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Linear score of udder dimension and structural traits in White Fulani cattle

Olaniyi, T. A., *Popoola, M. A., Raji, A. M., Adekanbi, A. O., Ayoola, A. O., Kolawole, D. O., Abdul-Ganiy, S. O. and Ojueyanmi, O. P.

Federal College of Animal Health and Production Technology, Ibadan, Nigeria

***Corresponding author:** moshood.popoola@fcahptib.edu.ng

Abstract

Linear descriptive scoring system is commonly used especially in cattle where number of analyses has been performed for selection purposes. The linear scoring of udder and structural traits of 700 White Fulani cattle of average age of 3 - 4 years was conducted in this study. These traits were subjectively scored through visual appraisal. Data were subjected to descriptive statistics and Pearson correlation. Result revealed that White Fulani cattle possess intermediate flank depth (6.40± 1.46); rump height (6.74± 1.31); rump length (5.94±1.23) and rump angle (5.26±1.29) but rump width (4.77 ±1.60) of the cattle was short and there were intermediate rear udder height (5.30±1.74), fore udder attachment (5.78±1.54), front teat placement (5.60±1.26), rear teat placement (5.40±1.34), teat length (5.01±1.95), teat placement side view (5.00±1.28) and udder balance (5.40±1.54), while, the cattle had short udder depth (4.90±1.95) and thickness of teat (4.93±1.83). Result further revealed that there was low or no correlation between udder type traits and structural traits of the cattle. There was no or low correlation among udder traits except the moderate correlation between front teat placement and rear teat placement; moderate correlation between teat length and teat thickness. It was concluded that white Fulani cattle possess medium body and udder structure and no or low correlation between udder dimension traits of the cattle and their structural traits which may be suitable selection markers to improve White Fulani cattle milking ability particularly among pastoralists.

Keywords: cattle, linear, scoring, traits, udder

Introduction

White Fulani is the most numerous and widespread of all Nigerian cattle breeds, it represents 37 % of the national herd and is important for their genetic predisposition of hardiness, heat tolerance and adaptation to local conditions (Alphonsus *et al.,* 2012). White Fulani cattle are the leading triple purpose (milk, meat and draught) breed in West Africa (Belewu, 2006). It has white coat colour, fairly large, about 130 cm height, bull weighs about 500 kg and cows about 325 kg. The hump is large and well developed, navel flab is small, horns are of medium length, up curving, and lyre shaped.

Milk quantity, quality and production efficiency of dairy cattle is directly dependent on the udder health (Prithard *et al.*, 2010). The udder is the most important part of the body of the dairy cattle; its morphological and physiological characteristics affect health of dairy cattle's (Žakas, 2002). The most appropriate udder for mechanized milking is the one which quarters are evenly developed. Forsbäck *et al*. (2011) reported that development of the dairy cattle's udder quarters is very important for better milk production. The interest in the dairy cattle udder has increased in the last few years when the anatomy has been explored in depth (Ruberte *et al*., 1994), and a linear scoring system has been developed to select udders with good milk ability in Spanish and Italian breeds (Caja *et al*., 1999), as well as the evaluation of its genetic parameters (Fernández *et al.*, 1995; Caja *et al.*, 1999).

Structural traits are known to be important to dairy producers that dairy cattle's produce milk efficiently and look appealing in doing so, over a long productive lifetime. As a result, structural traits are recorded in many of the modern dairy cattle breeds. These traits have been known to have moderate to high heritability and often can be recorded in a single assessment, which makes them reliable and relatively cheap traits that can be included in selection indices for several purposes (Kistemaker *et al.*, 2006). According to Mantysaari (1996), pure size traits, such as stature and heart girth, are closely related to body weight. Other structural traits such as muscularity and body condition score (BCS) could be expected to be more specifically related to metabolic reserves and indicative of problems associated with a negative energy balance (McGovern *et al.*, 1993). A linear descriptive scoring system has been used in cattle where number of analyses has been performed (Bouška *et al.*, 2006). However, there is paucity of information on linear scoring of udder dimension and structural traits for milk production in White Fulani cattle. Thus, this study aimed to evaluate the linear scoring of udder dimension and structural traits of White Fulani cattle.

Materials and methods

This study was conducted in Iseyin, Oyo state, Nigeria. It was conducted among settled Fulani pastoralist. A total number of 700 White Fulani cattle of average age of 3 - 4 years were sampled for this study. Linear assessments were done subjectively by at least 2 classifiers at every round of scoring. The method considers 8 udder traits and 5 structural traits. Udder traits scored include Length of the Teat (LT), Udder Balance (UB), Fore Udder Attachment (FUA), Front Teat Placement (FTP), Udder Depth (UD), Rear Udder Height (RUH), Rear Teat Placement (RTP), Teat placement Side view (TPSV). Data were also collected on structural traits such as, Rump Angle (RA), Rump width (RW), Rump length (RL), Rump Height (RH), and Flank Depth (FL) while the structural traits scored were Rump Angle (RA), Rump width (RW), Rump length (RL), Rump Height (RH), and Flank Depth (FL). Each trait was scored with a 9-point linear scale following the procedure of ICAR (2015).

Data were subjected to descriptive statistics (such as mean, standard deviation range, coefficient of variation) and Pearson correlation using SAS (2004).

Results and discussion

Descriptive statistics of structural traits in White Fulani cattle is presented in Table 1. The result showed a relatively high variability (coefficient of variation) for the variables considered. Highest coefficient of variation was obtained in rump width (35 %) and the lowest was obtained in rump height (20 %). The smaller the coefficient of variation, the better the accuracy of the test, the smaller the error of the result (Acourele *et al*., 2001; Popoola, 2015; Popoola and Oseni, 2018). Mean values ranged from 4.77 ± 1.60 obtained in rump width to 6.74 ±1.31 obtained in rump height. The minimum values obtained for the traits ranged from 1 to 3, while, the maximum value recorded for all the traits was 9. According to ICAR (2015) scale, result further revealed that White Fulani cattle possess intermediate flank depth, rump height, rump length and rump angle but rump of the cattle is short. Skewness assesses the extent to which a variables distribution is symmetrical. If the distribution of responses for a variable stretches toward the right or left tail of the distribution, then the distribution is referred to as skewed. According to Hair *et al.* (2017) kurtosis is a measure of whether the

distribution is too peaked that is a very narrow distribution with most of the responses in the centre. The result revealed skewness values that were less than 1 for flank depth, rump height and rump length, this implies that the distribution of values for flank depth, rump height, and rump length possess normal peak. The skewness of values greater than 1 was obtained for rump angle and rump width, this is an indication that values of rump angle and rump width had distributions that were too peaked. The skewness value obtained in this result indicates substantially skewed distributions for these traits. Also, kurtosis values that are less than -1 were obtained for flank depth and rump height, this implies a distribution that is too flat. However, kurtosis values of greater than 1 were obtained for rump length, angle and width; this indicates a distribution that is substantially flat.

Table 1: Descriptive Statistics of Structural Traits in white Fulani Cattle and their crosses

Variables	Mean	Standard Deviation	Minimum	Maximum	Coefficient of Variation	Skewness	Kurtosis
Flank Depth	6.40	1.46	2.00	9.00	24.07	0.86	-0.10
Rump Height	6.74	1.31	3.00	9.00	20.00	0.17	-0.49
Rump Length	5.94	1.23	1.00	9.00	21.26	0.60	1.59
Rump Angle	5.26	1.29	3.00	9.00	26.27	1.34	1.67
Rump Width	4.77	1.60	1.00	9.00	35.42	1.46	1.61

Table 2: Descriptive Statistics of Udder dimension in white Fulani cattle and their crosses

Variables	Mean	Standard Deviation	Minimum	Maximum	Coefficient of Variation	Skewness	Kurtosis
Rear Udder Height	5.30	1.74	2.00	9.00	33.00	0.12	-0.90
Fore Udder Attachment	5.78	1.54	3.00	9.00	27.00	0.18	-0.35
Udder Depth	4.90	1.95	1.00	9.00	40.00	0.33	-0.65
Front Teat Placement	5.60	1.26	3.00	9.00	23.00	-0.23	-0.30
Rear Teat Placement	5.40	1.34	3.00	8.00	24.38	-0.05	-0.59
Teat Length	5.01	1.95	1.00	9.00	39.00	0.13	-0.73
Teat Placement Side View	5.00	1.28	3.00	9.00	26.00	0.52	-0.06
Thickness of Teat	4.93	1.83	2.00	9.00	38.00	0.28	-0.91
Udder Balance	5.40	1.54	2.00	9.00	29.00	0.25	-0.46

Descriptive statistics of udder dimension in white Fulani cattle is presented in Table 2. The result showed that there was relatively high variability (coefficient of variation) obtained for the variables considered. The highest coefficient of variation was obtained in udder depth (40 %) and the lowest was obtained in front teat placement (23 %). The smaller the coefficient of variation, the better the accuracy of the test, the smaller the error of the result (Acourele *et al*., 2001; Popoola and Adekanbi, 2017). The mean values ranged from 4.93 ± 1.8 obtained in thickness of teat to 5.78 ± 1.54 obtained in fore udder attachment. According to ICAR (2015) scale, the result

Table 3: Phenotypic Correlation between Udder Dimension and Structural Traits in White Fulani Cattle and their Crosses.

Variables	RUH	FUA	UD	FTP	RTP	TL	TPSV	TT	UB	FD	RH	RL	RA	RV
RUH	1.00	-0.12	0.23	0.08	0.08	-0.02	0.08	0.03	0.13	-0.04	-0.10	-0.07	-0.11	-0.05
FUA		1.00	0.02	-0.06	-0.04	-0.03	0.01	-0.07	0.08	0.01	0.06	0.06	-0.07	0.40
UD			1.00	-0.18	-0.06	-0.38	-0.09	0.12	0.01	0.16	0.20	0.09	0.16	0.11
FTP				1.00	0.49	-0.03	0.02	0.03	-0.04	-0.18	-0.19	-0.18	-0.26	-0.24
RTP					1.00	0.02	-0.12	-0.06	0.06	-0.21	-0.19	-0.16	-0.15	-0.21
TL						1.00	-0.01	0.46	0.14	0.13	0.11	0.10	0.09	0.13
TPSV							1.00	-0.01	-0.05	-0.29	-0.23	-0.19	-0.25	-0.25
TT								1.00	0.02	0.18	0.13	0.16	0.09	0.18
UB									1.00	0.04	0.03	0.07	0.03	0.08
FD										1.00	0.68	0.70	0.03	0.08
RH											1.00	0.60	0.59	0.56
RL												1.00	0.53	0.64
RA													1.00	0.63
RW														1.00

also revealed that White Fulani cattle had intermediate rear udder height, fore udder attachment, front teat placement, rear teat placement, teat length, teat placement side view and udder balance, while, the cattle had short udder depth and thickness of teat. Also, the result revealed skewness values that are less than 1 for rear udder height, fore udder attachment, udder depth, teat length, teat placement side view, thickness of teat and udder balance, while, skewness of values less than -1 were obtained for front teat placement and rear teat placement. Also, kurtosis values that are less than -1 were obtained for all the traits. However, when both skewness and kurtosis are zero, the pattern of response is considered normal distribution. The negative kurtosis values observed indicates that the distribution has lighter and flatter peak than the normal distribution with kurtosis value of 0 and sample kurtosis that significantly deviates from 0 may indicate that the data are not normally distributed and positive kurtosis value indicates that the distribution has heavier and sharper peak than the normal distribution (Hair *et al*., 2017).

Phenotypic correlation between udder dimension and structural traits in white Fulani cattle and their crosses is presented in Table 3. The result showed strong and positive correlations between flank depth and rump height; flank depth and rump length; rump height and rump length; rump height and rump angle; rump height and rump width; rump length and rump angle; rump length and rump width; rump angle and rump width. This implied that increase in one of the traits will lead to corresponding increase in the other correlated traits. Contrarily, Mc Kusick *et al.* (2000) did not find a significant phenotypic correlation between udder height score and teat placement score in East Friesian crossbred dairy ewes. There was no or low correlation among udder traits except the moderate correlation between front teat placement and rear teat placement; moderate correlation between teat length and teat thickness. The positive association between these pairs of udder is an advantage for ease of milking these cattle. However, there was no or low correlation between udder dimension traits of the cattle and their structural traits.

Conclusion

This study revealed that white Fulani cattle possess medium body structure and udder structure. Also, there was no or low correlation among udder traits except for moderate correlation between front teat placement and rear teat placement; moderate correlation between teat length and teat thickness. Also, there was no or low correlation between udder dimension traits of the cattle and their structural traits. These traits may therefore be suitable selection markers to improve White Fulani cattle milking ability particularly among the pastoralists.

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