



Evaluation of Bunaji Cows Temperament Traits in Relation to Animal's Welfare and Handler's Safety

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Abstract

The study was carried out to explore the phenotypic relationships and dependencies among temperament traits that significantly affect the functions of Bunaji cows. Fifty-one (51) multiparous Bunaji cows that were non-pregnant, lactating in their third stage of lactation were used for the study. The cows were tagged and certified clinically fit by animal health personnel. The techniques implored to assess the animals' temperament traits were chute, chute exit score, chute exit speed and facial hair whorls positioning. All the data in the experiment were analyzed using SAS (2000) version 9.0. Computations using means procedure were done to determine the means and standard errors for each trait; and coefficients of variation (CV). Pearson's correlation coefficients were computed to determine the degrees of relationship among and between variables for all animals within each temperament group. Significant differences in means were compared using the Duncan Multiple Range Test (DMRT). The major findings showed that chute temperament score (CT), chute exit score (CES) and chute exit speed (FS) were highly ($P < 0.01$) correlated traits. Temperament had significant ($P < 0.05$) effect on exit speed and body measurements. The result suggested that reactive had faster exit speed. It is thus concluded that cows that walked (CES1) and trot (CES 2) while exiting the chute were calmed. Therefore, handlers need to be conscious of temperaments of cattle to ensure safety. The study could also be replicated for other breeds of cattle.

Key word: Chute, Hair whorls, Exit speed, Multiparous, Lactation, Linear traits,

Introduction

Cattle temperament varies and comprises of behavioural characteristics that constitute an important feature of behavioural genetics (Friedrich *et al.*, 2015). The trait has production, animal welfare and human safety implications. The foremost of which is the handling temperament and the impacts of poor temperament on farm management efficiency and animals, maternal aggressiveness, resource-based aggression and sociability Burrow, 1997; Barrozo *et al.*, 2012; Turner *et al.*, 2013). Several factors such as production system, breed type, sex, age, and horn status, season, body weight and body condition are known to influence the trait (Fordyce *et al.*, 1988; Voisinet *et al.*, 1997). The trait is open

to selection as the genetic basis such as identification of quantitative trait loci (QTL), moderate heritability estimates and vast variations in the major handling temperament traits has been investigated (Haskell, *et al.* 2014).

The study was necessitated because several techniques of assessing cattle temperament traits have been developed. Yet the extent to which the trait is quantified by these techniques is not certain in many breeds of dairy cattle from review in literatures. More so, because human- cattle contact cannot be avoided (Adedibu and Musa, 2017), cattle with poor workability traits would often time

negatively influence their response to husbandry and handlings.

As the improvement on cattle handling, animal's fitness and reduction in handling injuries is paramount to increase economic efficiencies in dairy and beef production; the significance of this study would reveal the impact of temperament traits on animal welfare, animal handler's safety and production attributes to animal scientist, veterinary workers and dairy farmers.

The main objective of this study was to explore the phenotypic dependencies and relationships among temperament traits that significantly affect the function of Bunaji cows' reared under extensive system of management. The specific objectives were:

1. To evaluate the effect of temperament on exit speed, Body weight and body linear traits;
2. To evaluate the relationship between temperament traits with body weight and body linear measurements.

Materials and methods

Experimental site

The empirical study was carried out at Alhaji Adamu Haruna Farms, along Kaduna–Kachia express way, Kamshi- Iburu, Kajuru Local Government Area of Kaduna State. The farm is located on Latitude 10.303217 and Longitude 7.831113 (Handheld GPS Receiver-GERMIN 78 CSX).

Experimental Animals and Management practice

Fifty-one (51) multiparous, non-pregnant, lactating Bunaji cows were used for this study. These cows in their third stage of lactation were sorted from four different herds of the same farm on same geographical location. The animals were tagged and certified clinically fit by animal health personnel. The experiment was carried out within a month (May to the beginning of June 2018), just after the peak of

dry season and the onset of rainy season. The experimental cows had access to salt-lick prior to grazing and they had unrestricted access to drinking water. Feeding was via unrestricted grazing under the supervision of herdsmen for about 8 - 9 hours period daily.

Data collection and traits definition

Facial hair whorls position (FW)

The whorl placement methodology (Grandin *et al.*, 1995) was to investigate the hypothesis that the speed of solving maze tests and locomotor behaviour of cattle in open-field is affected by the height location of facial whorl. The hair whorl position was determined on the basis of three patterns: high, middle and low.

- a. High hair whorl position if the center was above the top of eye level;
- b. Middle if the center was located in between the top and the bottom of the eyes;
- c. Low if the center was located below the bottom of the eye level.

Chute temperament (CS)

The chute test assessed the strength of response to confinement, whilst the animal was inside the chute (Grandin, 1993). This involves the observer scoring an animal's behavioural response on a five (5) point scale, while the animal is restrained by a head gate in a manually operated chute (Woiwode *et al.*, 2016). The scoring criteria are:

- 1: The cow is calm, no movement;
- 2: The cow is slightly restless;
- 3: The cow will be squirming, occasional shaking of chute and / or vocalization;
- 4: Continuous vigorous movement of chute and vocalization;
- 5: The cow would be rearing, twisting or violently struggling.

Chute Exit Score (CES) / Chute Exit Speed (FS)

The chute exit speed developed by (Burrow *et al.*, 1988) was carried out using two methodologies, the subjective and the objective as adopted by Lanier and Grandin (2002), Jones (2013) and; Adedibu and Musa (2017). The subjective methodology involved the classification of the gait of the animal as it leaves the chute based on a four point scale:

- 1: The cow walked;
- 2: Trot (the cow walked but in a hurry);
- 3: The cow run;
- 4: The cow jumped out of the chute.

The objective method which is the flight speed incorporated a digital stop watch to record the time where cow exit the chute until it has travelled the measured distance of 2.0m (Adedibu and Musa, 2017). The speed was calculated by dividing the measured distance in meters by the reported time in seconds.

Body linear measurements

All the body linear measurements were recorded in centimetres (cm) except for body weight which was recorded in Kilogram (kg) using a universal weigh band (WEBO animal measure, ref. 240591, manufactured by Kruuse Den, and approved by the Danish Agricultural Association, Denmark). Details of the body linear measurements (Tebug *et al.*, 2018) are described as follows:

- a. Ear length (EL): Measured from the ear base to the zygomatic arc of the ear
- b. Chest girth (CG): Measured as standing the animal with the head in any normal position and placing a flexible tape around the animal at the

point of lowest circumference just behind the fore-legs and the hump

- c. Tail length (TL): Measured from the base of the tail to the tip (caudal vertebrae)
- d. Body length (BL): Measured as the highest point on the shoulder to the pin bone
- e. Height at wither (HW): Measured as the distance from the ground to the highest point of the withers when the animal is standing in an upright position
- f. Thigh length (TL): Measured as the length between the hip joint up to the stifled joint
- g. Body weight (BW): Measured as the weight equivalent of the chest girth reading on the weighing band.

Statistical Analysis

All the data in the experiment were analyzed using SAS (2000) version 9.0 at 0.05 and 0.01 level of significance. Computation using means procedure was done to determine the means and standard error for each of body linear traits, udder and temperament traits; and coefficients of variation (CV) to determine the variability in the population sample. Significant differences in means were compared using the Duncan Multiple Range Test (DMRT). Computation of Pearson correlation coefficients to determine the degrees of phenotypic relationship among all variables was done. The estimates of the phenotypic correlation coefficients (r) was to evaluate the changing magnitude of association among variables according to the formula:

$$r_{A_1A_2} = \frac{\sigma_{A_1A_2}}{\sqrt{\sigma^2A_1 \cdot \sigma^2A_2}}$$

Where $\sigma_{A_1A_2}$ is the covariate between traits A_1 and A_2 and σ^2A_1 and σ^2A_2 are variance for traits A_1 and A_2 , respectively.

Statistical Model

The temperament trait follows the general linear model:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where;

Y_{ij} is the individual’s phenotypic value for the trait (body weight or body linear measurement);

M is the overall mean;

T_i is the i^{th} effect of the T temperament trait;

e_{ij} is the residual random error, $nid(0, \sigma^2)$ $nid(0, \sigma^2)$: Normally and independently distributed with zero means and constant variance.

Results

Descriptive Statistics of Body Weight Body Linear Measurements and facial hair whorls of the Bunaji Cows

The mean values for the descriptive statistics for body weight, body linear measurements,

and facial hair whorls of the Bunaji cows are presented on Table 1. The mean, minimum and maximum values of the body weight and body linear traits were within normal distribution in the sample population. The coefficients of variation (CV) ranged from 4.40% (height at wither) to 16.40% (Body weight) for body measurements and 0% for the facial hair whorls as all the cows had the center of the whorls above the eye level.

Summary statistics for the distribution of Bunaji cows based on temperament techniques

Table 2 showed the percentage distribution of Bunaji cows based on the subjective and objective temperament traits. The mean, minimum and maximum values of the temperament traits shows that values exhibited by majority of the cows were below the mean for the temperament traits.

The coefficients of variation for these traits ranged from 53.74 % (CES) to 69.71% for chute exit speed.

Table 1: Descriptive Statistics for the Mean Body Weight, Body Linear measurements traits and facial hair whorls of the Bunaji Cows (N =51)

Variable	Mean ± SE	Min.	Max.	CV (%)
Body Weight (Kg)	212.05 ± 4.87	145.30	305.00	16.40
Body Linear traits (cm)				
Ear Length	20.87 ± 0.27	16.00	25.00	9.35
Chest Girth	134.12 ± 1.12	117.50	154.25	5.96
Tail Length	107.15 ± 1.27	92.00	127.00	8.43
Body Length	118.59 ± 0.97	104.00	135.00	5.86
Height at Wither	127.50 ± 0.79	114.00	141.00	4.40
Thigh Length	66.61 ± 0.42	59.00	73.00	4.47
Facial hair whorl	1.00	1.00	1.00	0.00

cm: centimeter, Kg: kilogram, SE: standard error, Max.: maximum, Min.: minimum, and CV: coefficient of variation, %: percentage.

Table 2: Summary Statistics for the Distribution of Bunaji Cows based on Temperament Assessment of (N = 51)

Traits	Scores					Mean	Min	Max	CV (%)	P- vale
	1	2	3	4	5	± SE				
CT	12 (25.53)	14 (27.45)	11 (25.17)	5 (9.80)	9 (17.65)	2.71 ± 0.20	1	5	51.89	<0.0001
CES	21 (41.18)	6 (11.76)	14 (27.45)	10 (19.61)	NA	2.25 ± 0.17	1	4	53.10	<0.0001
FS/m.se c ⁻¹	NA	NA	NA	NA	NA	1.75 ± 0.17	0.33	5.00	69.71	<0.0001

N: number of observations, SE: standard error, min.: minimum, max.: maximum, CV: coefficient of variation, CT, Chute temperament, CES: chute exit score, FS: exit speed temperament, m.sec⁻¹: metres per seconds, values in parenthesis: percentage distribution. Temperament score 1: the animal is very calm, and score 4 (for CES) or 5 (for, CT): the animal is very reactive. NA: not applicable, <: Less than.

Effect of chute exit temperament on flight speed and body linear measurements of the Bunaji cows

Table 3 showed the effect of chute exit temperament (CES) on a four point scale; one (the cow walk) and four (the cow jump) and its corresponding effect on flight speed, body weight and body linear measurements. The results showed that exit speed had significant ($P < 0.05$) effect on body weight, tail length and body length. Calm cows that walked (CES1) and trot (CES2) exit the chute at a significantly ($P < 0.05$) slower speed than cows that ran (CES3) and jump (CES4). The chest girth (or body weight equivalent), tail lengths and body lengths of CES1 and CES2 groups were similar to CES3 and CES4 groups. However, the cows that trot were significantly ($P < 0.05$) different from cows that jumped while exiting the chute by their higher weight, longer tail and wider widths of the rear udder.

Correlations of temperaments with body weight and body linear measurements of the Bunaji cows

Table 4 showed the phenotypic correlations of temperaments, body weight and body linear measurements of the Bunaji cows. The result shows significant ($P < 0.05$) negative correlations between: chute score (CS) with ear length (EL), chest girth (CG) and body weight (BW); chute exit score (CES) with BW.

Discussion

Description of body weights, Body linear measurements and temperament traits of the Bunaji cows

The result suggests that body weights and body linear measurements were evenly distributed (symmetrical) while the distribution of the temperament traits (chute temperament, chute exit score and chute exit speed temperament) were asymmetrical in the study population. Except for the tail lengths, the body weight and the body linear traits showed that the Bunaji cows in this population were smaller animals compared to those reared under semi-intensive system of management (Kanai *et al.*, 2013). Kanai *et al.* (2013) reported higher mean values of the quantitative traits of the cows under semi intensive management as follows

hearth girth (151cm), height at wither (58 cm), tail length (107 cm), body weight (249 kg) respectively.

The lower temperament scores (scores 1 and 2) for less reactive cows as opposed to higher scores (scores 4 and 5) for more reactive cows denotes that the animal is suitable to be approached, driven, weighed and treated for injury; and exhibits minimal danger to the

handlers and other cows in the heard (Haskell *et al.*, 2014).

The CV suggests that while facial hair whorls position is homogenous in the population as all the animals had their hair whorls above the eye level, the distribution of body measurements in relation to the mean was good for the body linear measurements. The CV for the temperament traits were not within the acceptable range of field data.

Table 3: The Effect of Chute Exit Temperament on Exit Speed, Body Weight and Body Linear Measurements of the Bunaji Cows

Variables	Chute exit Score (CES)				SEM
	CES1 (n=18)	CES2 (n=12)	CES3 (n=8)	CES4 (n=13)	
Exit speed (FS) m/s	0.77 ^c	1.33 ^c	2.09 ^b	3.28 ^a	0.17
Body weight (BW)kg	219.14 ^{ab}	215.44 ^{ab}	226.41 ^a	190.25 ^b	4.89
Body linear traits (cm)					
Ear length (EL)	21.42	20.58	20.88	20.38	0.27
Chest girth (CG)	135.25 ^{ab}	135.23 ^{ab}	137.50 ^a	129.44 ^b	1.12
Tail length (TL2)	106.22 ^{ab}	107.92 ^{ab}	113.13 ^a	104.08 ^b	1.49
Body length (BL)	118.86 ^{ab}	118.63 ^{ab}	123.38 ^a	115.23 ^b	0.97
Height at wither(HW)	125.81	130.33	128.63	126.54	0.79
Thigh length (TL3)	66.11	67.58	67.25	66.00	0.42

^{abc} Means within the rows with the same superscript are not significantly different ($P > 0.05$), n: number of observations (cows), m/s: meters per seconds, kg: kilogram, cm: centimeter, score 1: the cow walked, 2: the cow trotted, 3: the cow ran, 4: the cow jumped, SEM: standard error of the mean.

Table 4: Phenotypic Correlation between Temperament and Body linear measurements of the Bunaji Cows (N = 51)

	BW	CG	BL	HW	ThL	TL	EL	CS	CES	FS
BW	1.00									
CG	0.96**	1.00								
BL	0.37*	0.34*	1.00							
HW	0.51*	0.48*	0.36*	1.00						
ThL	0.39*	0.38*	0.26*	0.48*	1.00					
TL	0.49*	0.55**	0.28*	0.37*	0.31*	1.00				
EL	0.30*	0.32*	0.32*	0.10	0.20	0.40*	1.00			
CS	-0.37*	-0.33*	-0.14	-0.10	-0.09	-0.02	-0.26*	1.00		
CES	-0.27*	-0.24	-0.13	0.04	-0.01	-0.03	-0.19	0.72**	1.00	
FS	-0.17	-0.13	-0.18	0.04	0.05	-0.01	-0.12	0.65**	0.82**	1.00

N: number of observations, *: Significant ($P < 0.05$), **: Highly significant ($P < 0.01$), EL: ear length, CG: chest girth, TL2: tail length, BL: body length, ThL: thigh length, BW: body weight, CS, Chute temperament, CES: chute exit score, FS: chute exit speed.



The effect of chute exit temperament score on exit speed, and body measurements of the Bunaji cows

The result suggested that animals that exit the handling chute at a slower speed were calm because they took a longer time to traverse the measured distance. The smaller body weight, tail and body lengths associated with the very reactive cows agrees with Burrow (1997) and Burdick *et al.* (2011); that faster exit speed in cattle have been associated with lighter body weight (Burrow, 1997); and greater carcass bruising compared to the calmer cattle (Burdick *et al.*, 2011). It is thus recommended in this study that cows that exit the chute at a speed above 2.50 m/sec. were extremely dangerous and should be treated with caution.

Relationship between temperaments and body linear measurements

The result means that short ears, lighter body weight and flightiness were influenced by the higher scores for reactive cows in the handling chute. High reactivity of cattle has been reported to be associated with faster exit speed, lower body weight and higher carcass bruising (Burrow, 1997; Burdick *et al.*, 2011). From animal welfare and safety stand point, handlers should be conscious of cattle temperament to improve safety.

Summary and Conclusion

The major finding of this study shows that the combination of different temperament traits would give a better insight of temperament and its influence on the animal. Chute temperament score, chute exit score and chute exit speed were highly significant correlated temperament traits; the tendency for reactive cows inside chute to be reactive while exiting the chute is very high. In concluding, very reactive cows were distinguished by their high speed, shorter ears and lighter body weight.

Recommendation

The study thus recommends that handlers need to be conscious of temperaments of cattle to ensure safety.

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