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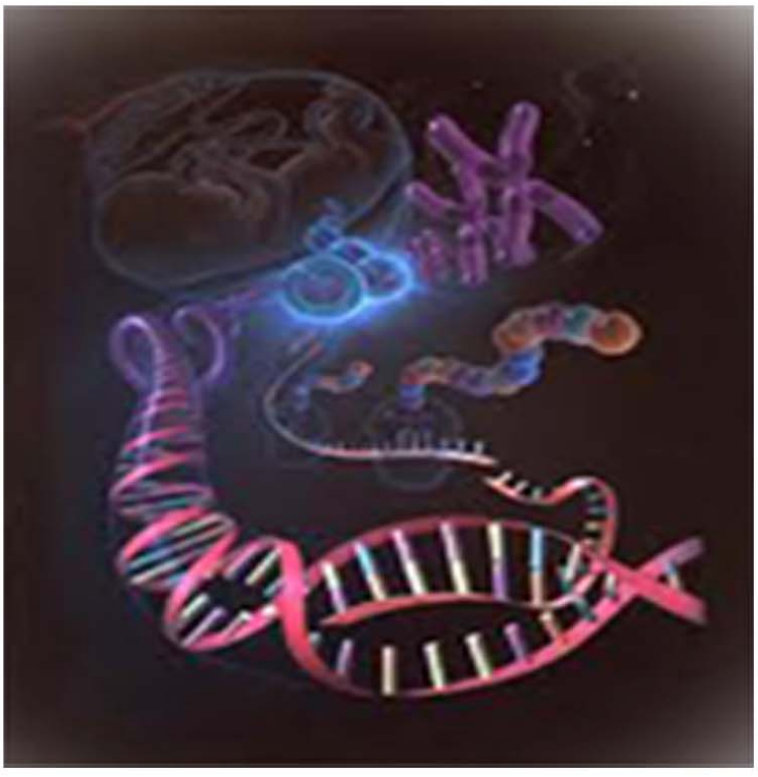

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Research Paper

QUANTITATIVE-TRAITS AND BLOOD-BIOCHEMICAL CHARACTERIZATION OF WHITE BORNU AND RED SOKOTO GOAT BREEDS IN NIGERIA

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A total of 173 animals comprising 85 Bornu White and 86 Red Sokoto breeds from Borno State of Nigeria were used. The Bornu White breed was significantly different ($p < 0.01$) from the Red Sokoto in body weight, height at withers, heart-girth, and body length. The Limb parts did not differ significantly, although greater values still persisted. In the Bornu White; parts of the hind limb were however significantly different ($p < 0.05$). Considering breed and sex, the Bornu White males weighted heaviest and had highest body measurements for all the body parts measured, this should be an advantage for its use as a meat animal. The females were also larger than the Red Sokoto females, thus suggesting a higher potential for milk production. Correlation and regression coefficients of linear body measurements on body weight were high in Bornu White males ($r \geq 0.73$) and ($b \geq 0.72$) for height withers, heart girth and body length, values for the Red Sokoto breed ($r \geq 0.34$) for body length and height for height at withers and heart girth r = 0.77 and 0.89 respectively. Results obtained from the biochemical analysis of blood showed higher frequency for Tf A (P = 0.84) in Bornu white and the Red Sokoto had comparatively higher frequently for Tf B (q = 0.33).

Keywords: Traits, Blood-biochemical, Characterization, Goat, Breeds

INTRODUCTION

The importance of goat in Nigerian livestock economy can be attributed to its value for meat, milk and leather, primary use being for meat production. Meat from goats contributes about 17% of the total national meat supply (Kurtze, 1982; and Ngere *et al.,* 1984). In the rural areas, the value of goat is far greater that it's usually appreciated, being often the most-readily available source of meat. Additionally, goat milk with its special attributes is very valuable to the rural populace. The goat skin although is consumed as meat in some parts of the country, forms is very useful by product with a significant export

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trade; the skin of the Red Sokoto breed for example is known for its superior quality and the premium it commands in the world market.

Indigenous goat breeds in Nigeria include the Red Sokoto, West African dwarf, Borno White and their crosses of these; the Red Sokoto is widely distributed in the Savanna Zones extending to the Southern forest zones, while in West African dwarf in confined to the southern parts. The Borno White occurs chiefly in the sahelian region of the extreme North Eastern Nigeria, Borno State. It is kept largely by the rural population, with an estimated average of 15-20 animals per house hold. Preliminary survey on this breed has indicated that it is of relatively large size; measuring an average of 72cm at withers and 40kg mature weight. It is therefore a large breed. The Red Sokoto breed for example which measure between 55 – 60cm height at withers with an average mature live weight of 25kg is relatively smaller breed although it occurs in the same econich. Thus with the increasing interest in providing animal protein in form of meat and other products, the relative large size of Born White might be useful for upgrading other local stocks that are smaller in size, provided it also possess other useful attributes. From available literature, information on this breed is scanty (Mason, 1951) and are largely descriptive. Quantitative data on its performance are very few. Therefore to bridge this gap, it was thought useful to establish baseline information on this neglected but potentially important breed. For this purpose, easily determined phenotypic characters viz body weight and linear measurements and biochemical characterization of the blood was utilized to further characterize this breed. This will probably serve as a first step to its further use in selective breeding, cross breeding or both.

MATERIALS AND METHODS

Experimental Animals

The 173 goats used in this study were all from Bornu State. This consisted of two breeds, the Bornu White and the Red Sokoto. Animals were randomly selected form herds from private farm of Afuze and farm, some villages around Afuze main town. The later consisted of animals being brought from the various parts of the Sahelian region of slaughter. Animals were first separated into breeds based on their coat colour, Bornu White being generally white with occasionally black patches, while the Red Sokoto is predominantly glossy red with slight variation to brown colour. All parameters studied were from mature animals. In the absence of accurate records, age was estimated using incisor teeth count all which were eight (Starke and Pretoorius, 1951).

Management of flocks – animals were housed indoors for most parts of the day on concrete floor laid a thin layer of fine sand litter in barns provided with wide open windows covered with wire mesh at the University farm. Confinement was from about noon till the following morning (sunrise). Animals were herded to the fields from morning to about noon. When confined, animals were fed grass-hay and mixed supplements of groundnuts cake or cotton seed cake with wheat or rice bran obtained from commercial mills. They were left to fend for themselves on the open range lands under the supervision of herdsmen for half of the day they were outdoors. Management of those from the villages surveyed and from Maiduguri abattoir was similar characteristic of the traditional methods of husbandry. The animals were herded along with cattle during the day, thus thrive essentially on the pastures and browses or three

that are usually chopped by the herdsmen to their animals. Salt licks were often provided in some herds in the evening together with cattle, when animals returned from gazing. In some herds the goats were separated and sheltered during the night while they remained outside with cattle even during the night in others.

Measurements

Body weight (kg) and linear measurements (cm) in all animals were recorded. Animals were weighed on a spring balance and a flexible table was used for linear body measurements. Both were recorded simultaneously:

- Body weight (BWT) - obtained by lifting the animal off the ground with the aid of a spring balance hooked to a sting tied around the belly.
- Height at withers (HAW) – measured on a platform from the surface to the withers when the animal has been restrained in such a position that the limbs are at normal position and the back is not chest.
- Heart girth (HG) – the circumference around the chest.
- Body length (BL) – measured from the external occipital protuberance to the base of the tail, after the animal has been restrained in such a way that its head, neck and body are attached almost in straight line.
- Upper fore Limb (UFL) – measure from alecranon process (Point of elbow) to styloid process of cannon.
- Lower fore Limb (LFL) – measured from the lateral lower edge of the claw to styloid process of the cannon bone in a straight line.
- Upper Hind Limb (UHL) – measured from point of hock to the stifle joint at the proximal end of tibia.
- Lower Hind Limb (LHL) – mentioned from the lateral edge of claw to the point of hock.

Blood Collection and Analysis

Samples were obtained from healthy non-lactation goats. Age of animals was not considered, since it has no bearing on the variation of goat sera (Watanabe and Suzuki, 1966). Three goat populations were surveyed, considering of the two breeds, under study. Group 1, were animals kept on the private farm maintained for breeding purpose. Group 2, were animals from herds in three villages around parts of Afuze town for slaughter at the main urban abattoir all together blood sera of 60 heads were used for the study.

Various blood samples were obtained from animals in groups 1 and 2, using and 18mm gauge needle, into a disposable syringe then transferred into clean, non-heparinised dry bottles and allowed to clot. Group 3 animals were killed, thus blood was collected immediately after severing the neck into clean, non-heparnised bottles and also allowed to clot. The clothed samples were kept for few hours at refrigeration temperatures in a flask containing ice crystals on transit to the laboratory the samples were then centrifuged at 300 g for 10 min and the serum was carefully separated with a pipette into clean dry bottle and stored at freezing temperatures, sample collection was conducted for 3 days; after which they were transported by road in a flask containing ice crystals from Afuze to Ibadan for analysis.

Paper electrophoresis was conducted on the Sera. This was performed on cellulose acetate size 50 x 90cm sephra pore III cellulose polycetate on a Shandon Southern instrument, vokam CO, trisbarital pH 8.8 ionic strength 0.05 buffers. Standard operating procedures were adopted

(Anon Gelman, 1975). Buffer pH was measured prior to each electrophoresis run on a pw 9410 digital ph meter. Only buffer solution with pH 8.8 was used. The serum samples were always applied at about 5 cm from cathode end of the cellulose acetate strip. The electrophoresis immigration of the various proteins-rich zones in each serum was observed. Because the albumins immigrated towards the anode, the distance from the point of application in the direction of anode were shown as positive migration towards the cathode.

Notations

Notations used for describing transferring types were designed after suggestions made by (Mason and Buvanendran, 1982). The first phenotypes were designated as Tf AA, while the slow one was referred to as Tf BB. The Phenotypes which showed 3 bands with mobility's equivalent to the bonds of Tf AA and BB was referred to as Tf AB.

Classification of Serum Phenotypes

Classifying the serum into different patterns was based on the migration of the component in B-globulin as suggested by Ashton and McDougali (1958). The fastest migrating zones A were observed in the first pattern which was called the AA type, the slowest migrating zones B in the third pattern called the BB type. In the second pattern A and B components were observed, but appeared to be 3 components probably due to the fact that parts of components of A and B were overlapped on each other. This pattern was called the AB type. To further confirm it to be as intermediary, equal parts of AA and BB type sera were mixed, which could not be distinguished between the two. Hence the AB types were considered to be from the heterozygote animals.

Statistical Analysis

Means + S.E. for body weight and linear body measurements viz HAW, HG, BL, UFL, LFL, UHL and LHL were calculated. The mean + SE for different sex within breed were calculated for the two breeds. Differences between means of the same sex also examined for all traits studies student – Newman – Keul's multiple range test (Steel and Torrie, 1980). Linear body measurement were regressed on body weight and regression and correlation coefficients calculated, further analysis of covariance was performed (Steel and Torrie, 1980). It is assumed that sampling was from a population under Hardy-Weinberg's equilibrium. Thus frequency of appearance of the transferring phenotypes in the two goat breeds was examined and gene frequencies of Tf A and Tf B were determined.

RESULTS AND DISCUSSIONS

Measurements

Means+S.E. for all parameters studies were presented in Table 1 of the eight traits it was observed that body weight, height at withers, heart girth and body length showed marked variations.

Table 1: Distribution of Transferring (TF) Phenotypes and Gene Frequencies of TE Alleges

Breed	No. of Animals (r)	Phenotypes				Gene Frequency	
		AA%	AB%	BB%		A	B
Bornu White	28	19	68	9	32		
Red Sokoto	26	12	46	11	42		

plz chk table clarify the column headings

This was attributed to differences in the same sex of the two breeds compared. The Bornu White has significantly higher ($P < 0.01$) values for all the aforementioned traits this findings is in agreement with earlier study (Moruppa, 1982) where higher carcass yield than those of Red Sokoto even during the advantaged periods of the long dry season was reported. This goat breed would therefore be more productive in terms of meat supply, since it is the main purpose of which goats like other classes of livestock are being kept in Nigeria. Higher productive performance may be obtained if better husbandry practices are adopted. The present system is that the animals are kept as adjust to crop agriculture as a source of quick income and probably for the production of manure with less attention to its potential for providing animal protein. They are generally maintained on crop residues with animals in most cases devoid of supplemental feeding. Salt likes are often provided, being a readily available commodity in this area; it is affordable by most farmers. There supplement are given it is essentially the traditional millet or sorghum bran or chaff and husks during harvest season. The traditional method of husbandry is practiced as in larger parts of the developing world. The nomadic pastoralist who own larger herds move from one place to another, sometimes across international boundaries between Nigeria, Cameroun, Chad and Niger. They move about with their animals in search of sparse fodder, which may not even be found with the advanced stages of dry season. Tethering or some form of confinement in backyards are common in the villages or in compounds where space is not available is practiced in town. These are practiced during the cropping to harvest season in which case out herbage, crop residues, Kitchen wastes and often mixed gains are given to the animals. Others allow their animals to roam about the street fending for them and shelter may not be provided.

Under such production system there were some large flocks but records keeping were often impractical. On the other hand, there were those smaller flocks kept to the backyards and compound with closer with closer supervision but are too small for effective selection procedures. This group also did not keep records. State sponsored and institutional farms with few flocks of goats often reared together with other classes of ruminants were also found. These have been set up with a view to effect genetic improvement in these flocks and passing improved stock chiefly males to farmers. The success of these organization in the development of better husbandry practices among the traditional herd is however limited primarily due to lack of inputs either technology or finance or both.

The results indicates that there are variations among means for the parts of the legs with Bornu White breed maintaining higher values, the did not however differ significantly except for the upper and lower limbs that were significantly different ($P<0.05$) among males. A long extremity which though did not differ significantly for most portions with those of Red Sokoto seems to be an additional advantage in a Sahel' region. They may serve in lifting the body high above the ground thereby protecting the animals from the reflected heat from the ground. Long legs are also necessary in these regions where animals may be compelled to trek long distance in search of immense advantage in browsing bushed and trees with relative ease. This is very apparent especially during the advanced stages of the dry season when much of the lower parts of the browse plants has been exhausted and only

animals that are tall can reach the upper parts of the browse. The non significant difference between the two breeds in this trait could be concluded to be due to the uncontrolled breeding prevalent in these herds. The Red Sokoto breed seems to have these advantages to enable it survive in the environment are only animals that are well adapted to dry hot conditions that can thrive and produce in this region.

Sex difference within breed though expected was not conspicuous in the Red Sokoto, but marked difference was observed in the Bornu White breed. This further implies that the former is more uniform than the later. Since masculinity enhances greater muscles development which in turn leads to higher yields. The rearing of the male animals of the Bornu White breed for meat may prove more economical. The highly significant difference (P<0.01) for body weight within females in favour of Bornu White breed also suggest that they are of advantage in terms of both reproductive and productive performance. Its superiority in reproduction may not however mean higher prolificacy. Larger due weight has been reported to be highly correlated to high birth weights in kid (Amoah and Bryant, 1983) and high milk production (Moruppa, 1982; and Ngere *et al.*, 1984). The later trait need to be further investigated in this breed, known to possess high potential.

This will aid in identifying some of our indigenous dairy goats that might be used in upgrading other local stocks. To determine the extent of association between body weight and different linear body measurements, correlation and regression coefficients were computed, these coefficients along with the Y-intercepts are presented in Table 2. All the correlation coefficient (r) were positive and were observed to be significant (P<0.05) except for lower forelimb (LFL) and lower limb (LHL) in Red Sokoto females. This exception as probably due to chance. The correlation coefficient for height at others, heart girth and body length are high, generally ($r \geq 0.50$). it is apparent therefore, that in both breeds of goats kept at present by the traditional herdsmen, reasonable height girth and body length should be selected for and whatever improvements that could be brought about in terms of suitable environment – both nutritional and climatic should be done to attain these measurements at least under the natural conditions.

The Sokoto males, correlation coefficient for body growth for limb and lower hind limb are low (R<0.3), other measurements however maintain high correlation coefficients (R>0.6). Correlation coefficients are comparatively lower within the female animal of both breeds (R<0.55) except for a few traits viz heart girth and upper hind limb

Table 2: Means ± SE. of Body Weight and Linear Measurements

Breed	Sex	No.	BWT (KG)	HAW (CM)	HG (CM)	BL (CM)	UFL (CM)	LFL (CM)	UHL (CM)	LHL (CM)
BW	M	43	$33.69 \pm 0.84^{a**}$	$74.44 \pm 0.73^{a**}$	$80.44 \pm 0.79^{a**}$	$94.53 \pm 1.14^{a**}$	23.28 ± 0.45^{a}	15.26 ± 6.18^{a}	$26.76 \pm 0.49^{a*}$	18.65 ± 0.37^{a}
RS	M	90	24.60 ± 0.74^{b}	63.50 ± 0.74^{b}	69.02 ± 90^{b}	34.55 ± 0.81^{b}	20.10 ± 0.32^{a}	12.77 ± 0.32^{a}	22.70 ± 0.32	15.60 ± 0.33^{a}
BW	F	42	$30.83 \pm 0.63^{a**}$	$70.62 \pm 0.61^{a**}$	$76.50 \pm 0.74^{a**}$	$90.62 \pm 1.00^{a**}$	21.00 ± 0.33^{a}	14.59 ± 0.18^{a}	24.09 ± 0.36^{a}	16.45 ± 0.32^{a}
RS	F	48	22.33 ± 0.41^{b}	62.89 ± 0.61^{b}	68.73 ± 0.73^{b}	34.84 ± 0.65^{b}	19.54 ± 0.27^{a}	12.50 ± 0.23^{a}	22.44 ± 0.29^{a}	$16.73 \pm 0.19a$

Note: Means ± SE not followed by the same superscript letter between breeds of same sex were significantly different at (P/0.05)* and (P/0.01)**.

in the Bornu white breed r = 0.78 and 0.77 respectively. The larger correlation efficient for Bornu white males than those in Red Sokoto males indicates that on the basis of the dimensions of the different body portions, the body weight could be predicted more accurately for Bornu White males than red Sokoto males. This trend also holds true for their females' counterparts; however the correlation coefficients were lower in both breeds. This then makes prediction of body weight bases on different body portions relatively imprecise. This finding may not be unrelated to the fact that some female animals might not have pregnant at the time of study which though did not show evidence of pregnancy due to early period of gestation, feotal weight must have led to increase in weights.

The regression coefficient (b) were all higher that (b = 0.65) for height at withers, heart girth and body length in all the classes of animals this reveals that increase in these traits per unit increase in body weight is high. The values were fairly high within the Bornu white breed with body length having highest values indicating that per unit increase of these portions was greater in this breed. The regression of hart girth or body weight was consistently high (0>0.77) in all classes of animals. The highest value of (b = 1.0.8) observed in Red Sokoto males, suggested that this is an important trait in this class of animals especially those intended for meat. This finding is in line with the report of (Orme, 1963) who showed definite relationship between weight of carcass lean and heart girth in sheep. All leg measurements had low regression coefficients generally (b < 0.030), the value for upper hind limb was however in all classes (b > 0.43) in Bornu white breed while it is about (b = 0.30) in Red Sokoto breed. Lowest regression values were those for lower hind limb in all classes except for Bornu white males where regression coefficient of lower forelimb on body weight showed that lowest value (b = 0.05) these results suggest that after mature height has been attained, the length of the various parts of the legs have little bearing on body weight.

Haematological Studies

The frequency of appearance of serum phenotypes were observed on breeds and gene frequencies presented in Table 3. Not all separated resulted in tint protein - rich and protein – poor zones. Frequently the indistinct separations consisted of blurred zones. The data given in Table 3 was derived from those strips that gave distinct separations. It was observed that despite slight difference due to breed, the BB – type was observed in Bornu white breed, indicating that if present, it is rare in this breed and low in the Red Sokoto where it was observed. As reviewed by (Dimopoullos, 1963) the relative constancy of the serum protein profiles of a normal subject over a considerable length of time is apparently genetically controlled, and that this makes it possible to differentiate breeds and even strains. The proportion of the AA- type expressed in percentage was higher in Bornu White breed with a value of 68%. The AB – type was higher in Red Sokoto, almost at a ratio 1:1 with AA – type. The two goat breeds examined showed variation in the frequency of allelomorphs A and B. these variations are similar to those reported by (Watanabe and Suzuki, 1966) who however worked on different goat breeds, reported great difference on the frequency of Tf B (q = 0.33) in Red Sokoto might be due to the fact that this allelomorphsis said to favour higher prolificacy which trait is higher in this breed than in the Bornu White. The results of this study further suggest that their exist a negative correlation between the presence of Tf B and relative tolerance to hot dry environments characteristic of this region; since

Table 3: Correlation (R) and Regression (B) Coefficients and Intercepts (A) Using Body Weight as Independent (X) Variable and Various Body Measurements Dependent (Y) Variables

Breed-sex (n = number of Observation)	Statistical Coefficient	HAW	HG	BL	UFL	LFL	UHL	LHL
Bornu White-Male	r	0.83*	0.83	C.73*	C.58*	0.27*	C.77*	0.71*
(N=43)	b	0.72**	0.78**	0.92**	0.31*	0.05NS	0.45*	0.32*
	a	50.04	53.91	63.45	12.81	13.36	11.57	7.39
Red Sokoto-Male	r	0.77*	0.89*	0.34*	0.60*	0.32*	0.67*	0.30*
(N = 40)	b	0.75**	1.08**	0.65*	0.25*	0.37*	0.29*	0.13*
	a	42.4	42.3	75.72	13.63	14.00	15.31	12.19
Bronu White-female	r	0.51*	0.78*	0.55*	0.37*	0.47*	0.77*	0.27*
(a = 42)	b	0.87**	0.88**	0.89**	0.19*	0.13ns	0.43*	0.13ns
	a	42.35	49.69	62.86	15.15	10.61	10.69	12.52
Red Sokoto female	r	0.52*	0.59*	0.47*	0.32*	0.1805	0.42*	0.19ns
(a= 46)	b	0.69*	0.77*	0.78*	9.18*	0.11ns	0.30	0.09ns
	a	46.47	50.38	67.00	15.26	10.08	15.66	14.63

these protein have an association with the physiology of the animal as it relates to its environment; as reviewed by (Prasad *et al*., 1983).

CONCLUSION

The findings from this study have implied that the Bornu white goat breed is superior to the Red Sokoto breed in terms of linear body measurements and body weights. Since meat rather than any of the valuable products derived from goat are kept in Nigeria, the large size of this breed could be of advantage. The male animals are more suited for this purpose having greater muscle development and hence meat. In addition the female animals are also large and have high potential for milk production; which trait is highly correlated to size. To further uphold this fact, the Bornu White breed has been said to resemble the Nubian desert goat and would have possible traced its origin from it; which known to be a good milker.

However, despite its obvious potentials for better performance, it has been neglected and most often classified under the sahelian goat breeds. The difference is the frequency of the blood protein types between the Bornu White and the Red Sokoto goat breeds implies that they are of different breeds. The econiche of this goat breed is characteristic of the hot dry tropical environments with extremely high ambient temperatures (40 ^{o}C) for most parts of the year. However it's morphology, being long legged and white coat colour, which enables it adapt better to this hot environment. Further more the husbandry practices under was being kept at present Bornu White breed is able to produce up to some levels.

The Red Sokoto breed on the other hand is a smaller animal relative to the Bornu white. It is however more widely distributed found in most pats of the country. It's spreading to the North Eastern pats have led to the larger size owing to the uncontrolled breeding system. Of the production trait, proficiency is low in the Bornu White and high in other indigenous breeds. The West African dwarf is most prolific followed by the Red Sokoto. Therefore, with these obvious advantages, breeding programmes could be conducted aimed at upgrading the other indigenous breeds for large size using the Bornu White and taking advantages its adaptability to tropical environments. These other breeds also ensures high prolificacy and coupled with better husbandry practices, efficient production system could be achieved.

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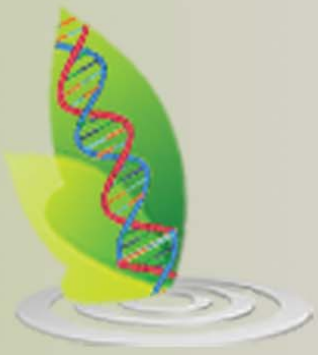

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