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PHENOTYPIC CHARACTERISTICS OF WEST AFRICAN DWARF (WAD) SHEEP IN THREE LOCAL GOVERNMENT AREAS (LGA) IN EKITI STATE

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Abstract

This study was carried out in three (3) Local Government Areas in Ekiti State, Nigeria; Ikole (07°47'53.76"N 05°30'52.17"E), Oye (07°47'52.55"N 05°19'42.78"E) and Ado (07°37'15.9996"N 05°13'17.0004"E) Local Government Areas. The study aimed at evaluating the phenotypic characteristics of West African Dwarf (WAD) Sheep in the study location. A total of one hundred and eighty (180) adult WAD Sheep of the same age group, comprising ninety (90) males and ninety (90) females, were randomly selected for the study. Body weight, sex, colour and other seven body traits (ear length, heart girth, rump height, wither height, body length, head length, tail length) were collected from the 180 Sheep. Data collected were subjected to Analysis of Variance (ANOVA), Chi-square and means were separated using Tukey`s test. Results obtained showed that sex had a significant effect (p< 0.05) on some of the body parameters considered. This trend confirms sexual dimorphism in WAD Sheep in the study location. White and black (37.2%) and White (26.1%) are the dominant color types while 36.7% comprises Brown (21.7%), White and brown (10.0%) and Black (5.0%) colour types with long thin tail in both ewe and ram. The results obtained showed significant differences (P<0.05) between the following traits for Ikole, Oye and Ado respectively; EL (11.33 ± 0.14^{b}; 11.80 ± 0.17^{a}; 11.6 ± 0.15^{ab})cm, HG (75.30 ± 0.95^{c}; 80.38 ± 0.69^{a}; 77.67 ± 0.89^{b})cm, MBW (38.14 ± 1.2^{c}; 44.61 ± 1.00^{a}; 41.36 ± 1.16^{b})kg, RH (68.47 ± 0.81^{a}; 68.07 ± 0.81^{ab}; 66.10 ± 0.65^{b})cm, WH (68.47 ± 0.81^{a}; 68.07 ± 0.81^{ab}; 66.10 ± 0.65^{b})cm, BL (87.43 ± 0.98^{a}; 83.37 ± 0.97^{b}; 87.3 ± 0.94^{a})cm while HL (20.80±0.28; 21.38±0.24; 21.48±0.27)cm, and TL (32.15±0.44; 34.78±0.70; 32.98±0.50)cm did not show significant differences between the locations. The highest correlation was obtained between BW/HG and RH/WH for all the locations.

Keywords: WAD sheep, Body dimensions, Phenotypic characters, Traits, Body weight.

Introduction

Small ruminants contribute largely to the livelihoods of the livestock keeping households of low and medium income farmers in the developing world. The keeping of small ruminants is mainly concentrated in the developing countries of the world. Small ruminants make up a large proportion of the domestic ruminants in terms of numbers and in contribution to meat production. Small ruminants have been part of the history of the world since the colonization with arrival of goats from Spain and hair sheep from West Africa. Sheep and goats contribute about 47.3 million to national economy through various products and byproducts (Rekib and Vihan*, 1997*). Sheep and goats are a potential source of meat, milk, fibre, hide, manure for landless rural small and marginal farmers and provides dependable source of income to 40 per cent of rural population. Thus, the small ruminants have a very significant contribution in revenue generation through livestock products.

Sheep belongs to the family Bovidae and genus Ovis (Gillespie, 1997). The characterization of local genetic resources depends on the knowledge of the variation in their morphological traits, which have played a very fundamental role in the classification of livestock based on size and shape (Yakubu *et al, 2010*). All visible traits that define a particular breed are considered in building the phenotypic profile of the characters. They present variable coat colors, ranging from black, brown, gray, red and white, and sometimes combinations of these in a variety of patterns (Mourad *et al., 2000*). Body weight is the commonly reported measure of size (Fitzhugh and Bradford, 1983). The reliability of single measurements such as wither height, body length, hearth girth, rump height and width etc. in the estimation of weight at both traditional and institutional levels have been widely documented. Others have even used cephalic dimension as indicators of breed origin and relationships within species (Jewel, 1993). The WAD Sheep production is constrained by the following factors: low genetic potential, seasonality of availability of feed and scarce water resources, high ambient temperature, and mortality. However, Okoli *et al,* (2000) and Odeyinka and Okunade (2005) stated that other constraints to indigenous small ruminant production in the tropics include: diseases, accidents, seasonality of feed supply, theft, lack of capital and land. The problems of sheep production can neither be efficiently nor successfully solved until research concentrates on studying all of the related and interrelated components involved.

This current study seeks to evaluate the different phenotypic variability of the body traits of WAD sheep, estimate the live body weight using the hearth girth, determine how body weight and other body measurements vary within and between the different locations, reveal how sex affects the various body traits within and between the different locations and determine the economic profitability of carrying out the experiment and make useful recommendation from the results vary within and between the different locations.

Materials and Methods

Study Areas

The research was conducted in three different Local Government Areas (LGA) in Ekiti State; Ikole, Oye and Ado LGA. The coordinates for the three (3) locations were documented using a Global Positioning System (GPS). Ikole is located on Latitude/longitude: 07°47′53.76″N 05°30′52.17″E and Altitude of 557.06m. Oye is located on Latitude/longitude: 07°47′52.55″N 05°19′42.78″E and Altitude of 546.91m. Ado is located on Latitude/longitude: 07°37′15.9996″N 05°13′17.0004″E and Altitude of 431m.

Collection of Data

The data were collected randomly from one hundred and eighty (180) sheep of the same age group; sixty (60) from each of the three (3) Local Government Areas (LGA) consisting of both males (30) and females (30) from different markets at Ado, Ikole and Oye Local Government Areas (LGA), Ekiti State. Prior to taking the measurements, the animals were identified in each location on the basis of species, breed/strain, coat colour, sex and age; only the adult WAD Sheep were considered for average uniformity. Ages of animals were provided by the farmers and verified using dentition method (*Sastry and Thomas, 1980*).

The traits considered during the collection were;

i. Sex, coat color, ear length which was measured from the point where the ear is attached to its tip, heart girth: measured as circumference around the chest just behind the front legs and withers.
ii. Body weight: The body weight (kg) was gotten using the heart girth measurement (cm) (done with a measuring tape).
iii. Rump height: This is the distance from the surface of a platform on which the animal stands to the rump of the animal.
iv. Withers height: The distance from the surface of a platform on which an animal stands, to the withers of the animal.
v. Body length: The distance from the base of the tail to the tip of the head.
vi. Head length: This was measured from the tip of the skull at the mouth region to the point where the cervical vertebrae connect to the skull.
vii. Tail length: This was measured as the distance

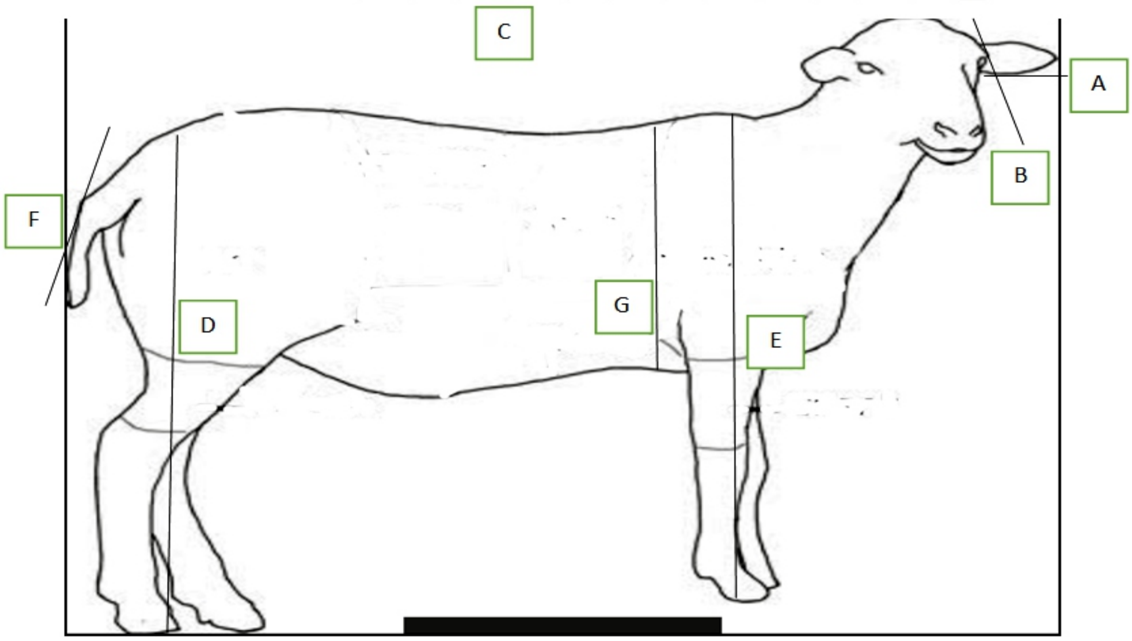

Figure 1: Typical diagram of a Sheep showing the various body linear measurements taken

Where;

- A- Ear length
- B- Head length
- C- Body length
- D- Rump height
- E- Wither height
- F- Tail length
- G- Heart girth

Statistical Procedure

Data collected from the experiment were analyzed using descriptive statistics and were subjected to Analysis of Variance (ANOVA) test using the general linear model procedure of SAS (v 9.4) (SAS 2013) to test the fixed effects of location, sex and their interactions and also Pearson and Spearman Correlation Analysis of SAS (2013) was employed. Data collected were subjected to PROC MEAN and CORR procedures of SAS (v 9.4). Means were separated using Tukey's Honesty significant difference at 5% probability level , standard error and bar charts were drawn in excel. Data obtained were subjected to cross tabulation to determine if sex and location were associated with coat colours. The strengths of the associations were measured using Cramer's V. The distributions of coat colour were determined using Chi-square statistics.

RESULTS

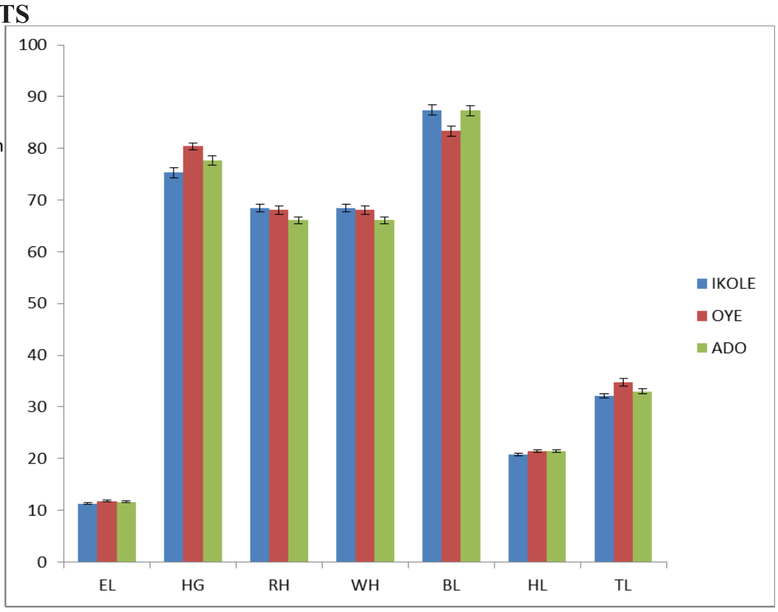

Figure 2: Phenotypic traits across the three locations

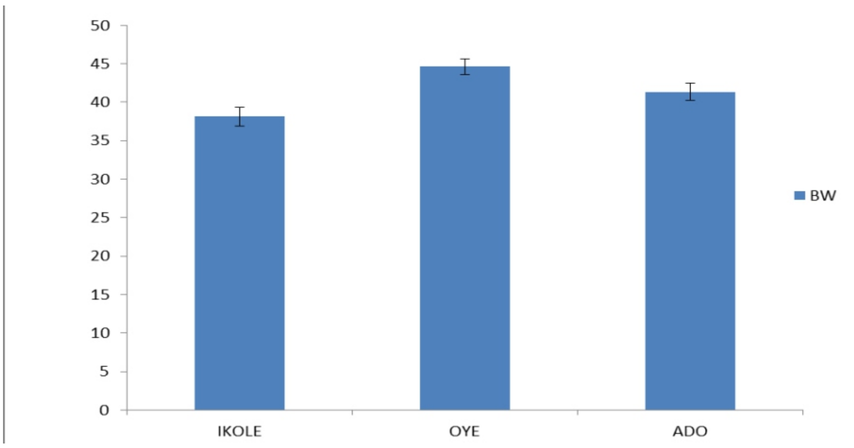

Figure 3: Body weight (Kg) across the three locations

Table 1 : Least square mean of the linear measurement and weight of Sheep in the three LGA of Ekiti

Location	SEX	COLOUR	EL	HG	BW	RH	WH	BL	HL	TL
		WB	11.64±0.16	77.04±0.83	40.51±1.09	67.29±0.69	67.29±0.69	86.87±0.85^{ab}	20.82±0.24	33.84±0.
		WBR	11.44±0.38	80.33±2.5	45.17±3.55	70.11±2.56	70.11±2.56	85.33±1.32^{ab}	22.44±0.53	32.44±1.
		black	11.56±0.29	75.89±2.57	39.18±3.14	67.67±1.2	67.67±1.2	83.89±2.74^{ab}	21.44±0.65	32.89±1.
		brown	11.56±0.19	77.62±1.13	40.9±1.49	67.92±1	67.92±1	88.72±1.24^{a}	21.56±0.35	33±0.8
		white	11.51±0.15	79±0.83	42.85±1.11	67.13±0.82	67.13±0.82	83±1.11^{b}	21.32±0.28	32.94±0.
Ado			11.6±0.15^{ab}	77.67±0.89^{b}	41.36±1.16^{b}	66.1±0.65^{b}	66.1±0.65^{b}	87.3±0.94^{a}	21.48±0.27	32.98±0.
Ikole			11.33±0.14^{b}	75.3±0.95^{c}	38.14±1.2^{c}	68.47±0.81^{a}	68.47±0.81^{a}	87.43±0.98^{a}	20.8±0.28	32.15±0.
Oye			11.8±0.17^{a}	80.38±0.69^{a}	44.61±1^{a}	68.07±0.81^{ab}	68.07±0.81^{ab}	83.37±0.97^{b}	21.38±0.24	34.78±0.
	F		11.57±0.14	77.5±0.68	40.92±0.9	68.21±0.68	68.21±0.68	87.11±0.8	21.49±0.23	33.32±0.
	M		11.59±0.12	78.07±0.76	41.83±1.01	66.88±0.56	66.88±0.56	84.96±0.8	20.96±0.2	33.29±0.
COLOUR			0.71	0.71	0.72	0.41	0.41	0.04	0.13	0
Location			0.20	0.00	0.00	0.02	0.02	0.04	0.85	0
SEX			0.73	0.85	0.70	0.57	0.57	0.30	0.39	0
Location*COLOUR			0.42	0.07	0.07	0.04	0.04	0.05	0.03	0
SEX*COLOUR			0.98	0.03	0.03	0.73	0.73	1.00	0.31	0
Location*SEX			0.01	0.00	0.00	0.86	0.86	0.58	0.95	0
Location*SEX*COL			0.16	0.27	0.40	0.65	0.65	0.15	0.13	0

Table 1: Least square mean of the linear measurement and weight of Sheep in the three LGA of Ekiti

Location	Sex	Colour	EL	HG	BW	RH	WH	BL	HL	TL
		WR	11.60±0.16	77.04±0.83	40.51±1.09	67.29±0.69	67.29±0.69	88.87±0.85[ab]	20.82±0.24	33.84±0.50
		WBR	11.44±0.38	80.33±2.50	45.17±3.55	70.11±2.56	70.11±2.56	85.33±1.32[ab]	22.44±0.53	32.44±1.67
		Black	11.56±0.29	75.89±2.57	39.18±3.14	67.67±1.20	67.67±1.20	83.89±2.74[ab]	21.44±0.53	32.89±1.46
		Brown	11.56±0.19	77.62±1.13	40.90±1.49	67.92±1.00	67.92±1.00	88.72±1.24[a]	21.56±0.35	33.00±0.80
		white	11.51±0.15	79.00±0.83	42.85±1.11	67.13±0.82	67.13±0.83	83.00±1.11[b]	21.32±0.28	32.94±0.59
Ado			11.60±0.15[a]	77.67±0.89[b]	41.36±1.16[b]	66.10±0.65[b]	66.10±0.65[b]	87.30±0.94[a]	21.48±0.27	32.98±0.50
Ikole			11.30±0.14[b]	75.30±0.95[c]	38.14±1.20[b]	68.47±0.81[b]	87.43±0.81[b]	87.43±0.98[a]	20.80±0.28	32.15±0.44
Oye			11.80±0.71[a]	80.38±0.69[a]	44.61±1.00[a]	68.07±0.81[ab]	68.07±0.81[ab]	21.37±0.97[b]	21.38±0.24	34.78±0.70
	F		11.57±0.14	77.50±0.68	40.92±0.90	68.21±0.68	68.21±0.68	87.11±0.80	21.49±0.23	33.32±0.49
	M		11.59±0.12	78.07±0.76	41.83±1.01	66.88±0.56	66.88±0.56	84.96±0.80	20.96±0.20	33.29±0.45
Colour			0.71	0.71	0.72	0.41	0.41	0.04	0.13	0.26
Location			0.20	0.00	0.00	0.02	0.02	0.04	0.85	0.04
SEX			0.73	0.85	0.70	0.57	0.57	0.30	0.39	0.97
			0.42	0.07	0.07	0.04	0.04	0.05	0.03	0.03
OLOUR SEX OUR			0.98	0.03	0.03	0.73	0.73	1.00	0.31	0.73
location•S EX			0.01	0.00	0.00	0.86	0.86	0.58	0.95	0.30
location•S EX•COL			0.16	0.27	0.40	0.65	0.65	0.15	0.13	0.08

[a, b, ab] Means with different superscripts in a row differ significantly; $P \leq 0.05$- Sig, $P \leq 0.01$- Very sig, $P \leq 0.001$- Highly sig

Table 2: Pooled phenotypic correlation of WAD sheep from the three LGA in Ekiti

Correlations

	EL	HG	BW	RH	WH	BL	HL	TL
EL		.415**	.442**	0.071	0.071	.285**	.209**	.398**
HG			.980**	.197**	.197**	0.087	0.055	.281**
BW				.194**	.194**	0.075	0.059	.285**
RH					1.000**	.178*	0.108	.160*
WH						.178*	0.108	.160*
BL							.316**	.255**
HL								.268**
TL								

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Distribution of the Qualitative Traits of WAD Sheep

Table 3: Frequency table of LGA by coat colour

LGA		White	White/Black	Brown	White/Brown	Black	Total
Ikole	**Frequency**	3	32	13	9	3	60
	Percent	1.67	17.78	7.22	5	1.67	33.34
Oye	**Frequency**	23	18	13	6	0	60
	Percent	12.78	10	7.22	3.33	0	33.33
Ado	**Frequency**	21	17	13	3	6	60
	Percent	11.67	9.44	7.22	1.67	3.33	33.33
Total	**Frequency**	47	67	39	18	9	180
	Percent	26.12	37.22	21.66	10	5	100

Table 4: Statistics for table of LGA by coat colour

Statistic	DF	Value	P-value
Chi-Square	12	57.0132	<.0001
Likelihood Ratio Chi-Square	12	68.6257	<.0001
Mantel-Haenszel Chi-Square	1	0.0558	0.8133
Phi Coefficient		0.5628	
Contingency Coefficient		0.4905	
Cramer's V		0.3980	

Table 5: Frequency table of sex by coat colour

SEX		White	White/Black	Brown	White/Brown	Black	Total
Male	**Frequency**	24	34	18	10	4	90
	Percent	13.33	18.89	10	5.55	2.22	49.99
Female	**Frequency**	23	33	21	8	5	90
	Percent	12.78	18.34	11.67	4.45	2.78	50.01
Total	**Frequency**	47	67	39	18	9	180
	Percent	26.11	37.23	21.67	10	5	100

Table 6: Statistics for Table of sex by coat colour

Statistic	DF	Value	P-value
Chi-Square	6	9.6013	0.1425
Likelihood Ratio Chi-Square	6	10.5656	0.1028
Mantel-Haenszel Chi-Square	1	1.1251	0.2888
Phi Coefficient		0.2310	
Contingency Coefficient		0.2250	
Cramer's V		0.2310	

P-value = probability with values in parenthesis

Discussion

Least Square Mean of the lLnear Measurements and Weight of Sheep in Three (3) LGA of Ekiti

The effect of coat colour; location; sex; location and colour; sex and colour; location and sex; location, sex and colour on the different body traits among the three (3) locations are shown in table 1.

The phenotypic parameters examined from WAD sheep in Ekiti State showed that coat colour has no significant effect on the phenotypic parameters of the animals except for the BL, brown and white had significantly higher body length than mixed colour and black.

Some parameters increased significantly at the location. HG, BW and TL were significantly highest in Oye than in other locations with the least in Ikole. White BL, WH and RH were significant higher in Ikole than in other locations.

Sexes showed no significant differences among the examined parameters but males were numerically higher in values than their female counterpart for all the observed parameters, showing a sense of sexual dimorphism.

The interaction levels between location and the coat colour did not show significant differences in most of the observed parameters, except in RH, WH, HL and TL. The HG and BW were significantly affected by interactions between sexes and the coat colour; while EL, HG and BW were significantly affected by location and sexes. Interactions among ocation, sex and coat colour did not significantly affect any of the observed parameters.

Phenotypic Characteristics of West African Dwarf (WAD) Sheep in 3 LGA in Ekiti State

Sex is a key determinant of price in livestock marketing as consumers buy animals for specific purposes especially during festive occasions (*Birteeb and Dickson, 2016*). Fur/Coat texture of sheep could also influence price because animals with rough coat might be perceived to be showing signs of ill-health. Meanwhile, the sheep in this study, on the bases of physical appearance, were healthy animals, hence their rough coat could have resulted from exposure to thorny bushes and rains since they were reared under the extensive system.

The coat colour patterns observed in the experimental animals fell within the colours of WAD sheep which is usually characterized by coat colours of white, black, brown, with white having black or brown patches but most observed significant colours are black, brown and white. Mixture of these significant colours include either of black with white shades, brown with white shades and other mixtures. However, the most frequent occurrence is plain white with spots or shades of other colours – brown and or black. This result is consistent with that of Hassen *et al*. (2012), Hagan *et al*. (2012) and Birteeb and Lomo, (2015) which reported that colours observed most frequently among sheep included black, brown and white with spots. WAD sheep observed in Ekiti State were characterized by five (5) coat colour patterns which were not equally distributed; White and black (37.2%) and White (26.1%) are the dominant color types while 36.7% comprises of Brown (21.7%), White and brown (10.0%) and Black (5.0%) colour types with long thin tail in both ewe and ram sheep. The predominance of white as a solid or pied with other colours may indicate the dominant influence or higher frequency of the allele for white fur. The different colour patterns in the experimental sheep may be due to uncontrolled breeding since the animals were kept under the extensive management system.

The measurement taken from sheep in Ikole for different coat colour showed no significant differences ($p<0.05$) in all of the observed parameters for the different coat colours. i.e. the coat colour pattern did not have any significant influence on any biometric trait in the experimental sheep. There was a slight numerical increase in values of white sheep over other colours for HG, BW, RH, WH, HL and TL. The least values were obtained for black in BW, HG, RH, WH, BL and TL. Also, brown sheep was consistently higher than black sheep for EL, HG, BW, RH, WH, BL and TL except for

HL. This result is in agreement of Birteeb and Lomo, (2015) who stated that coat colour did not significantly influence any of the phenotypic body traits of the WAD sheep. The slight increase in body trait measurements in white sheep over other colours could be because of selection of white sheep for its good adaptive colouration for body temperature maintenance. White colour reflects heat hence a good advantage during the hot season as heat stress is among the many factors that limit productivity in small ruminants (*Cam et al., 2010*).

Females were better for parameters such as HG, BW, RH, WH and HL but lower than male for EL, BL and TL. Sex effect was not statistically significant (p>0.05) for all parameters except EL. This result agrees with that of Birteeb and Lomo, (2015) who reported that both male and female sheep were similar in all the phenotypic traits. This result also showed that sex did not influence the body traits as opposed to the claim/report of Hagan *et al*. (2012). Also, body weight observed for male and (38.29kg) female were lower than values of 39.50 for male and 38.40 for female reported by Karnuah *et al*. (2018).

The results of interaction (colour x sex) showed no statistically significance (p>0.05) for all parameters. This result agrees with that of Karnuah *et al*. (2018) which reported that effect of the interaction on the body traits are not significant for most traits except the Ear Length and Body Length. Also, Black colour x F had the least values for most parameters including HG, BW, RH, WH, BL and TL except in EL and HL. Results of body measurement also showed that RH and WH values were the same for all the interactions. Also, as this research presented body traits to be more quantitatively prominent in females at least for 2 out of the 3 LGA, this result agrees with the findings of Birteeb and Lomo, (2015) but however disagrees with findings of Okpeku *et al*. (2011) in which males were superior to females in all body measurements. The significant differences in the phenotypic body traits of the WAD sheep in the 3 different local government areas could be attributed to the different plane of nutrition, availability of grazing reserves for small ruminants and management practices the animals are exposed to (Cam *et al., 2010,* Karnuah *et al., 2018*).

Pooled Phenotypic Correlation of Wad Sheep from the Three LGA in Ekiti

Pooled phenotypic correlation of WAD Sheep in the three (3) locations is presented in table 2 above. The result revealed that there was significant, positive and higher correlation of some parameters with the Body weights of the WAD sheep in the zone. EL (0.44) and HG (0.98) were moderately and highly correlated with the body weight; while RH (0.194), WH (0.194) and TL (0.281), though positive, were lowly correlated with the body weight of the animals. All observed parameters were significant, positive and lowly correlated with TL. All the parameters except EL and BL were not significant with HL.

Phenotypic Correlation of the Body Traits of West African Dwarf (WAD) sheep in 3 LGA in Ekiti State

Results from bivariate correlation of the parameters were done using the Pearson's correlation co-efficient. The result revealed that phenotypic correlation among the body traits is significant (P<0.05) between only few to many parameters which range from lowly to highly correlated: 0.004-1.000 for positive correlation and -0.33—0.132. Even though there were some negative correlation, and also that correlation of most traits range from moderate to high (0.20-0.40); the highest correlations were found between parameters such as RH and WH and HG and BW. The correlations in this study were consistent and generally higher than those reported in other studies (Khan *et al* 2006; Pesmen and Yardimci 2008; Okpeku *et al* 2011) but lower than those reported by Fajemilehin and Salako, (2008).

The result also revealed that HG and EL when correlated with BW yielded high correlation values indicating that both HG and EL could be used to make predictions for future body weight yield of the sheep. This result agrees with the findings of Oseni and Ajayi, (2014) and Birteeb and Lomo, (2015). Also, the BL when correlated with BW has low correlation coefficient as contrary to the reports of Karnuah *et al*. (2018) who reported a moderate to high correlation between body length and body weight. Heart girth correlation with live body weight reported in this study is the highest correlation with live body weight (r=0.962-0.999 P<0.01) much higher than that reported by Oseni and Ajayi, (2014) (r=0.88 P<0.001). Correlation of HG with BL also ranges from low to high indicating the high probability of predicting the BL using the HG as normally, animals with longer body (BL) and height at withers (WH) should have bigger body frame unlike animals with short body length (Oseni and Ajayi, 2014; Karnuah *et al*., 2018). The RH and BW were low to moderately correlated which is inconsistent with findings of Fajemilehin and Salako, (2008). The result of the study showed that the live body weight of the WAD sheep could be predicted using the HG and EL in consonance with reports of many earlier studies such as Fajemilehin and Salako, (2008), Oseni and Ajayi, (2014) and Birteeb and Lomo, (2015).

Distribution of the Qualitative Traits of WAD Sheep

Table 3 shows the frequency and percentage of the relationship between LGA and coat colour as cited by

Carneiro *et al*., (2010). White coat colour was highest in Oye LGA followed by Ado LGA, and then Ikole. White/Black coat colour was more in Ikole LGA, followed by Oye LGA, then Ado LGA. Brown coat colour was observed equally among the three (3) LGA. White/Brown coat colour was more in Ikole LGA, followed by Oye LGA, then Ado LGA. Black coat colour was observed more in Ado LGA, then Ikole LGA but none was observed in Oye LGA.

The chi-square distribution of the qualitative traits of the experimental WAD sheep revealed that LGA was significantly ($P < 0.001$) associated with coat colours of the Sheep. The Cramer's V of 0.398 indicated a moderate association (Table 4).

White, White/Black, White/Brown coat colours were observed more in the males than the females while Brown, Black coat colours were observed more in the males. Generally, the females had a higher percentage for all the coat colours observed (Table 5).
The chi-square distribution of the qualitative traits of the experimental WAD sheep revealed that sex was not significantly ($P > 0.001$) associated with coat colours of the Sheep. The Cramer's V of 0.231 indicated no association (Table 6).

The West African Dwarf (also Djallonke) is a domesticated breed of sheep and is the dominant breed from southwest to central Africa. This breed is primarily raised for meat. The WAD Sheep of Nigeria are very important not only because they are a source of quick revenue but also because their qualitative traits appear to possess selective properties which could serve as a reliable indicator when economic concerns mount pressure on the variety for genetic improvement. Sheep rearing is one of the most important means of livelihood and food security for majority of the rural populace, especially in developing countries (Amadou *et al. 2012*).

The various traits of the sheep considered were their Ear Length (EL), Heart girth (HG), Body Weight (BW), Rump Height (RH), Wither height (WH), Body Length (BL), Head Length (HL), and Tail Length (TL). Preliminary findings based on their computed means and their respective standard deviations showed some differences in the measured traits across the three locations. Rump height and Wither height, Heart girth and Body weight were highly correlated in all the three locations. Generally, positive and significant ($P < 0.01$; $P<0.05$) correlation was obtained between the body weight and most of the linear body measurement. Therefore, it is strongly recommended that further genetic analyses be used to determine the genetic variation between and within these small populations to develop an effective conservation and utilization program. The moderate to high correlation coefficients between body weight and linear body measurements for the sheep suggests that either of these variables or their combination could provide a better evaluation for forecasting live weight of sheep. The result of this study showed that the live body weight of the WAD sheep could be predicted using the HG and EL in consonance with reports of many earlier studies (Fajemilehin *et al*., 2008). The chi-square distribution of qualitative traits of WAD sheep showed that the LGAs (locations) were significantly ($P<0.0001$) associated with the coat colours of the sheep. It also showed that sex was not significantly ($P>0.0001$) associated with coat colours of the Sheep.

Conclusion

It could be concluded that WAD sheep has a potential role to generate income for livestock keepers. Therefore, genetic improvement program should aim at farmers need to cope with trait preference and existing traditional herding and breeding practice. This study will help researchers to uncover the critical area of phenotypic characterization in WAD sheep population that many researchers were not able to explore. This study reveals the effect of location and sex on body weight and linear body measurements. These values can be used as references in future studies on the genetic characterization and improvement through conservation of the breeds.

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The chi-square distribution of the qualitative traits of the experimental WAD sheep revealed that LGA was significantly ($P < 0.001$) associated with coat colours of the Sheep. The Cramer's V of 0.398 indicated a moderate association (Table 4).

White, White/Black, White/Brown coat colours were observed more in the males than the females while Brown, Black coat colours were observed more in the males. Generally, the females had a higher percentage for all the coat colours observed (Table 5).
The chi-square distribution of the qualitative traits of the experimental WAD sheep revealed that sex was not significantly ($P > 0.001$) associated with coat colours of the Sheep. The Cramer's V of 0.231 indicated no association (Table 6).

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Conclusion

It could be concluded that WAD sheep has a potential role to generate income for livestock keepers. Therefore, genetic improvement program should aim at farmers need to cope with trait preference and existing traditional herding and breeding practice. This study will help researchers to uncover the critical area of phenotypic characterization in WAD sheep population that many researchers were not able to explore. This study reveals the effect of location and sex on body weight and linear body measurements. These values can be used as references in future studies on the genetic characterization and improvement through conservation of the breeds.

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