

Assessment of body linear measurements of semi-intensively managed Bunaji calves raised during major dry season in the derived savanna zone of Nigeria

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ABSTRACT: Survival of semi-intensively managed cattle during dry season is critical towards their successful development. Cattle are of large size that obviously require high volume of feeds, for sustenance and productive purposes. A completely randomized design study over a period of three months during the major dry season (January to March) was carried out. The mean body measurements [chest girth (CG), body length (BL), body circumference (BC), tail length (TL), height at withers (HW) and body weights (BW)] were monitored fortnightly. The calves were allowed to graze in the morning, between 7.00 - 11.00 h and concentrate feed of 2 kg/day was offered in the afternoon on daily basis. Results from the study showed that the all the body measurements for the males increased till 6th week of the study, decreased till 9th week and thereafter increased till the 12th week. The estimated body weight for the males were 113.27 kg and 118.16 kg for the females at the end of the study. The mean CG was 122.89 ± 3.54 cm, BC was 132.41 ± 4.45 cm, TL was 81.74 ± 2.01 cm, BL 89.54 ± 2.01 cm, HW 102.24 ± 3.22 cm and BW was 125.04 ± 2.89 kg. The correlation coefficient values were generally positive and significant. Highest positive correlations with significant differences were observed in all the parameters except for CG and BL ($r = -0.07$); and BL and HW ($r = -0.57$) which were negatively correlated. It was concluded that Bunaji calves would survive remarkably, with improved body measurements and weight gain if managed semi-intensively with available forage and concentrate during the dry season.

Keywords: Body measurements, body weight, Bunaji calves, dry season.

INTRODUCTION

Farm animals are in abundance but faced with poor management practices, seasonal feed availability, and unfavourable climatic conditions, pests and diseases infestation among others (Akinlade *et al.*, 2005). Cattle are generally referred to as large ruminants and are of great economic value, providing instant financial gains to farmers and effectively serve as insurance against crop failure that could arise as a result of draught, fire disaster and any other unforeseen situation (Bettencourt, *et al.*, 2015). Cattle have provided humans with many benefits and thus means of improvement should be investigated so as to meet up with the increasing demand of animal protein source. A wide variety of cattle breeds exist and in Nigeria with Muturu and N'dama in the South and Bunaji (White

Fulani) in the North. The Bunaji cattle are of dual type and show certain degree of tolerance to trypanosomiasis in the heavily infested areas of Southern Nigeria when well nourished (Akinlade *et al.*, 2003). Similarly, Kanai *et al.* (2013) observed that it could perform comparatively better when properly managed under same conditions as the Bunaji x Friesian; and Otchere (1986) reported that its productivity under sedentary pastoral management which is very well below genetic potential could be improved when raised semi-intensively.

Live weight and body measurements provide basis for research interests and management activities like growth rate assessment, diet and environmental responses, health care, breeding and feeding (Assogba *et al.*, 2017).

One of the ways apart from the use of scale for estimating live weight is the use of body measurements. Body measurements can be taken at a cheaper cost and with high relative accuracy. Body measurements/morphometry (both skeletal and tissue classification) have been used to predict live weight of animals which is important in animal selection and decision making by farmers (Musa *et al.*, 2012). Salako (2006) reported that body measurements in addition to weight measurements describe more completely an individual or population than the conventional methods of weighing and grading. Assogba *et al.* (2017) reported that live weight and body measurements depend on age, sex and breed. Ige *et al.* (2015) corroborated this fact that established genetic difference is a source of variation in linear body measurement work. All these have suggested a recurring interest to the beef cattle industry either to supplement body weight as a measure of productivity or as predictors of some other characteristics that are less visible. Ige *et al.* (2015) established that for selection and breeding program in white Fulani cattle, the relationship between body measurements could be exploited.

Protein intake is of importance in human nutrition as it is essential for optimal growth, development and health status (Wu, 2016). Animal protein has been identified and recommended for humans (Wu, 2016) and this recommendation has created research interest and especially in livestock. As humans depend on livestock for animal protein source, these animals' productivity is being challenged by climate, pests and diseases infestation (Smith *et al.*, 2013 and Akinlade *et al.*, 2005). The most critical months of the year for cattle farmers in the derived savanna zone of Nigeria is March/April. Not only is the pasture scarce due to over dependence on natural rainfall, but because farmers hardly made any adequate preparation during the wet season, that will take care of cattle during the said season (Duguma, 2021). Bush burning, desert encroachment and over population of herds through unrestricted and uncontrolled migration of herders in to the region, made feeding of cattle even at maintenance level difficult. A semi-intensive system of production is a well-known mode of livestock production, where ruminant animals are allowed to graze for certain period of time and are brought back to the enclosure where further feeds are offered as supplements (Islam *et al.*, 2009). The system is popular in derived savanna of Nigeria crop production and crop cultivation are rampant and popular. Thus, this study assessed the body linear measurements of Bunaji calves raised semi-intensively during the dry season in the derived savanna zone of Nigeria.

MATERIALS AND METHODS

Experimental site

The experimental site was at the Cattle Unit, Teaching and Research Farm of Ladoke Akintola University of

Technology, Ogbomoso, Oyo State, Nigeria. Ogbomoso is located at 8°7' North of the equator and 4°15' East of Greenwich meridian in the derived savannah zone, Southern Nigeria. The temperature ranges between 28 and 34°C and humidity range of 50 to 80% (NASA, 2016).

Management of experimental animals

Twelve Bunaji calves (6 males and 6 females) with body weight range of 90 to 98 kg were acquired from a reputable market in Igbeti, Oyo State. They were given anti stress (honey) on arrival. The calves were quarantined for two weeks, during which the sick ones were treated with antibiotics (oxytetracycline), dewormers, iron dextrin and multivitamins intramuscularly at 1 ml per 10kg body weight. All the animals were injected with ivomec to protect them against endoparasites and ectoparasites. After the quarantine period, two weeks of adjustment period was observed. The calves were offered cassava peel and a wide variety of forages like *Panicum maximum*, *Gliricidia sepium*, *Imperata cylindrica* and *Brachiaria decumbens*. The animals were tagged and kept individually in separate pens of size 1.0 m wide by 1.7 m long. The experimental period lasted for three months (January to March). Concentrate diet was offered in the afternoon 3.00 h after grazing from 7.00 to 11.00 h daily. The concentrate diet (2 kg/day) contained corn bran, wheat offal, palm kernel cake, groundnut cake, maize and oyster shell; and the calves grazed on *Gliricidia sepium*, *Imperata cylindrica*, *Ageratum conyzoides*, *Sporobolus pyramidalis* and *Panicum maximum* (12 - 15 kg/day) so as to meet up with the required 2 to 3% dry matter of their body weight.

Data collection

Data was collected on body measurements which was taken with measuring tape in centimeters; for body length (distance between shoulder pin and the caudal pin); height at wither (back tip to the leg tip); chest girth (distance round the chest just behind the elbow joint) and tail length (from caudal region to the tip of the tail). Measurements were taken once in four weeks for the 16 weeks experimental period. Body weight was estimated by using the Shaeffer's formula (Khan, 2003) given below. Weight change was determined by subtracting the initial live weight from the final live weight.

$$\text{Live weight (kg)} = \frac{\text{Body length (cm)} \times (\text{Chest girth})^2 (\text{cm})}{10815}$$

Laboratory analysis

The samples of the forages and concentrate diet offered to the calves were collected; oven dried at 60°C, milled and then kept in airtight containers pending analysis. Moisture

Table 1. Nutrient composition of the forage samples in the grazing area and the concentrate diet. LSM±SEM

Forages	Crude protein (%)	Crude fibre (%)	Ether extract (%)	Ash (%)	Dry matter (%)
<i>Gliricidia sepium</i>	24.49 ^a ± 0.02	11.44 ^b ± 0.02	5.84 ^d ± 0.00	9.51 ^b ± 0.02	84.4 ^{ab} ± 0.02
<i>Imperata cylindrical</i>	13.12 ^c ± 0.01	29.37 ^a ± 0.02	4.24 ^e ± 0.00	7.63 ^c ± 0.00	85.88 ^a ± 0.02
<i>Ageratum conyzoides</i>	24.48 ^a ± 0.00	13.65 ^b ± 0.01	6.17 ^b ± 0.00	10.37 ^a ± 0.02	84.50 ^{ab} ± 0.01
<i>Sporobolus pyramidalis</i>	14.02 ^c ± 0.00	27.26 ^a ± 0.00	6.10 ^c ± 0.00	6.13 ^d ± 0.02	84.42 ^{ab} ± 0.02
<i>Panicum maximum</i>	10.40 ^c ± 0.02	21.43 ^{ab} ± 0.00	7.41 ^a ± 0.00	6.08 ^d ± 0.01	65.97 ^c ± 0.00
Concentrate diet	13.50 ^c ± 0.12	3.61 ^c ± 0.05	4.46 ^e ± 0.14	9.53 ^b ± 0.04	80.57 ^c ± 0.01
SEM	1.02	2.54	0.01	0.01	0.01

a, b, c, d and e means in the same column with the same superscripts are not significantly different ($p < 0.05$). SEM: Standard error of mean.

Table 2. Mean body measurements of Bunaji calves as affected by sex. LSM±SEM

Body measurement	Week 3		Week 6		Week 9		Week 12	
	Male	Female	Male	Female	Male	Female	Male	Female
Chest girth (cm)	112.43 ± 0.50	115.26 ± 2.00	117.48 ± 2.00	120.65 ± 2.50	115.57 ± 0.00	122.56 ± 0.50	116.97 ± 2.50	117.80 ± 1.02
Body circumference (cm)	127.64 ± 3.00	132.20 ± 2.60	132.08 ± 0.50	138.43 ± 2.59	129.67 ± 0.25	135.66 ± 3.21	133.04 ± 0.54	137.80 ± 3.12
Tail length (cm)	82.30 ± 0.95	74.93 ± 1.15	82.55 ± 1.00	77.47 ± 0.76	81.28 ± 0.88	76.84 ± 0.66	84.58 ± 1.00	80.33 ± 1.21
Body length (cm)	87.63 ± 0.50	86.36 ± 1.18	88.27 ± 0.95	88.90 ± 1.23	88.90 ± 1.12	90.17 ± 2.00	89.54 ± 2.00	92.08 ± 1.88
Height at wither (cm)	101.99 ± 5.00	102.24 ± 7.23	103.52 ± 6.89	104.14 ± 4.45	103.83 ± 5.23	104.14 ± 4.89	103.14 ± 4.33	102.87 ± 3.45
Body weight (Kg)	102.16 ± 7.12	109.24 ± 9.28	112.69 ± 4.56	119.67 ± 6.34	109.79 ± 5.67	125.13 ± 6.25	113.27 ± 6.45	118.16 ± 5.89

content, ash, ether extract and crude fibre contents of the samples were determined using the methods described in AOAC (2005). Total Nitrogen (N) was determined by the micro-Kjeldahl method while the crude protein was calculated by multiplying % N with a factor of 6.25 (AOAC, 2005). Nitrogen free extract (NFE) was obtained by subtracting the sum of the percentage of protein, ash, ether extract and crude fibre from dry matter.

Statistical analysis

All the data collected were subjected to PROC means procedure using SAS (2000). Mean and standard deviation for each body measurements were estimated. Pearson correlation coefficients were calculated to determine the degree of associations between variables.

RESULTS

Nutrient composition of the forage samples in the grazing area and the concentrate diet

Table 1 revealed the nutrients composition of the forages in the grazing area which were grasses-*Panicum*

maximum, *Sporobolus pyramidalis*, and *Imperata cylindrical* and Legumes- *Ageratum conyzoides* and *Gliricidia sepium*. The forages varied with significant differences across the nutrient contents. However, there were no significant differences in the crude protein, crude fibre and dry matter contents of *Gliricidia sepium* and *Ageratum conyzoides*. As expected, the *Ageratum conyzoides* and *Gliricidia sepium* had higher crude protein contents and lower crude fibre contents compared to others. The crude protein content (CP), crude fibre content (CF) and dry matter content (DM) of the forages in the grazing area however ranged from 10.40 – 24.49%, 11.44 – 29.37% and 65.97 – 85.88 % respectively. The DM content of *I. cylindrical* (85.88%), *S. pyramidalis* (84.42%) and *A. conyzoides* (84.50%) were significantly high. The concentrate diet contained 13.50% CP, 3.61% CF, 4.46% ether extract content (EE) and 9.53% ash content.

Mean body measurements of Bunaji calves as affected by sex

Table 2 showed the mean body measurements of Bunaji calves as affected by sex. All the parameters increased significantly in the males as the dry season advanced till week 6, decreased at week 9 and then increased till week

Table 3. Mean body measurements of Bunaji calves managed semi intensively. LSM±SEM

Body measurement	Week 3	Week 6	Week9	Week 12
Chest girth (cm)	111.35 ±2.34	120.65± 1.36	121.29±2.28	122.89± 3.54
Body circumference (cm)	123.17± 3.21	127.64± 3.45	132.08± 5.61	132.41±4.45
Tail length (cm)	73.74± 3.29	78.11±1.16	74.93±2.31	81.74±2.01
Body length	88.27± 2.54	85.73±3.22	87.00± 2.21	89.54± 2.36
Height at wither (cm)	100.33± 4.45	103.51±5.34	104.47± 2.35	102.24±3.22
Body weight (Kg)	101.20± 3.26	115.39± 3.21	118.34±2.16	125.04±2.89

Table 4. Correlation relationships between body measurements of Bunaji calves managed semi-intensively during the dry season.

	Chest girth	Body circumference	Tail length	Body length	Height at withers	Body weight
Chest girth						
Body circumference	0.92***					
Tail length	0.72***	0.58**				
Body length	-0.07***	0.16	0.35			
Height at withers	0.78***	0.71***	0.14	-0.57**		
Body weight	0.97***	0.95***	0.80***	0.15	0.64	

12 except for body length (BL) which increased all through the study; and height at withers (HW) which increased till the 9th week and then declined. All the parameters in the females increased till the 9th week and thereafter declined. However, at the end of the study, the final average body weight (BW) of the males was 113.27 kg and the females had average 118.16 kg. Table 3 revealed the mean body measurements of Bunaji calves during the dry season. At the end of the study the mean CG was 122.89± 3.54 cm, BC 132.41± 4.45 cm, TL 81.74 ±2.01 cm, BL 89.54 ± 2.01 cm, HW 102.24 ± 3.22 cm and BW125.04 ± 2.89 kg.

Correlation relationships between body measurements of Bunaji calves managed semi-intensively during the dry season

The correlation coefficient showing the relationship between the body measurements of the Bunaji calves are shown in Table 4. The correlation coefficient values are generally positive and significant. Highest positive correlations with significant differences were observed in all the parameters except for CG and BL; and BL and HW which were negatively correlated ($r = -0.07$ and -0.57 respectively).

DISCUSSION

The nutrient composition of the forages and concentrate diet revealed that the feeds complimented each other and thus the cattle had access to balanced ration and enough CP and CF contents in the feed as recommended by NRC (2016) for young cattle. The crude protein content of

Gliricidia sepium reported in this study (24.49%) compared favourably with the 17.88-26.25% of Akinlade *et al.* (2022), 24.49% of Adegun (2014) and 22.6% of Rusdy *et al.*, (2010) but differed from the 17.90% CP reported by Onyeonagu and Eze (2013). The season and geographical location could have been responsible for the differences as it had been reported (King *et al.*, 2012; French, 2017 and Lee, 2018).

It was observed that the body parameters increased as the dry season advanced in male cattle till the 6th week at which it declined at the 9th week and then increased again. The intense of the dry season's effect on the forages and the adequate provision of nutrients through the concentrate supplement offered to the Bunaji calves could have been responsible for the increase and the decrease. Meanwhile the females showed increase for all the linear body measurements till the 9th week after which it declined. This implies that females showed consistent increase (9th week) than the males (6th week). This finding corroborates the report of Ige *et al.* (2015) that sex is a source of variation in most body measurement traits in white Fulani cattle, thus similar in the calves. In a similar study with N'dama calves, it was reported that linear body measurements were influenced by calf sex, birth year and birth season (Essien and Adesope, 2003). Oni *et al.* (2011) also reported that sex effect was significant for most body measurements except for WH. However, the decrease in some body measurements as observed in both the females and males could be attributed to the low quality of the forages as the dry season advanced (Mtengeti *et al.*, 2008).

The mean body measurements of the calves revealed that CG, BC and BW increased as dry season advanced

while HW, TL and BC showed undulating measurements at week 6, 9 and 12. The CG (122.89 cm), and WH (102.24 cm) values reported in this study were higher than the 109.88 cm and 93.76 cm reported by Oni *et al.* (2011) but the contrary was for BL (89.54 cm versus 92.88 cm). The high positive correlation observed between body weight and chest girth in this study ($r = 0.97$) confirmed the strong relationship earlier established in cattle (Abdelhadi and Babiker, 2009; Sahu *et al.*, 2017). The correlated relationships between the parameters further confirmed the submission of Ige *et al.* (2015) and Oni *et al.* (2011) that body measurements have direct relationships with body weight. It can thus be concluded that the body measurement parameters increased significantly till the 6th and 9th week of the major dry season when Bunaji calves were semi-intensively managed with forages and supplemented with concentrate.

Bunaji calves can be semi-intensively managed during the dry season. The available forages with 300 g/day concentrate supplement improved the performance of Bunaji calves. It is hereby recommended during the dry season in southern Nigeria. This would increase production during the dry season when forage is scarce.

Conclusion and Recommendation

The body measurements of the Bunaji calves raised semi-intensively during the major dry season in Nigeria showed that supplementation is essential for accelerated growth. The values of some of the body measurements increased till the 6th and 9th week of the experimental period, declined and thereafter increased. Supplementation with concentrate after morning grazing is hereby recommended for Bunaji calves when raised semi-intensively during the major dry season to increase body measurements which is an index of growth.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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