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Phenotypic Characterization of Local Chicken Ecotypes in the Central Zone of Tigray Region

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The study was conducted in three districts of central zone of Tigray, with the aim, to assess the phenotypic characteristics of the local chicken. Nine qualitative and nineteen quantitative traits from 457chickens were considered. The study revealed that local chicken mostly have normal feather (hens 97.8%, cocks 96%)with a few showing necked neck(0.6%) and feathered shank and feet(2%).Very diverse plumage coloration of chicken was observed with highest proportion of red (32%), grayish and brownish (17%). Red comb color in females and males dominated in all of studied area. The highest proportion of eye color was orange (hens 96.1%, cocks 98%) followed by brown (hens 2.2%, cocks 2%) yellow and blue and red. The majority of the chickens possessed comb shape type (44.3%) followed by single (39%) and pea (15.7%)comb. Almost all chickens (91.6%) of the study area do not have spur. The predominant earlobe color was white and red (35.7%), black (33.7%) red (28.9%).The overall mean body weight of local chicken across agro ecologies was 1.36kg (1.54kg male and 1.34kg female).The average length of breast width, length of spur, thigh circumference, chest circumference and shank length in the study area was 13.61cm, 2.46cm, 9.08cm, 28.90cm and 9.78cm, respectively. The average width of earlobe, beak length, beak width, earlobe length, comb length, comb width and height at back in the study area were 1.78cm, 2.80cm, 3.24cm, 1.50cm, 1.50cm, 3.85cm and 29.12cm, respectively. Morph metric measurements indicated that significance differences (P<0.05) were observed between agro ecology with respect to breast width, spur length, chest circumferences and shank length. In all parameters, male shows higher significance (P<0.001) value than female except breast width and beak width. In conclusion, there is diversity of indigenous chicken population that may invite to design community based genetic improvement.

Key words: indigenous chicken, midland, highland

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INTRODUCTION

The world poultry population has been estimated to be about 16.2 billion, with 71.6 % in developing countries, producing 67, 718,544 metric tons of chicken meat and 57,861,747 metric tons of hen eggs (Gueye, 2005). In Africa, village poultry contributes over 70% of poultry products and 20% of animal protein intake (Kitalyi, 1998). In East Africa over 80% of the human population live in rural areas and over 75% of these households keep indigenous chickens (Kitalyi, 1998).

Ethiopia has a large population of chicken, estimated to be 49,286,932 (CSA, 2010/11). Recent estimates put the poultry population in Ethiopia at around 47,954,978 with native chicken of none descriptive breeds representing 97.3 %, hybrid chicken 188,032 which represents 0.38% and exotic breeds of chickens mainly kept in urban and peri-urban areas 1143,922 represents 2.32% (CSA, 2010/11). From the total population of chicken in Ethiopia, 97.82% of the population consists of local breed types under individual farm household management and the remaining 2.18% of birds are mainly in state-run modern production systems, with a very small proportion in private units (Berihun 2007). According to the central statics authority census in 2010/11, the total poultry population in Tigray Region is estimated to be about 4,308,595, which are about 11.65% of the total national indigenous chicken population, contributing about 15% of the total annual national egg and poultry meat production. The regional rural areas constitute about 80.9% of the total regional chicken population, while the urban areas constitute 19.1% (CSA, 2010/11). A central administration zone of Tigray accounts 1,117,881chicken population which accounts for about 34.58 % of the total regional poultry population (CSA, 2010/11).

The traditional poultry production system is characterized by small flock sizes, low input, output, and periodic devastation of the flock by disease. Even with its challenges, backyard poultry production, which is still important in low-income food-deficit countries, is an appropriate system to supply the fast-growing human population with high quality protein (Tadelle et al., 2003). It is also a source of employment for underprivileged groups in many local communities (Mengesha et al., 2008). As a matter of fact, improving the village chicken production system in rural Ethiopia will result in increasing opportunities and more equitable distribution of food and income within and among households of rural areas. However, these genotypes of existing Chicken have to be characterized for their overall merits and need subsequent improvement. Improvement of the productivity of indigenous chicken resource demands characterization of the available genotypes.

Characterization is the distillation of all knowledge which contributes to the reliable prediction of genetic performance of an animal genetic resource in a defined environment and provides basis for distinguishing between different Animal genetic resources and baseline information for selecting and designing of breeding strategies (genetic improvement methods) for improving genetic potential of the available Ethiopian indigenous chicken breeds so as to boost their productivity and reproductively (FAO,2012). It is the initial step for long-term genetic improvement as it provides the basis for any other livestock development interventions and pre-requisite information for designing appropriate breeding and utilization programs (Solkner, *et al,* 2009).

Although several researches have been done on characterization of local chicken ecotypes in Ethiopia on a comprehensive standard. Previous research works indicated that indigenous chickens are non-descriptive, with a variety of morphological appearances (Halima, 2007; Mokennen, 2007). Researches on Phenotypic characterization of indigenous chickens in Ethiopia have been also carried out at Debre Ziet Agricultural Research Center (Duguma, 2006), at South West and South Part of Ethiopia (Emebet Morda *et a,l* 2013), at Fogera district (Bogale, 2008) and at North Wollo zone of Amhara regional state (Addisu, 2012). However, there was no or little research carried out in the central zone of Tigray to characterize the existing local chickens phenotypically. Appropriate design of breeding programmes is impossible for local chicken ecotypes that have not been adequately characterized either phenotypically and /or genetically. There for this project was designed with the objectives to assess the phenotypic characteristics of the local chicken ecotypes based on their phenotype in their environment.

MATERIAL AND METHODS

Description of Study Area

The study was conducted in three rural districts of the central zone of Tigray: Laelay Maichew, Ahferom and Adwa (Fig. 1). The Central Tigray zone is bordered by Eritrea in the north, East Tigray zone in the East and south east Tigray, West Tigray zone in the west and Amhara National Regional State in the south. The central zone of Tigray covers about 9741 km^2 with a total population of 1,132,229 of which (51% are female). The central zone is divided into nine districts and three major marketing towns, Axum, Adwa and Abyi Adi. The zone consists of about 859,066 cattle, 134,223 sheep, 711,624 goat, 98,910 honeybee colonies, 1,117,881chicken and about 26,709 ha of irrigated area largely used for vegetable and fruit (CSA, 2010).

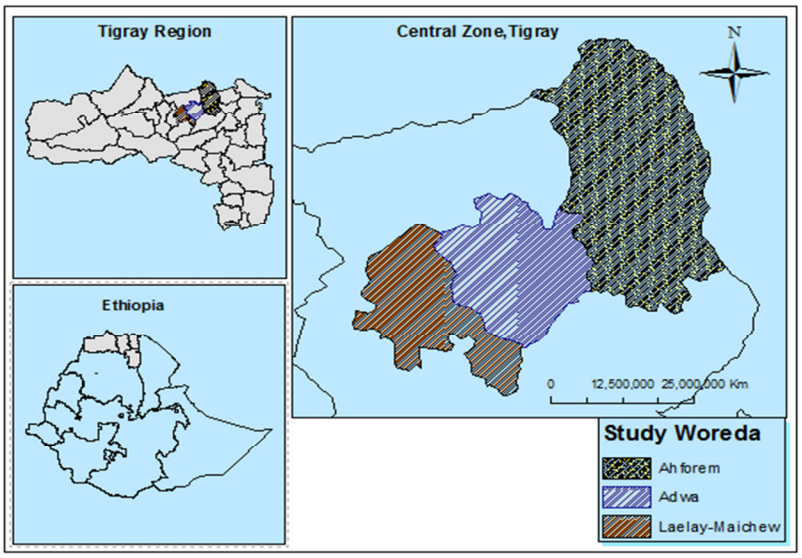

Figure 1. Map of the study area

Topography and Climate

The Central zone of Tigray extends between 13°15' and 14°39' North latitude, and 38° 34' and 39°25' East longitude. The larger part of the zone receives mean annual rainfall ranging from 400 to 800mm. The mean monthly maximum and minimum temperatures of the zone are 30°C and 10°C, respectively (National Meteorological Service Agency of Ethiopia, 1996).

The selected districts vary in biophysical conditions, including agro-ecological zoning, elevation, rainfall pattern and amount, temperature, land use and soil types. The selected zone was categorized as Dry Weina Dega in Laelay-maichew and Adwa districts followed by Dega in the highlands of Ahferom. The elevation of the study districts ranges from 1920 to 2921 masl. Annual rainfall is variable within a range of 540-850mm. Temperature ranges from 14 to 22°C. Most of the lands are cultivated with some patchy grazing bottomlands and degraded hilly sites (Gebremedhin *et al.,* 2013).

Sampling Method and Sample Size

Stratified sampling technique was employed to stratify kebeles (smallest administrative unit in Ethiopia) of the three districts into midland or waina dega (1500-2500 masl) and highland or dega (>2500masl) (EARO, 2000). Multi-stage sampling technique was employed to select both sample kebeles and respondents. Six sample kebeles were selected purposively to represent midland and highland (four kebele from midland and two kebele from highland agro ecology) based on the village poultry population density, chicken production potential, road accessibility and agro-ecological representation.

Mapping expenditure was done before the main survey, to validate the geographical distribution, concentration and populations of local chicken ecotypes, the kebeles of each sample districts and to gate sampling framework from which sampling of districts was taken. A total of 464 six-month or older chicken (279 from midland and 185 from highland agro ecology)were selected randomly for the study and the numbers of chickens per midland and highland agro ecology were determined by a proportionate sampling technique based on the chicken flock size.

Sample size determination

The numbers of chicken per single agro ecology were determined by proportionate sampling technique based on their chicken flock size as follows:

$$W = \left[\frac{A}{B}\right] \times N_0$$

Where:

W, Number of chicken required per single agro ecology
A, Total number of chicken per a single selected agro ecology
B, Total sum of chicken in all selected sample ago ecology and
$\mathbf{N_o}$, the total required calculated sample size (http://www.raosoft.com/samplesize.html)

Data collection

Observational and body measurements

Qualitative traits

From direct observation on sexually matured chicken and additional information about the owner a total of 464 six-month or older chicken were used to collect qualitative data, such as plumage color, comb type, feather morphology, feather distribution, presence or absence of spurs, shank color, earlobe color, eye color and head shape based on standard format breed descriptor list (FAO, 2012). The data on morphological traits were collected by taking a picture of each surveyed bird.

Quantitative traits

A total of 457 adult chickens (357 female and 100 male) six month or older in age matured chicken were used based on the proportion of the poultry population of the selected districts to collect quantitative variables. Based on the methodology developed by FAO (2012), linear body measurement like body weight, breast width, thigh circumference, chest circumference, shank length (SL), neck length (NL), body length (BL), wing length, wingspan, wattles width, wattles length, ear lobe width, ear lobe length, beak length (BKL), beak width, comb length (CL), comb width, height at back were measured by using a textile measuring tape to the nearest unit centimeter. Body and shank lengths were measured using a graduated tape while the bird was standing upright and body weight was measured in kilogram using sensitive balance.

Statistical model and data analyses

Statistical model

General linear model was used to evaluate the effect of sex and agro-ecology on the quantitative traits of each prevailing local chicken types at each district separately.

$$Y_{ijk} = \mu + A_i + B_i + AB_{ij} + e_{ijk}$$

Where Y_{ijk}: the corresponding quantitative trait of local chicken in i^{th} agro-ecology (i=2, midland & highland) of j^{th} sex (j= 2, male and female)

μ: overall population mean of the corresponding quantitative trait

A_i: effect of i^{th} agro-ecology

B_j: effect of j^{th} sex (j=2, male & female)

AB_{ij}: agro-ecology & sex interaction effect and e_{ijk}: residual error

Data analyses

Qualitative morphological data

Descriptive statistics were used to analyze qualitative traits (plumage colour, body shape, comb type, feather morphology, feather distribution, presence or absence of spurs, shank colour, earlobe colour, eye color and head shape) of the local chicken ecotypes for each district and agro-ecology.

Quantitative morphological data

Morphological traits that show quantitative characteristics were subjected to analysis of variance using the general linear model procedure (PROC GLM) of SAS 9.1 to determine the effects of agro-ecology, sex and their interaction.

RESULT AND DISCUSSION

Qualitative traits

Qualitative traits such as feather distribution, plumage color, earlobe color, spur presence, shank color, comb color, comb shape, eye color and head shape were evaluated in two agro ecology of the central zone of Tigray (Table 1). The results indicated that there are large variations in morphological appearances (Table1). Local chicken was mostly normally feathered (hens 97.8%, cocks 96%) with a few showing necked necks (0.6%) and feathered shank and feet (2%).

This results are consistent with the observations of Halima, 2007; Bogale, 2008; Faruque *et al.* (2010) who reported that most of the indigenous chickens have no shank feathers and shanks are yellowish in color.

Very diverse plumage coloration of a chicken was observed (Table 2). The results indicated that red(32%), grayish/sigem (17.5%), brownish/bunama(17%), wheaten(7.8%), multi-color (6.9%), black(6.5%), white(5.4%), gold (5.2%) and black and red white with red stripes, respectively being the dominant color in these areas in hens. This result is in agreement with reports of Halima, (2007) which reports that, the plumage color in North West Ethiopia were 25.49% white, 7.79% black, 16.44% red, 22.23% gebisama and 13.64% black with white strips. The large variation in plumage color might be attributed to a lack of selection of breeders for this trait, which was also reported from Nigeria (Daikwo *et al.,* 2011), Jordan (Abdelqader *et al.,* 2007) and Botswana (Badubi *et al.,* 2006).

There was a high diversity in color and type of the combs and earlobes observed between and within the agro ecology indigenous ecotypes. The commonest

comb color observed was red (hens 95%, cocks 97%), while the remaining 5% of hens and 3% of cocks showed brown and black colors. Red comb color in females and males dominated in all our study areas, which agrees with the findings of Halima, (2007) for local chicken in North West Ethiopia. The light color of comb and skin might contribute to the birds' tolerance of heat stress (Egahi *et al.,* 2010).

The highest proportion of eye color was orange (hens 96.1%, cocks 98%) followed by brown (hens 2.2%, cocks 2%) yellow and blue and red. Comb size is associated with gonadal development and intensity of light, but comb type is the consequence of gene interaction (Bell, 2002). A significant domination ($P<0.05$) of the single comb in females (42.1%) and rose comb in males (67%) was observed. The majority of the chickens possessed comb shape with rose shape (44.3%) followed by single (39%) and pea (15.7%) (Table26). This finding was in line of the research work of Halima, (2007) who reported that in North West Ethiopia comp type 16.6% chickens have rose,50.72% have pea and 13.34% single comb shape of chicken and Apuno *et al.* (2011) in Nigeria reported that (96.45%) single comb and 0.44% pea comb. Almost all chickens (91.6%) of the study area have not spurred only 8.4% of the chickens have spurs. The predominant earlobe color was white and red (35.7%), black (33.7%) red (28.9%) white and black orange and white in lower proportions. The commonest shank color was white (47.1%), yellow (26.1%), black (9.1%), brown (5.6%), green (5.2%), gray blue (3.2%), red (1.7%), and orange (1.5%), respectively (Table 2). This finding was also slightly similar to findings of Halima, (2007) reported that, chickens in North Western Ethiopia have yellow (64.42%), black (9.61%), white (13.99%), green (11.98%) shank color.

Table 1. Qualitative traits of chickens in the different agro ecology of the study area

Qualitative traits	Agro ecology								Over all n=457						X^2 value	P-value
	Midland				Highland											
	Female n=214		Male n=65		Female n=149		Male n=36		Female n=363		Male n=101		Sum n=464			
	freq	%	freq	%	freq	%	freq	%	freq	%	freq	%	freq	%		
Feather distribution															4.975	0.083
Normal	207	96.7	61	93.8	148	99.3	36	100	355	97.8	97	96.0	452.0	97.4		
Necked neck	2	0.9	1	1.5	0	0	0	0	2	0.6	1	1.0	3.0	0.6		
Feathered shanks & feet	5	2.3	3	4.6	1	0.7	0	0	6	1.7	3	3.0	9.0	1.9		
Plumage color															37.998	0.000
White	12	5.6	6	9.2	6	4.0	1	2.8	18	5.0	7	6.9	25.0	5.4		
Black	9	4.2	1	1.5	20	13.4	0	0	29	8.0	1	1.0	30.0	6.5		
Red	45	21.0	42	64.6	41	27.5	24	66.7	86	23.7	66	65.3	152.0	32.8		
Grayish/sigem	51	23.8	5	7.7	24	16.1	1	2.8	75	20.7	6	5.9	81.0	17.5		
Multi color	7	3.3	7	10.8	11	7.4	7	19.4	18	5.0	14	13.9	32.0	6.9		
Brownish/bunama	58	27.1	0	0.0	21	14.1	0	0	79	21.8	0	0.0	79.0	17.0		
Gold	15	7.0	4	6.2	2	1.3	3	8.3	17	4.7	7	6.9	24.0	5.2		
Wheaten	14	6.5	0	0.0	22	14.8	0	0	36	9.9	0	0.0	36.0	7.8		
White with red stripes	2	0.9	0	0.0	0	0.0	0	0	2	0.6	0	0.0	2.0	0.4		
Black and red	1	0.5	0	0.0	2	1.3	0	0	3	0.8	0	0.0	3.0	0.6		
Earlobe color															4.963	0.420

White	69	32.2	12	18.5	47	31.5	5	13.9	116	32.0	17	16.8	133.0	28.7		
Red	54	25.2	39	60.0	46	30.9	26	72.2	100	27.5	65	64.4	165.0	35.6		
White and red	86	40.2	14	21.5	51	34.2	5	13.9	137	37.7	19	18.8	156.0	33.6		
Black	3	1.4	0	0.0	1	0.7	0	0	4	1.1	0	0.0	4.0	0.9		
White and black	0	0.0	0	0.0	4	2.7	0	0	4	1.1	0	0.0	4.0	0.9		
Orange	2	0.9	0	0.0	0	0.0	0	0	2	0.6	0	0.0	2.0	0.4		
Spur presence															0.902	0.342
Present	6	2.8	21	32.3	0	0	12	33.3	6	1.7	33	32.7	39.0	8.4		
Absent	208	97.2	44	67.7	149	100	24	66.7	357	98.3	68	67.3	425.0	91.6		

n = *is referred to total number of chicken taken*

Table 2. Qualitative traits of chicken in different agro ecology of the study area

Qualitative traits	Agro ecology								Over all n=457						X^2 value	P-value
	Midland				Highland											
	Female n=214		Male n=65		Female n=149		Male n=36		Female n=363		Male n=101		464			
	freq	%	freq	%	freq	%	freq	%	freq	%	freq	%	freq	%		
Shank color															96.049	0.000
white	94	43.9	18	27.7	92	61.7	10	27.8	186	51.2	28	27.7	214	46.1		
Red	4	1.9	4	6.2	0	0.0	0	0.0	4	1.1	4	4.0	8	1.7		
Brown	10	4.7	0	0.0	5	3.4	11	30.6	15	4.1	11	10.9	26	5.6		
Yellow	71	33.2	39	60.0	9	6.0	9	25.0	80	22.0	48	47.5	128	27.6		
Black	18	8.4	3	4.6	20	13.4	1	2.8	38	10.5	4	4.0	42	9.1		
Gray blue	14	6.5	1	1.5	0	0.0	0	0.0	14	3.9	1	1.0	15	3.2		
Green	3	1.4	0	0.0	18	12.1	3	8.3	21	5.8	3	3.0	24	5.2		
Orange	0	0.0	0	0.0	5	3.4	2	5.6	5	1.4	2	2.0	7	1.5		
Comb color															4.778	0.189
Red	202	94.4	62	95.4	143	96.0	36	100	345	95.0	98	97.0	443	95.5		
Brown	7	3.3	3	4.6	1	0.7	0	0	8	2.2	3	3.0	11	2.4		
Black	5	2.3	0	0.0	5	3.4	0	0	10	2.8	0	0.0	10	2.2		
Comb shape															2.653	0.265
Single	87	40.7	14	21.5	66	44.3	14	38.9	153	42.1	28	27.7	181	39.0		
Pea	42	19.6	5	7.7	26	17.4	0	0.0	68	18.7	5	5.0	73	15.7		
Rose	85	39.7	46	70.8	57	38.3	22	61.1	142	39.1	68	67.3	210	45.3		
Eye color															9.296	0.054
Orange	201	93.9	63	96.9	148	99.3	36	100	349	96.1	99	98.0	448	96.6		

n = *is referred to total number of chicken taken*

Yellow	1	0.5	0	0.0	0	0	0	0	1	0.3	0	0.0	1	0.2		
Brown	8	3.7	2	3.1	0	0	0	0	8	2.2	2	2.0	10	2.2		
Blue	1	0.5	0	0.0	1	0.7	0	0	2	0.6	0	0.0	2	0.4		
Red	3	1.4	0	0.0	0	0	0	0	3	0.8	0	0.0	3	0.6		
Head shape															37.069	0.00
Crest	86	40.2	22	33.8	20	13.4	3	8.3	106	0.3	25	24.8	131	28.2		
Flat plain	128	59.8	43	66.2	129	86.6	33	91.7	257	0.7	76	75.2	333	71.8		

According to Nesheim, Austic and Card (1979), the size and colors of combs and wattles are associated with gonad development and secretion of sex hormones. Large wattle and long legs are important morphological traits that allow better heat dissipation in the hot tropical environment.

Quantitative Traits

Body weight and other body measurements are useful parameters that are used to describe a breed or type, jointly with the breed's morphological characteristics and the environment it inhabited. The body weight and other linear measurements of the sample population were summarized in (Tables 3, 4 and 5).

Table 3 shows least square means for body weights (Bwt), breast width (Brwth), spur length (SPl), thigh circumference (TC), chest circumference (Cc) and shank length (SL) measurements of local chicken populations in the study area. The overall average value (LSM ± SE) of body weights (Bwt), breast width (Brwth), spur length (SPl), thigh circumference (TC), chest circumference (Cc) and shank length (SL) measurements of local chicken in midland and high land agro ecology was.36±0.02kg, 13.61±0.08cm, 2.46±0.23cm, 9.08±0.09cm, 28.90±0.15cm and 9.78±0.06cm.

The results of the present study show that the overall mean body weight of local chicken across agro ecology were 1.36kg (1.54kg male and 1.34kg female). The result was almost similar to values (1.46kg) from North Gonder (Addisu.G., 2013) and 1.27kg (1,035 gram female and1.5 kg male) from the Central Highlands of Ethiopia Alemu and Tadelle (1997), while higher weights (1.7kg) were reported from Northwest Ethiopia (1,316 gm hen and 2049.07gm cock) by Halima (2007). Adult cocks (1.54±0.04kg) was significantly ($p<0.05$) heavier than that of hens (1.31±0.02kg). The differences in body weight and body measures between male and female birds are in agreement with reports from Central Highlands of Ethiopia Alemu and Tadelle (1997; North Gonder Addisu.G., (2013) and Northwest Ethiopia Halima (2007) such difference are due to the differential effects of androgens and estrogens and estrogen on growth(Yakubu *et al.,* 2009). The results also revealed that both agro ecology and sexes differed also with respect to other body measurements.

Table 1. Least squares means for body weight and other body measurements of local chickens summarized by agro ecology and sexes

Effect	Traits					
	Bwt	Brwth	SPl	TC	Cc	SL
			Agro ecology			
Midland	1.36±0.02	13.69±0.10	2.61±0.3	9.20±0.11	29.16±0.19	9.95±0.07
Highland	1.36±0.03	13.48±0.13	2.13±0.36	8.88±0.13	28.49±0.25	9.51±0.09
Overall	1.36±0.02	13.61±0.08	2.46±0.23	9.08±0.09	28.90±0.15	9.78±0.06
P-value	0.553	0.038	0.0006	0.126	0.005	0.0003
			Sex			
Male	1.54±0.04	13.52±0.17	2.62±0.8	10.31±0.21	29.67±0.38	11.01±0.12
Female	1.31±0.02	13.63±0.09	2.44±0.25	8.74±0.08	28.69±0.16	9.43±0.05
P-value	<.0001	0.267	<.0001	<0.0001	0.0507	<0.0001
Sex*agroecology	0.2097	0.081	0.0017	0.6922	0.061	0.5442

Bwt, body weights, Brwth, breast width, SPl, spur length, TC, thigh circumference, Cc, chest circumference SL, shank length.

Significance differences (P<0.05) were observed between agro ecology with respect to breast width, spur length, chest circumferences and shank length. The length of spur, thigh circumference, and chest circumference and shank length in midland was relatively higher than those of highland agro ecology (Table 3). The average length of breast width, length of spur, thigh circumference, chest circumference and shank length in the study area was 13.61±0.08cm, 2.46±0.23cm, 9.08±0.09cm, 28.90±0.15cm and 9.78±0.06cm. It was also observed that there were no significant differences between agro ecology with respect to body weight and thigh circumference because gene flow might have taken place between the two subpopulations.

The observed large variation in breast width, spur length, chest circumferences and shank length between agro ecology indicates the existence of divergent subpopulations within the local chicken population. Such variation gives room for genetic improvement between and within subpopulations.

The average shank lengths observed (9.78±0.06cm) in the present study were almost similar to values from Jarso district and Horro 11.32 cm and 9.99 cm (Eskindir A. *et al.,* 2013), from Fogera district 9.8 cm reported by Bogale (2008), from Northwest Ethiopia (10.31 cm) reported by Halima (2007) but higher than reports of Addisu.G.(2013) 7.79±0.15cm in North Gonder. The average super length observed (2.46±0.23) in the present study were higher as compare to findings of Adisu, (2013) from North Gonder (0.18 ±0.02cm).

Results also revealed that agro ecology differed also with respect to other body measurements. Significance differences (P<0.05) were observed between agro ecology with respect to neck length and highly significant difference (P<0.01) were observed in wing span wattle width and wattle length (Table 4). The average length of neck, body length, wing length, wing span, wattle width, wattle length in the study area were 11.18±0.11cm, 26.39±0.13cm, 12.23±0.08cm, 33.07±0.17cm, 2.41±0.05cm, and1.92±0.06cm. It was also observed that there were no significant differences between agro ecology with respect to body length and wing length.

The average body lengths observed in the present study were much higher than those reported by Badubi *et al.* (2006) in Botswana which were 20.2 and 18.1cm for male and female chickens, but lower than reports of Adisu,(2013) in North Gonder (35.79±0.09 cm). The average live weight of 1.3kg reported in this study is lower as comparable to those reported from North Gonder by Adisu,(2013) that obtained (1.63±0.03kg) for male and (1.37±0.02kg) for female indigenous chickens. The average wing span observed in the present study were much higher than those reported by Halima,(2007) in North West Ethiopia, which were found(15.83cm) in Gelila and melo Hamisit male and (14.00cm) found in Tilili and Melo Hamusit female chickens, but lower than reports of Adisu,(2013) in North Gonder (but lower than reports of Adisu,(2013) in North Gonder (35.79±0.09 cm).

Table 4. Least square means for neck length and other body measurements of local chickens summarized by agro ecology and sexes

Effect	Traits					
	NL	BL	WL	WS	WAW	WAL
			Agro ecology			
Midland	11.54±0.15	26.27 ±0.17	12.20±0.12	33.44±0.23	2.53±0.07	2.05±0.08
Highland	10.62±0.15	26.57±0.19	12.27±0.12	32.48±0.25	2.24±0.07	1.71±0.08
Overall	11.18±0.11	26.39±0.13	12.23±0.08	33.07±0.17	2.41±0.05	1.92±0.06
P-value	0.006	0.3098	0.8747	0.0015	<0.0001	<0.0001
			Sex			
Male	12.08±0.24	27.26±0.28	13.30±0.18	36.27±0.34	3.79±0.12	3.61±0.13
Female	10.93±0.12	26.14±0.14	11.93±0.09	32.17±0.17	2.03±0.03	1.44±0.03
P-value	<0.0001	0.0004	<.0001	<0.0001	<0.0001	<0.0001
Sex*agroecology	0.0162	0..9479	0.4851	0.0762	0.0160	0.0141

NL, neck length, BL, body length, WL, wing length, WS, wing span, WAW, wattle width, WAL, wattle length

Table 5. Least square means for earlobe width and other body measurements of local chickens summarized by agroecology and sexes

Effect	Traits						
	EAW	BKL	BKW	EAL	CL	CW	HB
Agro ecology							
Midland	1.82±0.05	2.82±0.03	3.27±0.03	1.53±0.04	1.59±0.08	3.91±0.12	29.49±0.20
Highland	1.71±0.05	2.77±0.03	3.20±0.03	1.46±0.05	1.35±0.09	3.77±0.14	28.53±0.22
Overall	1.78±0.04	2.80±0.02	3.24±0.02	1.50±0.03	1.50±0.06	3.85±0.09	29.12±0.15
P-value	0.0095	0.2776	0.1030	0.2951	0.059	0.928	0.0048
Sex							
Male	2.60±0.09	3.02±0.04	3.31±0.05	2.11±0.08	2.68±0.17	6.03±0.24	31.96±0.35
Female	1.55±0.03	2.74±0.02	3.22±0.03	1.33±0.03	1.17±0.05	3.25±0.06	28.32±0.14
P-value	<0.0001	<0.001	0.1792	<0.0001	<0.0001	<0.0001	<0.0048
Sex*agroecology	0.0039	0.579	0.4198	0.5572	0.432	0.636	0.573

EAW, earlobe width, BKL, beak length, BKW, beak width, EAL, earlobe length, CL, comb length CW, comb width, HB, height at back

Data presented in Table 5 showed that earlobe width and height at back were affected by agro ecology. There was highly significant difference among agro ecology for earlobe width and height. It was also observed that there were no significant differences between agro ecology with respect to beak length, beak width, earlobe length, comb length and comb width. The average width of earlobe, beak length, beak width, earlobe length, comb length, comb width and height at back in the study area were 1.78±0.04cm, 2.80±0.02cm, 3.24±0.02cm, 1.50±0.03cm, 1.50±0.06cm, 3.85±0.09cm and 29.12±0.15cm.

The result was similar to values from North Gonder (Addisu *et al.,* 2013) reported that the overall length of local chicken ecotype 35.79±0.09cm, 2.76±0.09cm, 1.68±0.04cm and 2.03±0.02cm for body length, comb length, comb width and beak length. Comb size is associated with gonadal development and intensity of light but comb type is the consequence of gene interaction (Bell, 2002). Nesheim, Austic and Card (1979), also reported that the size and colours of combs and wattles are associated with gonad development and secretion of sex hormones.

Sex effect

The value for body weight and other parameters was shown in Table 3, 4 and 5. Wide variation in values was observed between male Vs female. In all parameters, male shows higher significance (P<0.001) value than female except breast width and beak width. The differences in body weight and body measures between male and female birds are in agreement with reports from Jarso district and Horro (Eskindir A. *et al.,* 2013), from Fogera district (Bogale, 2008), from Northwest Ethiopia (Halima, 2007) and from North Gonder (Addisu.G., 2013); such differences are due to the differential effects of androgens and estrogens on growth (Yakubu *et al.,* 2009). The lower body measurement values observed for females than for male chickens in this study are also consistent with the findings from other studies (Msoffe *et al.,* 2004; Alabi *et al.,* 2012; Semakula *et al.,* 2011; Olawunmi *et al.,* 2008), suggesting that sexual dimorphism in chickens is manifested with respect to a large number of body attributes and in most breeds. This may be attributed to sex hormones, which may promote larger muscle development in males than in females.

The effect of sex in favor of males can be attributed to the anatomical and physiological difference. Physiologically, the sex related differences might be partly a function of the sex differential hormonal effect on growth (Semakula *et al.,* 2011). Therefore, the lower body measurement values observed for females than for male chickens in this study, suggesting that sexual dimorphism in chickens is manifested with respect to a large number of body attributes and in most breeds. This may be attributed to sex hormones, which may promote larger muscle development in males than in females.

There was no significant(P<0.05) interaction observed between agro ecology and sexes with respect to morph metric traits except for breast width, spur length, neck length, wattle width, wattle length and earlobe. In those traits higher measurements were observed in midland as compare to highland. The phenomenon observed significant interaction between agro ecology and sexes with respect to those morph metric traits was could be due to the differences between the two subpopulations with respect to the degree of expression of sex dimorphism for the traits.

CONCLUSION

The result of the current study revealed that, local chicken was mostly normally feathered (hens 97.8%, cocks 96%) with a few showing necked necks (0.6%) and

feathered shank and feet (2%). Red (33%), grayish/sigem (17.5%), brownish/bunama(17.3%),wheaten(7.9%), multi color(6.8%) black(6.3%), white(5.2%), gold (4.8%) and black and red white with red strips, respectively being the dominant color in these areas in hens. The commonest comb color observed was red (hens 94.7%, cocks 97%). The highest proportion of eye color was orange (hens 96.1%, cocks 98%) followed by brown (hens 2.2%, cocks 2%) yellow and blue and red.

Morph metric measurements indicated that significant differences ($P<0.05$) were observed between agro ecologies with respect to breast width, spur length, chest circumferences and shank length. In all parameters, male birds show higher significance ($P<0.001$) value than female except breast width and beak width.

RECOMMENDATIONS

- The findings of this study demonstrate that there are diverse indigenous chicken ecotypes in phenotype but there is a need to study carcass and egg quality of the chickens and other variability at molecular levels that will further clarify the genetic similarity and diversity among the ecotypes in order to record and registered these breeds internationally.

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