Influence of Breed and Sex on Morpho-structural and haematological parameters in some Nigerian Cattle.

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Abstract

Morpho-structural, adaptive and haematological indices in Cattle are indicators of accessing performance, health status, nutritional and metabolic status and they are influenced by genetic factors such as breed including sex. This study aims to determine the effects of breed, sex, age and their interactions on morphological, adaptive and haematological traits in the studied cattle populations. A total of 200 indigenous cattle breeds White Fulani (84), N'Dama (43) and Muturu (73) with mean body weight of 218.21 kg were collected from south western Nigeria. White Fulani was made up of 44 males and 40 females, N'Dama consisted of 16 males and 27 females and Muturu comprised 13 males and 60 females. The reason for the disparity in numbers of males and females is based on the availability of the animals. The traits measured included body length (cm), heights at withers (cm), chest depth (cm), heart girth (cm), rump height (cm), hip width (cm), fore cannone bone length (cm), hair length (cm), ear length (cm), tail length (cm), rectal temperature (^oC), respiratory rates (Breaths/min), pulse rates (Beats/min). The data obtained were subjected to general linear model (ANOVA) using SAS (2009) statistical software. Blood samples collected were analysed for packed cell volume (%), red blood cells ($x10^{12}/L$), haemoglobin (g/dL), white blood cells ($x10^9/L$), neutrophils (%), lymphocytes (%), monocytes (%), and eosinophils (%). The result of the study showed that breed and age had significant effects ($p<0.05$) on height at withers (HW), Rump height (RH), chest depth (CD), and heart girth (HG). Also, breed had significant ($p< 0.05$) effect on all the heat tolerance traits examined (Respiratory Rate (RR), Pulse Rate (PR), Rectal Temperature (RT), Body Temperature (BT)). This implies that breed and age are important factors to be considered in cattle breeding for optimum productivity.

Key Words: Physiology, Cattle Breed, Haematology, Morphometry, Sex

Influence de la race et du sexe sur les paramètres morpho-structurels, adaptatifs et hématologiques chez certaines races bovines nigérianes

Résumé

Les indices morpho-structurels, adaptatifs et hématologiques chez les bovins sont des indicateurs pour évaluer les performances, l'état de santé, l'état nutritionnel et métabolique et ils sont influencés par des facteurs génétiques tels que la race et le sexe. Cette étude vise à déterminer les effets de la race, du sexe, de l'âge et de leurs interactions sur les traits morphologiques, adaptatifs et hématologiques dans les populations bovines étudiées. Un total de 200 bovins indigènes des races White Fulani (84), N'Dama (43) et Muturu (73) avec un poids corporel moyen de 218,21 kg ont été collectés dans le sud-ouest du Nigeria. Le White Fulani était composé de 44 mâles et 40 femelles, le N'Dama comprenait 16 mâles et 27 femelles et le Muturu comprenait 13 mâles et 60 femelles. La raison de la disparité dans le nombre de mâles et de femelles est basée sur la disponibilité des animaux. Les traits mesurés comprenaient la longueur du corps (cm), la hauteur au garrot (cm), la profondeur de poitrine (cm), le tour de poitrine (cm), la hauteur de la

croupe (cm), la largeur des hanches (cm), la longueur du canon antérieur (cm), la longueur des poils (cm), la longueur de l'oreille (cm), la longueur de la queue (cm), la température rectale (°C), les fréquences respiratoires (respiration/min), les fréquences pulsées (battements/min). Les données obtenues ont été soumises au modèle linéaire général (ANOVA) en utilisant le logiciel statistique SAS (2009). Les échantillons de sang prélevés ont été analysés pour l'hématocrite (%), les globules rouges (x1012/L), l'hémoglobine (g/dL), les globules blancs (x109/L), les neutrophiles (%), les lymphocytes (%), les monocytes (%) et les éosinophiles (%). Le résultat de l'étude a montré que la race et l'âge avaient des effets significatifs (p<0,05) sur la hauteur au garrot (HW), la hauteur de la croupe (RH), la profondeur de poitrine (CD) et le tour de poitrine (HG). De plus, la race avait un effet significatif (p < 0,05) sur tous les traits de tolérance à la chaleur examinés (fréquence respiratoire (RR), fréquence pulsée (PR), température rectale (RT), température corporelle (BT)). Cela implique que la race et l'âge sont des facteurs importants à considérer dans l'élevage bovin pour une productivité optimale.

Mots-clés : Physiologie, Race bovine, Hématologie, Morphométrie, Sexe

Introduction

Cattle is a multi-functional animal and plays a significant role in the Nigerian economy (Adebambo, 1992). Cattle rearing is an enterprise which has been practiced by a large section of population in rural areas. There are many cattle breeds in Nigeria. According to Babayemi, *et al.*, 2014, and popular breeds of cattle in Nigeria include White Fulani, Red Bororo, Sokoto Gudali, Adamawa Gudali, Wadara, Azawak, Muturu, Keteku, N'dama and Kuri.

The White Fulani is important for its hardiness, heat tolerance and adaptation to local conditions (Alphonsus *et al*., 2012). It has a white coat color and it is fairly large, its height about 130 cm, bull weighs about 500 kg, and cows weigh 325 kg. The hump is large and well developed, naval flab is small, horns are of medium length, up curving, and lyre shaped. The White Fulani is a triple-purpose animal, with milk production of 2,300 kg per lactation. It can be fattened for beef, kept for milk production, or used as draught animal, especially the bull.

The N'Dama is compact and set on short legs of fine bone; neck is thick and deep; back is fairly broad, well-fleshed and straight from withers to tail head. They have a short and broad head, straight profile and broad muzzle. The breed is known for its tolerance to trypanosomiasis (Ngamuna *et al*., 1988; Claxton and Leperre, 1991; Dwinger *et al*., 1992; Mattioli *et al*., 1995). The White Fulani is also reported to be markedly resistant to tick-borne infections (Mattioli *et al*. 1995), but not to rinderpest. In addition, the breed is well-adapted to stressful humid and dry tropical climates. The N'Dama is a multipurpose breed with relatively low milk production, although partial milking is frequently carried out in the traditional herds of West Africa. The typical coat colour of forest Muturu is black and that of the Savannah Muturu is black and white. Height at withers is 95 cm for bulls and 88 cm for cows (Maule, 1990). It is the smallest cattle breed known. The management level where these cattle are kept is low in spite of which they maintain good body condition by grazing and browsing throughout the year. The breed is also reported to be trypanotolerant (Adeniji, 1983).

Linear body measurements is a tool that enables the livestock producer to identify structural weaknesses and strengths that are genetic and thus heritable. Thus, linear body measurements can be used as an indirect way to estimate body weight. Linear measurements of animal's body are growth indicators in animal life (Goe *et al.*, 2001; Attah *et al.*, 2004), also determining these linear measurements would help to predict body weight and carcass traits in future (Atta and El-Khidir, 2004; Thiruvenkadan, 2005). Linear body measurements have been found to be moderately high and has a strong positive relationship with growth traits in cattle (Afolayan *et al.*, 2006).

Stress is described as the cumulative detrimental effect of a variety of factors on the health and

performance of animals, or also described as the magnitude of forces external to the body which tend to displace its systems from their ground state (Silanikove, 2000). Animals undergo various kinds of stressors, i.e. physical, nutritional, chemical, psychological and heat stress. Among all, heat stress is the most concerning issue nowadays in the ever-changing climatic scenario (Silanikove and Koluman, 2015), and it is one of the most important stressors especially in the tropical, subtropical (Marai *et al.,* 2007; Nardone *et al.,* 2010), arid (Silanikove, 1992), and semi-arid (Silanikove, 2000) regions of the world. Heat stress is the perceived discomfort and physiological strain associated with an exposure to an extreme and hot environment (Gupta *et al.,* 2013). Heat stress is a major constraint to animal productivity (Shelton, 2000).

The three breeds of cattle are of utmost concern to farmers in terms of productivity, therefore, the aim of this study is to determine the effects of breed and sex on morpho-structural parameters, heat tolerance traits and haematology parameters in the three breeds of cattle involved in this study.

Materials and Methods

Study Locations

A total of 200 indigenous cattle breeds were sampled comprising White Fulani (84), N'dama (43) and Muturu (73), White Fulani is made up of 44 males and 40 females, N'Dama consists of 16 males and 27 females and Muturu comprises 13 males and 60 females. The study locations were divided into two: field location and wet haematology laboratory location. The field locations were at the Cattle Production Venture (CPV) at the Federal University of Agriculture, Abeokuta, located on latitude 70^{o} 10'N and longitude 3^{o} 2'E within Odeda Local Government Area of Ogun State, Nigeria. Institute of Food Security, Environmental Resources and Agricultural Research (IFSERAR) Farm, Federal University of Agriculture, Abeokuta, and other cattle farms located at Odeda Local Government in Ogun State. Institute of Agriculture Research and Training (IAR&T), Moor Plantation, Ilora in Oyo State located on latitude 70^{o} 22.5'N and longitude 30^{o} 50.5'E. Ogbomoso in Oyo State, and Ipokia Local Government Area of Ogun State, Nigeria located on latitude 60^{o} 53'N and longitude 20^{o} 51'E. The regions lie within the humid zone with average annual rainfall of 1458 mm and temperature ranges between 28^{o}C and 32^{o}C with average humidity of about 82%. The wet laboratory location was at the Animal Breeding and Genetics (ABG) Biotechnology Laboratory of the College of Animal Science and Livestock Production, Federal University of Agriculture, Abeokuta, Nigeria.

Data Collection

Live Measurements Data Collection- some of the morpho-structural traits that were taken with measuring tape and ruler (in cm) according to the method described by Searle *et al.* (1989) and Katongole *et al.* (1996) as follows:

Body length: the distance from the tip of the mouth to the end of the hind quarter.

Heart girth: the circumference of the chest.

Height at withers: the distance between the most dorsal point of the withers and the ground level.

Rump height: the distance between the most dorsal point of the rump (hind quarter) and the ground level.

Tail length: the distance between the junctions of the hip to the apex of the last tail bone.

Hip width: the width of the last fused sacral bones at the hip region.

Ear length: the distance between the two ears on the head region.

Chest depth: the dorso-ventral distance between the most dorsal point of the withers and the ventral surface of the sternum.

Fore cannon bone length: the length of meta-carpal of the front limb.

Hair length: the length of the hair around the wither

The age of the cattle was determined through their dentition and the sex were also recorded.

Heat Stress Data Collection

The thermo-tolerance traits recorded were:

Rectal temperature: This was taken on each cattle using a digital thermometer. The sensory tip was properly disinfected or cleaned with methylated spirit soaked with cotton wool and inserted into the rectum. The displayed temperature was recorded after the sound of an alarm signal.

Respiratory rate: This was measured by the counting of the number of flank movements per minute.

Pulse rate: This was measured by placing clinical stethoscope on the femoral arteries of the hind limb for one minute and the reading taking accordingly.

Blood Collection and Analysis

About 0.5ml of blood samples were obtained using a 2ml needle and syringe by jugular vein puncture into the EDTA (ethylene diamine tetra-acetic acid) bottles used as an anti-coagulant. Blood sample collected was used for haematological parameters automated methods analysis through the use of the auto-haematology analyzer where the packed cell volume (PCV), red blood cells, white blood cells, neutrophils, lymphocytes, eosinophils, monocytes and haemoglobin concentration were determined. In the process of the data collection, adequate measures were taken to minimize pain and discomfort of the animals.

Statistical Analysis

Data collected from the morphological traits such as body length (cm), fore cannon bone length (cm), tail length (cm), heart girth (cm), height at withers (cm), ear length (cm) and body length (cm) were subjected to analysis of variance (ANOVA) using SAS (2009) statistical software. Physiological indices such as pulse rate (beats/s), respiratory rate (breaths/s) and rectal temperature (^{o}C) were measured. Quantitative parameters were analysed using descriptive analysis and means, standard errors and co-efficients of variation were compared as percentages. Model for the analysis is as follows for the effects of sex and breed on morpho-structural traits;

$Y_{ijk} = \mu + B_{i+} X_j + M_k + BX_{ij} + BM_{ik} + XM_{jk} + e_{ijk}$

Where; Y_{ijk} = dependent variable

μ = Overal mean

B_i = Fixed effect of sex

X_j = Fixed effect of breed

M_k = Fixed effect of age

BX_{ij} = Interaction effect between sex and breed

BM_{ik} = Interaction effect between sex and age

XM_{jk} = Interaction effect between breed and age

e_{ijk} = Residual error

For the effects of sex and breed on haematological parameters, the model used for the analysis is as follows;

$Y_{ijk} = \mu + B_{i+} X_j + M_k + BX_{ij} + e_{ijk}$ where

μ= Overall mean

B_i= fixed effect of sex

X_j= Fixed effect of Breed

M_k= Covariate effect of age

BX_{ij} = Interaction effect between sex and breed

e_{ijk} = Residual Error

For the effects of sex and breed on heat tolerance traits, the following model was used;

$Y_{ijk} = \mu + B_{i+} X_j + M_k + BX_{ij} + e_{ijk}$ where

μ= Overall mean

B_i= fixed effect of sex

X_j= Fixed effect of Breed

M_k= Covariate effect of age

BX_{ij} = Interaction effect between sex and breed

e_{ijk} = Residual Error

Results and Discussion

Results

Least square means of the Morphological traits as influenced by Age and Breed

Least square means of the effects of age and breed on morphological traits in locally adapted breeds of cattle are presented in Table 1. The effect of breed on height at withers (HAW) was significant ($P < 0.05$) and highest mean value of 112.23 ± 0.82 cm was observed for White Fulani. The effect of breed on rump height (RH) was also significant ($P < 0.05$) with a highest mean value of 117.36 ± 0.82 cm observed for White Fulani breed. The effect of breed on chest depth (CD), hirth girth (HG), and tail length (TL) were all significant ($P < 0.05$) with the highest mean values of 61.55 ± 0.77 cm (chest depth), 136.97 ± 1.32 cm (hirth girth) and 71.65 ± 0.83 cm (tail length) respectively for White Fulani.

However, the effect of breed did not significantly ($P > 0.05$) affect fore cannon bone length (FCBL), hip width (HW), hair length (HL) and body length (BL) and possess the highest mean values of 19.49 ± 1.23 cm (FCBL), 36.07 ± 0.46 cm (HW), 0.14 ± 0.03 cm (HL).

The effect of sex did not significantly ($P > 0.05$) affect heights at withers, rump height, fore cannon bone length, chest depth, hip width, heart girth, tail length, hair length, body Length but with the highest mean values of 101.49 ± 1.51 cm females (HW), 124.40 ± 1.51 cm females (RH), 16.74 ± 1.37 cm males (FCBL), 56.17 ± 0.66 cm females (CD), 35.41 ± 0.48 cm females (HW), 131.13 ± 1.44 cm females (heart girth), 67.76 ± 1.11 cm males (TL), 0.09 ± 0.03 cm females (HL), 143.25 ± 2.24 females (BL)

Table 1: Effects of Age and Breed on Morphological Parameters of Nigerian Locally Adapted Cattle Breed

Parameters	Class	HAW/cm	RH/cm	FCBL/cm	CD/cm	HW/cm	HG/cm	TL/cm	HL/cm	BL/cm
Age	1	95.27±2.07^{c}	98.77±2.16^{a}	15.08±1.88^{a}	51.18±1.26^{b}	30.87±0.80^{b}	120.28±1.44^{c}	61.74±1.57^{b}	0.08±0.04	123.54±2.95^{c}
	2	101.26±1.63^{b}	105.68±1.68^{b}	15.64±0.45^{a}	56.25±0.71^{b}	34.90±0.46^{b}	131.04±1.47^{b}	68.95±1.06^{b}	0.08±0.03^{a}	138.94±2.52^{b}
	3	106.42±1.96^{a}	112.20±1.93^{a}	18.29±0.34^{a}	60.35±0.77^{a}	38.97±0.61^{a}	138.00±2.21^{a}	71.45±1.33^{a}	0.07±0.00^{a}	151.91±3.09^{a}
Breed	MU	83.92±0.72^{b}	88.15±0.77^{b}	14.25±0.31^{a}	50.54±0.48^{b}	32.87±0.77^{a}	119.35±0.95^{c}	60.03±0.79^{b}	0.11±0.00^{a}	126.19±2.95^{a}
	ND	106.80±1.13^{b}	111.14±1.16^{a}	15.28±0.25^{a}	55.68±0.87^{b}	35.82±0.70^{a}	133.01±1.75^{b}	70.47±1.24^{a}	0.00±0.00^{a}	146.99±1.99^{a}
	WF	112.23±0.82^{a}	117.36±0.82^{a}	19.49±1.23^{a}	61.55±0.77^{a}	36.07±0.46^{a}	136.97±1.32^{a}	71.65±0.83^{a}	0.14±0.03^{a}	141.21±3.01^{a}

$^{*\ a,\ b}$ means within the same column having different superscripts are significantly different ($P < 0.05$)

HAW-Heights at withers, RH-Rump height, FCBL-Fore cannon bone length, CD-Chest depth, HW-Hip width, HG-Heart girth, TL-Tail length,HL-Hair length, BL-Body length, MU-Muturu, WF-White Fulani, ND-N'Dama, F-Female, M-Male. 1= 0 to10months, 2=11months to 1.5 years, 3=1.5 years> above

The effect of age on morphological traits significantly ($P < 0.05$) affected heights at withers, rump heights, chest depth, hip width, heart girth, tail length and body length with the observed highest mean values of 106.42 ± 1.96 cm, 112.20 ± 1.93 cm, 60.35 ± 0.77 cm, 38.97 ± 0.61 cm, 138.00 ± 2.21 cm, 71.45 ± 1.33 cm and 151.91 ± 3.09 cm respectively. However, fore cannon bone length and hair length were not significantly ($P > 0.05$) affected by age both possessing the highest mean values of 18.29 ± 0.34 cm and 0.08 ± 0.04 cm respectively.

The effect of interaction between breed and sex on the morphological traits has no significant effect on any of the morphological traits of the breeds.

The effects of Breed, Sex, age and their interactions on heat tolerance traits in locally adapted breeds of Cattle are presented in Table 2.

The effect of breed on rectal temperature was significant ($P < 0.05$) and highest mean value of 38.91 ± 0.05 ^{o}C was observed for N'dama while muturu breed possessed the least mean value 37.76 ± 0.07 ^{o}C. The effect of breed on pulse rate and respiratory rate were not significant ($P > 0.05$) with highest mean values of 69.26 ± 2.00 beats/mins and 46.18 ± 1.41 breaths/min respectively observed in N'Dama breeds. The least mean values observed for pulse rate and respiratory rate include 65.36 ± 1.63 beats/mins and 42.33 ± 0.78 breaths/min respectively for Muturu and White Fulani.

The effect of sex on pulse rate, respiratory rate and rectal temperature were not significant ($P > 0.05$) with the highest mean values of 67.23 ±1.21 beats/min, 43.90 ± 0.98 breaths/min, 38.39 ± 0.08 ^{o}C observed in the males respectively. The least mean values include 67.23 ± 1.16 beats/min, 43.32 ± 0.86 breaths/min, 38.44 ± 0.05 ^{o}C respectively observed in the females.

The effect of age on pulse rate, respiratory rate and rectal temperature were not significant ($P > 0.05$) with the highest means values of 67.67 ± 2.33 beats/mins, 44.11 ±0.94 breaths/min and 38.64 ± 0.07 ^{o}C were observed respectively. The least means values include 66.04 ± 1.23 beats/mins, 43.24 ± 1.36 breaths/mins and 38.29 ± 0.10 ^{o}C respectively. The effect of the interactions between breed and sex on the heat tolerance traits were not significantly different ($P > 0.05$) and the highest mean

Table 2: Effects of Age, Breed and Sex on Heat Tolerance Parameters of Nigerian Locally Adapted Cattle Breeds

Parameters	Class	Pulse Rate (beats/min)	Respiratory Rate(breath/min)	Rectal Temperature(°C)
Age	1	66.54±1.25[a]	43.49±1.06[a]	38.64±0.07[a]
	2	66.04±1.23[a]	44.11±0.94[a]	38.33±0.07[a]
	3	67.67±2.33[a]	43.24±1.36[a]	38.29±0.10[a]
Breed	MU	65.36±1.63[a]	42.33±0.95[a]	37.76±0.07[b]
	ND	69.26±2.00[a]	46.18±1.41[a]	38.91±0.05[a]
	WF	65.64±0.75[a]	42.33±0.78[a]	9±0.07[a]
Sex	F	67.23±1.21[a]	43.32±0.86[a]	38.44±0.05[a]
	M	67.23±1.16[a]	43.90±0.98[a]	38.39±0.08[a]

[a, b] means within the same column having different superscript are significantly different ($P < 0.05$)

1= 0 to10 months, 2=11months to 1.5 years, 3=1.5 years> above; MU-Muturu ;ND-N'dama,; WF-White Fulani; M-Male; F-Female

values observed includes 69.69 ± 2.33 beats/mins, 46.67 ± 1.59 breaths/mins and 39.14 ± 0.07 ^{o}C for pulse rate, respiratory rate, and rectal temperature respectively observed in the N'Dama females. The least mean values observed includes 63.79 ± 3.13 beats/mins, 42.11 ± 2.03 breaths/mins and 37.59 ± 0.18 ^{o}C, respectively for pulse rate, respiratory rate and rectal temperature for Muturu males.

Means of Haematological Parameters as influenced by Age, Breed, Sex and their interactions

The least square means of the effects of age, breed, sex and their interactions on haematological parameters in locally adapted breeds of cattle are presented in Table 3.

The effect of age on PCV was not significant (P > 0.05) with a highest mean value of 35.76 ± 0.77 % observed in the oldest cattle and least mean value of 32.01 ± 0.58 %. Also, the effect of age on white blood cell, red blood cell, neutrophil, lymphocytes, monocytes, eosophytes and haemoglobin were not significantly different (P > 0.05) with the highest means values observed which include 7.22 ± 0.27/ l, 7.31 ± 0.18/ l, 32.45 ±1.06 %, 64.40 ± 0.94 %, 2.22 ± 0.19 %, 2.49 ± 0.19 % and 12.20 ± 0.29 % respectively.

The effect of breed on PCV was not significant (P > 0.05) with Muturu breed having the highest mean value of 34.96 ± 0.54 % and N'Dama having the least value of 31.87 ± 0.73 %. The effect of breed was not also significant (P > 0.05) on white blood cell, red blood cell, neutrophil, lymphocyte, monocytes, eosophytes and haemoglobin with the highest mean values 7.48 ± 0.32/ l, 7.44 ± 0.16/ l, 33.48 ± 0.78 %, 65.92 ± 0.75 %, 2.25 ± 0.11 %, 2.41 ± 0.15 %, 11.94 ± 0.17 % observed respectively for each of the haematological parameters.

Table 3: Effects of Age, Breed and Sex on Haematological Parameters of Nigerian Locally Adapted Cattle Breeds

Parameters	Class	PCV/%	WBC/(x10^9/l)	RBC/(x10^{12}/l)	NEUT/(%)	LYMPH/(%)	MON/(%)	EOS/(%)	HAEM/(g/dl)
Age	1	32.01±0.58^a	7.22±0.27^a	7.06±0.17^a	32.45±1.06^a	64.25±0.90^a	2.12±0.14^a	1.49±0.15^a	10.23±0.22^a
	2	32.37±0.46^a	6.69±0.22^a	6.62±0.10^a	31.83±0.71^a	62.94±0.66^a	1.97±0.12^a	1.77±0.12^a	11.09±0.16^a
	3	35.76±0.77^a	6.57±0.33^a	7.31±0.18^a	31.73±0.79^a	64.40±0.94^a	2.22±0.19^a	2.49±0.19^a	12.20±0.29^a
Breed	MU	34.96±0.54^a	7.48±0.32^a	6.85±0.12^a	29.88±0.71^a	65.92±0.75^a	2.17±0.16^a	2.41±0.15^a	11.94±0.17^a
	ND	31.87±0.73^a	7.05±0.31^a	7.44±0.16^a	33.48±0.78^a	64.41±0.98^a	1.87±0.15^a	1.53±0.17^a	10.32±0.28^a
	WF	33.28±0.43^a	5.95±0.19^a	6.70±0.11^a	32.64±0.79^a	61.26±0.61^a	2.25±0.11^a	1.80±0.11^a	11.26±0.16^a
Sex	F	32.75±0.44^a	6.92±0.19^a	6.95±0.10^a	31.29±0.61^a	64.32±0.57^a	1.91±0.11^a	2.38±0.11^a	10.92±0.15^a
	M	34.00±0.50^a	6.73±0.25^a	7.03±0.14^a	32.71±0.84^a	63.41±0.78^a	2.29±0.12^a	2.05±0.13^a	11.42±0.20^a

$^{a, b}$ means within the same column having different superscript are significantly different ($P < 0.05$).

PCV- Packed Cell Volume, WBC-White blood cell, RBC-Red blood cell, NEU-Neutrophil LYMPH-Lymphocyte, MON-Monocytes, EOS-Eosophyl, HAEM-Haemoglobin

MU-Muturu, ND-N'dama, WF-White Fulani, M-Male, F-Female; 1= 0 to10 months, 2=11months to 1.5 years, 3=1.5 years> above

The effect of sex on PCV, white blood cell, red blood cell, neutrophil, lymphocytes, monocytes, eosophytes and haemoglobin was not significant ($P > 0.05$) with the highest means of 34.00 ± 0.50 %, 6.92 ± 0.19/ l, 7.03 ± 0.14/ l, 32.71 ± 0.84 %, 64.32 ± 0.57 %, 2.29 ± 0.12 %, 2.38 ± 0.11 %, 11.42 ± 0.20 % observed respectively for each of the parameters.

The effect of the interactions between breed and sex on PCV, white blood cell, red blood cell, neutrophil, lymphocyte, monocytes, eosophytes and haemoglobin was not significant ($P > 0.05$) with highest means of 36.19 ± 1.32 %, 7.88 ± 0.88/ l, 7.52 ± 0.19/ l, 34.77± 1.17 %, 66.06 ± 0.78 %, 2.44 ± 0.34 %, 2.41 ± 0.32 %, 12.51 ± 0.41 % observed for each of the parameters respectively.

Discussion

The result of the effect of breed, sex and age on the morphological traits, heat tolerance traits and haematological parameters of White Fulani, Muturu, and N'Dama showed that breed had significant effect on the morphological traits. The highest mean value observed for White Fulani is closely similar to the discoveries of Dorji and Gyeltshen, (2014) who noticed a value of 113.91 ± 1.02 cm of height at withers for the Yangkum indigenous breed of Bhutanese local cow. The slight difference might be due to the variation in genotypes, environment and management practices involved in the research work. Height at withers is practically unaffected by changes in live weight, but may be affected slightly by prolonged periods of standing. The live weight of a cattle may increase or decrease (for any reason, such as over-feeding, underfeeding, or pregnancy), but the height at withers remains virtually the same. Approximately one-half of the height-at-withers growth is completed before birth; consequently overfeeding or underfeeding during growth cannot so greatly influence this measurement. In other words, height at withers, unlike chest girth, is almost independent of environmental conditions and thus expresses more closely the hereditary size of the animal Reference. The breed also had significant effects on rump height, chest depth, heart girth and tail length respectively with the highest mean values of 117.36 ± 0.82 cm, 61.55 ± 0.77 cm, 136.97 ± 1.32 cm, and 71.65 ± 0.83 cm observed for White Fulani. The figure for the tail length (71.65 ± 0.83 cm) is closely similar to the report revealed by Dorji and Gyeltshen, (2014) on the tail length of the Bhutanese native population breeds. He discovered that the mean values of the breeds (Yangkum, Yangku and Thrapa) for tail length respectively were 71.16 ± 1.45 cm, 71.02 ± 1.50 cm, 71.56 ± 1.44 cm for each of the breeds. These variations might be due to the different genetic effects, age of animals and management practices of animals involved in these studies. The result of the heart girth (136.97 ± 1.32 cm) is also closely related to that of Soro *et al.,* (2015), in the breeds of Baoule of Ivory Coast, Bouna and Doropo which respectively posess the heart girth of 132 ± 8.86 cm, 132 ± 8.16 cm. Heart girth also known as chest girth is one of the major morphological parameter of interest to farmers since it helps to assist in the determination of the body weight of cattle for the productivity and profitability of the farmer. Estimation of live weight of cattle can be determined once the heart girth is known. This is because majority of the weight of the animal is concentrated on that region of the body, thereby giving a clue to scientist about the live body weight of the cattle. The importance of these morpho-structural traits in cattle breeding cannot be overemphasized. The linear body measurements are important to evaluate and access the rate of growth of the cattle thereby preserving its genetic heritage, improving the productivity and profitability of the farmer, giving useful information on these phynotypic traits that will easily be accessible by the farmers. The trend of the morphometric values reveals that the White Fulani breed has the highest values when compared with Muturu and N'Dama breed

for the linear body measurements and this could be attributed to its larger body conformation in comparison to the other breeds, reason for which farmers prefer it in their herds, and its ready availability.

Sex did not significantly ($P > 0.05$) affect the morphometric traits of the cattle however, it was observed from this study that the females dominated the males in most of the morphometric measurements implying that the size of the female animals are larger or bigger than the males. This could be attributed to their physiological condition and early production of the female hormones which will stimulate rapid growth in preparation for maturity, heat period, copulation, calving, milking etc. This observation is in line with the results of Seifemichael *et al.* (2014) who discovered that the influence of sex on the body weight and some morphometric traits indicates the usual difference between sexes due to hormonal actions leading to differential growth rates. This result did not corroborate with Ige *et al.* (2015) who discovered a significant difference between male and female cattle in their morphometric measurements females being superior in the morphometric values. The author suggested that sexual dimorphism might have permitted the difference in performance between bull and cow.

The effect of age on morphological traits significantly ($P < 0.05$) affected majority of the linear body measurements (height at withers, rump height, chest depth, hip width, heart girth, tail length and body length). The linear body measurements of these breeds were found to increase with age, as expected. This is in line with the submission of Dorji and Gyeltshen (2014) who researched on the Baoule cattle who conclusively also observed an increase in the body measurements with advancement in age. This result also corroborates the submission of Rashid *et al.* (2016), who used Brahman crossbred cattle in his research, he concluded that most of the morphometric measurements of the Brahman crossbred were linearly increased with advances in age. The results of this study also support the findings of Kayastha *et al*. (2011) who conducted a research on indigenous cattle of Assam. He conclusively observed an increment in height at wither, heart girth, pouch girth and head length as the age of the cattle increases to 4 to 5 years of age after which there was no more significant increase in the body measurements. However, these results do not agree with the findings of Sokouri (2002) who objected to the increment of the ear length to advancement in age of the Baoule cattle breed of Ivory Coast, the reasons could be attributed to the different study locations, different management systems and the genetic composition of the cattle.

The results of the effect of breed, age and sex on heat tolerance traits in locally adapted cattle breeds in Nigeria showed that breed had significant effect ($P < 0.05$) on the rectal temperature with N'Dama breed having the highest rectal temperature value ($38.91 \pm 0.05\ ^oC$) and Muturu breed possessing the least rectal temperature value ($37.76 \pm 0.07\ ^oC$). This result corroborates with the discovery of Wenz *et al.* (2011) in the Holstein Dairy cows who reported a value of $38.9 \pm 0.04\ ^oC$ rectal temperature in his research work. This temperature depicts the actual total temperature of both the internal organs, systems, tissues, cells all concentrated at the rectum part of the animal. The normal value of rectal temperature for a beef cow is 36.7-39.1^oC, implying that anything below or above the value indicates abnormality in the health status of the animal and the infestation of pathogens on the cattle.

Conclusion

Breed and age had profound effects on height at withers Rump height chest depth, hirth girth, and tail length of Nigerian locally adapted cattle breeds (White Fulani, Muturu, and N'Dama) with White Fulani having the largest measurements. The older the animals, the larger their body measurements.

Breed also had marked effect on rectal temperature of locally adapted Nigerian cattle (White Fulani, Muturu, and N'Dama). Therefore, we recommend White Fulani cattle for breed improvement and selection for environmental adaptation and thermal resilience in the tropics.

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