Agricultural Journal 5 (3): 211-214, 2010
ISSN: 1816-9155

Breed and Environmental Factors Affecting Body Measurements of Beef Cattle in Yewa, Nigeria

B.B.A. Taiwo, O.D.D. Olaniran and F.A. Aluko
Department of Animal Production, Faculty of Agricultural Production and Renewable Resources,
Yewa Campus, Olabisi Onabanjo University, Ayetoro, Ogun State, Nigeria

Abstract: The study examined the effects of breed, age, sex and body condition scores on linear body measurements on White Fulani (Bunaji), Rahaji and Sokoto Gudali. Sokoto Gudali was significantly ($p<0.05$) superior to Rahaji and White Fulani in Height at Withers (HAW), Heart Girth (HG) and Depth of Body at Rear Flank region (DARF). Body measurements increased with age. Maximum increase was between 1-3 years. Sex of animals significantly ($p<0.05$) affected most body measurements, bulls being superior to cows in Height at Hips (HAH), Width at Hips (WAH) and DARF which are good measures of tissue development. Also Body Condition Scores (BCS) significantly ($p<0.05$) affected all body measurements. Distributions of animals in the three conditions (fat, medium and lean) were 21, 51.2 and 27.5%, respectively. Animals with medium BCS showed consistent relationship with body measurements. Within breed, BCS were strongly ($p<0.01$) related to body measurements to make linear measures a possible good indices and reliable indicator of BCS which can be used to assess beef cattle under field conditions.

Key words: Breed, age, sex, body condition score, body measurements, Nigeria

INTRODUCTION

Fresh beef consumed in Nigeria comes mostly from indigenous cattle. The large Zebu breeds found in the north account for over 90% of this cattle population and produce bulk of the beef (Buvanendran *et al*., 1983). Among these breeds, White Fulani (Bunaji), Sokoto Gudali and Rahaji account for over 75% of this cattle population (Nuru, 1996).

Variation in beef traits in Nigerian cattle markets are observed by subjective assessment which is a form of visual appraisal. Animals are then graded according to the locally set standards. Assessment by objective measurements which employs frame scores and linear measurements of different body parts to monitor growth rate, body weight and carcass characteristics (Brown *et al*., 1973) is an upcoming method of evaluating beef cattle in Nigeria. Gilbert and Gregory (1952) noted that such linear body measurements like body length, head to shoulder, height at withers, circumference of round describe an animal more completely than conventional methods of weighing and grading. A number of studies have been carried out on linear body measurements in several African breeds (Spencer and Eckert, 1988; Orheruata, 1988). But there is a dearth of information on major Nigerian breeds of beef cattle. The use of linear body measurements in assessing animals is advantageous especially in Nigerian situation where farmers cannot afford weighing scales besides their ability to know how to operate them. This study therefore, examined the effects of breed and environmental factors on linear body measurements in major beef cattle breeds in Guinea Savannah zone of Nigeria.

MATERIALS AND METHODS

Study location: The study was carried out at a sedentary Fulani settlement in Anigbado/Ileniku village in Ayetoro environment of Ogun state. The settlements are located within latitude 7°15'N and longitude 3°3'E. The rainfall pattern is bimodal with peaks in June and September. The mean annual precipitation is about 1909.3 mm while the maximum temperature varies from 29°C during early dry season (October-December) to 34°C at the late dry season (January-March). The relative humidity is 81% and the vegetation is Guinea Savannah.

Herd management: Two hundred and three indigenous Zebu cattle consisting of White Fulani (Bunaji), Rahaji and Sokoto Gudali were used in this study. The animals

Corresponding Author: Taiwo Babatunde Badiu Ayinde, Department of Animal Production, Faculty of Agricultural Production and Renewable Resources, Yewa Campus, Olabisi Onabanjo University, Ayetoro, Ogun State, Nigeria

were kept in herds managed by one to two Fulani herdsmen. As there was no planted pasture, animals were grazed on the range in the morning and then returned to the homestead in the evenings.

Aggressive animals were usually restrained to prevent wandering. In the late dry season, animals were provided with supplementary hay made of *panicum maximum*, cowpea vines and groundnut tops locally purchased at the cattle markets. Even though there is no organised health care management, occasionally animals were treated against trypanosomiasis and ticks infestation by visiting veterinarians. There is no organised breeding plans and the offtake for sales is high.

Data collection: Eight body measurements defined by Brown *et al*. (1973) were taken on restrained animals on a plane ground using fibre and steel tapes and graduated measuring poles. These measurements included:

Height at Withers (HAW): Taken on the dorsal midline at the highest point on the withers.

Body Length (BLT): Distance between the point of the shoulder (lateral tuberosity) on the humerus and the pin bone (tuber ischii).

Heart Girth (HG): The body circumference immediately posterior to the front legs or the body circumference on the fore ribs.

Height at Hips (HAH): It was measured mid sacrum on the dorsal midline.

Width at Hips (WAH): The distance between the lateral surfaces and the tuber coxae.

Width at point of Shoulder (WAS): The distance between the lateral surfaces on the point of shoulder (humerus).

Depth of body at Fore girth (DAF): The distance between the dorsal point immediately to the front legs down to the ventral point on the fore flank.

Depth of body at Rear Flank region (DARF): The distance between the dorsal point on the loin (tuber coxae) down to the ventral point on the hip.

Breed, age, sex and Body Condition Scores (BCS) of the animals were also taken. Age was determined by using the dentition of the animals (Ensminger, 1968) supported by oral evidence of the Fulani herdsmen. The condition scores described by Nicholson and Butterworth (1986) were used to classify animals on an L^+, L, L^- scale for lean animals, M^+, M, M^-, scale for medium animals and F^+, F, F^- scale for fat animals.

Analysis of data: Data collected were analysed by a least square procedure which included terms for breed, sex, age and body condition scores (Harvey, 1987). Within breed, Pearson product moment correlations were run to establish phenotypic relationship between the variables while means within the subclasses were tested by Duncan multiple range test (Steel and Torrie, 1990).

RESULTS AND DISCUSSION

Breed of animal significantly ($p<0.05$) affected all body measurements except BLT and DAF (Table 1). Sokoto Gudali was significantly ($p<0.05$) superior to Rahaji and White Fulani in HAW, HG and DARF while Rahaji was significantly ($p<0.05$) better than White Fulani in WAH and WAS.

Age of animal significantly ($p<0.01$) affected all body measurements (Table 1). Table 2 showed that body measurements increased with age. Maximum increase was between 1-3 years. At 3 years of age, WAS, DARF and HG were 135.11, 127.12 and 125.20%, respectively better than at 1 year. However, there was no significant ($p>0.05$) effect of age on body measurements between 3 and 4 years. Thereafter, body measurements increased progressively until 11 years with HG having the highest value. Sex of animals significantly ($p<0.05$) affected HAH, BLT, WAH, DAF, WAS and DARF (Table 1). Of the 203 animals used in this study, bulls accounted for 80.3%. Also, bulls consistently had higher body measurements than cows reaching significance ($p<0.5$) in HAH, WAH and Body Condition Scores (BCS) significantly ($p<0.05$) affected all body measurements (Table 1). Distribution of animals in the three conditions (fat, medium and lean) gave 21, 51.2 and 27.5%, respectively. Linear measurements differed significantly ($p<0.05$) from fat to lean conditions (Table 2). While, animals with medium BCS showed consistent relationship with body measurements, animals with fat and lean BCS did not. There were overlaps across some of the BCS where values in lower sub-groups were higher than values in higher sub-groups. Within breed however, Table 3 showed strong association of BCS with body measurements.

In line with this finding, Payne (1990) also reported that Sokoto Gudali was larger than Rahaji and White Fulani. Similarly, Bogart *et al*. (1955) also reported that the birth year significantly ($p<0.05$) affected body measurements in growing beef cattle. In another study, Orheruata and Olutogun (1994) reported significant

Table 1: Analysis of variance of the effects of breed, age, sex and body score on body measurements

Source	DF	MS HAW	MS HAH	MS HG	MS BLT	MS WAH	MS DAF	MS WAS	MS DARF
Breed	2	0.017**	0.024***	0.042**	0.001	0.187***	0.007	0.305***	0.015**
Age	10	0.055***	0.079***	0.198***	0.134***	0.218***	0.063***	0.262***	0.017***
Sex	1	0.001	0.093***	0.004	0.075*	0.170*	0.036*	0.022	0.054*
Score	8	0.016***	0.009*	0.169***	0.011*	0.048***	0.014***	0.059***	0.013***
Error	181	0.007	0.006	0.220	0.014	0.210	0.007	0.021	0.006
Total	202								

*p<0.05, **p<0.01, ***p<0.001

Table 2: Least square means of body measurements and their standard errors

Variables	N	HAW	HAH	HG	BLT	WAH	DAF	WAS	DARF
Breed									
Sokoto gudali	61	1.25^{a}	1.29^{a}	1.64^{a}	1.16^{a}	1.47^{a}	0.67^{a}	1.36^{a}	0.78^{a}
Rahaji	60	1.21^{b}	1.27^{a}	1.55^{b}	1.15^{a}	1.38^{b}	0.66^{a}	1.25^{b}	0.73^{b}
White fulani	82	1.99^{b}	1.24^{b}	1.55^{b}	1.14^{a}	1.32^{c}	0.65^{a}	1.18^{c}	0.72^{b}
Age									
1	29	1.07^{a}	1.12^{a}	1.27^{a}	0.96^{c}	1.13^{d}	0.53^{e}	0.94^{d}	0.59^{e}
2	37	1.17^{cd}	1.23^{cd}	1.46^{cd}	1.09^{b}	1.27^{cd}	0.60^{de}	1.16^{c}	0.68^{de}
3	32	1.24^{bcd}	1.29^{bcd}	1.59^{bcd}	1.17^{ab}	1.37^{bc}	0.65^{cd}	1.27^{bc}	0.75^{bcd}
4	22	1.24^{bcd}	1.28^{bcd}	1.58^{bcd}	1.17^{ab}	1.41^{bc}	0.66^{cd}	1.31^{bc}	0.73^{bcd}
5	30	1.28^{bc}	1.32^{bc}	1.74^{ab}	1.23^{ab}	1.52^{ab}	0.74^{abc}	1.34^{b}	0.82^{abc}
6	22	1.27^{bc}	1.34^{b}	1.63^{bc}	1.23^{ab}	1.53^{ab}	0.69^{bcd}	1.37^{b}	0.81^{abc}
7	16	1.29^{b}	1.32^{bc}	1.75^{ab}	1.27^{a}	1.52^{ab}	0.78^{ab}	1.41^{ab}	0.87^{a}
8	3	1.25^{bcd}	1.33^{bc}	1.72^{ab}	1.20^{ab}	1.44^{bc}	0.69^{bcd}	1.29^{bc}	0.78^{abc}
9	3	1.15^{de}	1.21^{de}	1.41^{de}	1.20^{ab}	1.37^{bc}	0.66^{cd}	1.25^{bc}	0.71^{cd}
10	8	1.31^{b}	1.34^{b}	1.86^{a}	1.21^{ab}	1.52^{ab}	0.78^{ab}	1.40^{ab}	0.83^{ab}
11	1	1.44^{a}	1.48^{a}	1.90^{a}	1.28^{a}	1.70^{a}	0.85^{a}	1.59^{a}	0.80^{abc}
Sex									
Bull	163	1.22^{a}	1.27^{a}	1.58^{a}	1.15^{a}	1.39^{a}	0.66^{a}	1.26^{a}	0.71^{a}
Cow	40	1.21^{a}	1.23^{b}	1.53^{a}	1.14^{a}	1.33^{b}	0.65^{a}	1.23^{a}	0.72^{b}
Body score									
F^{+}	1	1.37^{a}	1.40^{a}	1.92^{a}	1.31^{a}	1.82^{a}	0.83^{a}	1.74^{a}	0.89^{a}
F	19	1.31^{ab}	1.35^{ab}	1.82^{ab}	1.24^{ab}	1.59^{b}	0.73^{abc}	1.44^{b}	0.87^{ab}
F^{-}	23	1.31^{ab}	1.34^{abc}	1.88^{ab}	1.27^{ab}	1.53^{bc}	0.78^{ab}	1.40^{bc}	0.85^{bc}
M^{+}	37	1.25^{abc}	1.28^{abc}	1.65^{bc}	1.17^{abc}	1.42^{bcd}	0.68^{bcd}	1.31^{bcd}	0.77^{bc}
M	41	1.21^{bc}	1.27^{bcd}	1.56^{c}	1.15^{abc}	1.40^{bcde}	0.66^{bcd}	1.28^{bcd}	0.73^{c}
M^{-}	26	1.17^{cd}	1.22^{cd}	1.48^{cd}	1.08^{bc}	1.30^{cde}	0.61^{cd}	1.19^{cde}	0.68^{c}
L^{+}	37	1.16^{cd}	1.21^{cd}	1.44^{cd}	1.10^{bc}	1.26^{de}	0.60^{cd}	1.15^{de}	0.69^{c}
L	18	1.13^{cd}	1.21^{cd}	1.27^{d}	1.08^{bc}	1.18^{e}	0.59^{d}	0.99^{e}	0.61^{c}
L^{-}	1	1.06^{d}	1.15^{d}	1.42^{cd}	1.01^{c}	1.39^{bcde}	0.62^{cd}	1.21^{cde}	0.71^{c}
SE		0.01	0.01	0.02	0.01	0.02	0.01	0.02	0.01

Means with different subscripts within the same subclass differ significantly (p<0.05)

Table 3: Correlation between age, sex, body score and body measurements in white fulani, sokoto gudali and rahaji cattle

Variables	HAW	HAH	HG	BLT	WAH	DAF	WAS	DARF
White fulani								
Age	0.587***	0.605***	0.578***	0.493***	0.562***	0.727***	0.618***	0.622***
Sex	0.132	-0.092	-0.017	0.019	-0.045	0.055	-0.065	0.026
Body score	0.501***	0.325**	0.688***	0.317***	0.489***	0.604***	0.495***	0.547***
Sokoto gudali								
Age	0.607***	0.617***	0.173***	0.718***	0.718***	0.529***	0.64***	0.710***
Sex	-0.079	-0.111	-0.116	0.008	-0.100	-0.107	-0.096	-0.202
Body score	0.723***	0.692***	0.818***	0.563***	0.691***	0.456***	0.632***	0.684***
Rahaji								
Age	0.507***	0.469***	0.639***	0.493***	0.683***	0.652***	0.665***	0.622***
Sex	-0.162	-0.226	-0.056	-0.156	-0.123	-0.139	-0.046	-0.101
Body score	0.267*	0.250*	0.422***	0.352**	0.392**	0.384**	0.390**	0.323*

*p<0.05, **p<0.01, ***p<0.001

effects of age on pre-weaning and post-weaning body measurements in N'Dama cattle with the highest significance pr-eweaning. Progressive increase in body measurements with age agreed with the observations of Hassan and Ciroma (1990) who reported that correlations of body measurements varied with age and was more accurate at late ages. A much higher proportion of bulls in this study is because few bulls were required in pasture mating (ratio 1:50) while excess males were usually turned out for sales which agreed with Abanikanda and Leigh (2002) who reported 80% in their study. Body measurements can be further divided into horizontal

measurements like Body Length (BLT) and Head to Shoulder (HDS) and vertical measurements like Height at Withers (HAW) and chest depth. In skeletal development, there is faster growth in length than in width and circumference, hence there was no significant difference in HAW, BLT, DAF and WAS which agreed with the findings of Blackmore *et al*. (1995).

The distribution of animals in the fat BCS in this study (21%) was much <58.8% reported by Abanikanda and Leigh (2002) while all the BCS were much lower than the reports of Nicholson and Butterworth (1986) probably because of breed and management differences.

CONCLUSION

In this study, the overlaps across some of the BCS may be because of the body weight of the animals which is an important component of assessment was not part of this analysis since this study was carried out on the field and there was no weighing scale. However, from the foregoing, it is obvious that linear measures are possible good indices and reliable measures of the BCS which can be used to assess beef cattle under field conditions.

REFERENCES

Abanikanda, O.T.E. and A.O. Leigh, 2002. Comparative (visual and condition) scoring of zebu cattle in Lagos State. Proceeding of the 7th Annual Conference of Animal Science Association of Nigeria, (ASAN'02), University of Agriculture, Abeokuta, Nigeria, pp: 352-354.

Blackmore, D.W., L.D. McGulliard and J.L. Lush, 1995. Growth and development of aberdeen angus cattle. Arkansas Agric. Exp. Station Bull., 571: 10-10.

Bogart, R.G., R.W. Nelms, D.A. Mason, C.E. Price and R.T. Clark, 1955. Body dimension score, gains and feed efficiency of growing beef cattle. J. Anim. Sci., 14: 1175-1176.

Brown, J.E., C.J. Brown and W.T. Butts, 1973. Evaluating relationship among immature measures of size, shape and performance of beef bulls. J. Anim. Sci., 36: 1011-1031.

Buvanendran, V., U.J. Ikhatua, B.Y. Abubakar and M.B. Olayiwole, 1983. Carcass characteristics of indigenous breeds of cattle in Nigeria. J. Agric. Sci., 100: 407-411.

Ensminger, M.E., 1968. Beef Cattle Science. 4th Edn., Intestate Publishers Inc., USA., pp: 98-109.

Gilbert, H.R. and P.W. Gregory, 1952. Some features of growth and development of Hereford cattle. J. Anim. Sci., 11: 3-16.

Harvey, W.R., 1987. User's Guide for LSMLMW, Mixed Model Least Squares and Maximum Likelihood Computer Program. The Ohio State University, USA.

Hassan, W.A. and A. Ciroma, 1990. Body weight relationship in Nigeria Red Sokoto goats. Proceeding of African Small Ruminant Research Network First Bi-Annual Conference and General Assembly, Dec. 10-14, Nairobi, Kenya, pp: 428-432.

Nicholson, M.J. and M.H. Butterworth, 1986. A Guide to Condition Scoring of Zebu Cattle. 1st Edn., International Livestock Centre for Africa, Addis Ababa, Ethiopia.

Nuru, S., 1996. Agricultural Development in the Age of Sustainability: Livestock Production. In: Sustaining the Future Economic, Social and Environmental Changes in Sub-Saharan Africa, Benneh, G., W.B. Morgan and J.I. Vitto (Eds.). Winrock International, USA.

Orheruata, M.A. and O. Olutogun, 1994. Pre-weaning and post-weaning phenotypic relationships between some N'Dama cattle linear measurements in the tropics. Nig. J. Anim. Prod., 21: 76-78.

Orheruata, M.A., 1988. A study of some linear measurements of N'Dama cattle of various ages. M.Sc. Thesis, University of Ibadan, Nigeria.

Payne, W.J.A., 1990. An Introduction to Animal Husbandry in the Tropics. 4th Edn., Longman Group, UK., pp: 12-33.

Spencer, W.P. and J.B. Eckert, 1988. Estimating liveweight and carcass weight in Gambia N'Dama cattle. World Anim. Rev., 65: 18-23.

Steel, R.G.D. and J.A. Torrie, 1990. Principles of Procedure of Statistics. 3rd Edn., McGraw-Hill, New York.