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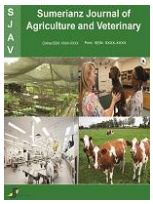

Original Article Open Access

Assessment of Morphological, Egg Quality and Carcass Characteristics of Local and Exotic Chickens Reared in Two Districts of Metekel Zone Ethiopia

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Abstract

A study was conducted in two selected districts (Pawe and Bulen) of Metekel Zone to assess the morphological and egg quality traits and carcass components of local and exotic chickens. Morphometric traits were assessed from 900 adult local and exotic chickens while qualitative traits were determined from 600 local chickens. For the evaluation of egg quality, 600 eggs from both genotypes (300 eggs from exotic and 300 from local) were used from sampled households. A total of 80 chickens (40 from each genotype) were used to assess the carcass components. The results indicated that the majority of local chickens raised in the two districts are characterized by normal feather type. The local chickens from Pawe were characterized by pea comb while those of Bulle by the rose comb. Creamy ear lobe and yellow shank colors were predominant in both districts. Except for back length and shank length, chickens in Bulen were superior ($p<0.05$) to those of Pawe in all other morphometric traits. Male chickens had higher ($p<0.05$) values in all morphometric traits than females. Except for body length and back length, other morphometric traits were higher ($p<0.05$) in exotic chickens than in locals. Except egg yolk colors, egg quality values were higher for Bulen ($p<0.05$) chickens than those of Pawe. Eggs of exotic chickens had higher ($p<0.05$) qualities than those of local chickens. Most of the carcass components were higher ($p<0.05$) in Bulen chickens than those of Pawe. Exotic genotypes were superior ($p<0.05$) to local chickens in most carcass components. Male chickens had higher ($p<0.05$) carcass values than females. In conclusion, exotic chickens were found to be superior to local chickens in most of the studied quantitative traits and thus could be further used by the smallholder farmers. The survival ability and egg production potential of exotic chickens under smallholder settings appears to be relevant research gaps to be addressed by other scholars.

Keywords: Carcass; Egg quality; Exotic chicken; Local chicken; Metekel zone; Morphological traits.

1. Introduction

Ethiopia is representative of countries where local chickens play a dominant role in total poultry production which represents an important part of the national economy in general and rural economy in particular [1]. In Ethiopia, majority of the chickens are raised under the traditional management system by farmers for whom it may be the only form of savings and their own consumption [2, 3]. Native chicken production is vital in the livelihood of many households in the country, especially the resources for poor rural farmers providing nutrition for the family (good source of protein), a small cash flow reserve for times of celebrations or need and in some areas contribute to religious ceremonies and recreation [2, 4]. Production of both egg and meat is fundamental measure to reduce animal protein deficiency in the nutrition of smallholder farmers [2, 5]. Chicken production is thus vital to meet food security by producing animal source protein and being income source to most of the rural population.

According to CSA [6], there are about 60 million chicken populations in Ethiopia. About 95.9%, 2.8% and 1.35% of the total poultry are reported to be indigenous, crossbreeds and exotic, respectively. They are distributed across contrasting agro-ecologies and reared under traditional scavenging management system, which is predominately characterized by small flock, low input, poor management, periodic flock devastation with short life cycle, quick turn over and unorganized market system [2, 7]. The most adaptive and dominant chicken types for this rearing system are local ecotype with large phenotypic and genetic variations [1]. Moreover, the local chickens are known to possess desirable characters such as thermo-tolerance, resistance to some disease, good egg and meat flavor, hard egg shell, high fertility and hatchability [5, 8, 9], However, their performance is generally low due to poor housing and feeding, disease and predators [1, 2, 8]. As a result, governmental and nongovernmental organizations have been trying to improve the productivity of local chickens through the introduction and distribution of suitable exotic chickens to some rural communities. Although such efforts have been repeatedly criticized by scholars due to the dilution effect of the local chicken genetic resource, most households are still

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demanding to rear exotic chickens along with their local chickens or alone. In Metekel zone, some dual-purpose exotic chicken genotypes were introduced over the last few years. Thus, assessment of morphometric and egg quality traits along with carcass components of both local and exotic chickens becomes relevant to make decisions on the continuity of such activities in the future. To the authors' knowledge, however, there is no information on the comparative performance potentials of local and exotic chickens reared under smallholder settings in the study areas. Therefore, this study was conducted to assess the morphological and egg quality traits as well as the carcass characteristics of both exotic and local chicken populations in the selected districts of Metekel zone.

2. Materials and Methods

2.1. Description of Study Area

The study was conducted in two selected Districts of Metekel zone in Benishangul Gumz Region. Metekel Zone is one of the three zones in the Region, which consists of seven districts and is situated within an altitude ranging from 550 to 2500 m a.s.l. Metekel is the largest zone with an area of 26 272 km^2. The average annual temperature ranges between 20 and 25 $^{\circ}$C. The annual rainfall varies from 500 to 1800 mm [10].

2.2. Sampling Design and Data Collection Procedures

2.2.1. Sampling Design

The study was conducted in two purposely selected Districts, namely Pawe and Bulen. A multi-stage purposive sampling technique was used for the study. The districts were selected based on the population and availability of indigenous and exotic chickens. The Kebele (the smallest administrative unit) from each districts were selected purposively based on the availability of both local and exotic chicken's population and proximity of all-weather road. Four Kebeles were selected from each district. From each Kebele, 38 households that have a minimum of 5 one year and above aged local and exotic chickens were first purposively and then randomly selected (with a total of 300 households). From each household, 3 matured chickens (1 male and 2 Females) were considered for the study.

For the assessment of egg quality traits, a total of 600 eggs (2 eggs per household of which 1 egg from exotic chickens and 1 from the local chickens) were purchased. The maximum care has been taken to collect eggs that have been stored not more than a week after being laid. Moreover, the freshness of the eggs was checked by immersing them in bucket filled with water during the egg collection process. The collected eggs were properly labeled according to their origin (District, Kebele and Breed) and transported to the laboratory. For the analysis of carcass components, a total of 80 (40 local and 40 exotic chickens) chickens were purchased from households representing each district. From each breed, 20 male and 20 female were used.

2.3. Data Collection Procedures

2.3.1. Morphological Traits

Morphological traits were taken from a total of 900 matured chickens, of which 300 were exotic chickens and the rest 600 were indigenous chickens. From 600 indigenous chickens, 200 were roosters and the rest were hens. Among 300 exotic chickens, 100 were roosters while the rest 200 hens.

Data on qualitative traits (feather morphology, feather distribution, plumage color, shank color, ear-lobe color and comb type) were collected from 600 local chickens by visual appraisal [11]. Morphometric traits were taken following FAO's descriptor for the characterization of chicken genetic resources [11]. The following traits were considered: body weight, body length, back length, chest circumference, wing span length, beak length, neck length, wattle length, shank length, shank circumference, and keel length). Data were taken using a textile measuring tape (cm) and a digital hanging spring balance (kg)

2.3.2. Egg Quality Parameters

For determination of external and internal egg quality, the following parameters were considered: egg weight, length and width of egg, height and diameter of yolk, yolk colour, height of albumen and shell thickens. Eggs were weighed using triple beam balance. Egg length and width and yolk diameter was measured using digital caliper. A tripod micrometer was used to measure the heights of albumen and Yolk. Yolk colour was measured by using the Roche Colour Fan. Egg shell thickness was measured according to Melesse, *et al.* [12]. Shell thickness was determined by taking the average thickens of large end, the center and narrow end. Individual Haugh unit was calculated according to the equation of Haugh [13]. Index of yolk was calculated by dividing yolk height by its diameter.

2.3.3. Carcass Components

Before slaughtering, the chickens were deprived of feed and water over night. Chickens were weighed individuals (taken as pre-slaughter weight) using spring balance (SALTER Model 235, England). For weighing carcass components, a digital balance with one gram accuracy was used. Each chicken was slaughtered by cutting jugular vein for proper bleeding and then immersed in hot water and defathered manually. The dressed carcass weights were taken after de feathering and removal of feet, head and the viscera while keeping the skin. The carcass of breast, thighs, drumsticks, wings, necks, keel bone meat, backbone and thorax were weighed inclusive with bones. The giblets (heart, liver and gizzard) are edible in most part of Ethiopia and included in the carcass weight. The wings were removed by a cut through the shoulder joint at the proximal end of humerus. The breast portion was obtained as described by Haugh [13]. The thigh and drumstick portions were obtained by cutting through the joint

between the femur and ileum bone of the pelvic girdle. The drumsticks were separated from the thigh by a cut through the joint formed by the femur, fibula and tibia. The dressing percentage was calculated from dressed carcass weight (inclusive of giblets) as a percentage of the slaughter weight.

2.4. Statistical Analysis

Data on production system and qualitative traits were coded and statistically analyzed using SPSS soft ware (SPSS ver. 24). Data on morphometric, egg quality and carcass parameters were analyzed using GLM procedures (SAS, 2012, ver. 9.4) by fitting the district, breed and sex as independent variables. Mean comparisons were conducted using Tukey's Studentized Range (HSD) Test. The values were considered significant at $P<0.05$.

Morphometric traits were analyzed using the following model:

$Y_{ijk} = \mu + D_i + B_j + D_i * B_j + D_i * S_k + B_j * S_k + D_i * B_j * S_k + e_{ijk}$

Y_{ijk} = the observations of dependent variables

μ = overall mean of the observed variable

D_i = the effect due to i^{th} district (i = pawe, bule districts)

B_j = the effect due to j^{th} breed (j = local, exotic chicken)

S_k= the effect due to k^{th} sex of chickens (k = male, female)

$D_i * S_k$ = the effect due to interaction between district and sex

$B_j * S_k$ = the effect due to interaction between breed and sex

$D_i * B_j * S_k$ =the effect due to interaction between district, breed and sex

e_{ijk} = random residual error

For carcass traits, the same model for mophometric traits was used; however, interaction effects due to district with breed and sex were dropped as they were not significant.

The following statistical model was used to analyze the egg quality traits.

$Y_{ijk} = \mu + D_i + B_j + D_i * B_j + e_{ijk}$

Y_{ijk} = the observations of egg quality parameters

μ = overall mean of the respective variable

D_i= the effect due to i^{th} district (i = Pawe, Bulen)

B_j= the effect due to j^{th} breed (j = local, exotic)

$D_{i*}B_j$= the effect due to interaction between district and breed

e_{ijk} = random error term

3. Results and Discussion

3.1. Qualitative Traits

The proportionate of major qualitative traits of local chickens reared in the two districts is presented in Table 1. Several adaptation and morphological variations of Ethiopian indigenous chicken populations have been reported by different scholars [1, 3, 14]. In the current study, highly diverse plumage color is observed among the local chicken population which is in good agreement with the observation of Melesse and Negesse [1] and Aklilu [15]. The possible explanation for the presence of different plumage colors might be due to segregation of alleles from panmictic mating among the birds possessing different plumage patterns and the a lack of selection of breeders for this trait. The present study further showed that most of the local chickens in both districts have normal feather morphology and distribution and is in close agreement with those reported by Melesse and Negesse [1] in Sidama zone. The chickens with frizzle feather are believed to able to tolerate tropical weather better than those with normal feather type. Nevertheless, the normal father could also equally important as that of frizzle in providing better insulation against cold weather conditions [1].

Table-1. Proportionate (%) of major qualitative traits of local chickens reared in two districts

Variables	Pawe (N = 300)	Bulen (N = 300)	Overall mean	X^2
Feather type				2.95^{ns}
Normal	93.7	96.7	95.2	
Necked neck	4	2	3.02	
Feathered shank	2.3	1.3	1.80	
Comb type				25.31***
Single	30	33	31.5	
Pea	44.7	26.3	35.5	
Rose	25.3	40.7	33.0	
Ear lobe color				23.45***
White	32	18	25.0	
Red	20.3	35	27.7	
Creamy	47.7	40.7	44.2	
Shank color				31.4***
White	19.7	32.7	26.2	
Yellow	47	52.3	49.7	
Blue-Black	33.3	15	24.1	

The chi-square (x^2) value denoted significance difference between district; *** ($P<0.001$) and ** ($P<0.01$)

In the current study, a high proportion of pea comb type was observed among local chicken followed by single comb type and rose comb type. The findings are in harmony with those of Hassen [16] and Dana, *et al.* [14] who reported respectively 50.72% and 53% of the chicken populations having pea comb in different parts of Ethiopia. However, in contrary to the current findings, Tadele, *et al.* [3] reported that about 60% of local chickens reared in three districts of the Kaffa zone were characterized by single comb type. The observed differences could be attributed to the sample of study with differences in gene frequency of the trait and socio cultural importance of particular comb types as suggested by Maharo, *et al.* [17]. The pea comb gene has been related to an important effect in breeding for tropical conditions in terms of reduced frequency of breast blisters and improved late juvenile growth [18].

The ear lobe color depends on pigmentation pattern which can be attributed to the genetic makeup of the chickens [1]. In the present study, there was difference among ear lobe color of local chicken in both districts. Creamy ear lobe color was the most dominant types in the study location followed by red ear lobe colors. The findings were in agreement with those reported by Fasil, *et al.* [19]. According to Desta, *et al.* [20], 40.7 % of the Horro and 31.7 % of the Jariso chicken had white ear lobe color. On the other hand, Tadele, *et al.* [3] observed that over 80% of the local chickens in Kaffa zone were characterized by red ear lobe color. The reported differences with the current findings might be due to adaptability of chicken for a specific local condition as well as the genetic background of the chickens.

The highest proportions of local chickens in the study districts were characterized by yellow shank color. The findings were in agreement with those reported by Melesse and Negesse [1], Tadele, *et al.* [3] and Negassa, *et al.* [21] who reported similar shank colour for local chickens raised in various parts of the country. Yellow shank color was found to be dominant over the other which might be attributed to the presence of xanthophylls in the scavenging feed of local chickens as suggested by Zhu, *et al.* [22].

3.2. Morphometric Traits

As shown in Table 2, the effect of district and sex was significant for all studied quantitative traits. The exotic chicken's were heavier than local chicken, the native chickens are usually lighter than those of exotic which can be attributed to their genetic makeup and selection process used to develop them [23, 24]. Moreover, male chickens were heavier than the females which could be due to the differential effects of androgens and estrogen on the growth performances of chickens. The mean body weight of current finding is in agreement with the findings of Melesse and Negesse [1] for local Naked-neck chickens but was higher than those of Aklilu [15] for Horro and Jarso chickens. About 2.1 kg adult body weight for male chickens were reported by Hassen [16] in northwest Ethiopia, which is higher the current findings. The observed differences might be attributed to various factors in which breed, location, age and nutrition are the most important ones.

The current finding revealed that Bulen chickens had longer body length with higher body weights which is in good agreement with that of Dumont [25], who reported that chicken with higher body length had higher body weight and was suggested to be attributed to the effect of the larger skeletal dimension of such birds. The observed body length in the present study is in line with the findings of Aklilu [15] for Horo chicken but is higher than that of Moreda, *et al.* [26] and Hailu, *et al.* [8] for chicken reared in various part of Ethiopia.

Chest circumference has economical significance as the thoracic circumference house for some the most vital organ of birds for better development [27]. The chest circumference of local chickens in the current study was in close agreement with the findings of Tadele, *et al.* [3] for indigenous chicken populations reared in Kaffa zone of southern part of Ethiopia. According to Ige, *et al.* [28] chest circumference was considered as a reliable trait in genetic study for the reason of its good prediction of body weight.

The significance of measurement of keel bone is carried out as pictorial major and minor muscles (the most expensive meat of chickens) which surround the keel bone [29]. There is significance difference in length of keel bone between the study districts. Bulen district chickens had longer keel bone length than Pawe so were exotic chickens better than local chickens for the trait. The observed keel bone length for both breeds in the current study was higher than that of Aklilu [15] reported for local chickens. The reason for this variation might be the age of the bird in which the measurement was taken.

Shank length is regarded as a good indicator of skeletal development, which is related to the amount of meat a chicken can carry [1]. Long and wide shank of chickens was measured in Bulen district. Exotic chickens had wider and longer shank than local chicken. Roosters had higher values in shank length and circumferences in both districts. The average mean of shank length of chicken found in this study is comparable with those reported by Dana, *et al.* [14] for the five chicken ecotypes in Ethiopia; but was shorter than reported for Horro and Jarso ecotypes [15]. The shank circumferences of current study were in agreement with the finding of Getu, *et al.* [30] from North Gondar; but were lower than those reported by Bett, *et al.* [29] for male indigenous Bangladesh chickens. The observed variations in shank length and circumferences among different reports could be related to the genetic makeup birds in which case meat type birds possess short but wide shank size while long and narrow shanks are characteristics of egg layer type birds.

Table-2. The average body weight (kg) and morphometric traits (cm) in local and exotic chickens reared in two districts (N = 900)

Morphometric traits	District (D)		Breed (B)		Sex (S)		Pooled	Sources of variations						
	Pawe	Bulen	Exotic	Local	Cock	Hen	S.E.M	D	B	S	D*B	D*S	B*S	D*B*S
Body weight	1.62	1.68	1.71	1.62	1.78	1.58	0.005	<.001	<.001	<.001	0.004	0.327	0.930	0.041
Body length	42.7	43.0	42.5	42.8	45.6	41.5	0.098	0.005	0.630	<.001	<.001	0.174	0.024	0.001
Back length	22.0	21.8	21.9	21.8	23.0	21.3	0.049	0.002	0.113	<.001	<.001	0.372	0.007	0.014
Chest circumference	26.3	27.1	27.2	26.5	28.6	25.8	0.074	<.001	<.001	<.001	0.446	0.016	0.001	0.002
Wing span	40.9	42.2	41.7	41.4	44.1	40.2	0.095	<.001	<.001	<.001	0.029	<.001	0.001	0.306
Keel length	11.8	12.3	12.1	11.9	12.8	11.7	0.031	<.001	<.001	<.001	0.347	0.018	0.085	0.088
Shank circumference	3.62	3.74	3.78	3.63	4.24	3.40	0.021	<.001	<.001	<.001	0.005	0.062	0.010	0.010
Shank length	7.72	7.51	7.78	7.53	8.86	7.01	0.039	<.001	<.001	<.001	0.001	0.096	0.370	<.001
Beak length	2.56	2.73	2.78	2.58	3.01	2.46	0.014	<.001	0.046	<.001	<.001	0.701	0.073	0.014

S.E.M = standard error of the mean

The current study showed that there is no significance difference in wingspan length between districts and breeds. However, there were differences ($p<0.05$) between sexes. Accordingly, the roosters had a higher wing span than hens. Chickens with longer wing span usually possess strong pectoral muscles which are helpful for flight to escape from their predators [31]. The wing span in the current study was higher than those reported by Negassa, *et al.* [21] in Eastern Oromia of Ethiopia. However, it was lower than the value reported by Getu, *et al.* [30] from north Gondar. The observed variations might be due to differences in genotype, feed availability, location, traditional husbandry practices and other environmental factors.

3.3. Egg Quality Parameters

As presented in Table 3, except for albumen height, HU and shell thickness, the effect of district was significant for the other traits being higher in those chickens reared in Bulen district. However, chickens reared in Pawe district produced eggs with the highest ($p<0.05$) yolk color value. It has been suggested by Kul and Seker [32] that HU and egg weight are parameters greatly influenced by egg storage period and ambient temperature. Since Pawe district is characterized by relatively high temperature than Bulen district, egg weight size was smaller compared to that of Pawe. Higher yolk color score was recorded from eggs collected in Pawe district. The differences might be due to the presence of xanthophylls some of which are precursor of vitamin A and influenced to a large degree by nutrition of the bird [33]. Birds that scavenge on green plant materials may lay eggs with better egg yolk colour. This may suggest that chickens reared in the Pawe district scavenge more frequently on green plants than those raised in Bulen district.

The current findings for all studied egg quality parameters were similar with those reported by Hassen [16] for eggs collected from seven chicken ecotypes of north-western part of the country. However, these values are generally higher than those reported by Melesse, *et al.* [34] for local chickens raised at different agro-ecological zones. Such differences could be attributed, among others, to the genetic makeup of birds evaluated in the study, availability of scavengeable feed resources and differences in agro-ecological setup of the location.

Table-3. Least square means of external and internal egg quality parameters as affected by district and breed (N = 600)

Egg quality traits	District (D)		Breed (B)		Pooled	Sources of variations		
	Pawe	Bulen	Exotic	Local	S.E.M	D	B	D*B
Egg weight (g)	44.0	48.4	52.8	42.9	0.282	<.001	<.001	<.001
Egg width(g)	39.1	40.8	42.0	39.2	0.092	<.001	<.001	0.039
Egg length(g)	53.1	54.3	55.5	52.8	0.097	<.001	<.001	0.002
Shape index (%)	73.0	75.1	75.5	73.3	0.096	0.044	0.044	0.212
Yolk width(g)	36.7	38.6	39.8	36.6	0.098	0.054	<.001	0.113
Yolk height(g)	16.0	16.7	17.5	15.7	0.058	0.006	<.001	0.679
Yolk index (%)	43.2	43.5	44.1	43.0	0.107	0.002	<.001	0.187
Albumen height (mm)	5.71	6.10	6.30	5.80	0.042	0.069	<.001	<.001
Haugh unit	72.3	78.9	80.1	77.1	0.308	0.869	0.649	0.002
Yolk color	10.1	9.80	8.10	10.9	0.080	<.001	<.001	<.001
Shell thickness (mm)	0.31	0.33	0.33	0.31	0.001	0.438	<.001	<.001

S.E.M = standard error of the mean

The shell thickness in present study was comparable with that of Tadesse, *et al.* [35] and Edmew, *et al.* [36] who reported comparable shell thickness values in local chickens of southern and central parts of the country. However, lower shell thickness values (0.26 mm) were reported by Moges [37] for local chickens reared in rural areas while Melesse, *et al.* [12] reported relatively higher shell thickness value in local naked neck chickens reared under improved production system. In contrary, Hassen [16] reported much higher shell thickness values (0.69 to 0.71 mm) than observed in the present study and even elsewhere. These variations might be due to the methods employed to accurately measure the shell thickness and; the inclusion or exclusion of the shell membrane during the measurement of the shell thickness could have caused such extreme variations. Moreover, the type of feed provided particularly feeds that are rich in calcium might explain such discrepancies.

The overall albumen height of current study was higher than reported by Molla [38] for eggs collected from south-western part of the country. The HU value in the current study was consistent with those of chickens reared in Jarso district; but was higher than reported for Horro local chickens [15]. The observed differences might be attributed to the poor handling method and storage time of the eggs. Reduced egg quality was reported by Raji, *et al.* [39] with increased storage time and methods. The HU unit is computed based the egg weight and the albumen height, which are severely affected by the storage time of the egg itself. The longer the storage duration the smaller would be the size of the egg as well as the albumen height [39]. Thus, fresh eggs can score higher HU value than older ones. The yolk height of the current finding is in good agreement with those of Melesse, *et al.* [12] for naked neck local chickens. The mean yolk color of the current study was comparable with that of Melesse, *et al.* [12] and Bekele, *et al.* [40]; but was higher than reported by Leta and Bekana [41] for Fayoumi chicken breed under scavenging system.

3.4. Carcass Components

As presented in Table 4, the overall mean of pre-slaughter body weight was higher than that of Raphulu, *et al.* [42] for venda scavenging chickens in South Africa. The observed differences might be due to chicken genetic makeup, management system, age of the bird seasons of the year when body measurement of chicken were taken. Most of the carcass components of local chickens is low as compared to exotic breeds. Because of the local chicken ecotypes are late matured and the body weights relatively low with great variation among ecotype [5]. However, Melesse and Negesse [1] argued that the variation is due to shank length and it is a good indicator of skeletal development and meat production potential of indigenous chicken ecotypes. The mean weight of most of the carcass cuts in the current study was higher than the findings of Melesse, *et al.* [34] and Raphulu, *et al.* [42]. The dressing percentage of local chickens in the current study was in good agreement with that of Edmew, *et al.* [36] for local chickens reared in southern parts of Ethiopia. Similar dressing percentage values were also reported by Shishay, *et al.* [43] in local scavenging chicken ecotypes reared in northern and central parts of Ethiopia.

Table-4. The main carcass components of local and exotic chicken breeds raised in Pawe and Bulen districts (g)

Carcass traits	District (D)		Breed (B)		Sex (S)		Pooled S.E.M	Sources of variations			
	Pawe	Bulen	Exotic	Local	Cock	Hen		D	B	S	S*B
Slaughter weight	1691	1754	1784	1661	1810	1634	18.2	0.022	<0.001	<0.001	0.129
Dressed carcass	1128	1181	1193	1115	1220	1088	12.80	0.007	<0.001	<0.001	0.164
Dressing (%)	66.7	67.3	66.8	67.2	67.3	66.5	0.150	0.046	0.219	0.009	0.732
Skin	99.0	103	104	98.0	104	98.3	0.690	0.003	<0.001	<0.001	0.012
Drumsticks	181	194	200	175	203	172	2.950	0.061	<0.001	<0.001	0.002
Thighs	204	214	220	199	227	192	3.00	0.010	<0.001	<0.001	0.002
Wings	120	126	127	119	132	114	1.680	0.018	0.002	<0.001	0.238
Breast	135	143	139	138	145	133	2.250	0.065	0.832	0.007	0.032
Keel bone	124	127	126	125	127	125	0.837	0.049	0.636	0.027	0.267
Back bone	126	132	132	126	137	120	1.820	0.045	0.038	<0.001	0.342
Neck	64.5	66.3	67.9	63.0	68.2	62.7	0.619	0.020	<0.001	<0.001	<0.001
Gizzard	37.0	37.9	38.5	36.3	38.5	36.4	0.289	0.032	<0.001	<0.001	0.003
Heart	9.54	9.70	9.89	9.36	9.91	9.34	0.071	0.132	<0.001	<0.001	0.468
Liver	27.9	27.5	28.4	27.0	28.1	27.3	0.135	0.132	<0.001	<0.001	0.468

S.E.M = standard error of the mean

Although not significant, local chickens in the current study had numerically higher dressing percentage than exotic chickens. Such observations might be explained by the small slaughter weight of local chickens relative to their dressed carcass weight. Moreover, it might be due the presence of more non-edible offal in the carcass of exotic chickens than that of the local chicken.

The higher values in carcass traits observed in male chickens might be attributed to the presence of sex hormones (androgen) that enhanced muscle development than the sex hormone (estrogen) in females which is mostly responsible for fat deposition rather than muscle tissue development [44]. The carcass components including the breast, two wings, two thighs and two drumsticks together are generally considered as the sensitive index of the profit margin and consumer desirability. In the current study, these components (except drumsticks) were affected by district suggesting that Bulen district might be more favorable in raising chickens than Pawe district. Similarly, except for breast cut, exotic chickens had higher values of wings, thighs and drumsticks, which imply that exotic chickens could be recommended for meat production than locals in the study area.

4. Conclusions

Creamy ear lobe and yellow shank colors were the most frequently observed traits in both districts. Chickens reared in Bulen district were better in most egg quality and morphometric traits than those of Pawe district were. Exotic chickens were superior in most of the morphometric and egg quality parameters than local chickens. Exotic chickens were found to be superior to the locals in all carcass components. The survival ability and egg production potential of exotic chickens under smallholder settings appears to be key research gap to be addressed by other scholars in the future.

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