ABG 16

Comparative Study of Linear Type Measurements and Functional Type Traits in Two Nigerian Cattle Breeds

E.A. Abare[1], H.K. Yahaya[2] and B.I. Nwagu[2]
[1]Department of Animal Science, Ahmadu Bello University, Zaria; [2]National Animal Production Research Institute, Ahmadu Bello University, Zaria
Corresponding author: H.K. Yahaya; E-mail: hkyahaya@hotmail.co.uk

Abstract
A study was conducted to evaluate the effect of linear measurements and linear type traits in two breeds of cattle in Nigeria. Observations on linear type traits of 143 cows consisting of 89 Bunaji and 53 Sokoto Gudali breeds were scaled and scored thrice within a period of May to July, 2017. Live weight and nine body linear measurements (height at rump-HR, height at withers-HW, body length BL, hip length LGT, rump length RL, hips width WH, width of pins WP, chest depth-CD, and chest width-CW) and eight linear type traits scores (stature-ST, body depth-BD, rump width-RW, teat length-TL, udder depth-UD, body condition score-BCS, rear legs set (side view), and fore udder attachment) were also measured. Results obtained from linear type measurements showed significant ($p<0.05$) difference for HW, BL, LGT, RL and CW (129.61, 107.87, 85.37, 40.04 and 35.07), respectively for Bunaji cows against (127.67, 104.02, 82.22, 37.87 and 30.04) for Sokoto Gudali cows. Chest depth was significantly ($p<0.05$) higher (76.09) in Sokoto Gudali than (74.16) in Bunaji. The coefficients of variation ranged from 3.79 - 13.11, respectfully in Bunaji and 3.92 to 12.30 for in Sokoto Gudali cows. The highest live weight was obtained with Sokoto Gudali (230.61 kg) which differed significantly ($p<0.05$) from the Bunaji cows (219.05 kg).

Keywords: Cattle, Bunaji, Sokoto Gudali, cows, linear type traits

Introduction

Livestock production is a major component of the agricultural economy of developing countries that goes beyond food production to providing direct cash returns to farmers (Jabbar *et al.,* 1995). The use of linear type traits as indirect indicators of fertility to improving reproductive performances could be an option to reducing generation interval since it allows for early selection. Linear type traits depict measurements for a range of visual characteristics of an animal (Berry *et al*., 2004). Literally, it describes what 'type' or external form of an animal. It also describes the animal's physical form as measured over 20-25 distinct individual points of its conformation (Centre for Dairy Information, 2016). Functional traits are traits impacting commercial dairy production such as udder type; feet and legs (Centre for Dairy Information, 2016). Alternative body measurements and indices estimated from diverse combinations of different body traits produced a superior guide to weight and were used as an indicator of type and functional traits in domestic animals (Salako, 2006). Since 1994, a group within the International Committee for Animal Recording has been established to study conformation recording, but its work was directed mainly at dairy cattle (Stoll *et al*., 1996).Type traits are usually obtained early during the productive life; they are cheap and easy to measure.

This work therefore is aimed at determining the effect of body linear type traits and functional indices on Bunaji and Sokoto Gudali cows.

Materials and Methods

The research was conducted at the Beef Research Programme of National Animal Production Research Institute (NAPRI), Ahmadu Bello University, Shika, Zaria, Kaduna State, Nigeria. The location is as described by Meteorological Unit, IAR/ABU (2009). A total of one hundred and forty three (143) cows consisting of eighty nine (89) Bunaji and fifty three (53) Sokoto Gudali breeds were used for the study. The animals were supplemented with concentrates made up of cotton seed cake and wheat offals before and after their normal unrestricted grazing of about 7-9 hours per day. They had access to water and salt lick *ad-libitum.*

Nine separate measurements and live weight were taken from each breed of the cows. These include: Height at rump, height at withers, Body length, Hip length, Rump length, Hips width, Width of pins, Width of chest and Depth of chest. All the traits were measured using flexible tape (in cm) with the exception of height at withers and height at rump which were measured using a measuring stick calibrated in centimeter. The measurements taken were used in calculating the appropriate indices for each breed of cows in the study. The calculated indices were: height slope (HS), length index (LI), rump length index (RLI), balance (Bal.), width slope (WS), depth index

(DI), foreleg length index (FLI) and cumulative index (CUI). Live weight was taking using Avery weighing bridge scale (Tronix ModelE1010) calibrated in kilogram. The calculations followed the procedures on White Park cattle in the United Kingdom in 1994-1995.

Data was analyzed using the General Linear Model procedure of Analysis of Variance. Means with significant differences were separated using the Duncan's multiple range procedures of SAS 9.0 (SAS, 2002).

Result and Discussion

Table 1 showed least mean square of effect of linear type measurements while Table 2 showed least square means of effect of linear type and functional indices in Bunaji and Sokoto Gudali cows. Most of the linear type traits and functional traits differed significantly ($p<0.05$) between the genotypes. Bunaji were taller, had longer bodies, longer rump length and wider chest than Sokoto Gudali, while Sokoto Gudali had deeper chest than the Bunaji breed. The most variable trait being chest width (CV=13.11% and 12.30%) in Bunaji and Sokoto Gudali breeds, respectively while the least variable trait was height at rump (CV=3.79% and 3.92%) in Bunaji and Sokoto Gudali, respectively.

Table 1: Least squares means ± S.E of effect of linear type measurements in Bunaji and Sokoto Gudali cows

Traits	N	Mean ± SE	SD	Min.	Max.	C.V.
Bunaji						
HW	267	129.61±0.31^{a}	5.1	117	143	3.93
HR	267	126.13±0.29	4.8	112	138	3.79
BL	267	107.87±0.32^{a}	5.2	89	121	4.77
LGT	267	85.37±0.34^{a}	5.6	68	102	6.59
RL	267	40.04±0.17^{a}	2.7	30	49	6.74
WP	267	20.37±0.12	1.9	15	29	9.31
WH	267	44.88±0.25	4.1	29	53	9.22
CD	267	74.16±0.32^{b}	5.2	36	84	7.03
CW	267	35.07±0.28^{a}	4.6	29	81	13.1
Sokoto Gudali						
HW	159	127.65±0.4^{b}	5.7	114	139	4.47
HR	159	125.99±0.39	4.9	108	137	3.92
BL	159	104.02±0.51^{b}	6.5	79	115	6.2
LGT	159	82.22±0.40^{b}	5.1	67	93	6.15
RL	159	37.87±0.91^{b}	2.3	32	44	6.15
WP	159	20.26±0.15	1.9	15	28	9.11
WH	159	44.47±0.39	4.9	31	53	11.1
CD	159	76.09±0.34^{a}	4.3	64	86	5.61
CW	159	30.04±0.29^{b}	3.7	24	41	12.3

HW= Height at withers; HR= Height at rump; BL= Body length; LGT= Length; RL= Rump length; WP=Width of pins; WH= Width of hips; CD= Chest depth and CW= chest width; C.V. = Coefficient of variation; Min, = Minimum; Max, Maximum; N= Number of observation; Means with uncommon superscripts for each trait differ significantly, $p<0.05$.

There is a significant difference between the two genotypes in some linear type and functional indices which indicated that Sokoto Gudali appeared to be heavier well balanced with a wider and deeper body than Bunaji breed. On the other hand, Bunaji have a sloppier body from withers to rump, longer body, longer rump, and taller forelegs set than Sokoto Gudali breeds. The observed significant ($p<0.05$) differences in most body measurements, linear type and functional indices and those observed in linear type trait of the two studied population indicates clear breed distinction, moreover, breed difference have been found with regard to conformational traits (Bewely and Schutz, 2008).The height slope of Bunaji over Sokoto Gudali differs from the study of Okeh and Uguru (2014) who reported that the body measurements of Sokoto Gudali were higher than those of White Fulani but agrees with the study of Rege and Tawah (1999) who reported that Sokoto Gudali have deeper body than the White Fulani (Bunaji) breed and resemble East African Boran and the Sudanese Kenana.

Table 2: Least squares means ± S.E of effect of linear type and functional indices in Bunaji and Sokoto Gudali cows

Traits	N	Mean ± SE	SD	Min.	Max.	C.V.
Bunaji						
LW	267	219.05 ±1.907^{b}	31	135	295	14.2
HS	267	3.48 ± 0.181^{a}	3	-4	13	84.9
LI	267	0.83 ± 0.002^{a}	0	0.66	0.93	4.52
RLI	267	0.47 ± 0.002^{a}	0	0.36	0.59	7.69
Bal.	267	0.70 ± 0.007^{b}	0.1	0.39	0.99	15.7
WS	267	9.80 ± 0.403^{b}	6.6	-44	21	67.1
DI	267	0.57 ± 0.002^{b}	0	0.27	0.64	6.77
FLI	267	55.45 ± 0.370^{a}	5.9	43	96	10.8
CUI	267	2.54 ± 0.011	0.2	1.88	2.97	7.21
Sokoto Gudali						
LW	159	230.61 ± 3.352^{a}	42	130	320	18.3
HS	159	3.45 ± 0.306^{b}	3	-9	12	86.4
LI	159	0.82 ± 0.004^{b}	0.1	0.63	0.92	6.45
RLI	159	0.46 ± 0.003^{b}	0	0.37	0.57	7.68
Bal.	159	0.75 ± 0.010^{a}	0.1	0.46	1.17	17
WS	159	14.42 ± 0.488^{a}	6.2	-4	28	42.7
DI	159	0.60 ± 0.002^{a}	0	0.53	0.66	4.17
FLI	159	51.56 ± 0.334^{b}	4.2	41	62	8.16
CUI	159	2.56 ± 0.019	0.2	1.95	3.41	9.43

HS= Height slope; LI= Length index; RLI= Rump length index; Bal. = Balance; WS= Width slope; DI= Depth index; FLI = Foreleg length index; CUI= Cumulative index; CV = Coefficient of variation; Min. = Minimum; Max, Maximum; N = Number of observation; Means with uncommon superscripts for each trait differ significantly, $p<0.05$.

Measurements of both breeds showed that Sokoto Gudali is genetically shorter and wider than the Bunaji. Furthermore, the indices suggested that when live weight, balance, width slope and depth index are considered, Sokoto Gudali is heavier than Bunaji. The moderate coefficient of variation observed for chest width was in close range with the White Park cows observed by Alderson (Alderson, 1999). The respective coefficient of variation between breeds indicates the amount of opportunity available for improving the breeds through selection. The observed differences for live weight among the genotypes might be due to changes in the genotypic makeup of the breeds as well as tools used in analysing the data set as observed by Minvielle and Oguz (2002).

Conclusion

There were considerable variations in some body measurement, linear type and functional indices and type traits scores among the genotypes which indicated clear genetic distinctions between Bunaji and Sokoto Gudali cows.

References

Alderson, G.L.H. (1999). The development of a system of linear measurements to provide an assessment of type and function of beef cattle. *Animal Genetic Resources Information*, 25:45-55.

Berry D.P., Buckley F., Dillon P., Evans, R.D., Rath, M. and Veerkamp, R.F. (2004). Genetic relationships among linear type traits, milk yield, body weight, fertility and somatic cell count in primiparous dairy cows. *Irish Agricultural Food Research*, 43: 161–176.

Bewerly, J. and Schuntz, M. (2008). Review: An interdisciplinary review of body condition scoring for dairy cattle. *Professional Animal Science*, 24: 507-529.

Centre for Dairy Information (CDI), (2016). Breeding Terms Glossary.thecdi.co.uk/breeding-improvement. Accessed on 15th December, 2016.

Jabbar, M.A., Reynolds, L. and Francis, P.A. (1995). Sedentarisation of cattle farmers in the derived savannah region of southwest Nigeria: Results of a survey. *Tropical Animal Health and Production*, 27:55-64.

Meteorological Service Unit, IAR/ ABU (2009).Weather Report. Institute for Agricultural Research, Samaru Ahmadu Bello University, Kaduna State.

Minvielle, F. and Oguz, Y. (2002). Effects of genetics and breeding on egg quality of Japanese quail. *World's Poultry Science Journal,* 58: 291-295.

Okeh, B. I. and Uguru C. (2014). Phenotypic differentiation of Sokoto Gudali and White Fulani KuriIn breeds of cattle. *International Journal of Agriculture and Crop Sciences*, 7(11): 847-852.

Rege, J.E.O. and Tawah, C. L. (1999).The state of African cattle genetic resources II.Geographical distributions, characteristics and uses of present-day breeds and strains.*FAO/UNEP Animal Genetic Resources Information Bulletin*, 26:1-25.

Salako, A.E. (2006). Application of morphological indices in the assessment of type and function in sheep. *International Journal of Morpholo*gy, 24:13 – 18.

SAS (2002). Statistical Analysis for Sciences. User's guide, release 9.0 edition publication. SAS Circle, Cary, NC. USA.

Stoll, J., Duckerts, J.F., de Graaf, F., Journeaux, L. and Rehben, E. (1996). Report of the ICAR Working Group on conformation recording. In: Renaud, J. and Van Gelder (eds.), *Performance recording of animals (European Federation of Animal Science Scientific Series* No. 87, Wageningen Pers.