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DISTRIBUTION OF QUALITATIVE TRAITS AND HAEMOGLOBIN TYPE AMONG RED SOKOTO GOATS IN SEMI-ARID ZONE OF NIGERIA

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ABSTRACT

This research was conducted to determine the age distribution of Red Sokoto Goats of 6 months and above according to coat type, hair type, tail shape, tassels, sex and haemoglobin type that may serve as indicators for production performance and determine the existing associations of haemoglobin types and body physical characteristics. A total of 321 Red Sokoto goats were used for the study and 213 of them were sampled for haemoglobin type. The population of Red Sokoto goats Hb types was studied in Hardy-Weinberg equilibrium. The frequencies of observed morphological characteristics such as coat type, hair type, tail shape, tassels and their Hb types, age, sex were recorded. Four haemoglobin types were discovered, namely; HbAA, HbAB, HbBB and HbAC. Only two (2) animals sampled had the rare pre-adult haemoglobin type (HbAC). The distribution of all the parameters were determined using Descriptive Statistics and the Haemoglobin types were expressed as homozygous (HbAA and HbBB) and heterozygous (HbAB and HbAC); phenotypes with HbAC being a pre-adult form of Hb and were determined. The red sokoto goats within 8 months of age had the highest frequencies (24.61 %) while the least (3.12 %) was obtained in those that are within 48 months. The highest coat type, hair type and tail shape were found in Brown (B), Short-smooth (SS) and Curled up (CU) respectively. The Red Sokoto goats without tassels (308) were more than those with tassel (13). The 89.4% frequencies in female red sokoto goats were higher than those in male (10.6 %). In can be concluded that Hb type and other physical characteristics can serve as indicators for production. Also, variation in our goat herd could be drastically improved within a short time. Larger sample sizes could also come to ones' aid when investigating traits or physical characteristics that are not so common such as tassels. Further work of this nature should be carried out on different breeds of goats and the results for each breed could then be compared with one another to find the trend in results.

Keywords: Goat, Red Sokoto, Qualitative traits, Semi-arid and Haemoglobin type

INTRODUCTION

The burgeoning population in Africa calls for quick attention to means of increasing the level of food production in the continent. A number of Africans depend to a greater extent on low quality starchy foods such as cereals, tubers and root crops (African Farming, 1996) which cannot satisfy human need for proteins. The livestock sector is essential to the livelihood of the populace, more so in the sub-Saharan Africa than in any other part of the world, as it contributes significantly not only to food security and nutritional quality of the diet but also to the sustenance of national economies (Hoste, 1999. Adding to this is the increased demand for livestock products in this region owing to a combination of population growth, rising incomes and urbanization (Hoste, 1999). Therefore, there is the need for increased livestock production which has been estimated at 23,836 million tons for milk, beef and buffalo meat, sheep and goat meat,

chicken meat (white meat) and eggs in Sub-Saharan Africa (FAO, 2001).

Intake of animal protein in Nigeria at present is 4.82g/caput/day (Tewe, 1999) as against a minimum required of 35g recommended by the FAO and also a stark contrast to the 58g per day consumed in developed countries such as the United States of America.

Small ruminants are increasingly becoming a major source of animal protein in Nigeria; they are almost as ubiquitous as poultry, though not as numerous. They have a total estimate of 56.6 million throughout the country, with goats outnumbering sheep by three to two (Rim, 1992). The Red Sokoto goat (RSG) or Maradi is the most predominant goat and accounts for about 70% of Nigeria's total goat population which has been estimated at 34.45 million (Tewe, 1999). The breed is predominantly reddish brown in colour and is found in the Savanna zone of Nigeria (8°N-11°N) where it constitutes more than 90% of the goat population in that area. The breed weighs about 1.5-2.0kg at birth and reaches about 12.0kg when weaned at 3 months under good management. Weights of adult does and bucks are 20-35kg and 25-40kg, respectively (Osuhor *et al.,* 2002).

The existence of two types of Haemoglobin (Hb), types A and B, has been well documented in goats. They are expressed as homozygous (HbAA and HbBB) and heterozygous (HbAB and HbAC); phenotypes with HbAC being a pre-adult form of Hb (Johnson *et al*., 2002).

The understanding of biochemical polymorphism has contributed immensely towards unraveling some of the mysteries behind certain biological phenomena. In so doing, gene codes for proteins like haemoglobins and transferrins (Henkes *et al*., 1994).

Physical traits have long been used in selecting animals for parents of the next generation. However, few experiments have likened various body features or physical characteristics to haemoglobin type and production traits viz characters such as hair type and coat color variations.

Knowledge of haemoglobin types, body measurements and production characteristics of Red Sokoto goats will go a long way to improving the genetic background of our indigenous herd. With this study, by simply knowing a goat's haemoglobin type, we can predict the possible body traits to expect. Therefore, the objective of the study was to determine distribution of Red Sokoto of 6 months and above according to their physical characteristics and haemoglobin type in Red Sokoto goats.

MATERIALS AND METHODS

Experimental Location

The field research was conducted in the semi-arid zone of Nigeria. The semi-arid zone of Nigeria starts from about 11ºN latitude and ends at the Nigeria-Niger frontier. It encompasses the Sudan and Sahel Savanna and part of the Northern Guinea Savanna. The mean annual temperature runs between 26 and 28ºC. There is a single rainy season from May to October, with mean annual rainfall ranging from 1016mm in the wettest parts to less than 508mm in the driest parts. The length of growing period is about 100-150 days which makes it possible to cultivate a wide variety of crops (Ogungbile *et al*., 1998). The semi-arid zone has a land mass of 113,530km2 and a population of over 35 million people (NPC, 2006). The major inhabitants of this area are Hausa and Fulani who are predominantly mixed crop-livestock farmers and livestock herders respectively.

Sampling Size, Sampling Structure and their Characterization

The Red Sokoto goats were sampled using a random sampling method to determine their body morphological traits. A total of three hundred and twenty one (321) Red Sokoto goats were used for this study while two hundred and thirteen (213) of them were evaluated for haemoglobin type or polymorphism. Thirty-four (34) of the goats sampled were male while two hundred and eighty-seven (287) were female.

Each were then categorized for age, coat type, hair type, tail shape, presence or absence of tassels, sex and haemoglobin type.

The age of the goats was determined using teeth count (FAO, 2001) in combination with the information provided by the goat owners.

Measurements/Observations of Physical Parameters

1. **Tassels/ Wattles**: The presence or absence of the loose fold of bare skin hanging from the throat of goats, called 'tassels' was noted.
2. **Tail shape**: The orientation of the tail shape of the goat; whether straight, curling upwards or curling downwards was noted.
3. **Coat type**: This was observed as the colour pigmentation of the goat.
4. **Hair type**: The types of hair observed was also documented and this was categorized into smooth, rough, and curly (woolly) hair type.
5. **Age**: The pairs of permanent incisors in the dentition of the goat was used to determine age.
6. **Sex:** The sex of the animal was also noted.

The tassels, tail shape, coat type and hair type served as physical characteristics served as indices for production performance in Red Sokoto goat.

Blood Sampling and Analysis for Hb Types

Blood samples were obtained via jugular venipuncture; about 5ml of blood was drawn by using a syringe into heparinized vacutainer tubes containing ethylene diamine tetra-acetic acid (EDTA) as blood anti-coagulant. The test tubes were then labelled according to ascribed numbers given to each goat sampled for body mensuration characteristics. The blood samples were then taken to the laboratory, washed with normal saline and then haemolysed with distilled water to release the haemoglobin. The supernatant was removed after centrifuging at 3000 rpm for 5 min and the sample haemoglobin stored until ready for electrophoresis.

Human haemoglobin AA and AS were used as controls for the first 100 samples. This was to develop a control for the caprine samples. On development of caprine control, the procedure was then repeated for all the samples using caprine haemoglobin AA and BB as controls.

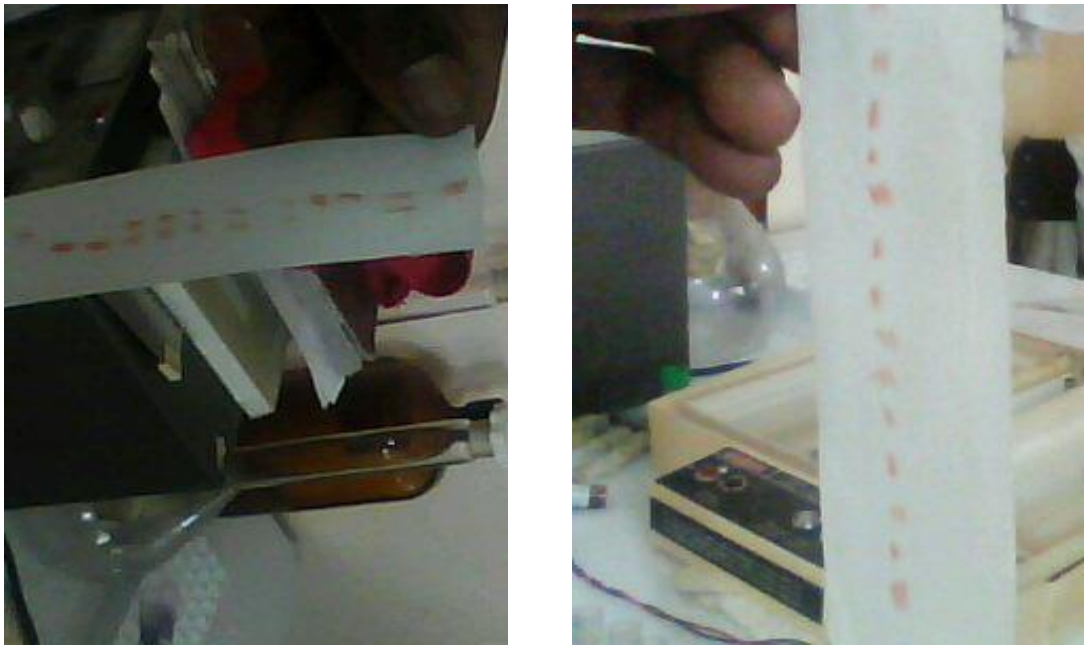

Fig. 1: Showing haemoglobin bands using Electrophoresis.

Cellulose acetate paper strip electrophoresis was employed to separate the globin fractions. Electrophoresis was carried out in a Shandon electrophoresis tank on cellulose acetate strips 34.5x 150mm with 0.26MTris buffer (pH 9.1) at both the anode and cathode. The strips were run for 5 minutes at a constant voltage of 250v until a clear separation is observed. On separation, the strips were stained with ponceau-s stain, later washed with 5% glacial acetic acid, and dried using filter paper. Interpretations were made based on the relative mobility of the haemoglobin bands towards the anode. The genotype that migrated faster was labeled HbAA, the slow moving fraction was identified as HbBB while the heterozygote (consisting of both slow and fast bands) was HbAB (Tella, 2000; Das *et al*., 2004).

Statistical Analysis

Distribution of the measured qualitative traits was assessed using Descriptive Statistics and computed based on pooled data using frequency procedure of SAS (2004) package and haemoglobin types were determined as earlier stated above.

RESULTS AND DISCUSSION

Table 1 shows the age distribution of Red Sokoto goats that were studied. A total of 321 goats from different herds that aged 6 months and above were sampled. The maximum age observable from the different herds was 48 months. Goats that aged 8 months (24.61%) constituted the majority herds. This was followed by goats that aged 36 months (17.13%), 30 months (16.51%) and 24 months (12.46%), respectively. The rest of the age categories were less than 10% with the least distribution coming from goats that aged 48 months (3.12%). The distribution further revealed that goats that aged between 6 and 12 months (36.76%) constituted the majority in the herds; followed by 24-36 months (33.64%) and 12-24 months (20.87%), respectively. The least was for goats that aged greater than 36 months (8.73%). This is similar with the trend observed in the study of Peacock (1996). However, this may be attributed to the genetic factors.

The distribution of coat type, hair type, tail shape and tassel in Red Sokoto goats is presented in Table 2. Four basic colors (Dark red, Brown, Light Brown and White) were observed in the goat population studied. Majority of the goats (44.2%) were brown followed by light brown (25.5%) while the dark red (7.5%) and white (6.9%) goats were minimal in the goats. There were 4 other color mixture patterns deriving from the identified basic colors and these constituted about 15.9% of the goat population.

Three hair types; short-smooth (SS), short-rough (SR) and long-curly (LC) were observed in the goat population. However, most of the goats exhibited short-smooth hair type (69.8%), followed by short-rough (18.4%) and the least was the long-curly (11.8%) type.

The identifiable tail shapes in the herds were curled up, curled down and straight tails. Curled up tail (95.0 %) was the most observed tail shape in these goats. Curled down (4.0 %) tail shape was very minimal while straight tail shape (1.0%) was insignificant. The occurrence of tassel in the population of goats studied was very minimal; only 4.0 % of the goats had tassels while 96.0 % of them do not have it.

The most populous age group sampled was goats of 8 months; next to that were 36 months, that is, 3 years old goats. Given that this research was an exploratory field research, the animals sampled were many and came from an array of goat herds. The Red Sokoto goat is primarily used for meat (Peacock, 1996) as such most of these animals hardly reach their full peak potential for growth before being slaughtered for table meat. Most of the males left behind were mostly immature bucks. The 3 year old goats were mostly females as only few males are kept by herdsmen for breeding. The 48 month (4 years) old goats were mostly old pregnant females kept solely for breeding or milking

purposes (Peacock, 1996). In either case all coat types are used in the leather or hides and skin industry.

Hair type determines the fleece characteristics such as fleece texture and weight. Fleece which is the wool or hair type shorn at one time from a goat or any similar animal is used to make bags, garments such as jackets etc. Most of the goats sampled had the 'Short and Smooth' (SS) and 'Short and Rough' (SR) hair type, while the 'Long and Curly' (LC) type came in third. The ubiquitous nature of the SS hair type in Red Sokoto goats all over could be ascribed mainly to adaptations to the hot and humid climate of the tropics.

As is the characteristic features of a goat, the tail shape is usually pointed up, while a tail shape pointing down is usually adjudged to be a sign of illness that was not the case in my findings. Fen goats had the 'Curled Down' (CD) tail shape as against the 'Curled up' (CU) type and even fewer animals had the 'Straight" (S) type. Each animal's state of health was examined by veterinarians before being sampled so as not to misjudge the CD tail shape for illness (Peacock, 1996)

Tassels or wattles which are the loose, fold of bare skin hanging from the throat of the goats are the last indicator for production to be assessed.

More females were obviously sampled more than males. The buck has a shorter life span than a doe, simply because they are used for meat immediately they attain table weight. Only few bucks are kept for breeding purposes. The oldest male sampled was 1 year while the oldest female sampled was 4 years. Many does are kept for many years solely for breeding and milking purposes.

Table 1: Age distribution of Red Sokoto goats of 6 months and above in the studied herds

Age (months)	Observed	Frequency (%)
6	12	3.74
8	79	24.61
12	27	8.41
18	27	8.41
24	40	12.46
30	53	16.51
36	55	17.13
42	18	5.61
48	10	3.12
Total	**321**	**100**

Table 2: Distribution of Red Sokoto goats of 6 months and above of age according to coat type, hair type, tail shape and tassels

Attribute	Observed	Frequency (%)	N
Coat Type			321
Dark Red (DR)	24	7.5	
Brown (B)	142	44.2	
Light brown (LB)	82	25.5	
Brown and white (BW)	24	7.5	
White (W)	22	6.9	
Brown with white spots/streaks (BWS)	21	6.5	
White with black spots/streaks (WBKS)	5	1.6	
White with brown spots/streaks (WBS)	1	0.3	
Hair Type			321
Short-smooth (SS)	224	69.8	
Short-rough (SR)	59	18.4	
Long-curly (LC)	38	11.8	
Tail Shape			321
Curled up (CU)	305	95.0	
Curled down (CD)	13	4.0	
Straight (S)	3	1.0	
Tassels			321
Present	13	4.0	
Absent	308	96.0	

The distribution of the goats according to sex and haemoglobin type is presented in Table 3. There were 89.4% females and 10.6% males for goats at aged 6 months and above in the goat herds studied. Four haemoglobin types were identified from the population under study, HbAA, HbAB, HbBB and HbAC. The HbAB (58.22%) was the most frequent type followed by HbAA (30.52%) and HbaBB (10.33%). The frequency of HbAC (0.93%) in the studied population was very minimal.

The HbAB genotype was the most occurring genotype in the Red Sokoto goat population with 58.22% of the population positive for this genotype. The next populous was AA (30.52%) and BB (10.33%) came in last. The HbAC genotype which had only 0.93% of its member's positive for this type was negligible in our findings.

The four haemoglobin types observed, that is, HbAA, HbAB, HbBB and HbAC were similar to those documented by Huisman *et al.* (1969). The observation in this study that HbA moves faster than HbB and HbAB has both the A and B bands (double bands) plus the fact that the foetal haemoglobin HbC has a faster mobility than the two adult variants (A and B) agrees with the findings of other workers (Johnson *et al*., 2002; Das *et al*., 2004; Salako *et al*., 2007). Several authors have reported that HbC is always associated with incidence of anaemia due to illness and environmental stress (Salako *et al*., 2007).The low frequency of HbC emanating from only two animals could either be associated with this or error in reading the bands due to the band's weak and faint appearance or error due to poor resolution normally experienced for certain experimental protocols in electrophoresis. Deza *et al*. (2000) also recorded low frequencies of HbAC allele in the goats of Colon and Ischlin in Argentina.

The genotype results gotten were dissimilar to the results of Salako *et al.* (2002) and Das *et al.* (2004) who had greater population of HbBB genotypes in both Red Sokoto goats (50%) and Garole Sheep (97.3%) respectively. However, result here was similar to the one reported by Johnson *et al.*

(2002) for Omani goats which had 66% HbAB genotype in their population.

Generally, the overall results obtained could be as a result of the low population of bucks sampled in this study rather than a total absence of the genotype all together in the male gender.

Table 3: The Distribution of goats aged 6 months and above according to sex and haemoglobin type.

Attribute	Observed	Frequency (%)
Sex	321	
Male	34	10.6
Female	287	89.4
Haemoglobin Type (Hb)	213	
HbAA	65	30.52
HbAB	124	58.22
HbBB	22	10.33
HbAC	2	0.93

CONCLUSION AND RECOMMENDATIONS

The HbAB genotype was the most occurring genotype in the Red Sokoto goat population with 58.22% of the population. Hb type and other physical characteristics can serve as indicators for production.

Larger sample sizes can be use to investigate physical characteristics that are not so common such as tassels. Further work of this nature should be carried out on different breeds of goats and the results for each breed could then be compared with one another to find the trend in results.

REFERENCES

African Farming Magazine (1996). Alain Charles Publishing Ltd., London March/April. Pp. 9-11.

Das, D. K., Sinha, R., Dattagupta, R. and Senapati, P. K. (2004). Association of haemoglobin types with some mensuration and reproductive characteristics in Garole Sheep. Pp 382-384. *Indian Journal of Animal Sciences,* 74(4):382-384.

Deza C., Petrez, G. T., Gardenal, C. N., Valrela, L., Villar, M., Rubiales, S. and Barrioglio, C. (2000). Protein polymorphism in native goats from central Argentina. *Small Ruminant Research*, 35(3):195-201.

FAO/World Bank (2001). Farming systems and poverty: Improving farmers' livelihoods in a changing world. Washington, D.C.: Food and Agriculture Organization of the United Nations (FAO) and World Bank.

Henkes, L. E., Weimer, T. A. and Moraes, J. C. F. (1994). Genetic, Markers and the Fertility Gene (Fec') in a 3/4 Romney Marsh X 1/4 Merino Booroola Flock. *Small Ruminant Research*, 14:55-59.

Hoste, P. (1999). The creation of a dual purpose goat in Malaysia as a model case

for collaborative research and development. In: Wilson, R.T. and Azab, M. (Eds) *African Small Ruminant Research and Development*. ILCA, Addis Ababa, Ethiopia, Pp. 114-128.

Huisman T. H. S., Lewis, J. P., Blunt, M. H., Adams, H. R., Miller, A., Dozy, A. M. and Boyd, E. M. (1969). Haemoglobin C in new born sheep and goats; a possible explanation for its function and biosynthesis. *Paediatric Research*, 3:189-198.

Johnson, E.H., Nam, D. and Al-Busaidy, R. (2002). Observation of haemoglobin types in three breeds of Omani goats. *Veterinary Research Communications*, Netherlands, 26(5):353-359. Kluwer Academic Publishers.

NPC, (2006) National Population Commission, Abuja, Nigeria. www.nigeriannews.com/census/census2006.htm (Accessed on 5th December, 2018).

Ogungbile, A. O., Tabo, R., VanDuivenbooden, N. and Debrah, S. K. (1998). Analysis of constraints to Agricultural Production in the Sudan Savanna Zone of Nigeria using multi-scale characterization. *Wageningen Journal of life Sciences*, Volume 46 No 1.

Osuhor C. U., Alawa, J. P. and Akpa, G. N. (2002). Research note: Manure production by goat grazing native pasture in Nigeria. *Tropical Grasslands*, 36:123-125.

Peacock, C. (1996). *Improving Goat Production in the Tropics- A Manual for Development Workers*. Oxfam Publishers, FARM Africa.

Rim (1992). Nigerian livestock resources. Four volume report to the Federal Government of Nigeria by Resource Inventory and Management Limited: I. Executive summary and atlas; II. National synthesis; III. State reports; IV. Urban reports and commercially managed livestock survey report.

Salako, A. E., Ijadunola, T. O. and Agbesola, Y. O. (2007). Haemoglobin polymorphism in Nigerian indigenous small ruminant populations-preliminary investigation. *African Journal of Biotechnology*, 6(22):2636-2638.

SAS (2004). SAS/STAT User's Guide version 8.0 edition: Statistics, SAS Institute Incorporation, Cary, NC., USA.

Tella, M. A., Taiwo, V. O., Agbede, S. A. and Alonge, O. D. (2000). The influence of hemoglobin types of the incidence of babesiosis and anaplasmosis in West African Dwarf and Yankasa sheep. *Tropical Veterinary Journal*, 18:121-127.

Tewe, O. O. (1997) Post Harvest Technologies from Research Institutes and Universities in Nigeria. Compiled by Technological Vision organization (TECHNOVISOR) for the United Nations Development Programme. Oyo State June, Ibadan. Pg.72.