MORPHOMETRIC CHARACTERISTICS OF RED SOKOTO GOATS IN SOME SELECTED LOCAL GOVERNMENT AREAS OF BAUCHI STATE, NIGERIA

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ABSTRACT
The study was conducted to determine the morphometric characteristics of Red Sokoto Goats (RSG) in Dambam, Gamawa and Misau Local Government Areas of Bauchi State. A total of six hundred (600) RSG were used for the study, out of which 121 were males and 479 were females. Body condition score (BCS) was assessed subjectively through principally massaging the loin region, abdominal fat and chest cavity and scored using the 5 points scale (where; 1 = very thin, 2 = thin, 3 = average, 4 = fat and 5 = Very fat/ obese) for both sexes. The effects of location and sex on morphometric characteristics were also determined. The qualitative traits recorded via visual observation included: coat colour, presence or absence of beard, wattle and supernumerary teat. Morphometric traits measured using tailor's tape and recorded in cm were: head length, ear length, horn length, chest girth, height at wither, body length, loin girth, rump length, rump height, rump width, tail length, udder length, udder circumference, teat length, scrotal circumference and scrotal length. The live body weight was measured using a digital weighing scale in kg. The findings of this study revealed that the RSG found in Gamawa had the highest values for all the significantly different parameters, while the least values were recorded on RSG in Misau (38.26±0.41 vs 24.16±0.41). Sex is confirmed to have influence on live weight (P < 0.05) where the male appeared to be heavier than the female animals. The effects of qualitative traits on morphometric characteristics were determined and found out that they have little to less impact on growth parameters.

Keywords: Beard, Body condition score, Morphometric characteristics, Red Sokoto Goats, Wattle

INTRODUCTION

Small ruminants are valuable genetic resources in the tropics and subtropics, where they play a great role in the sustenance of the livelihoods of less able families especially in the rural communities. In Nigeria, they represent about 63.70% of the total grazing domestic animals (Yakubu *et al.,* 2010). The goat is a household animal and its importance cannot be over emphasized. This livestock asset could be seen as "bank account" and it is also an important source of family savings that can be used in years of low crop production, reducing income insecurity and household vulnerability (Elisa *et al.,* 2015). Goats perform the task of supplying human population with meat, milk, skin, hair and other products. The World Health Organization (WHO) recommended protein requirement of an adult is 0.5- 1.0g per kg body weight per day (65g per day) (Juliette, 2017). Goat milk is a vital source of protein, fat, calcium, iron, phosphorous, magnesium, and vitamins, particularly vitamin A. Recent studies have shown that several of these vitamins from goat milk are more easily absorbed than cow milk (Peacock, 2008). The small fat globule of goat milk makes it more easily digestible than cow milk and therefore particularly suitable for children and the sick (Sachin *et al.,* 2017). The characterization of local genetic resources depends on the knowledge of the variation of morphological traits, which have played a very essential role in the classification of livestock based on size and shape (Yakubu *et al*., 2010). Size and conformation are important characteristics in meat animals especially ruminants. Traditionally, animals are usually assessed visually, which is a subjective method of judgment (Fajemilehin and Salako, 2008). Red Sokoto goats are one of the most important indigenous breeds of goats in Nigeria. They are more adaptable to the climatic conditions of Northern Nigeria. These breeds of goats are not adequately

characterized and an appropriate design of breeding procedure is impossible for breeds that have not been adequately characterized either phenotypically and/or genetically (Mwacharo *et al.,* 2002).

MATERIALS AND METHODS

Study Location

The study was carried out in Dambam, Gamawa and Misau Local Government Areas of Bauchi State. Bauchi State occupies a total land area of 49,119 km^2 (18,965 sq mi) representing about 5.3% of Nigeria's total land mass and it is located between latitudes 9º 3'N and 12º 3'N of the equator and longitudes 8º 50' and 11ºE of the Green Which Meridian. Dambam, Gamawa and Misau are located between 11º 40' 48" N and 10º 42' 32" E, 12º 08' N and 10º 32' E, 11º 19' 6" N and 10º 28' 4" E, respectively. The State is bordered by seven States; Kano and Jigawa to the North, Taraba and Plateau to the South, Gombe and Yobe to the East and Kaduna to the West. Bauchi State has two distinctive vegetation zones, namely, the Sudan and the Sahel Savannah. Sudan savannah vegetation covers the Southern part of the State. Sahel type of the savannah, which is also known as the semi-desert vegetation, becomes manifest from the middle of the State as one moves from the State's South to its North. This type of vegetation comprises isolated stands of thorny shrubs. On the other hand, the Southwestern of the State is mountainous as a result of the continuation of the Jos Plateau, while the Northern part is generally sandy. The vegetation types are conditioned by the climatic factors, which in turn affects the amount of rainfall received in the area. For instance, the rainfall in Bauchi State ranges between 1,300 millimeters per annum in the South and only 700 millimeters per annum in the extreme North.

Method of Data Collection

Live weight in kg was measured along with sixteen (16) linear body measurements (LBM) in cm on each animal. The LBM were: head length (HDL), ear length (EL), horn length (HL), chest girth (CG), height at wither (HW), body length (BL), loin girth (LG), rump length (RL), rump height (RH), rump width (RW), tail length (TL), udder length (UL), udder circumference (UC), teat length (TTL), scrotal circumference (SC) and scrotal length (SL) all in cm. The height measurements (cm) were done using a graduated measuring stick. The length, circumference and the width measurements (cm) were done using a tape rule (Tailor's tape). While the weight (kg) was measured using a weighing scale.

Data Analysis

Body condition score, live weight (kg), linear body measurements (cm) and qualitative parameters of each of the animals were coded into spreadsheets. Data collected were subjected to descriptive statistics and were analyzed using Statistical Package for Social Sciences (SPSS version 22, 2013) using the General Linear Model (GLM) procedure. The effects of class variables were expressed as overall mean ± SE. Significantly different means were separated using Duncan Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Effect of Location on Body Condition Score, Live Weight and Morphometric Traits

Influence of location on average live weight (LW), head length (HDL), ear length (EL), horn length (HL), chest girth (CG), height at wither (HW), body length (BL), loin girth (LG), rump length (RL), rump height (RH), rump width (RW), tail length (TL), udder length (UL), udder circumference (UC), teat length (TTL), scrotal circumference (SC) and scrotal length (SL) are presented in Table 1. Location had significant effect on LW, HDL, EL, HL, CG, HW, BL, LG, RL, RH, RW, TL, UL, TTL, SC and SL ($P < 0.001$). The RSG found in Gamawa local government had the highest values for all the significantly affected traits, while the least values were recorded in Misau local government. The effect of location may be attributed to certain factors. These include the varying climatic conditions, vegetation and availability of feeds.

Table 1: Average Body condition score, Live weight and Morphometric traits (Linear body measurements) According to Location.

		Location			
Parameters	**Overall mean ± S.E**	**Dambam**	**Gamawa**	**Misau**	**LOS**
BCS	3.45±0.09	3.45±0.10	3.45±0.10	3.45±0.10	NS
LW	31.23±0.37	31.27±0.41^{b}	38.26±0.41^{a}	24.16±0.41^{c}	***
HDL	19.02±0.22	18.95±0.25^{b}	21.75±0.25^{a}	16.37±0.25^{c}	***
EL	16.82±0.31	16.97±0.35^{b}	18.97±0.35^{a}	14.52±0.35^{c}	***
HL	15.15±0.40	16.22±0.45^{b}	17.94±0.45^{a}	11.27±0.45^{c}	***
CG	70.98±1.26	70.55±1.42^{b}	78.65±1.42^{a}	63.73±1.42^{c}	***
HW	64.46±0.53	64.23±0.60^{b}	78.65±0.60^{a}	59.84±0.60^{c}	***
BL	65.70±0.67	65.05±0.76^{b}	76.05±0.76^{a}	55.99±0.76^{c}	***
LG	71.16±1.21	77.40±1.37^{b}	89.40±1.37^{a}	46.70±1.37^{c}	***
RL	15.46±0.45	15.75±0.51^{b}	18.26±0.51^{a}	12.37±0.51^{c}	***
RH	46.33±1.07	60.99±1.21^{b}	65.41±1.21^{a}	59.60±1.21^{c}	***
RW	14.45±0.44	14.76±0.49^{b}	17.48±0.49^{a}	11.11±0.49^{c}	***
TL	14.98±0.41	14.88±0.46^{b}	16.41±0.46^{a}	13.64±0.46^{c}	***
UL	14.88±0.28	14.51±0.36^{b}	16.75±0.36^{a}	13.40±0.36^{c}	***
UC	33.82±0.57	33.34±0.74	34.34±0.74	33.79±0.74	NS
TTL	3.81±0.10	3.73±0.12^{b}	4.37±0.12^{a}	3.34±0.12^{c}	***
SC	17.59±0.17	17.88±0.27^{a}	18.46±0.27^{a}	16.44±0.27^{b}	***
SL	13.83±0.17	13.85±0.27^{b}	15.01±0.27^{a}	12.62±0.27^{c}	***

BCS: Body condition score, LW: Live weight, HDL: Head length, EL: Ear length, HL: Horn length, CG: Chest girth, HW: Height at wither, BL: Body length, LG: Loin girth, RL: Rump length, RH: Rump height, RW: Rump width, TL: Tail length, UL: Udder length, UC: Udder circumference, TTL: Teat length, SC: Scrotal circumference, SL: Scrotal length; S.E = Standard error, NS= No significant differences, LOS= Level of significant. ***= ($P < 0.001$). a, b, c= Numbers with diff. superscript within the same row are statistical different.

Effect of Sex on Body condition score, Live weight and Morphometric traits

Influence of sex on live weight and linear body measurements are presented in table 2. Sex had effect on body condition score (BCS), height at wither (HW) ($P < 0.001$), ear length (EL) ($P < 0.01$), live weight (LW), horn length (HL), body length (BL), loin girth (LG) and tail length (TL).

Table 2: Average Body condition score, Live weight and Morphometric traits (Linear body measurements) According to Sex.

		Sex		
Parameters	**Overall mean ± S.E**	**Male**	**Female**	**LOS**
BCS	3.45±0.09	3.77±0.15	3.12±0.06	***
LW	31.23±0.37	31.96±0.63	30.50±0.24	*
HDL	19.02±0.22	19.33±0.39	18.71±0.15	NS
EL	16.82±0.31	17.51±0.54	16.14±0.21	**
HL	15.15±0.40	15.89±0.68	14.40±0.26	*
CG	70.98±1.26	73.02±2.16	68.93±0.83	NS
HW	64.46±0.53	66.32±0.91	62.61±0.35	***
BL	65.70±0.67	66.86±1.16	64.54±0.45	*
LG	71.16±1.21	73.24±2.08	69.08±0.80	*
RL	15.46±0.45	16.01±0.78	14.91±0.30	NS
RH	46.33±1.07	47.99±1.84	44.67±0.71	NS
RW	14.45±0.44	14.86±0.75	14.04±0.29	NS
TL	14.98±0.41	15.84±0.70	14.12±0.27	*

BCS: Body condition score, LW: Live weight, HDL: Head length, EL: Ear length, HL: Horn length, CG: Chest girth, HW: Height at wither, BL: Body length, LG: Loin girth, RL: Rump length, RH: Rump height, RW: Rump width, TL: Tail length. S.E = Standard error, NS= No significant differences, LOS= Level of significant.
* = ($P < 0.05$), ** = ($P < 0.01$), *** = ($P < 0.001$).

Males had higher (BCS), (HW), (EL), (LW), (HL), (BL), (LG) and (TL) than females. However, non-significant effect of sex on head length, chest girth, rump length, height and width were observed. Males had higher (BCS), (HW), (EL), (LW), (HL), (BL), (LG) and (TL) than females. However, non-significant effect of sex on head length, chest girth, rump length, height and width were observed.

CONCLUSION

It can be concluded that the Red Sokoto goats (RSG) found in Gamawa L.G.A. had the highest values for all the significantly different parameters, while the least values were recorded on RSG in Misau L.G.A. (38.26±0.41 vs 24.16±0.41). Sex is confirmed to have influence on live weight ($P < 0.05$) where the male appeared to be heavier than the female animals. The effects of some qualitative traits on morphometric characteristics were determined and found out that they have little to less impact on growth parameters.

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