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RESEARCH ARTICLE

MULTIVARATE ANALYSIS OF PHENOTYPIC AND FARMING SYSTEM CHARACTERIZATION OF INDIGENOUS CHICKEN POPULATIONS ON-FARM IN GUJI ZONE, ETHIOPIA

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ABSTRACT

Phenotypic characterizations of indigenous chicken genetic resources were undertaken in Guji zone of Oromia region. All HHs conditionally/occasionally provide feed and water as supplements and of the feed sources 54.2% and 16.7% were Grain and leftover; and Grain and crop residues., wall and floor which were made of 51.4% wood, 22.9% grass/bush, 14.3% (wood + mud), 8.6% bamboo, and 2.9% (bamboo + grass).. The mean separation with standard errors of the chicken population size were 18.5±1.97 of (3.4±.32) and (2.1± .30) with a ratio of 3.2:1 female with male. Population of young chicks were highest in umber (7.0 ± .70) followed by pullets (3.5 ±.33), hens (3.4 ±.3, cockerels (2.5 ±.32) and cocks (2.1± .30) per household respectively. The average mean values of all parameters except average body weight and Super Length were significantly different at ($P<0.05$) level between location. Quantitative traits between sex were significantly greater at ($p<0.05$) level, 2.1±0.05kg and 1.5±0.02 average body weight (ABW) of male and female respectively. All this qualitative and quantitative traits variations could be used as source of selection for improving the chickens which positively affect breeding program through community based improvement, conservation and setting wisely sustainable utilization in the future.

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INTRODUCTION

Poultry is by far the most widely distributed livestock species worldwide (FAO, 2000), The Food and Agriculture Organization of the United Nations estimated that in 2009 there were nearly fifty billion chickens in the world and by the Year 2015 that estimates of poultry would account for 40% of all animal protein in the world. Chicken population in Ethiopian is estimated to be 53.6 million and producing about 108 million eggs/year (CSA, 2015). In Ethiopia, the average flock size under rural chicken production system ranges from 7 – 10 birds in each house hold consisting of 2 – 4 adult hens, one cock and some growers of different age groups and also13 chickens population per household was reported by Samson Leta and Endalew Bekana (2010) at midl Rift valley region of Oromia. The egg production is estimated to be 40 to 60 eggs / birds /year with an average egg weight of 40 grams (Bushra Badhaso, 2012). Ethiopian chicken rearing system is characterized by extensive scavenging management, no immunization programs, increased risk of exposure of birds to disease and predators, and reproduction entirely based on uncontrolled natural mating and hatching of eggs using broody hens, where there is no or minimum intervention to maximize their production and reproductive performance (Tadelle Dessie ,2003) and (Samson Leta and Endalew Bekana, 2010) reported that the dominant Chicken production system of in Mid Rift Valley of Oromia was a free range system using majority of indigenous chicken (94%) managed mainly on scavenging with conditional feed supplementation. the study on assessment of village chicken production system and evaluation of the productive and reproductive performance of local chicken ecotype in Bure district also revealed that the dominant (83%) chicken production system was an extensive/traditional type of production, using a majority (97%) of local chicken ecotypes, managed mainly on scavenging with seasonal supplementation of home grown grains and household food left overs (Fisseha *et al*., 2010). The same author also reported that of Genetic variations in chickens can be described, among other approaches, using monogenic traits based on pigmentation differences and comb

types and According to Bushra Badhaso, (2012) Morphological variations of indigenous chicken ecotypes (between and within) are described in terms of comb types, shank types, earlobe types, plumage colors and other qualitative traits. Commonly observed plumage colors of indigenous chickens are: red, white, black, multicolor, black with red strips, white with red strips and red-brownish). In this regard, some study results on phenotypic traits were reported previously like plumage colors 15% red, 18% white, 7% black 16% brown,15% golden (Ngussie *et al*., 2010) on Morphological features of indigenous chicken populations of Fogera Woreda, Amhara Regional State, 28% red, 30% white and 8% black by (Bogal, 2008)o m Northwest Ethiopia and 16.44% red, 25.49% white, 7.79% black 22.23% grayish by (Halima 2007) and 20% red, 18.8% white, 13.9% black and 18.9% red brown by (Duguma 2008) on chicken ecotypes of Ethiopia respectively. (Should be separated which study is for what). Variable earlobe colors were also reported by (Ngussie *et al*., 2010) and (Bogal, 2008) 40% white, 52 % red, 8% yellow and 26% white and 74% white and red respectively. Similarly (Bogale 2006, Halima 2007) and (Ngussie etal. 2010). Reported that of feather presence on the neck and shank were 98%, 100% and 100%, 97.52 and Shank colors 28% white, 12% black and 60 % yellow respectively. In Ethiopia basis of chicken genetic of this variation was described by Eriksson *et al*. (2007).

In addition to their significance in describing genetic variations and adaptive attributes, qualitative morphological traits have important economic value in chickens. According (Jiang, 1999; Smyth, 1990) said that of around the world “”There are specific choices for plumage and skin colors that affect preferences of different geographic markets””). But Ethiopia there is no specific preference for skin color, while plumage color is only second importance next to live weight that highly affecting market preference for chickens (Ngussie *et al*., 2010). Naming of chicken has given based on certain local communities of Ethiopia by Tadelle (2003) referred to them as “local chicken ecotypes” and Halima *et al*. (2007) referred as “native chicken populations”, both named on the basis of the geographic region of sampling. Each local ecotype or native population actually comprised chickens with a wide range of morphologic or genetic diversity. Thus far, only 5 Ethiopian chicken types have been listed in the Domestic Animal Diversity Information System (DAD-IS) of the FAO (derived from FAO, 2008) and 10 in the Domestic Animal Genetic Resources Information System (DAGRIS) of the International Livestock Research Institute (ILRI; derived from DAGR-IS, 2008) (refer recent DADIS edited by us). The objectives of this study were to describe the physical features of different populations of indigenous chicken in the study9 (Guji) area and to assess the morphological variations among the populations in order to depict the useful attributes of

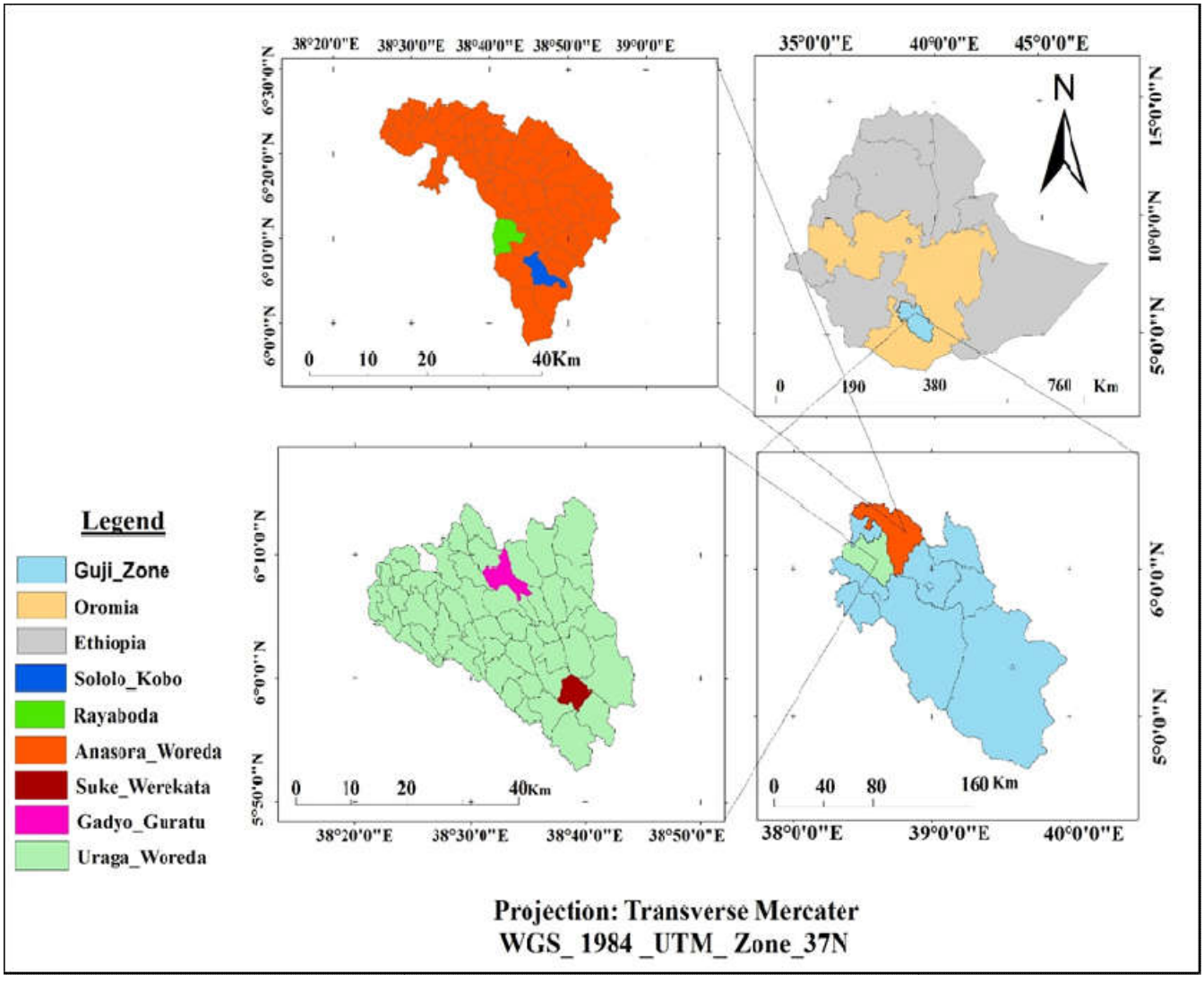

Figure 1. Map of the study areas

indigenous chickens. This work were also contribute to minimize the existing scarce information on the indigenous chicken genetic resources of Ethiopia. To bring the attentions of researchers and concerned body to conservation and sustainable utilization of indigenous genetic traits as source of variation for selection and improvements based on detailed research.

MATERIALS AND METHODS

Description of study areas: Uraga and Ana-Sora districts are parts of Guji zone in Oromia National Reginal State in Ethiopia. They are located 610km away from Addis Ababa to South-east direction. The minimum and maximum annual average temperature is 15°c and 25°c and the minimum and maximum annual average rain fall is 1450mm and 2900mm respectively. Map of the study area shows (Fig. 1).More than 94% of human population in the area is engaged in agricultural activities like producing crops, rearing animals and practicing honey bee production. They are mainly producing major crops like maize, wheat, barley, teff and sorghum and the perennial crops like coffee as well as enset (falls banana) are common crops in the area. Scavenging the leftover of field crops by local chickens as main feed source which ultimately being used as source animal protein.

Sample size determination and selection of households in the study area: The two study districts namely Uraga and Ana-sora were selected from 14 districts including two towns namely kebre mengist and Negele borena found in Guji zone of Oromia National Reginal State. Districts including the kebeles were chosen based on purposive sampling methods. In total 4 kebeles were selected from each districts to represent the population. The study were carried out by using structured questionnaires and those structured questionnaires were pre-tested in selected kebeles. The agricultural development agents were involved in data collection through briefing the objectives of the study before survey data collected. In this study 48 individual households were selected based on having two and/or more than two local matured chickens (hen and/or cock) to be involved in the interview. The selected farmers were interviewed to describe the chicken farming in the area. Moreover, 244 matured local chickens in which 203 and 41 female and male respectively were involved for measuring both qualitative and quantitative phenotypic parameters and for this purpose unrelated adult birds were sampled. Neighboring households were skipped to avoid the risk of sampling chickens sharing the same cock. For selection the study used consultation of key informants from zonal, district and kebele administrative levels.

Data collection and analysis: Descriptive statistics such as mean, range, frequency and percentage were analyzed using statistical package for social sciences (SPSS). List of physical descriptors were prepared to record both quantitative traits and qualitative morphological characters. Using cross sectional questionnaire surveys, data focusing on management practices such as housing, supplementation of additional feed, poultry health management practices and marketing systems were collected from member(s) of the households responsible for management and care of chicken. The data were analyzed using SPSS software, version 22 (SPSS, 2016). The same software were used for quantitative variables such as body weight, shank length, shank circumferences, wing length (span) were analyzed to obtain descriptive statist results of multivariate analysis of . Indexing formula = £ (1st rank * 3) + (2nd rank *2) + (3rd rank * 1)/1st*3 +2nd*2+ 3rd*1 was applied to rank the importance of livestock in study area.

RESULTS AND DISCUSSION

Household characteristics: Household characteristics of village local chicken owners in the study area are shown in Table (1). The result indicated that 83.3%, 100%, 83.3%, 83.3%, of male respondents were involved in Gadio Guratoo, Sukie Worketa, Raya Boda, and Sololo Kobo kebeles respectively. Females in all kebels were involved in small number as compared to males but in equal percentage of 16.7%, except Sukie Worketa kebeles where no female participant was involved at all. The educational level of the respondent were 31.3%, 2.08%, 12.5%, 37.5%, 12.5%, 2.08%, and 2.08% of Illiterate, Reading and writing, 1-4 grade, 5-8grade, 9-12,10+1 and 10+3 grade respectively. The result was completely different from (Halima 2007) reported that the majority of respondents were female (74.16 %) in North western Ethiopia and also (Dinka *et al.,* 2010) reported that (92.4%) respondent were women and children households at rift valley of Oromia. in addition to this other researcher reported that 65.7, 26.7 and 7.6% were children, wife and husband participating in rearing the chicken in midl rift valley region of Oromia (Samson Leta and Endalew Bekana, 2010). This research result indicated that most of the time women/female-headed households were less responsible for chicken rearing in the study area. Thus the participation of females in chicken rearing in this particular area was found to be less as compared other studies mentioned above. The possible reason might be most of the economic activities are dominated by male and there is lack of awareness about the benefit of chicken rearing by females at household level. This result shows that one can plan to push and enhance the participation of female chicken farmers to improve the household income and livelihood.

Livestock ranked based on importance index in the study area: About 7 species of livestock with importance value were indicated in (Table 2). The most important animals showed in a rank index value indicated that 0.480 (48.0%), 0.209 (20.9%), and 0.148 (14.8%) were cattle, chicken and sheep respectively. Other than those livestock species mentioned above in descending order of importance in the ranking index include horse, goats, donkey and beehive respectively. The result of this ranking index lead to deduce that cattle might be most important livestock species in this agrarian society that depends on cultivation of their land use animal traction using Them and local indigenous chicken usually practiced in an area of crop-livestock mixed farming system that become 2nd to cattle in ranking of Importance. Average mean numbers of animal species owned by respondents were 5.9, 3.7, 3.7, 10.3, 1 and 2 for Cattle, Sheep, goats, chicken, donkeys and horses respectively. Therefore, this result shows that chicken rearing was most important activities to generate household income.

The local chicken management practice: Parameters to measure the management practices of chicken rearing by the respondents were listed in the (Table 3). The dominant production system of the study area was crop-livestock production system with 97.2% while 2.1% was comprised by pastoralist and agro pastoralist system. The major occupation of the study area was 44 (91.7%) agriculture, 2 (4.2%) trade and 1(2.1%) teaching respectively.

Table 1. Household characteristics

Household characteristics		Study areas				Grand mean
		GG (N=12)	SW (N=12)	RB(N=12)	SK (N=12)	
Sex of respondent frequency (%)	male	83.3	100	83.3	83.3	87.5
	female	16.7	0	16.7	16.7	12.5
Education status of respondents						
Illiterate		2	1	7	5	31.3
Reads and write		0	0	0	1	2.08
1-4		0	5	1	0	12.5
5-8		7	5	2	4	37.5
9-12		1	1	2	2	12.5
10+1		1	0	0	0	2.08
10+3		1	0	0	0	2.08
total		12	12	12	12	48 (100)
Sex with age (year)						Over all mean ± SD
Male <14		2.33±1.22	3.00±1.95	2.11±.93	2.89±2.26	2.62±1.67
Female <14		2.44±1.50	3.50±2.17	1.89±.93	3.16±1.83	2.74±1.72
Male 15-30		1.90±1.50	1.78±1.09	1.57±1.13	2.30±1.49	1.92±1.32
Female 15-30		1.71±.75	1.41±.99	1.75±1.16	1.66±1.00	1.61±.96
Male 31-60		1.29±.75	1.00±.00	1.57±1.51	1.00±0.00	1.25±.89
female 31-60		1.62±1.76	1.50±1.00	1.43±1.13	1.13±1.12	1.41±1.15
Male >60		1.00±.00	Null	Null	1.33±.58	1.25±.50
Female>60		Null	Null	1.00±.00	1.00±.00	1.00±.00

GG=Gadio Guratoo, SW=Sukie worketa, RB=Raya Boda,SK=Sololo kobo

Table 2. Livestock ranking based on importance index in the study area

Species domestic livestock	Importance level			
	1st	2nd	3rd	index
Cattle	36	4	1	0.480
Sheep	2	14	2	0.148
goats	0	1	5	0.029
Chicken	1	13	22	0.209
horse	1	6	3	0.074
donkey	0	2	0	0.016
mule	0	0	0	0.000
camel	0	0	0	0.000
beehive	1	1	6	0.045
	41	41	39	

Indexing formula = £ (1^{st} rank * 3) + (2^{nd} rank *2) + (3^{rd} rank * 1)/1^{st}*3 +2^{nd}*2+ 3^{rd}*1

Table 3. The local chicken management practice of respondents in study area (N=48)

parameter		Study kebeles				Total respondent (N= 48)
		GG (N= 12)	SW N=12)	RB N=12)	SK (N=12)	
Scavenging (%)	yes	100.0	100.0	100.0	100.0	100.0
Watering (%)	yes	100.0	100.0	100.0	100.0	100.0
Culling (%)	yes	100.0	100.0	100.0	100.0	100.0
Selecting cock for breeding (%)	yes	91.7	100.0	100.0	100.0	97.9
	no	8.3	0.0	0.0	0.0	2.1
Selectin hens for breeding (%)	yes	100.0	100.0	100.0	100.0	100.0
Disease occurrences (%)	yes	66.7	50.0	58.3	54.5	57.4
	no	33.3	50.0	41.7	45.5	42.6
Diseased birds' treatment (%)	yes	1.94	0.56	1.32	2.40	6.22
	no	98.06	99.44	98.68	97.6	93.8
total		100.0	100.0	100.0	100.0	100.0
Provision of modern treatment		0.84	0.0	0.48	0.0	1.32
Traditional medication practice		1.12	0.56	0.84	2.40	4.92
Supplements (%)	Yes	100.0	100.0	100.0	100.0	100.0
Kind of supplements (%)	grains	25.0	0.0	8.3	0.0%	8.3
	Grain crop residue	33.3	0.0	25.0	8.3	16.7
	Grain+ leftover	25.0	75.0	33.3	83.3	54.2
	Grain leftover +crop residue	16.7	8.3	33.3	8.3	16.7
	Grain+ leftover +crop residue +vegetable++oilseed	0.0	8.3	0.0	0.0	2.1
	Grain+ leftover +crop residue +vegetable	0.0%	8.3%	0.0%	0.0%	2.1
Market problems	yes	66.7	41.7	58.3	8.3	43.8
	no	33.3	58.3	41.7	91.7	56.3

GG = Gadio Guratoo, SW= Sukie Worketa, RB= Raya Boda, SK=Sololo Kobo,TO = Total Observation

Table 5. Show the Results of qualitative trait local chicken in study area of Guji (N=240)

Qualitative parameters			Study kebels				Total observation 240 (N)
			Gadio Guratoo (N= 60)	Sukie worketa (N=58)	Raya boda (N=61)	Sololo kobo (N=61)	
Combsize (%)	small	1	80.0	72.4	73.8	59.0	71.3
	Medium	2	1.7	10.3	11.5	21.3	11.2
	large	3	18.3	17.2	14.8	19.7	17.5
Ear lob		yes	95.1	100.	100.0	100.0	98.8
		no	4.9	0.0	0.0	0.0	1.2
Super present		yes	24.6	21.7	26.2	51.6	31.1
total		no	75.4	78.3	73.8	48.	68.9
Shank feather		yes	00.0	00.0	00.0	00.0	00.0
		no	100.0	100.0	100.0	100.0	100.0
Feather distribution		normal	93.4	86.7	95.1	82.3	89.3
		Feather	6.6	13.3	4.9	17.7	10.7

Least square means ± SE of quantitative traits of cocks' and hens. ($p<0.05$)

Table 6. Shows the Color patterns and plumage of local chicken in study area of guji

Qualitative parameters		Study kebels				Total observation 240
		Gadio Guratoo (N= 60)	Sukie worketa (N=58)	Raya boda (N=61)	Sololo kobo (N=61)	
Plumage pattern of neck	plain	23.0	15.5	18.2	8.9	16.5
	Barred/auosomal	0.0	8.6	0.0	1.8	2.6
	barred	18.0	13.8	18.2	17.9	17.0
	Laced/single	3.3	1.7	20.0	7.1	7.8
	mottled	54.1	60.3	43.6	64.3	55.7
Plumage pattern of body	plain	23.0	13.3	16.4	8.1	15.2
	Barred/auosomal	0.0	10.0	0.0	1.6	2.9
	Barred	16.4	11.7	19.7	22.6	17.6
	Laced/single4	4.9	1.7	3.3	3.2	3.3
	mottled	54.1	63.3	60.7	64.5	60.7
	spangled	1.6	0.0	0.0	0.0	0.4
Plumage pattern of tail	plain	31.1	13.3	21.3	8.1	18.4
	Barredauosomal	0.0	8.3	0.0	1.6	2.5
	barred	14.8	13.3	18.0	22.6	17.2
	Laced/single	1.6	1.7	4.9	3.2	2.9
	mottled	50.8	63.3	55.7	64.5	58.0
	spangled	1.6	0.0	0.0	0.0	0.4
Ear lobe color	Non pigment(1)	15.5	18.3	13.3	8.2	13.8
	Red (2)	31.0	25.0	43.3	59.0	39.7
	White and red(3	51.7	56.7	43.3	29.5	45.2
	Red and yellew4	1.7	0.0	0.0	0.0	0.4
	other	0.0	0.0	0.0	3.3	0.8
total		100.0	100.0	100.0	100.0	100.0
Eye color	Amber	0.0	6.7	10.0	16.1	8.2
	golden-brown	27.9	55.0	46.7	33.9	40.7
	sunburst	70.5	28.3	36.7	21.0	39.1
	Flamed iris	1.6	10.0	6.7	29.0	11.9
Shank color	white 1	23.0	21.7	29.5	19.4	23.4
	blue 3	65.6	70.0	52.5	58.1	61.5
	black with white sole 5	11.5	8.3	18.0	22.6	15.2
total		100.0	100.0	100.0	100.0	100.0

Color and plumage of patterns Descriptors listed Based on FAO (2011) guideline

Table 7. Average chicken flock size in the study area (N=48)

Parameter	Study kebels				Overall
	Gadio Guratoo Sukie worketa (Uraga) district		Raya boda (Anasora) district	Sololo kobo	Mean ± SE
Young chicks	3.6 ±.75	11.4 ± 1.44	6.9 ±.94	5.2 ± .03	7.0± .70
pullets	3.8 ±.37	3.6 ± .91	3.3± .65	3.6+ .50	3.5 ±.33
cockerels	1.7 ±.81	3.9 ±.45	2.7± .58	1.8±.70	2.5 ±.32
hens	2.9 ±.59	4.4 ± .82	3.3 ± .62	2.9 ± .38	3.4±.32
cocks	1.5 ±.40	2.1 ± .38	1.6 ± .26	3.0± 1.02	2.1± .30
Total flock size	13.5±2.92	25.4±4.03	17.8±3.03	16.5±2.63	18.5±1.97

The feeding systems of chicken in the area was dominated by scavenging supplemented with little crop residues. This result is in conformity with the results reported by Ngussie (2010) and Bogale (2008) that in different areas of the country feeding chicken were in scavenging system. All chicken owners provide supplementary feed and practicing watering of chickens. that (94%) of Chicken production system managed mainly on scavenging with conditional feed supplementation. proportion of supplementation were 8.3%, 16.7%, 54.2%, 16.7% , 2.1%, 2.1% of whole grains, Grain crop residue, Grain + leftover, Grain +leftover +crop residue, Grain + leftover +crop residue + vegeTable + oilseed and Grain+ leftover + crop residue + vegeTable respectively. Other scholars (Dinka *et al*., 2010 and Fisseha *et al*., 2010) were also reported that local chicken at Rift valley of Oromia and Bure district of Amhara region reported that the dominant (98 %) and (83%)

Table 8. Least square means ± SE of quantitative traits of cocks' and hens in the study area of Guji. (p<0.05)

Study areas	Quantitative traits							
	ABW (kg)	ABL (cm)	WST (cm)	WSB (cm)	CC (cm)	SL (cm)	SC (cm)	SUL (cm)
location	Ns	***	***	***	***	***	NS	NS
GG (N=61)	1.6±0.05	40.2±0.40^{a}	42.7±0.44^{a}	44.8±0.43^{ac}	29.4±0.32^{ab}	8.00.11^{a}	4.0±0.06	1.0±0.27
SW (N=60)	1.7±0.05	41.7±0.41^{b}	45.8±0.0.46^{b}	47.3±0.45^{b}	30±0.33^{b}	9.20.11^{b}	4.10.11	1.0±0.21
RB (N=61)	1.6 ± 0.05	41.7±0.40^{b}	44.1±0.44^{c}	45.43±0.43^{c}	29±0.32^{a}	9.00.11^{b}	4.10.06	1.2±0.29
SK (N=62)	1.6 ±0.02	41.0±0.40^{a,b}	43.8±0.44^{c}	45.8±0.0.43^{c}	29±0.07^{ab}	9.20.11^{b}	4.10.06	1.0±0.21
Sex	***	***	***	***	***	***	**	NS
M (N=43)	2.1±0.05	43.4±0.36	47.4±0.40	49.4± 0.39	31.30.29	9.7±0.10	4.3±0.05	1.3±0.09
Fe (N=201)	1.5±0.02	38.9±0.17	40.7±0.19	42.4±0.40	27.40.13	8.0±0.05	3.8±0.02	0.8±0.24
Over all Mean	1.6 ± 0.02	41.1 ±0.20	44.1±0.12	45.9±0.22	29.4±0.16	8.8±0.06	4.1±0.29	1.0±0.13

- The mean difference is significant at 0.05 level, NS = non-significant at 0.05 level, within main effect means with different subscripts are significantly different
- ABW= Average Body Weight, ABL= Average Body Length, WST= Wing Span Top, WSB=Wing Span Bottom, CC= Chest Circumference, SL= Shank Length, SC=Shank Circumference, SUL=Super Length.

GG = Gadio Guratoo, SW = Sukie worketa , RB = Raya boda, SK= S.ololo kobo

Table 9. Performances trait value of local hens under farmers' management condition in study area

Variables (in mean average)	Study area/ wordas)		Total means ± SE
	Uraga	Anasora	
number of eggs laid/single clutch period	15.79±.75	16.67±.85	16.23±.56
Number of chicks hatched/time/hen	11.79±.80	13.33±.92	12.56±.61
Number of chicks surviving to adulthood	7.21±.59	6.33±.63	6.77±.43
Hatchability percentage (%)	74.5%	79,9%	77.9%
Survival percentage (%)	61.2%	47.5%	53.7%
sexual maturity of male	6.42± .30	5.50 ±.24	5.98 ± 20
sexual maturity of female	6.42±.35	5.50±.24	5.98±.20
age at first egg production (month)	6.17±.29	5.91±.23	6.04±.17
Number eggs produced/hen/year	71.67±5.65	87.19±6.89	79.09±4.52
Broodiness interval average (weeks)	7.79±1.08	4.130±.55	6.00±.66
Number of hatches/ year/hen	2.75±.19	2.8333±.19	2.79±.13
markeTable age of male chicken	9.04±.63	9.33±.53	9.19±.41
markeTable age of female	8.38±.50	7.68±.41	8.02±.32

Table 10. Show Pearson Correlations of Body Weight and Other Linear Body Measurements ofthe study area

Variables	BW (kg)	BL (cm)	SL (cm)	SC (cm)	SHL (cm)	CS (cm)	WB (cm)	WT (cm)
BW (kg)	1	.674**	.208	.546**	.612**	.725**	.718**	.587**
BL (cm)		1	.093	.542**	.611**	.609**	.775**	.686**
SL (cm)			1	.350*	-.155	.243	.037	.008
SC (cm)				1	.505**	.522**	.538**	.469**
SHL (cm)					1	.525**	.701**	.635**
CS (cm)						1	.650**	.602**
WB (cm)							1	.837**
WT (cm)								1

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed). ABW= Average Body Weight, ABL= Average Body Length, WST= Wing Span Top, WSB=Wing Span Bottom, CC= Chest Circumference, SL= Shank Length, SC=Shank Circumference, SUL=Super Length.

chicken production system were extensive/traditional type of production managed mainly on scavenging with seasonal supplementation of home grown grains and household food leftovers. Water was provided during the dry season (86.2%), rainy season (3.6%) and year round (10.2%) and this has similarity with the works of (Moges *et al*., 2010) who reported that 85.4% provide water only during the dry season and 14.3% throughout the year and different sources of water to drink their birds used like (60.2 %), pipe (21.4%), river (12.2%) and pond (6.2%) in west Amhara region. The possible reason for this result might be due to easily available crop residue and some leftover food refusal from family consumption and access water in the study area. Thus indigenous chicken are excellent foragers require few supplements only when there is shortage of feed. Owner of chickens have practiced Culling and selecting hens and cocks for breeding were found to be 97.9% and 93.8% respectively. Selection for breeding usually based on growth rate, large body size, high egg production, hatchability and good mothering ability. Chicken owners in the study were experienced with incidences of disease problem of 57.4% and treating chicken were 1.32% and 4.92% with modern and traditional treatments respectively. Similarly (Fessha M., *etal*, 2010) was reported that 97.5% of chicken owners experienced chicken disease problems, mainly Newcastle disease 98.2% and 95% of village chicken owners used only traditional means to treat sick birds at Bure district.

The critical constraints of scavenging chicken production in North wollo were disease (60.13%), predators (20.59%) and feed shortage (19.28%) (Addisu Hailu, 2012) and this is in agreement with the reports of (Worku Z. etal. 2012) 97.6% and 2.40% of predators and disease incidences respectively. In addition (Tadelle D, 2003) reported that Ethiopian chicken rearing system were characterized by extensive scavenging management, no immunization programs, increased risk of exposure of birds to disease and predators.

(it is not a must to give answer to every result) Market problems of the study area was assessed and indicated in (Table 3). Thus 43.8% of respondents reported of having market constraints with possible reason might be many a long distance away from market center and less access to the main road that goes to market center. Cross tabulation result on material used for construction of indigenous chicken house and house parts in the study area were shown in (Table 4). . Parts of house subjected to this study were Roof, wall and floor which were made of 51.4%of wood, 22.9%of grass/bush, 14.3% of (wood+mud) 8.6% of (bamboo),and 2.9% of (bamboo+grass). Walls were made from 57.6%, 18.2%, 15.2%, and 6.1% and 3% of (wood), (banbo), (wood+mud) and (wood+bamboo) respectively. While floor were made from 51.5%, 27.3%, 12.1%, 9.1% of (wood), (mud), (Mud), (bamboo) and (wood +mud) respectively. The result is inconformity with the report of (Worku Z. *etal*. 2012) which was much less 12 % of households construct separate poultry houses for their chickens. This is more or less agreed with the experiences used and practiced in other parts of the country

The analysis results of qualitative trait: The number of and percentage of each levels of qualitative traits that is comb size percent, ear lobe, super presence, shank feather presence were analyzed and their value showed in (Table 5). The univariate analysis indicted that there were little difference observed between the areas. From total observation 240 (N) the comb size were 71.3%, 11.2%, and 17.5% were small, medium and large consecutively. Local chicken involved in study comprise the presence 98.8%, 68.9%, and 100% of ear-lob, super, and shank feather presence respectively. The feather morphology of 89.3% was dominantly normal and 10.7 % feathered. The color patterns and plumage colors subjected to this study were neck, body and tail were dominated by 55.7%, 60.7%, and 58% of (mottled) respectively followed by 16.5% (barred) and 17% of (plain). Ear lobe color was dominated with 45.2% white and red, 39.2% red, and 13.8% non-pigmented while Eye color was dominated by 42.2% golden, 31.7% sunburst, and 11.9 % flamed colored.

Shank color showed 61.5% blue and 23.5% white while other colors were very small in proportion as compared to the dominant one in chicken population. This study have got different results agreement with Eskindir (2013) which reported that have brown mottled plumage color, 20.27% and 21.10% off chicken in Horro and Jarso districts respectively and also the same author showed that a complete red plumage is typical of 17.12% and 15.60% of chickens from Horro and Jarso districts respectively. Other side of the country reported by Haile Michael *etal. (*2015) plumage colors were 24.17% red followed by 13.33% white and 13.06% black in local population of Southern Zone of Tigray. Plumage pattern of neck, body, and tail of Chicken dominantly 55. %, 60.7% and 58% (mottled) respectively..

The eye and shank colors were dominant golden-brown (40.7%) and 61.5 % blue. Supportive results were reported by Eskindir *et al*, (2013) that revealed orange eye color was found in higher frequency in Horro (87.84%) than Jarso district (72.48%) and it was followed by the red, largely more represented in Jarso (24.31%) than in Horro (9.01%). other scholars (Ngussie *et al*. 2010., Bogal 2008 and Haile Michael *et al.,* 2015) reported that ear-lob colors were 40% white, 52 % red, 8% yellow and 26% white and 74% white and red Yellow(50.55%), followed by white (38.89%) and black (10.56%) and (40.28%) of chicken population exhibited white and red earlobe, followed by red (28.89%), white (26.94%) and yellow (3.89%) Respectively.

The measurement value of quantitative trait: The mean separation with standard errors of the chicken numbers were listed in (Table 7). Young chicken, pullet's cockerels, and cocks were analyzed average mean values and standard deviation of 7.0± .70, 3.5 ±.33, 2.5 ±.32, 3.4±.32, 2.1± .30 of. Each group of population value were observed respectively. The average flock size per household was (18.5±1.97) greater than average population number of 13 chicken's population per household that was reported by (Samson Leta and Endalew Bekana, 2010) at mid rift valley region of Oromia and a report by Dinka *et al.,* (2010) 13 chickens per household .. This is comparable with the country's average flock size under rural chicken production system that ranges from 7 – 10 birds per household, consisting of 2 – 4 adult hens, one cock and some growers of different age groups (CSA, 2015) .this result agreed with report by (Fisseha *et al*., 2010) that average flock size per household was 13 (ranged 1 - 57), with a hen to cock ratio of 3.7:1 at bure local chicken ecotype in Amhara region. However, the analysis of the survey data revealed that ratio of 1:3.2 population of young chicks were highest in umber (7.0 ± .70) followed by pullets (3.5 ±.33), hens (3.4 ±.3, cockerels (2.5 ±.32) and cocks (2.1± .30) per household respectively. The recommended (who recommend) cock to hen ratio is 1:10. However, this study identified female to male ratio of 2:1 that is much greater/lesser than the recommended one and is also higher/lesser than reported in (Tadelle *et al*. 2003b and Bogal Kibret, 2008) i.e. 2.5:1 and 1:3.21 ratio in the Central Highlands of Ethiopia and Fogera areas respectively.

Least square means ± SE of quantitative traits of cocks' and hens. (p<0.05): Least square means ± SE of quantitative traits of cocks' and hens in the study area were tabulated in (Table 8). There were no significant difference at (p<0.05) between location of average body weight (ABW) (1.6 –1.7kg), shank circumference (SC) (4.0-4.1cm) and super length of chicken (1.0-1.2cm) (SUL) in the study area. The average mean values of all parameters except average mean value of body weight and Super Length were significantly different at (P<0.05) level between location. GG and SK chicken mean value were not significantly different in mean average body length of 40.2±0.40 cm and 41.0±0.40cm respectively. Whereas, other locations were resulted in significantly greater value at (p<0.05) level 41.7±0.41 and 41.7±0.40 (ABL) (cm). The wing span top (WST) 45.8±0.0.46cm Sukie worketa was greater than 44.1±0.44cm and 43.8±0.44cm values of both Raya boda and sololo kobo while GG chicken wing span of top was shorter than others quantitative traits of other kebele. SW chicken have greater wing span bottom (WSB) 47.3±0.45 cm than other location which have equal value 44.8±0.43cm, 45.43±0.43 cm and 45.8±0.0.43cm of (WSB) were significantly greater at (p<0.05) levels.

Chest Circumference (CC) 30±0.33cm value of strike worrkata chicken was significantly greater than other location 9.20.11cm, 9.00.11cm, and 9.20.11cm values which was significantly different between each other at (P<0.05) level. Shank Length (SL) values 9.20.11cm, 9.00.11cm, and 9.20.11cm of SW, RB, and SK were significantly greater than the shank length 8.00.11cm of GG (SL) of chicken in the area

respectively. The possible reason of this variation is due to influence of genetic and environmental factors that exposed to chicken in the study area. All this qualitative traits variations could be used as source of selection for improving chickens of the study area and positively affect breeding program in the future. Quantitative traits between sex were evaluated with Least square means ± SE values of significantly greater value at ($p<0.05$) level of 2.1±0.05kg and 1.5±0.02 average body weight (ABW) male and female respectively. The study result is agreed with the result of (Addis Hailu, 2012) who reported that overall mean body weight of indigenous male and female chicken at North-Wollo were 1500.97gm (1.5kg) and 1253.36 gm (1.3kg) respectively and by (Haile Michael *et al.,* 2015) reported that the mean body weight of indigenous male and female chickens was 1271±12.6g and 1034±8.05g, respectively in Tigray region. Other scholar conducted research in local chicken at Fogera district reported that average weight of hens was 1.21kg (Bogal Kibret, 2008). Other parameters like 43.4±0.36cm (ABL), 47.4±0.40cm (WST) 49.4± 0.39cm (WSB), 31.30.29cm (CC), 9.7±0.10cm (SL), and 4.3±0.05cm (SC) on cock than value 1.5±0.02kg (ABW), 38.9±0.17cm (ABL), (WST) 40.7±0.19cm (WSB), 42.4±0.40cm (CC), 27.40.13cm (SL), 8.0±0.05cm (SC) of hen) were observed. Super length 1.3±0.09cm and 0.8±0.24cm was not significantly different between hen and cock respectively. Weight and other quantitative measurements above might be affected by gene and environmental interaction. It is obviously known that environment and gene interaction have great role on performance and adaptability chicken.

Performance of local hens under farmers' management condition: Performance trait value of local hens under farmer's management condition were indicated in (Table 9). Individual local hens has laid 16.23±.56 eggs per single clutch and 12.56±.61of chicks per hatched this study result greater than reported eggs incubated using a broody hen varied from 7-15 (Samson Leta and Endalew Bekana, 2010) at midl refit valley region of Oromia. Other Comparable result 12-13 egg/clutch was reported by (Bogale, 2008) at south Gondar, Fogera areas. The average number of eggs produced/hen/year was 79.09±4.52, which was greater than other reports 34 and 37.5 egg/year/hen mentioned in (Brannang and S. Person, 1990, and Fisseh *et al*., 2010) in all Ethiopian and North West Ethiopia respectively and (Fisseha *et al*., 2010b) on his report part revealed that 53-60 egg/hen/year int Bure, North-West Ethiopia. In addition, this result in agreement with (Bushra, 2012) who reported that egg produced was 40 to 60 eggs/bird /year for Ethiopian local chicken. The average number of eggs set to incubate per hen represented 77.9% of the eggs laid per clutch.

The result is similar to the one reported by Fisseha *et al.,* (2010) and Worku *et al*., (2012) with hatchability performance of local broody hens of 81.7%of eggs hatched at Bure District and 79.1% eggs hatched at West Amhara Region of Ethiopia respectively. However, the survival rate of hatched chicks to age of sexually matured was53.7% which is high chick mortality that at young stage. This result is also in agreement with (Fisseha *et al.,* 2010 and Worku *et al.,* 2012). However, the survival rate of young chicks, up to grower age, 60.5% and 58.3 % at Bure district and West Amhara Region respectively. Male and female chicken were reached to sexual maturity at equal time of 5.98 ± 20 months. Hens start to lay eggs at 6.04±.17 months which is slightly greater time than that of sexual maturity. Similarly (Halima M., 2007) reported that indigenous chickens reached the first egg production stage in 144 to 168 days and Addisu Hailu (2012) reported that the overall age at sexual maturity were 24.25 ± 0.04 and 23.84 ± 0.05 weeks at North Wollo for male and female chickens respectively. This result is also inagreement with findings of by Worku Z. *et al.* (2012) age at first egg and at sexual maturity (male) of village chickens at west Amhara region were 6.6 and 6.1 months, respectively. High hatchability performance of local hens (77.9%) and high mortality of young chicks (53.7%) were the two contradictory characteristics of the existing village chicken production system in the study area.

According to (Mekonnen, G., 2007) report productivity of indigenous chicken is low due to genetic and no-genetic factors like poor management of feeding, housing and health care. The hatchability frequency per year per hen was 2.79±.13. The markeTable age of chicken were observed to be significantly different with sex. The average age of female (9.19±.41 months) to reach for market size was found to be faster than males (8.02±.32 months). As the result indicated, people in the study area used to sell their chicken late after sexual maturity were attained. This give a better chance to replace themselves continued production at household level.

Correlations of Body Weight and Other Linear Body Measurements: As the analysis of body weight correlation indicated in (Table 10). Live body weight was positively correlated (r=.59, 72, .67, .73, .61, 55, $P<0.01$) with Wing span top, Wing span under, Body length, Chest circumference, Shank length, and Shank circumference respectively. This result agreed with repot of (Addis Getu *et al.* 2014) that the relationship of body weight with other body measurements for chicken in North Gondar in both sexes were highly significant ($r = 0.67$, $P< 0.01$) and Some traits like wing span, body length and super length ($r = 0.64$, $P < 0.01$) for males and for females ($r = 0.59$, $P < 0.01$) of necked neck chickens were significantly correlated with body weight, Live weight was positively correlated ($r = 55.5$, $P < 0.01$) with wingspan, Body length and super Length in Necked neck male were positively correlated ($r = 0.62$, $P < 0.01$) and females ($r = 0.55$, $P < 0.01$) whereas wing length (WL) was highest correlated trait ($r = 0.67$, $P < 0.01$). With body weight of male of indigenous Chicken Ecotypes in North Gondar Zone. Contrarily the correlation between live body weight is not significantly correlated (r=.21, $p>0.01$) with Spur length in the study area. The high correlation coefficients between body weight and other body measurements ($P<0.01$) help to predict live body weight of chickens.

Conclusion and recommendation

The indigenous chicken populations found in study area showed heterogeneity in most of qualitative and quantitative traits considered. All this observed variation and variability might use as sources of raw material for further detailed research of molecular and DNA level characterization to separate them from other related chicken genetic resources and or breeds found in other parts of the country.

Thus, on-farm monitoring supported with an in-depth molecular evaluation should be undertaken to prove the level of genetic difference and relationships among the indigenous chicken populations and the study result should be supported

by in depth on station study for performance evaluation of local chickens because this study were conducted under scavenging feed resource-based production systems which makes difficult to get potential of their performances. Indigenous chicken populations might possess useful genetic potentials for improved productivity though improving husbandry practice like health, research, extension, training and credit interventions and much more need to be done on improving productivity through selection as well as securing community based conservation and sustainable utilization of indigenous local chicken in the study area.

In general as the result indicated that the productivity of the village chickens was found to be very low and thus calls for appropriate interventions to be undertaken which should focus on the improvement of feeding, housing, breeding and health care of local chickens. And more over there is a need to design and implement a research programmer in order to improve their productivity in the proper place and technology.

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