(Short communication)

Cytological screening of Nigerian ecotype goats for reproductive potentialities

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Abstract

X-chromatin (drumstick) screening evaluated through the identification of the drumstick appendages of neutrophils was carried on Nigerian goat breeds. 150 weaner bucks and 150 weaner does were used for the study. Some of the animals exhibited aberrant x-chromatin while some showed normal percentage of incidence of the drumstick. Both genotypes and sex differences had significant effect ($P < 0.05$) on the x-chromatin status of the weaner kids. Since the study showed abnormal significant effect for the occurrences of x-chromatin in genotype III (RSG x WAD), Genotype III design should not be used for reproductive purposes except on the ground of fattening for slaughter.

Keywords: Cytology, Goat, Crossbreeding Designs, Reproduction

Introduction

Ensminger (1991) identified problems acting against reproduction of some farm animals to include repeat breeding, still births, abortions, poor libido and poor semen quality. It has been documented in the study of ruminant and human infertility that chromosomal abnormalities are the major causes of infertility and parental losses of foetus. King (1983), Bhatia and Shauber (1984) suggested that much will be saved by farmers if animals with abnormal reproductive trait were identified and culled early. Studies have shown that at least 15% of all recognized pregnancies terminate in spontaneous abortions and that upto 10% of these are due to chromosomal abnormalities (Bove *et al.*, 1975). Cytology (X-

mammal. It is sex specific and is observed in the interphase nuclei of mammalian cells particularly with the females. The number in the female mammals indicates the same number present in the polymorphonuclea neutrophils (PMN'S) of the animals. Bhatia and Shauber (1983) established its absence in normal males or very negligible if present. Males showing the x-chromatin structure in large number (xxy or xxx) are often sterile. Studies of the population of some ruminants revealed that spontaneous abortion was associated with X- chromatin abnormalities (Popescue, 1980; Gustaveson, 1980). This suggests that infertility and abortion in mammals are due to the presence of X-chromatin in the polymorphonuclear neutrophil below or above the normal status.

From both reproduction and productive point of view; the use of X - chromatin techniques as a tool for screening our goats will assist farmers and breeders to reduce losses associated with developing dams for such reproductive purposes only to find out later that such dams are not fertile. The aim for animal production is the reproductive ability of such animal from which accounts the continuity of animal's meat, milk, egg and other products are sure.

This study was therefore, carried out in realization of the increasing need for animal protein in Nigeria, and with a view of recognizing and improving the reproductive capacities of Nigerian goat breeds through X-chromatin screening.

Materials and Methods

Study Area

The experiment was conducted at the Small Ruminant Multiplication and Replication Unit of the Enugu State University of Science and Technology, Abakaliki Campus, Nigeria. The area has the annual mean temperature of 30°C during the hot period (February - April) and 22°C during the cold period (May - January). The area has an annual rainfall range of 1600 to 1700mm. It also lies in the derived savannah region of the tropical environment.

Experimental animals, designs and management.

The experimental animals from which data were collected were kids of 12 week old (weaners). They were housed with their dams in standard block house with asbestos roofing sheets. Each pen measured 4 x 6m. The animals were routinely treated for internal and external parasites and maintained on the university pasture, field (Table 1). Supplementary concentrate ration was served at 4% body weight. Water was provided *ad-libitum*. The kids were identified by neck tagging and housed

at night. They were allowed to suckle their dams during grazing until 12 weeks of weaning. The kids were also separated by sex at weaning into different flocks. Data from 300 weaner kids raised by mating involving 12 sires and 12 does from each of the five genotypes between 1995 to 2000 were used for the study.

The kids (150 males and 150 females) were generated from the five mating procedures comprising: West Africa dwarf x West Africa dwarf of Savannah eco zones (WAD x WADS), F1, back crosses of F1 progeny does backcrossed to Red Sokoto buck = II, West African dwarf x Red Sokoto buck (WAD x RSG) = III, Red Sokoto x West African dwarf buck (RSG x WAD) = IV, Red Sokoto x Red Sokoto (RSG x RSG) = V.

Procedures for blood sampling and staining for X - chromatin isolation.

Five sterile syringes and hypodermic needles were used for the blood collection. Samples (4 slides per animal) were collected from the jugular vein of the goats (at the neck region). Different syringes were used on each animal to prevent mixing the samples. The samples collected were labelled and placed immediately in the collection tubes with anticoagulant (EDTA). In the laboratory, tiny drops of blood were dropped on a clean slides. The smears were allowed to stand for 8 minutes after which they were inundated with water and air dried. The slides were examined under microscope (x 100) using microscopic glass coverslip and Lenzol immersion oil. The incidence of drumstick appendages were evaluated by examining the slides per animal per 200 of polymorphonuclear neutrophils (PMN's).

Statistical Analysis

The data collected on each animal were analysed for the percentage of drumstick incidence. The parentage for drumstick value was calculated as

Table 1. The list of grass and browse plants in ESUT grazing field as well as concentrate feeds on which the experimental animals were fed.

Type/species	Common Name	Remarks/descriptions
(i) <i>Andropogon gayanus</i>	(Gambia grass)	Perennial late flowering grass
(ii) <i>Panicum maximum</i>	(Guinea grass)	Perennial early flowering grass.
(iii) <i>Hyperahenia rufa</i>	(Red thatching)	Annual late flowering grass
(iv) <i>Setaria barbata</i>	(Water grass)	Annual late flowering grass
(v) <i>Cynodon dactylon</i>	(African star)	Creeping perennials
B. Native Grasses		
(i) <i>Digeteria decubens</i>	Wolly finger grass	Annual flowering
(ii) <i>Sporobolus pyramidalis</i>	Pyramid drop grass	Perennial all year round flowering
(iii) <i>Pennisetum polstrachum</i>	(Mission grass)	Annual late flowering
(iv) <i>Pennisetum pupurem</i>	(Elephant grass)	Perennial late flowering
C. Legumes and other Browse Plants and Crops		
(i) <i>Calapogonium muconoides</i>	(Calapo)	Annual late flowering
(ii) <i>Centrosema pubescens</i>	(Centro)	Perennial late flowering
(iii) <i>Impomae batatas</i>	(Sweet potato)	Leaves/stems
(iv) <i>Manihot Sp</i>	(Leaves)	Leaves/browsed
(v) <i>Carica papaya</i>	(Pawpaw)	Leaves/browsed
(vi) <i>Lucaena leucocephala</i>	(Lucaena)	Leaves bark
(vii) <i>Gmellina arbori</i>	(Leaves)	Bark of soft stem.
D. Concentrate feed/Feed stuff		
(i) Poultry growers mash	(15.8% CP; 2, 659 Kcal/Kg M.E)	
(ii) Barbara nut chaff (dusa)	(17.0% CP; 2,659 Kcal/Kg	
(iii) Crushed maize	(8.80% CP; 2,659 Kcal/Kg	
(iv) Salt (common salt)		
(v) Crushed and roasted full fat soya beans.		

** Nutrient composition sourced from: The Nutritional Laboratory, A.B.U., Zaria (Aduku, 1998).

$$\% \text{ incidence} = \frac{\text{No of drumstick observed} \times 100}{\text{No of PMN's examined}/200 \text{ PMN}}$$

The values obtained were transformed into arcsin angles and then subjected to analysis of variance in (CRD) as described by Steel and

Torrie (1980). Treatment means were separated by the use of Duncan (1955) multiple range test. The model adopted represents: $Y_{ijk} = \mu + B_i + C_j + e_{ijk}$ where Y_{ijk} = dependent variable
 μ = Overall mean
 B_i = effect of the i^{th} genotype (i ... v)

C_j = effect of the j^{th} sex (j = male and female)

E_{tot} = random error

Results

The range of X-chromatin incidents observed in the study among the females is between 2.5 - 4.0% while the males exhibited the incident between 0.0 - 2.0%.

Table 2 shows the percentage incidents of drumsticks in each of the five genotype groups raised by the different cross breeding designs per 200 polymorphonuclear neutrophils (PMN's). The results show that sex has significant effect on the percentage occurrence of the drumstick in the PMN's ($P < 0.05$). Sex differences influenced x-chromatin status of the weaner kids ($P < 0.05$). The incidence was higher in the females than in the males ($P < 0.05$).

Furthermore, results show the mean values for the incidence on both the males and females for the six genotypes (Table 2). It indicated higher number of the incidence for genotype III while genotype IV and V had comparable mean values which are only higher than those from genotypes I and II. Similarly, the females had higher incidence (3.91 ± 0.40) than the males (2.68 ± 0.44). Finally, the results show that there were significant differences ($P < 0.05$) among the genotypes within a particular sex with the females maintaining the lead (Table 3).

Discussion

The percentage incidence of drumstick is low in some of the female kids ($P > 0.05$) when compared to 1.2% which has been reported as the minimum incidence for some normal females (Hare and Singh, 1976). Such cases of low incidence may be indicative of several abnormalities like mixoploidy or chimerism

where the dam has acquired both xx/xy chromosomes in a percentage tilting more or less to one of the sexes.

Similarly, Bhatia *et al.* (1982) recorded less than 0.5% per 200 PMN's drumsticks in female goats showing impaired fertility. The highest incidence of drumstick recorded by genotype III would have been enhanced by the high abnormal incidence recorded by the females. Bhatia *et al.* (1982) noted that low incidence (like some of the kinds in the study) reflects reduced reproductive potentialities; whereas the higher levels in some of the males predicts sub-fertility. The level observed in some of the weaner bucks (2.23 ± 0.08) however, are higher than the observation for goats by Bhatia and Shanker (1991). The significant differences observed in the genotypes reflects the impact of cross breeding on X-chromatin status for Nigeria goat breeds. The result did not corroborate the observation of the incidence in cows by Hare and Singh (1979), based on different breeds. The result also differed from the findings of Wehke (1999) who reported that females are more prone to drumstick aberration than the females. The result agreed with the incidents reported by Bhatia and Shanker (1983 and 1984) where X-chromatin status in normal mammal female was 2.59 - 3.60% per 200PMN's.

The major reasons for desiring to access the X-chromatin status of Nigeria goat breeds in different mating designs is that the results will provide us with the best genotype base on the best Crossbreeding strategy. Since the x-chromatin incidence is abnormally high for genotype III, largely contributed by the female component, other crossbreeding designs that reduced the incidence (normal) can readily be accepted.

Table 2: *Incidence of the X - Chromatin for the Six Goat Genotypes per 200 PMN's*

	<i>No. of Goat Kids screened by sex</i>		<i>Total No. of kids screened</i>	<i>No. of Drumsticks Observed</i>	<i>% of Drumstick per 200 PMN's</i>	<i>Aresin- Angle</i>
I. WAD x WAD	Male	10		7	0.5	4.05
	Male	10	30	0	0.0	0.00
Savannah ecozone	Male	10		0	0.0	0.00
	Female	10		7	3.5	10.78
	Female	10	30	5	2.5	9.10
	Female	10		6	3.5	9.98
	Male	10		0	0.0	0.00
	Male	10	30	0	0.0	0.00
II. F1 back crosses	Male	10		1	0.5	4.05
	Female	10		5	2.5	9.10
	Female	10	30	5	2.5	9.10
	Female	10		6	3.5	9.98
	Male	10		1	0.5	4.05
	Male	10	30	2	1.0	5.74
III RSG x WAD dams	Male	10		1	0.5	4.05
	Female	10		8	2.5	9.10
	Female	10	30	8	4.0	11.54
	Female	10		7	3.5	10.78
	Male	10		1	0.5	4.05
	Male	10	30	0	0.0	0.00
	Male	10		1	0.5	4.05
IV WAD x RSG bucks	Female	10		7	3.5	9.98
	Female	10	30	7	3.5	9.98
	Female	10		5	2.5	9.10
	Male	10		0	0.0	0.00
	Male	10	30	0	0.0	0.00
V RSG x RSG	Male	10		0	0.0	0.00
Sahel ecozone	Female	10		5	2.5	9.10
	Female	10	30	5	2.5	9.10
	Female	10		7	3.5	9.98

Table 3. Mean $\pm$ SE (Arcsin Angles) for the X - Chromatin Incidence (Drumstick) of the Male and Female Weaner Goat Kids from the Five Mating Designs (Genotypes)

Sex	Genotypes	Mating Designs				Overall Sex Mean $\pm$ SE
	I	II	III	IV	V	
Male	3.0 $\pm$ 0.96 ^b	1.90 $\pm$ 0.833 ^a	1.26 $\pm$ 0.66 ^a	4.28 $\pm$ 1.15 ^b	1.76 $\pm$ 0.85 ^a	2.68 $\pm$ 0.44 ^a
Female	2.67 $\pm$ 0.97 ^a	3.00 $\pm$ 0.95 ^b	7.98 $\pm$ 0.58	2.51 $\pm$ 0.75 ^b	3.42 $\pm$ 7.88 ^c	3.91 $\pm$ 0.46 ^c
	2.87 $\pm$ 0.8 ^b	2.45 $\pm$ 0.89 ^b	4.60 $\pm$ 0.62 ^d	3.40 $\pm$ 0.95 ^c	3.11 $\pm$ 0.87 ^c	

Mean values not with different superscripts along the same row (within a particular sex) are statistically different ($P < 0.05$).

Conclusions

The chromosomes status of Nigeria goat breeds has been found to be the same with those elsewhere and they possessed either normal or abnormal X- chromatin incidence. The result indicates that Nigeria goat breeds can be improved systematically and reproductively through routine screening and culling of females with aberrant x - chromatin since it will be reproductively wasteful.

Crossbreeding design (genotype) III should not be adopted by farmers or breeders since it is prone to high level of aberrant x - chromatin incidence.

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