important to conduct comprehensive studies that include different indigenous chicken strains in study sites. Hence this study was undertaken with the aims of documenting the morphometric and morphological information on indigenous chickens in central Ethiopia.

Materials and methods

Description of Study Sites

The study was conducted in Gibe and Ameka districts. The study districts were located in Hadiya zone, in Central Ethiopia Region.

Gibe district's geographical absolute location is in between$7^0$37'53"-7^0 42'43''North Latitude and $37^0$37'07''-37^0 44'25'' East Longitudes and 264 km away from Addis Ababa city. Gibe is bordered on the north by Ameka woreda, on the south by the Gombora district, on the east by Misha District and on the west by Yem special Woreda. The mean annual rainfall of the district ranges between 600 and 2000 mm and average temperature is from 18.5 to 35^0c.

Ameka district's geographical absolute location is in between $7^0$34'53"- $7^0$50'43'' North Latitude and $37^0$36'07''- 37^0 49'25'' East Longitudes and 260 km away from Addis Ababa city. Ameka is bordered on the north by Gurage zone, on the south by the Gibe district, on the west by Yem special woreda, on the southeast by Misha and on the east by Silte zone. The mean annual rainfall of the district ranges between 600 and 2000 mm and average temperature is from 18.6 ^{0}C to 35 ^{0}C.

Sampling Techniques and Sample Size Determination

After identifying purposively, random sampling technique was used to select the study households. The sample size was determined by using probability proportional sample size technique. Using the population list of chicken farmer households, a total of 351 (Gibe 233 and Ameka 118) representative farmers were randomly selected using probability proportionality size by using a simplified formula provided by (Yemane, 1967). Accordingly, the required sample size at 95% confidence level and level of precision equal to 5% was used to obtain sample size required.

The formula was given as, $\mathbf{n} = \frac{N}{1+N(e)2}$

HH sample size = $\frac{2829}{1+2829(0.05)2}$ = 351

Where n= is the sample size
N = total population size
e= sampling error

A total of 224 live matured chickens were randomly selected from the study districts (18 males and 110 females from Gibe district) and (15 males and 81 females from Ameka district).

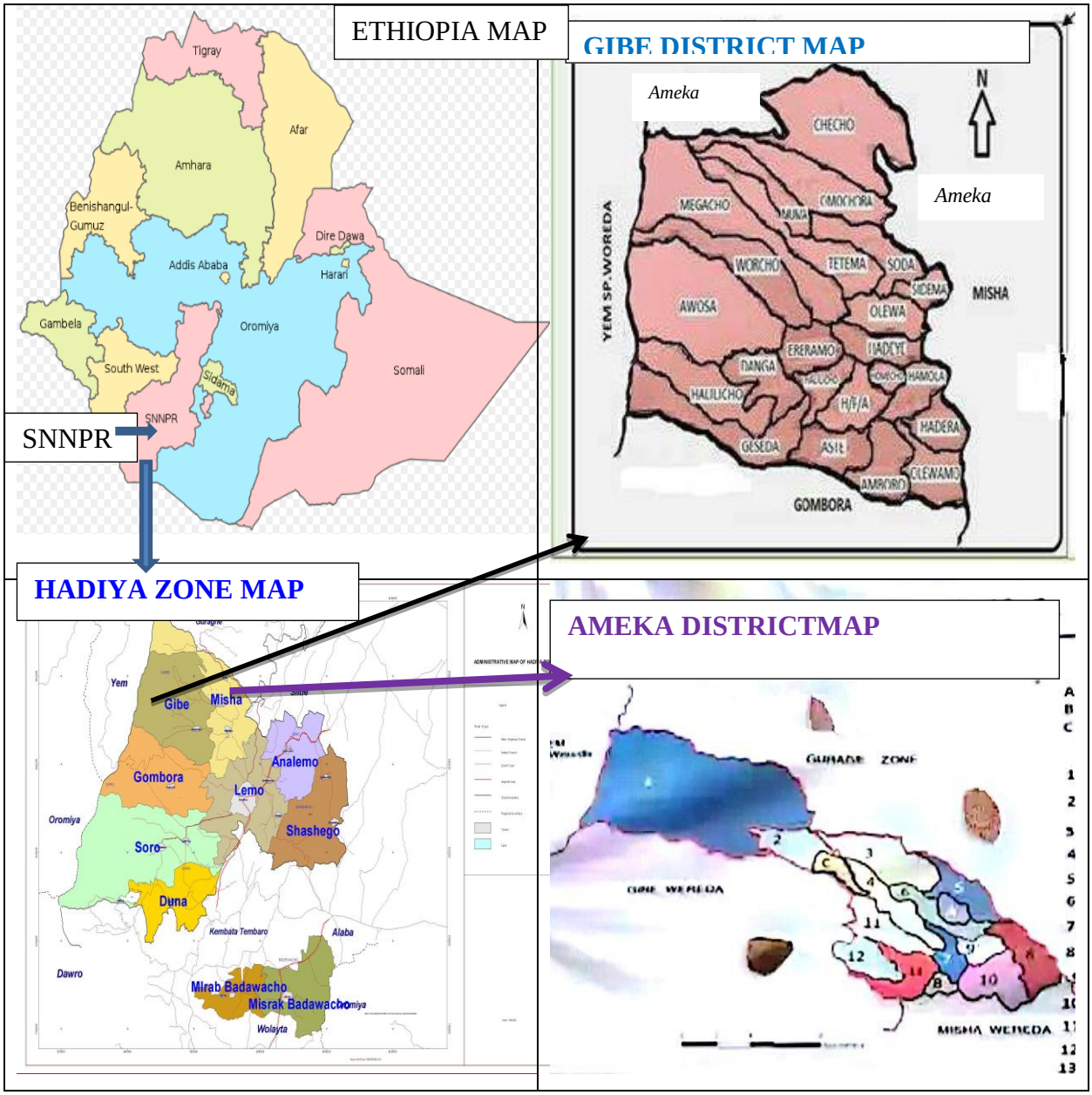

Fig-1 Map of study site

Data Collection

A cross sectional survey was carried out for each household to collect information focusing on status of chicken flock structure, source of breed, production systems, use of extension packages and its constraints from members of the households directly responsible for management and care of chicken. Moreover, the productive performances in terms of number of egg produced/hen/year, pullet age at first laying and husbandry practices were also the core points considered in the process. Average number of eggs was taken from farmers' estimation of eggs laid/hen/year. Furthermore, the management practices were assessed through observation of the incorporation of recommended scientific husbandry packages applied for each household.

Measured and observed variables

Data on nine (9) morphometric traits were scored following the descriptor list of FAO (2012) for phenotypic characterizations of chicken. Accordingly, the following quantitative traits were measured: body weight (BW), body length (BL), breast circumference (BC), wingspan (WS), shank length (SL), shank circumference (SC), comb length (CL), wattle length (WL) and beak length (BkL). Spring balance was used to measure body weight of individual adult bird. All other linear measurements were measured using textile measuring tape meter to the nearest unit centimeter. Measurements were taken from males aged 24 weeks and

above, and females that have already started laying eggs based on information obtained from the owner chickens. Qualitative variables were comb type, plumage color and pattern, ear lobe color, feather morphology and distribution, Spurs, shank color, feather on shark, eye color and Skin color. The qualitative traits were recorded through observation.

Secondary data

The secondary data, like livestock population, demographic structure, altitude, rainfall, topography and temperature were collected from Agricultural and financial governmental organizations from two study districts.

Statistical Analysis

Qualitative data from the recall survey

The qualitative survey data were analyzed for descriptive statistics using frequency procedures and cross-tabulation of statistical analysis system (SAS 9.2 (2008). The chi-square test option of the non-parametric tests of statistical analysis system (SAS 9.2 (2008) was employed to test the effects of the district on the proportion of each qualitative survey data.

Quantitative data from household characterization

General linear model procedure of statistical analysis system (SAS 9.2 (2008) was used to investigate the effects of district on household characteristics (family size and chicken flock size per household) and various performance related parameters of chicken (such as age at first laying, number of clutches per year, clutch length, eggs/hen per year and others).

Qualitative and quantitative traits data

The morphological traits (plumage color and pattern, skin color, eye color, earlobe color and shank color and, feather morphology and distribution, comb type, comb size and others), of the indigenous chicken were analyzed using frequency procedures and cross-tabulation of statistical analysis system (SAS 9.2 (2008). The chi-square test option of the non-parametric tests of statistical analysis system (SAS) was employed to test the effects of the district and sex of chicken on the proportion of each qualitative morphological trait. General linear model procedure of statistical analysis system (SAS) was used to evaluate the effect of sex and district on the quantitative traits of each prevailing indigenous chicken types.

Statistical model

$\mathbf{Y}_{ij} = \mu + D_i + S_j + e_{ij}$

Where Yij: The individual observations

μ: overall population mean or proportion for corresponding traits performance

Di: effect of i^{th} district (i= Gibe and Ameka)

Sj: effect of j^{th} sex (j= male and female)

eij: residual error

Results

Chicken Flock Structure

Flock structure of chicken reared in the districts is presented in Table 1 that the average number of chicks, pullets, cockerels, cocks and hens per household were 4.46, 1.4, 1.26, 0.59 and 2.22 in Gibe and 3.78, 1.38, 1.09, 0.54 and 2.25 in Ameka district, respectively.

Productive Performances

Egg production

Information on egg production performance in the studied districts is presented in Table 2. The average number of eggs laid per hen/year was 37.31 and 35.62 for Gibe and Ameka districts, respectively. There was significant difference ($P<0.05$) between Gibe and Ameka districts for number of eggs laid per hen/year.

The average number of eggs per hen per clutch, average number of clutches and clutch length in days were 11.29, 3.33 and 21.34 in Gibe and 11.12, 3.28 and 21.38 Ameka districts, respectively. There was no significant difference between the two districts for average number of eggs per hen per clutch, average number of clutches and clutch length.

Reproductive performances

The information collected on reproductive performances is shown in Table 3 indicates that the mean maturity of females, number eggs set per hen, number chicken hatched, number of chicks raised per hen, hatchability, survivability and pullets age at first egg were 21.74, 11.29, 8.49, 3.53, 76.03, 42.11 and 22.75 in Gibe and 21.56, 11.12, 8.39, 3.47, 75.45, 42.04 and 22.51 in Ameka district, respectively.

Table 1: Chicken flock structure per reared households in the studied districts.

Variables	Districts		Overall average (Mean±SD)
	Gibe (Mean± SD)	Ameka (Mean± SD)	
Chicks	4.46±4.247	3.78±3.676	4.23±4.073
Pullets	1.4±1.869	1.38±1.736	1.40±1.823
Cockerels	1.26±1.519	1.09±1.535	1.20±1.524
Cocks	0.59±0.574	0.54±0.549	0.57±.565
Hens	2.22±1.368	2.25±1.162	2.23±1.301

SD = standard deviation

Table 2: Egg production performance of indigenous chickens in the study districts.

Variables	Districts		Overall average (Mean± SD)	p-value
	Gibe (Mean±SD)	Ameka (Mean±SD)		
Total no. of eggs laid per hen/year	37.3±16.38[a]	35.62±4.98[b]	36.47±5.77	0.040
Average number of eggs per hen per clutch	11.29±1.825	11.12±2.097	11.21±1.962	0.543
Average number of clutches	3.33±535	3.28±1.642	3.31±.589	0.572
Clutch length in days	21.34±.641	21.38±.666	21.36±.52	0.715

SD = standard deviation

Table 3: Reproductive performance of indigenous chickens in the studied districts.

Variables	District		Overall average (Mean± SD)
	Gibe (Mean±SD)	Ameka (Mean± SD)	
Maturity of female in week	21.74±1.56	21.56±1.58	21.65±1.57
Number eggs set per hen	11.29±1.825	11.12±2.097	11.21±1.962
Number chicken hatched	8.49±1.343	8.39±.344	8.44±1.341
Number of chicks raised per hen	3.53±.761	3.47±.661	3.5±712
Hatchability%	76.03±6.809	75.45±6.594	75.74±6.692
Survivability%	42.11±9.584	42.04±8.783	42.08±9.171
Pullets age at first egg(weeks)	22.75±1.335	22.51±1.372	22.63±1.355

SD = Standard deviation

Table 4: Chicken quantitative traits characteristics in Gibe and Ameka districts

Parameters	Sex	Districts		Overall average (Mean±SD)	P-value
		Gibe (Mean±SD)	Ameka (Mean±SD)		
Body weight (kg)	M	1.68±0.25[b]	1.84±0.113[a]	1.76±0.2	0.031
	F	1.37±0.25[a]	1.26±.15[b]	1.3±0.22	0.001
Body length (cm)	M	38.9±2.25	39.2±1.01	39.03±1.78	0.624
	F	35.66±2.1	36.1±1.41	35.8±1.84	0.100
Breast circumference (cm)	M	29.56±2.2	31.0±3.0	30.2±2.65	0.121
	F	28.9±2.4[a]	27.65±1.01[b]	28.4±2.0	0.000
Shank length (cm)	M	8.5±1.14	8.7±1.28	8.6±1.19	0.583
	F	7.06±0.86[a]	6.7±1.00[b]	6.92±0.94	0.012
Shank circumference (cm)	M	4.96±.42	4.77±0.94	4.87±0.7	0.437
	F	4.4±0.5[a]	4.2±0.49[b]	4.3±0.5	0.042
Wing span (cm)	M	40.0±1.8	40.0±1.13	40.0±1.53	0.919
	F	37.0±1.7[a]	36.3±1.47[b]	36.7±1.64	0.002
Comb length (cm)	M	6.06±1.98	5.8±0.56	5.94±1.5	0.633
	F	2.66±0.7[a]	2.4±0.19[b]	2.56±0.57	0.005
Wattle length (cm)	M	3.79±1.2	3.3±1.3	3.56±1.26	0.261
	F	0.6±0.75[a]	0.20±0.01[b]	0.43±0.6	0.000
Beak length (cm)	M	2.2±0.18	2.0±0.09	2.1±0.17	0.332
	F	2.0±0.14	2.00±0.00	2.00±0.00	0.338

M=Male, F=Female and CV= Critical value and SD = standard deviation

Quantitative trait variation

The quantitative traits of indigenous chickens are indicated in Table 4. There was significant ($p<0.05$) influence of districts for both male and female chickens exhibited only on body weight.

Stepwise Discriminant analysis

Nine quantitative variables with complete data were subjected to the STEPDISC procedure using parametric discriminant analysis and four of them were identified as the best discriminating variables (Table 5). Wilk's lambda test confirmed that all the selected variables had highly significant ($p<0.0001$) contribution to discriminate the total population into separate groups. The variables with the highest discriminating power are comb length, breast circumference, body weight and body length. Wilks' Lambda is a measure of how well each trait separates populations into groups. Smaller values of Wilks' lambda indicate greater discriminatory ability of the traits. The remaining variables had poor discriminating power and were thus removed during the stepwise analysis.

Qualitative traits

Neck region qualitative traits of the indigenous chicken in both study sites were indicated in Table 6. Among the chicken observed for their comp type, about 18.2% were single combed male and 24.1% single combed female, the remaining chicken populations in studied sites are double combed.

Feather region of indigenous chicken is indicated in Table 7. All of the indigenous chickens were observed with normal feather morphology.

The leg region of indigenous chicken was shown in Table 8. All of the male chicken in the study sites have spurs; whereas 99% of the female indigenous chicken have no spurs. Majority of the chickens in both districts were observed with white shank color (81.8% for male and 81.2% for female). Only 3% of the male chickens were observed with feather on shark; unlike wise, the remaining studied chicken have no feather on their shank. The indigenous chicken populations were observed with white skin color (57.6% for male and 42.4% of female) followed by yellow (39.4% of male and 44% of female).

Indigenous chicken production constraints

Indigenous chicken production constraints are indicated in figure 2. Some of the problems that occurred in the study area were disease, shortage of feed, predator and lack knowledge in Gibe district accounted to 29%, 15%, 30% and 24% and also in Ameka, 27%, 13%, 27% and 32%, respectively.

Table 5. Summary of stepwise discriminant analysis for selection of traits with the highest discriminating power for the studied chicken populations

Step	Variables entered	Partial R^2	F-value	Pr > F	Wilks' Lambda	Pr< Lambda	ASCC	Pr > ASCC
1	CL	0.117	29.01	<.0001	0.242	<.0001	0.758	<.0001
2	BC	0.053	12.25	0.0006	0.229	<.0001	0.771	<.0001
3	BW	0.042	9.48	0.0023	0.220	<.0001	0.780	<.0001
4	BL	0.017	3.73	0.0550	0.216	<.0001	0.784	<.0001

ASCC = average squared canonical coefficient (exploring the relationship between two multivariate sets of variables), R^2 = coefficient of determinant, BC = breast circumference, BL = body length, BW = body weight, and CL = comb length

Table 6: The chicken neck region of qualitative traits characteristics

Parameters	Sex	Districts					
		Gibe		Ameka		Over all	
		Freq.	%	Freq.	%	Freq.	%
Comb types							
Single	M	3	16.7	3	20	6	18.2
	F	16	23.6	20	24.7	46	24.1
Double	M	15	83.3	12	80.0	27	81.8
	F	84	76.4	61	75.3	145	75.9
ELC							
White	M	4	22.2	9	60.0	13	39.4
	F	42	38.2	30	37.0	72	37.7
Red	M	13	72.2	5	33.3	18	54.5
	F	49	44.5	47	58.0	96	50.0
white and red	M	1	5.6	1	6.7	2	6.1
	F	19	17.3	4	4.9	23	12.0
Eye color							
Red	M	18	100	15	100	33	100
	F	110	92.7	81	100	183	95.8
Yellow	F	8	7.3	0	0	8	4.2

M=Male, F=Female, Freq. = frequency and ELC = ear lobe color

Table 7: The chicken feather qualitative traits characteristics.

Parameters	Sex	Districts						X^2-test
		Gibe		Ameka		Over all		
		Freq.	%	Freq.	%	Freq.	%	
FD								
Normal	M	18	100	15	100	33	100	
	F	110	100	81	100	191	100	
PP								
Plain	M	18	100	15	100	33	100	
	F	110	100	81	100	191	100	
FM								
Normal	M	18	100	15	100	33	100	
	F	110	100	81	100	191	100	
PC								32.69
White	F	3	2.7	3	3.8	6	3.2	
Black	M	3	16.7	1	6.7	4	12.1	
	F	42	38.2	8	10.1	50	26.5	
Blue	M	5	27.8	1	6.7	6	18.2	
	F	13	11.8	3	3.8	16	8.5	
Red	M	10	55.6	13	86.7	23	69.7	
	F	42	38.2	59	74.7	101	53.4	

FD=Feather Distribution, PC = Plumage Color, PP= Plumage Pattern, FM= Feather Morphology, M = male, F= female and Freq. = frequency

Table 8. The chicken leg region and skin color qualitative trait characteristics.

Parameters	Sex	Districts						X^2-test
		Gibe		Ameka		Over all		
		Freq.	%	Freq.	%	Freq.	%	
Spurs								18.4
Present	M	18	100	15	100	33	100	
	F	0	0	2	2.5	2	1.0	
Absent	F	110	100	79	97.5	189	99.0	
SHC								28.43
White	M	12	66.7	15	100	27	81.8	
	F	78	0.9	77	95.1	155	81.2	
Yellow	M	4	22.2	0	0	4	12.1	
	F	16	14.5	0	0	16	8.4	
Blue	M	2	11.1	0	0	2	6.1	
	F	12	10.9	0	0	12	6.3	
Black	F	12	10.9	0	0	12	6.3	
FOSH								0.339
Present	M	0	0	1	6.7	1	3.0	
Absent	M	18	100	14	93.3	32	97.0	
	F	110	100	81	100	191	100	
Skin color								4.549
White	M	7	38.9	12	80	19	57.6	
	F	43	39.1	38	46.9	81	42.4	
Yellow	M	10	55.6	3	20.0	13	39.4	
	F	49	44.5	35	43.2	84	44.0	
Blue black	M	1	5.6	0	0	1	3.0	
	F	18	16.4	8	9.9	26	13.6	

SHC= Shank Color, FOSH= Feather on Shark M=Male, F=Female and X^2 = chi-square

Discussion

Chicken Flock Structure

Flock structure of chicken reared in the study districts is presented in Table 1 has been reported in line with some reports revealed as 6.23, 13.68 and 13.1 average number of flock chicken structure per household by Molla (2010) in Gomma district of Jimma zone, Zewdu et al. (2013) in Metekel zone of Northwest Ethiopia and Moges et al. (2010a) in Bure district of North West Ethiopia, respectively.

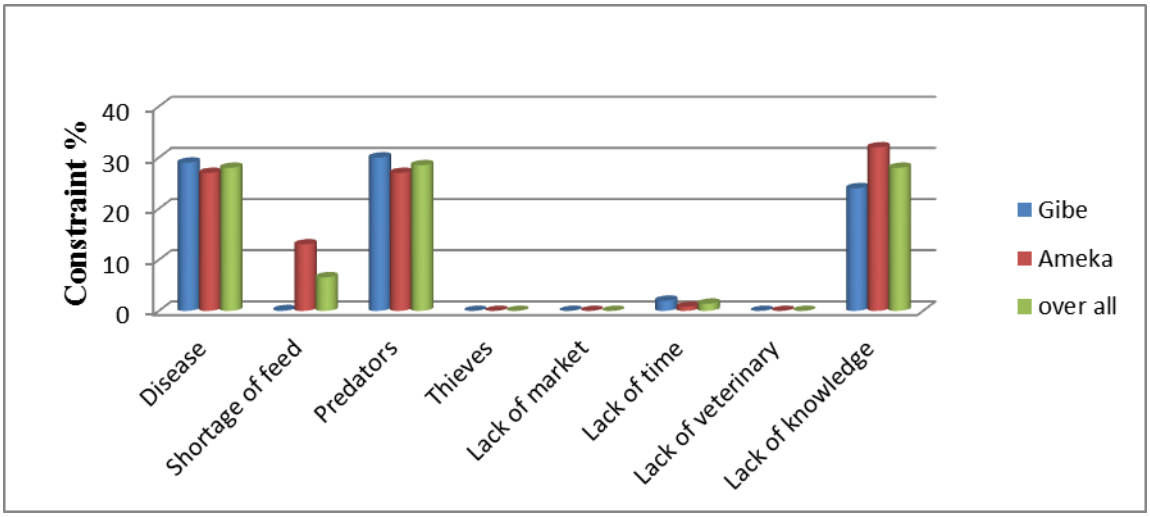

Fig 2 Chicken Production Constraints

Fig 3: Ethiopian Indigenous chickens

Productive Performances

Egg production

The report revealed in table 2 of the current study is in agreement with the study conducted by Hailu (2012) who reported that mean number of egg laid/clutch (37.91) in selected districts of North Wollo, Amhara regional state, Ethiopia. The report for eggs/clutch in the present study was in agreement with that of Habte et al. (2013) who reported production of average eggs/clutch was 11.23 in Nole Kobba district. Moreover, average clutch number is similarly reported as 3.53 by Getu et al. (2014) for indigenous chicken in Ethiopia.

Reproductive performances

Among the reproductive performances indicated in a Table 3 of current study, sexual maturity was not comparable with the result conducted by Molla (2010) who reported that the male and female indigenous chicken of Gomma district of Jimma zone attained sexual maturity at 25.88 and 25.32 weeks, respectively. In nearly similar in Sudan, the age at sexual maturity of two Sudanese native chicken ecotypes of Dwarf and bare neck ecotypes was 23.4 weeks and 26.4 weeks, respectively (Yousif and Eltayeb, 2011) and the findings of Hailu et al. (2013) who reported the age of sexual maturity of indigenous male and female of (24.25 and 23.84 weeks) and (23.48 and 23.6 weeks), respectively in north Wollo zone and Fogera district of Amhara regional state of Ethiopia. Zewdu et al. (2013) also reported similarly values on the average age sexual maturity/age at first mating/ of indigenous pullets and cockerels in Metekel Zone of North West Ethiopia were 20.8 and 21.76 weeks respectively.

The overall mean of age at first egg laying for indigenous female chicken in the study area was 22.63 weeks. This result was lower report of Habte et al. (2013) in which the mean age at first egg lay of indigenous pullets in the Nole Kabba district of Western Wollega was 28.08 weeks. In Kenya, Okeno et al. (2010) also reported lower figures on the average age at sexual maturity than Kenyan indigenous chicken under scavenging conditions was 26.9 weeks ranging from 24-44 weeks. This result reported slightly lower of average age at first egg lay of indigenous chickens in West Amhara region of Ethiopia, 26.4 weeks by (Worku et al. 2012).

The overall mean incubated eggs and hatched chicks per clutch of indigenous chicken were 11.21 and 8.44 respectively in this study as indicated in Table 3 is in agreement with the result revealed by Hailu et al. (2013) in which the mean number of incubated eggs and hatched chicks per clutch of indigenous chicken in North Wollo Zone of Amhara Regional state was 11.36 and 9.60 respectively. Worku et al. (2012) also reported somewhat similar values of average number of eggs incubated and eggs hatched per clutch per hen of indigenous chicken in West Amhara region of Ethiopia were 12.8 and 10.00 respectively. Likewise, Wondu et al. (2013) reported closer values on the average number of incubated eggs and hatched eggs per clutch per hen of indigenous chicken in the North Gondar Amhara regional state of Amhara was 10.95 and 9.49 respectively. In Kenya, Okeno et al. (2010) also reported congruent survey on the average of incubated eggs and hatched chicks per set of Kenyan indigenous chicken under scavenging conditions were 12.84 and 10.73, respectively.

Quantitative trait variation

Comparable reports were revealed by (Aklilu et al. 2013) for body length (39.97cm in Horro male and 36.13cm Jarso male chickens), body weight (1.69kg in Horro male and 1.41kg in Jarso male chickens) and shank length (11.32cm in Horro male and 9.99cm in Jarso male chicness) of Oromia, Ethiopia. This result was also in agreement with the findings of Bekele et al. (2021) who reported that the average values of shank length of indigenous cock in Ethiopia (7.66cm). Similarly, Dana et al. (2010) reported that the overall shank length and body weight of male mature indigenous chicken populations of Ethiopia were (9.1cm and 1.612kg). This result also corroborated the findings of Moreda et al. (2014) who reported that shank length, body length and body weight of Dawo, Seden sodo, Mahale Amebe and Mehurena Akile indigenous chicken were (9.8 cm, 10.5cm, 12.2cm and 10cm), (28cm, 30.85cm, 33.55cm and 28.83cm) and (1.297.18kg, 1.380kg, 1.955kg and 1.013kg), respectively in four districts of South West and South part of Ethiopia.

The analysis of quantitative traits of indigenous chicken characteristics of two districts confirmed that significant variations in most of studied quantitative traits. This phenotypic variability of indigenous chicken of the study area is a major indicator for the existence of some genetic variability among the two indigenous chicken characteristics of the study area which serve as a potential for genetic improvements of the indigenous chicken characteristics through appropriate genetic improvement methods.

Qualitative traits

All of the indigenous chickens were observed with normal feather morphology. This is similar with the findings of Marikos (2014) who reported normal feathered morphology (100%) and 92% of the feather distribution of indigenous chicken populations in Fogera district, Ethiopia. According to Melesse and Negesse (2011), 83.2% of the chicken populations in Southern region of Ethiopia had normal feather distribution followed by naked-neck (7.9%), crested (5.6 %), feathery shank and feet (2.0%).

The indigenous chicken in study suites were checked with white skin color (57.6% for male and 42.4% of female) followed by yellow (39.4% of male and 44% of female). Likewise, Aklilu et al. (2013) observed that majority of the indigenous chicken were found to be white and yellow-skinned chicken in Horro and Jarso districts of Ethiopia.

Indigenous chicken production constraints

As indicated on the figure 2 that comparable results have been reported from Rift valley of Oromia by Hunduma et al. (2010) who stated that disease, predators, lack of proper health care, poor feeding; poor marketing information and replacement of indigenous chicken by exotic chicken were found to be major barriers of chicken production. In the same way, Bekele and Shigute (2019) also reported that diseases and predators were the most important chicken production constraints in Anlemo and Gibe districts of Southern Ethiopia. Likewise, Hailu et al. (2013) reported that diseases, feed shortage and predators were the most economically important constraints of chicken production in North Wollo zone of Ethiopia.

Conclusions

The performance of indigenous chicken under their production system could not be improved through their housing, disease and predators controlling system, feeding, and health management, providing of extension service and training due to their chicken perform low egg production. The quantitative trait variation of chickens the study districts have a significant difference on breast circumference, wattle length, wing span and beak length and qualitative traits variation of chicken in districts have a significant difference on plumage color, ear lope color, shank color, and eye color.

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