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Effect of Ecotype on Semen Characteristics of Sahel Goats in Borno State

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Abstract: A research was conducted to study the influence of ecotype on semen characteristics in 5 white and 5 brown ecotypes of sahel goats. Semen was collected from eight to forty-eight weeks of age and analyzed for semen characteristics and abnormalities. Body weights and scrotal circumference were also measured from three months to 1 year of age on a monthly basis. Analysis to determine the difference between the two ecotypes was performed. The only significant difference between the two ecotypes was in body weights, scrotal circumference and protoplasmic droplet abnormality. It was concluded that there was no superiority in the mean semen characteristics between the white and brown ecotypes of sahel bucks. This may be due to the total absence of coordinated breeding programmes evidenced by random indiscriminate mating in the goat population in Borno pastoral setting. This suggests that the conservation and preservation of most cherished traits are un-achievable under the current husbandry practices.

Key words: Sahel, bucks, ecotype, semen characteristics

INTRODUCTION

The goat *(Capra hircus)* is thought to have been the first animal to be domesticated for economic purposes. Goats are small ruminants descended from the species (*Capra oegragus*) (Williamson and Payne, 1984).

Immediately after domestication, physical differentiation into breeds and types began. Early changes affected the ears, horns, colour and hair type. These changes arose from natural mutation and from selection by goat keepers within the environment in which the goats were reared usually in relative isolation (Mason, 1984).

Early goat keepers must have selected for the production characteristics, which were appropriate to their needs. New blood lines probably entered goat populations when people migrated for economic reasons or in times of conflict, leading to intermediate less distinguishing goats called types or subtypes.

In the Savanna of West Africa, goats are basically of two types: the Sudan or Sahel goats in the sahel belt and the dwarf goats in tropical countries of the Guinea Coast and Congo. There are several varieties, subtypes on ecotypes of sahel goats occupying the sahel belt of present Nigeria. The variants are listed as Sokoto Red, Kano Brown, Borno White and Damagaram Dapple Grey (Kwari, 2001).

In other parts of the Sahel, four other different subtypes are distinguished: The Chad, Maure, Tuareg and Burkina faso (Gall, 1996), Each of these Sahelian ecotypes have unique featural distinction from each other.

In modern animal breeding, a breed is conceived as a defined population in which pure breeding is the rule and breeding animals registered by a breeding organization which also sets standards and may devise breeding plans and assist breeders in their execution (Gall, 1996). This is mainly limited to the industrialized countries, in the temperature zones of the world.

In contrast, most of the goat breeds in tropical countries do not belong to a breed in this sense and breeds do exist all the same and are recognized by their physical appearance and performance characteristics (Gall, 1996). It is in the light of the above that a comprehensive assessment of the already identified ecotypes and possibly evolving subtypes becomes imperative in this vast pastoral setting.

A breed develops by genetic isolation from a larger population, this is achieved by mating only with animals of the same breed and preventing mating with members of other breeds (Dalton, 1981). The acting force may be geographic isolation alone or combined with mans decision. This could be facilitated by isolation in valleys, remote areas or on islands. On the other hand, improved communications, transport and movement will favour the mixing of populations which is likely to occur on the fringes of their distribution areas (Peters, 1987).

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MATERIALS AND METHODS

The study was carried out in the Artificial Insemination unit of the Veterinary Teaching Hospital University of Maiduguri Borno State, Nigeria. The present research was carried out to study the influence of ecotype on semen characteristics in 5 white and 5 brown ecotype of Sahel goat from May, 2001 to February, 2002.

Experimental animals: Five white and 5 brown ecotype of Sahel breed of goats were selected for the experiment. The bucks were aged two months and were obtained from the University of Maiduguri Animal farm.

Management of the animals: The bucks were weighed and dewormed orally with Albendazole (R) at the dose rate of 3 mg kg^{-1} body weight at the start of the experiment. Thereafter they were dewormed after the rainy seasons. They were taken out to graze in the morning and afternoon and penned at night. The animals were fed groundnut leaves 1½ kg^{-1}, maize bran 500 g, beans husks 500 g, wheat bran 500 g, per head daily and water was given *ad libidum*.

Semen collection: Semen collection was carried out by electro ejaculation. Semen samples were collected in a graduated transparent collecting tube covered by an insulating jacket and kept in a water bath (37°C) for further evaluation.

Experimental design: Semen was collected three times at an interval of every four days every week from the age period of 8-12 weeks. After an interval of two weeks semen was collected three times every two weeks from both the white and brown ecotypes of Sahel bucks, up to forty-eight weeks of age.

Semen evaluation: Each ejaculate was evaluated as described by Zemjanis (1970). This included: Visual or gross evaluation of the ejaculate soon after collection in respect of volume, colour and presence or absence of foreign material and Microscopic examination of wave pattern, (gross motility), individual sperm motility, live-dead counts, sperm concentration and abnormal spermatozoa.

The volume was read from the graduated collecting tubes. Mass activity was estimated by examining a drop of raw undiluted semen on a prewarmed slide under a light microscope at x 10 magnifications. The estimate of the mass activity (gross motility of the spermatozoa) was made based on the vigour of the wave motion. This was assessed on a 0-5 scoring system. Scores from least active (+ 0 = 10 – 20%) to most active (+ 5 = 90-100%) was given to the wave motion of the spermatozoa according to the intensity of the swirling bands.

The percentage of spermatozoa with forward progressive motility was estimated by diluting a drop of semen with 4 drops of normal saline on a clean prewarmed 37°C glass slide and covered with a clean cover slip. Observation was done under high (x40) power magnification of a microscope (Howard and Pace, 1988) and colour changes were matched with the standard chart reflecting the pH values. A drop of semen was placed on the pH paper and immediate colour change or pH readings recorded.

The percentage of live spermatozoa was obtained by placing a drop of semen on a clean prewarmed glass slide and 2 drops of Eosin-nigrosin stain. This was mixed and a smear prepared from the mixture. Dead cells picked the stain, while live cells repel it (Moss *et al*., 1979). Two hundred cells were counted in different fields and an average calculated.

The abnormalities of the sperm cells were also assessed by examining the stained slide under (x100 power magnification) with oil immersion.

Sperm cell concentration was determined by using the haemocytometer method (Bearden and Fuquay, 1992). Semen sample was sucked into the red cell diluting pipette up to the 0.1 mark and the volume made up to the 101 mark with 10% formal saline followed by thorough mixing. By capillary action, the mixture was allowed to spread under the cover slip placed tightly on the haemocytometer after discarding few drops. The cells were allowed to settle before counting under (x40 power magnification). Sperm cells were counted in 5 smaller squares of the improved Neubauer haemocytometer and the concentration determined using the formula.

Number of sperm cells mL^{-1} = Number of sperm cells counted in 5 smaller squares $x5x10^4$ x dilution factor (Bearden and Fuquay, 1992).

Statistical analysis

The results were analyzed by standard ANOVA procedures.

RESULTS

A univariate analysis of the differences between the two ecotypes for each of the parameters in the study was performed to find where these differences lie. The result showed that only protoplasmic droplet, scrotal circumference and body weights exhibits significant difference between the two ecotypes (Table 1).

The variable that showed a difference between the two ecotypes were further examined. The means distribution of each of these variables over age is shown.

Table 1: Univariate analysis tests for equality of group means

	Wilks' Lambda	F-value	df1	df2	Sig.
Concen	1.000	0.000	1	98	0.994
Motility	1.000	0.002	1	98	0.963
Mass act	1.000	0.021	1	98	0.886
%Live	1.000	0.000	1	98	0.986
Volume	1.000	0.001	1	98	0.972
pH	1.000	0.000	1	98	1.000
CT	1.000	0.011	1	98	0.916
DH	0.999	0.058	1	98	0.810
LT	1.000	0.032	1	98	0.058
PD	0.952	4.909	1	98	0.029
SBT	0.998	0.157	1	98	0.693
RT	1.000	0.000	1	98	1.000
Scrotum	0.925	7.891	1	98	0.006
Weight	0.920	8.577	1	98	0.004

Table 2: Mean±SD for protoplasmic droplets between two ecotypes

	Ecotype			
	Brown (1)		White (2)	
Month	Mean	SD	Mean	SD
2.00	0.00	0.00	0.00	0.00
2.25	0.00	0.00	0.00	0.00
2.50	0.00	0.00	0.00	0.00
2.75	20.00	7.56	12.20	4.90
3.00	23.53	3.81	13.40	2.95
3.50	12.13	3.96	0.93	1.16
4.00	13.53	6.81	1.20	1.42
4.50	7.60	4.88	0.73	1.03
5.00	6.73	5.47	0.73	0.88
5.50	3.60	4.88	0.93	1.03
6.00	0.93	1.03	0.93	1.03
6.50	1.20	0.86	1.20	0.86
7.00	1.13	0.99	1.13	0.99
7.50	1.20	1.08	1.20	1.08
8.00	1.00	0.85	1.00	0.85
8.50	1.00	1.20	1.00	1.20
9.00	1.33	1.11	1.33	1.11
9.50	1.47	0.74	1.53	0.74
10.00	1.13	1.25	1.13	1.25
10.50	1.20	1.08	1.20	1.08
11.00	1.33	0.98	1.33	0.98
11.50	1.13	1.06	1.13	1.06
12.00	0.80	1.15	0.80	1.15

The brown ecotype has much higher protoplasmic droplets at an earlier age and this decreases much shower over the months in the period of study than that for the white ecotype. By six months of age, the protoplasmic droplets for the white ecotype have already become negligible approximately (Williamson and Payne, 1984) in value (Table 2).

The scrotal circumference for the brown ecotype is consistently higher than that of the white ecotype over the months of the period of study. The mean distribution of scrotal circumference over the months is shown in Table 3.

The body weight of the brown ecotype is consistently higher than that of the white ecotype over the period of study (Table 4).

The regression analysis shows that the growth pattern of the two ecotypes is linear over time and that the growth rate is the same 1.238 kg per month (Table 5).

Table 3: Mean±SD of scrotal circumference between two ecotype

	Ecotype			
	White (1)		Brown (2)	
Month				
2.00	Mean	SD	Mean	SD
2.25	-	-	-	-
2.50	-	-	-	-
2.75	-	-	-	-
3.00	8.38	1.50	10.54	2.83
3.50	-	-	-	
4.00	12.06	2.83	15.00	3.69
4.50	-	-	-	-
5.00	14.32	2.61	17.00	3.54
5.50	-	-	-	-
6.00	17.20	1.89	20.76	1.15
6.50	-	-	-	-
7.00	18.36	1.62	21.44	2.23
7.50	-	-	-	-
8.00	19.18	0.74	21.42	2.56
8.51	-	-	-	-
9.00	19.72	1.06	21.90	2.41
9.50	-	-	-	-
10.00	20.12	0.82	22.20	1.86
10.50	-	-	-	-
11.00	20.54	0.75	22.50	2.00
11.50	-	-	-	-
12.00	21.00	0.79	22.84	1.85

Table 4: Mean±SD of body weight between two ecotype

	Ecotype			
	White (1)		Brown (2)	
Month	Mean	SD	Mean	SD
2.00	-	-	-	-
2.25	-	-	-	-
2.50.	-	-	-	
2.75	-	-	-	-
3.00	8.72	1.99	10.88	1.68
3.50	-	-	-	-
4.00	10.06	1.99	12.86	2.16
4.50	-	-	-	-
5.00	13.50	3.97	14.94	2.20
5.50	-	-	-	-
6.00	13.32	2.07	16.58	2.60
6.50	-	-	-	-
7.00	15.50	1.73	18.86	3.48
7.50	-	-	-	-
8.00	16.74	2.15	18.68	3.01
8.52	-	-	-	-
9.00	17.44	1.57	20.34	3.49
9.50	-	-	-	-
10.00	18.18	1.66	20.86	2.88
10.50	-	-	-	-
11.00	19.04	2.20	21.40	3.11
11.50	-	-	-	-
12.00	19.82	1.99	22.10	3.13

Table 5: Comparative regression of growth pattern

Multiple regression analysis

Parameter	Estimate	SE	t-statistic	p-value
Constant	8.46227	0.693395	12.2041	0.0000
Age	1.23836	0.081295	15.233	0.0000
Group 2	-2.698	0.467004	-5.77725	0.0000

Analysis of variance

Source	Sum of squares	df	Mean square	F-ratio	p-value
Model	1447.15	2	723.577	132.71	0.0000
Residual	528.876	97	5.45233		
Total (Corr.)	1976.03	99			

R-Squared = 73.2354%

Table 6: Multiple regression of selected variable

Semen characteristics	Subset variable selected	R^2
Volume	Months (Age)	0.597
pH	Scrotum (Size)	0.157
Mass activity	Months (Age)	0.322
Motility	Months (Age)	
	Scrotum (Size)	0.717*
Concentration	Months (Age)	
	Scrotum (Size)	0.696*
Percentage live	Months (Age)	
	Scrotum (Size)	0.842*

The results of the subset variables selected (Table 6) shows that the semen characteristics associate mainly with age and scrotal size. Ecotype and body weights are less significant.

DISCUSSION

There was no significant difference in semen characteristics values between the brown and white ecotype of Sahel bucks. Though Karagiannidis *et al.* (2000) gave breed differences in semen characteristics between Alphine, Saaanen and Damascus bucks as may be due to differences in body weight. The same was not observed in this study, as though there were differences in body weight, the semen characteristics were not significantly different, probably due to different weights at birth. The findings of Ibrahim (1997) which stated that the breed of ram was without significant effect on semen characteristics, agree with the results of this study. There was significant difference in protoplasmic droplet abnormality between the brown and the white ecotypes of Sahel bucks with the brown ecotype having the higher number. This may be due to bigger scrotal size and body weight.

The bigger scrotal circumference seen in the brown ecotype may be due to the higher body weight as opposed to the white ecotype. This confirms the positive correlation between the body weight and scrotal circumference. The higher body weight of the brown ecotype than that of the white ecotype may be due to difference in bodyweight at birth. Testicular growth with increasing age is faster in young animals than adults, until the attainment of a breed average size that remains relatively constant in mature animals (Coulter and Foote, 1979).

At three months of age, the mean body weight was 8.72 kg for the white ecotype and 10.88 kg for the brown ecotype. By twelve months of age, the white ecotype had a mean body weight of 19.82 kg while the brown ecotype had 22.10 kg.

Adu *et al.* (1979) reported body weight at three months as 7-12 kg and at twelve months as 15-17 kg for the Red Sokoto breed of goats. The linear live weight gain seen in the male Sahel bucks was also reported in Yankassa lambs. Several factors influence the growth of young kids. These include: sex, type of birth, age of dam, birth weight, season of birth, parity and milk yield etc. (Adu and Ngere, 1979; Osinowo *et al.*, 1988; Afolayan *et al.*, 1999).

The less significant association of semen characteristics with ecotype and body weight may explain why there is no significant difference in semen characteristic between the brown and white ecotypes.

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