ASSESSMENT OF MORPHOMETRIC TRAITS OF CAMEL *(Camelus dromedarius)* POPULATIONS IN KANO STATE, NIGERIA

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ABSTRACT

This research was conducted to assess the morphological characteristics of camel (Camelus dromedarius) populations in Kano state using phenotypic characteristics. In achieving the objectives, body weight and seventeen (17) morphometric traits were measured from two hundred and eighty-eight (288) adult camel of different ages (5yrs,10yrs and 15yrs) to determine the influence of strain (sand-brown, creamy, creamy white, gray white, black brown and dark brown) sex and age. Data obtained from the morphometric measurement were analyzed using SAS to determine the effect strain sex and age on morphological attributes. Linear regression was used to determine association between the variables. Result showed that sex and strain had a significant effect on body weight and other morphometric measurements ($p<0.05$) but there was no significant effect of age on the attributes ($p>0.01$) measured on the animal. The populations were not genetically pure but heterogeneous with varying degree of genetic similarity and distance. None of the populations exhibited genetic uniqueness. It can be concluded that the population exhibited high genetic diversity on strain of camel (sand-brown, creamy, creamy white, gray white, black brown and dark brown) and should be exploited in future genetic breeding program.

Keywords: Camel, Genetic diversity, Morphometric, Population, Kano

INTRODUCTION

Nigeria is home to a diversity of indigenous livestock breeds (Adebambo, 2003; Adebambo *et al*., 2004). Experts worldwide agree that the demand for livestock products will increase with population growth, urbanization and changing consumer demands (Moyo and Swanepoe, 2010; FAO, 2017; Gouel and Guimbard, 2017). Nigerian livestock diversity represents valuable genetic resources and national heritage (Adebambo *et al.,* 2004) that can be leveraged to pursue local and global food security because they constitute unique populations with unique genetic potential waiting to be tapped. Knowledge about existing morphological, physiological (production profile), and genetic diversity of any animal resource is an essential prerequisite to establish effective utilization and conservation programs. The development of morphometric as therefore, accepted with great enthusiasm as it was a breakthrough, promising to overcome this key limitation (Choudhary *et al*., 2008). resources. Furthermore, as the demand for certified products such as meat and milk are increasing, the focus is now on local indigenous breeds. Consequently, indigenous populations will be at a higher risk of genetic erosion due to selection pressure, indiscriminate mating and lack of characterization, unless adequate steps are taken to characterize and conserve their genetic diversity (Suleiman., 2017).

MATERIALS AND METHODS

location of the study

This study was conducted in the Kano main abattoir, Kano metropolis of Kano State. Kano State is located in the semi-arid area of North-western Nigeria. It has a population of 9,383,682 (NPC, 2006).

Kano State is the commercial nerve center of Northern Nigeria. Kano state is located between latitude 10°33' and 12°27' North of the equator and longitude 7°34' and 9°29' East of the Greenwich meridian and as such it is part of Sudan-Sahel vegetation zone of Nigeria. Kano has a hot semi-arid steppe climate which exhibits a tropical wet-dry season with a mono-modal rainfall distribution (KNARDA, 2001). Kano State occupies a total land area of about 42,582.8 km^2 out of which 754,200 ha are being used for agricultural production while forest and grazing land occupy 75,000 ha. The pattern of animal rearing in the study location includes keeping both ruminant and non-ruminant animals.

Study animals and their management

A total number of (288) camels were examined for this study. These animals were under the management of Kano main abattoir which include feeding, and quarantine, and this study was carried out on them before slaughter.

Sample collection

Six Strains of camel were used for the study. Each Strains of camel represented a population, hence, the Six populations considered in this study (Populations; Sb=Sand-Brown, Bb =Brown-Black, Cre-w =Creamy –White, Gre-W=Gray-White, Db=Dark- Brown Cre=Creamy). The body weight and seventeen morphometric traits such) Face length =(FL) Distance between eyes= (DBE Neck length =(NL) Height at hump (HAH) Length of forelimb= (LOF) Depth of chest =(DOC) Width of chest =(WOC) Weight Barrel girth= (BG) Barrel girth, HC) Hump length= (HL) Body length= (BL) Width of hip distance (WOH) Length of hind limb =(LOHL) Tail length =(TL) Ear length =(EL) Height at shoulder (SH) Heart or chest girth =(HG) were measured from two hundred and eighty eight camel population 288 adults camel in three locations of Nigeria Niger boarder(Garin Alkali, Maigatari and Maidua) . The experimental animals were managed under semi-intensive system. The Kano main abattoir was visited three times in a week (Monday Saturday and Sunday) to examine and collect samples from selected camels brought for slaughter, information on each camel was obtained from the abattoir staff, and these include;(a)Source of the camel came from, which include Garin Alkali, Maigatari and Maidua.(b) Age which was determined by dentition and sex was determine by the genital part of each animal.(c)The camel strain was determined using colour pattern.(d) Morphometric parameters were measured using measuring tape before slaughter.

Data Analysis

Data from the morphometric measurement were computed in excel and analysed using SAS, 9.4 (2000). Where there was significant difference, Duncan Multiple Range Test (DMRT) was used to separate the means. Pearson correlation matrix was used to determine the relationship among the variables (SAS 2000), simple linear regression was used to determine body weight predictions from morphometric measurement.

RESULTS

Tables 1a and 2 show the morphometric characteristics of camels as influenced by their strain. All the characteristics measured had a significant variation in relation to strain ($p<0.01$) except ear length (EL), height at wither (HW), face length (FL) and distance between eyes (DBE) Tables 2 show the morphometric characteristics of camels as influenced by their age and sex were as. All the parameters measured in term of age had no significant variation at ($p<0.01$) except neck length (NL), while in term of sex it revealed that all parameters significant variation at ($p>0.01$) except whose are not differed at ($p<0.01$) FL, DBE, HAH, LOP, WOC, HK, LOHL, TL, NS, SH, and NS respectably

DISCUSSION

Morphological Characterization of Camel Populations Studied in Kano

The effect of strain was strongly revealed in the morphological variation of camelid population than sexual dimorphism and age-related variation. This indicates that morphological characteristics can show high level of plasticity in response to environmental differences. Variation in the morphological features among the camel strains may be as result of hereditary potential, geographical distribution, environmental condition and production system (Gizaw *et al.,* 2007). Documentation of morphological characteristic of indigenous livestock breeds is important to implement reliable selection strategies for the breeds (FAO, 2007).

Table 1a: Morphometric attribute of camelid population in relation to strain

Strain/Var	DB	Gra-W	BB	S B	CRE	CRE-W
WT	398.34+8.50^{a}	349.29a+3.96	342.78a+0.57	342.78a+0.57	321.52ab+0.88	252.45b+5.26
FL	49.89+270	50.41+0.24	49.31+0.31	50.04+0.32	49.70+0.34	51.21+0.34
DBE	50.89+0.27	51.41+0.24	50.31+0.31	51.04+0.32	50.70+0.80	50.20+0.34
NL	107.56+0.63^{a}	114.00+0.97^{a}	108.56+0.95^{b}	101.62+0.69^{c}	104.27+1.20^{bc}	105.33+0.89^{bc}
HAH	187.56+1.27^{a}	186.70+1.20^{a}	186.08+1.2^{bc}	180.41+2.43^{c}	104.27+1.20^{bc}	252.45+5.26^{b}
LOF	118.25+0.86^{ab}	123.20+1.56^{a}	113.58bc+0.57	110.79c+0.91	110.37c+0.62	183.16+0.92^{a}
DOC	88.33+0.59^{ab}	85.75+0.42^{b}	90.60+0.85^{a}	87.10+0.75^{ab}	86.72+0.56^{ab}	89.35+3.15^{ab}
WOC	106.20+0.58^{bc}	101.18+0.56^{dc}	107.39+0.73^{b}	108.16+1.90^{b}	110.37+0.62^{c}	133.52+3.19^{a}
BG	248+71+1.40^{a}	206.02+0.97^{ab}	202.21+1.57^{ab}	192.23+2.80^{b}	201.68+1.07^{ab}	164.90+1.45^{b}
Note	Ns	Ns	**	**	**	**

a,b,c,d,e f Means with different superscripts in the same row differ (P < 0.01) =(HC) Hump length= (HL) Body length= (BL) Width of hip distance (WOH) Length of hind limb =(LOHL) Tail length =(TL) Ear length =(EL) Height at shoulder (SH) Heart or chest girth =(HG) Populations; Sb=Sand-Brown ,Bb =Brown-Black ,Cre-w =Creamy –White, Gre-W=Gray-White, Db=Dark- Brown Cre=Cream

Table 1a: Cont……. Nd Morphometric Attribute of Camelid Population in Relation to Strain

Strain/Var	DB	GW	BB	S B	CRE	CR/W
'IC	74.93+1.32^{d}	81.69+1.39^{b}	87.57+1.21^{a}	73.35+1.51^{e}	79.04+1.07 c	72.89+0.84^{f}
IL	47.79+0.79^{a}	47.79+0.79^{a}	43.64+0.86^{c}	44.54+0.9^{bc}	51.77+1.06 b	45.22+0.69^{bc}
3L	132.45+1.4^{a}	120.70+0.98^{b}	121.77+0.9^{b}	174.06+0.8^{a}	116.62+0.92 b	116.47+0.57^{b}
WHO	53.06+0.53^{bc}	49.91+0.35^{c}	54.60+0.47^{ab}	54.60+0.47^{a}	56.68+0.60 a	50.45+0.69^{a}
LOHL	170.12+1.14^{bc}	167.33+0.84^{bc}	169.64+0.91^{abc}	116.47+0.57^{b}	174.06+0.82 a	167.08+0.79^{bc}
TL	57.08+0.44^{ab}	59.12+0.25^{a}	59.12+0.25^{a}	57.64+0.25^{ab}	57.04+0.25 ab	56.70+0.24^{b}
EL	11.56+0.13	11.35+0.11	11.83+0.73	11.37+0.08	11.54+0.07	11.79+0.42
SH	168.47+1.00	170.85+0.96	168.00+1.59	182.83+1.03	172.25+0.93	166.41+0.95
HG	180.58+0.98^{ab}	186.12+0.94^{ab}	182.83+1.03^{a}	21.81+1.45^{a}	174.68+0.97^{b}	173.95+0.84^{b}
Note	**	**	**	**	Ns	Ns

a,b,c,d,e f Means with different superscripts in the same row differed (P < 0.01) =(HC) Hump length= (HL) Body length= (BL) Width of hip distance (WOH) Length of hind limb =(LOHL) Tail length =(TL) Ear length =(EL) Height at shoulder (SH) Heart or chest girth =(HG) Populations; Sb=Sand-Brown ,Bb =Brown-Black ,Cre-w =Creamy –White, Gre-W=Gray-White, Db=Dark- Brown Cre=Cream

Table 2a: and 2b Morphometric Attribute of Camelid Population in Relation to Age and Sex

	Age				Aex		
Variable	**5yrs**	**10yrs**	**15yrs**	**LoS**	**Male**	**Female**	**LoS**
WT	340.88±2.1	351.36±3.45	324.95±4.2	Ns	343.699±2.24a	337.98±6.75^{b}	**
FL	49.94±0.2	49.91±0.30	49.92±0.0	Ns	50.538±0.3	50.538±0.53	Ns
DBE	50.94±0.3	50.94±0.30	50.92±0.31	Ns	51.538±0.30a	50.331±0.27^{b}	**
NL	108.24±0.20^{b}	185.18±1.53^{a}	105.98±0.31^{b}	**	107.202±0.72	106.531±1.26	Ns
HAH	208.90±3.84	185.18±1.3	181.74±0.3	Ns	107.202±0.72	106.531±1.26	Ns
LOF	113.77±1.46	111.48±1.29	109.83±1.06	Ns	108.279b±1.5	186.531a±1.23	**
DOC	86.94±1.18	88.06±0.66	89.06±0.74	Ns	112.00±1.19^{a}	111.84±1.30^{b}	**
WOC	108.53±0.3	110.48±1.1	109.28±1.3	Ns	86.186±0.77	86.186±0.75	Ns
BG	194.74±1.77	212.73±2.19	199.04±2.23	Ns	111.58±0.75^{a}	106.59±0.56^{b}	**

a,b,c,d,e Means with different superscripts in the same row differ (P < 0.01); Face length =(FL) Distance between eyes= (DBE Neck length =(NL) Height at hump =(HAH) Length of forelimb= (LOF) Depth of chest =(DOC) Width of chest =(WOC) Weight Barrel girth= (BG) Barrel girth =(BG)

Table 2a cont……. nd : Morphometric attribute of camelid population in relation to age and sex

	Age				Sex		
Variable	**5yrs**	**10yrs**	**15yrs**	**LoS**	**Male**	**Female**	**LoS**
HL	49.99±2.25	45.14±1.47	47.00±1.31	Ns	46.3426±10	46.225±0.30	Ns
BL	129.18±1.30	121.09±1.08	121.24±0.93	Ns	120.531±1.80[a]	122.395±1.06[b]	**
WHO	53.70±0.82	52.89±1.01	53.93±1.07	Ns	54.398±0.52a	52.52±0.49b	**
LOHL	170.05±1.17	168.33±0.50	166.99±0.54	Ns	169.398±1.50	169.965±0.80	Ns
TL	56.94±0.59	57.22±1.01	58.15±0.98	Ns	57.118±0.30	57.579±0.32	Ns
EL	11.48±0.92	11.59±0.29	11.69±0.25	Ns	11.734±1.11	11.420±1.10	Ns
SH	171.72±0.36	170.97±0.80	171.85±0.12	Ns	170.398±1.40	170.398±1.60	Ns
HG	189.63±0.10	180.83±0.11	178.48±0.58	Ns	182.069±0.80	182.069±0.85	Ns

a,b,c,d,e Means with different superscripts in the same row differ ($P < 0.01$); at Hump length= (HL) Body length= (BL) Width of hip distance (WOH) Length of hind limb =(LOHL) Tail length =(TL) Ear length =(EL) Height at shoulder (SH) Heart or chest girth =(HG)

The results from this study showed a significant morphological variation between these animals in terms of strain with negligible influence from sex and age, which can be utilized for design and implementation of breeding programs. The existence of similar morphological features may be attributed to the fact that pastoralists were mostly involved in sharing of sire of a desired trait with those from other herds. These results are in agreement with Berhanu *et al.* (2015) and Yoseph *et al.* (2018) who worked with camel populations in Ethiopia, and also agreed with finding of Abdallah and Faye (2012) who reported phenotypic classification of Saudi Arabian Camel (*Camelus dromedarius*) by their body measurements.

Data regarding Age in the current study revealed that there are no significance differences across the populations but those with 10years has higher value followed by 5yrs while 15years has the least value, this corroborates with the finding of Tandon *et al* (2018) who reported results in camel cows at 4 to 6 years. The results on sex reveled higher value in male than in female in all parameters except in DBE, LOP, DOC, and BG, confirms sexual dimorphism in animals, these is in line with finding of Tandoh *et al* (2018) and Semakula *et al*. (2010) who reported that male has superior than female in body weight and other measurements.

CONCLUSION

This study assessed the morphometric and genetic diversity of *Camelus dromedarius* populations in Kano. The results demonstrated that camel populations in this region exhibit significant morphological

variation, primarily influenced by strain, with minimal effects from sex and age. The morphometric traits, such as body length (BL), tail length (TL), hump length (HL), and heart girth (HG), showed substantial diversity across the different strains, which suggests adaptive characteristics in response to environmental factors. Notably, strains like Sand-Brown, Creamy-White, and Gray-White displayed distinct traits that can be valuable for future breeding programs. Despite the observed variation in physical characteristics, the populations were found to be genetically heterogeneous, with no indication of inbreeding. While the populations are not genetically pure, they possess a high level of genetic diversity, which is essential for adaptability to changing environmental conditions and management practices. However, certain traits, such as the white colour and presence of the Long Hind Limb (LOHL), which are beneficial for adaptation to hot and humid environments, are at risk of extinction due to their low frequency.

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