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Semen Characteristics of the West African Dwarf Rams in The Southern Guinea Savannah of Nigeria

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Target Audience: Physiologists, Goat Producers, Researchers

Abstract

Studies were carried out on the semen characteristics of the West African Dwarf (WAD) rams in Makurdi. Semen samples were collected from five rams twice a week by electro-ejaculation method over a period of two months (September to October). The ejaculate volume, concentration, mass activity, progressive motility, the proportion of live/dead sperms, morphological normal sperms and the total sperm per ejaculate averaged 0.82 ± 0.05 ml, 0.57 ± 0.05 x 10^9/ml, 4.19 ± 0.09, 70.12 ± 13.7%, 81.29 ± 2.37%, 92.30 ± 0.58% and 0.48 ± 0.05 x 10^9 respectively. Spermatozoa abnormalities observed were: small heads, tapering heads, knobbed acrosome, detached heads, proximal cytoplasmic droplets, distal cytoplasmic droplets, bent midpiece, dag defect, coiled tails and bent tails. The percentage of morphological abnormal sperms (7.80±1.34%) was within the range for normal fertility. However, the semen volume and concentration appear to be lower in this breed in this environment. The correlations between body weight, scrotal circumference, sperm motility, sperm concentration, and sperm volume were positive, suggesting that body weight and scrotal circumference could be used to estimate semen quality in rams.

Key words: West African Dwarf rams Semen characteristics, Spermatozoa abnormalities, and environment.

Description of problem

The West African Dwarf (WAD) sheep is the predominant breed found in the area extending from the Southern Guinea Savanna to the very humid Atlantic Ocean Coast in the South [1]. They are relatively light sheep weighing between 25 and 45kg, exclusively kept for meat, and are also economically important because of their attachment to the Muslim faith [2]. Although they have remained genetically un-improved, they possess unique traits of adaptability to the environment in which they live [3]. These adaptability traits include hardiness and resistance to some local diseases like trypanosomiasis [4], ability to survive seasonal fluctuations in nutritional availability, and exhibit satisfactory growth and high prolificacy

irrespective of the harsh hot humid climate that characterize their home environment [3].

Although West African Dwarf sheep are known to breed all year round, their fertility characteristics have not been fully documented to facilitate effective genetic improvement by selection and crossbreeding at all levels of production. Osinowo [5] identified lack of experimental data on the reproductive physiology of the indigenous breeds as a serious constraint in the improvement of these breeds. Scrotal circumference (SC) and ejaculate characteristics may be used to study breeding soundness evaluation in the ram. It has been reported that fertility correlates positively with semen quality in rams [6]. The present study was therefore undertaken to obtain the baseline data on semen characteristics of the WAD in the Southern Guinea Savanna environment that may be used for the selection of proven rams for breeding and genetic improvement of this breed.

Materials and Methods

Study Location

The study was carried out in the small ruminant unit of the research farm, University of Agriculture Makurdi, which is situated at latitude 7^{o} 14 N and longitude 8^{o} 31E at a height of 90 meters above sea level [7]. The study location had earlier been reported to have distinct rainy and dry seasons [8].The rainy season starts in May and ends in October, while the dry season starts in November and ends in April. The annual rainfall ranges from 1270 to 1397 mm and average annual temperature ranges from 22.43^{o} C to 33.41^{o} C. Annual mean relative humidity has a value of 64.58% [7].

Experimental animals

Five healthy sexually mature WAD rams, weighing between 15.0 and 22.0 kg with ages between 1.5 and five years were used for this study. The animals were obtained from local markets within and around Makurdi town, and were allowed to acclimatize for two weeks before the commencement of the experiment. They were released to graze natural pasture between 0900 and 1600 hours daily and housed in pens overnight. The predominant grass species in the grazing land were *Andropogon gayanus*, *Andropogon schriensisi,Hyparrhenia involucurata, and imperata cylindrica.* Grazing was supplemented with maize offals and water was provided *ad libitum.*

Semen collection and evaluation

Semen samples were collected from each ram twice weekly (Tuesday and Fridays) between 0900 and 1000 hours by means of an electro-ejaculator [9]. The experiment lasted for two months (September and October, 2003).

The colour of the semen was assessed visually in the collection tube immediately after collection. The volume of ejaculate collected was read directly from graduated collection tubes. Progressive motility was examined immediately after collection by placing a drop of semen on a glass slide and

examining under a microscope at x 40 objective lense magnification Sperm concentration was determined using improved Neubauer haemocytometer. Total number of spermatozoa per ejaculate was calculated by multiplying of the sperm concentration and the semen volume. The proportion of live/dead spermatozoa was differentiated in smear preparations stained with Nigrosin-Eosin and counted as earlier described [10]. Morphological examinations of the sperms were determined from the slides stained for live/dead sperm ratios. 100 spermatozoa were evaluated per slide.

Results and Discussion

The ejaculate characteristics of the WAD rams are shown in Table 1. The observed semen volume was slightly higher than the 0.67 ± 0.12 ml reported by [10] in the WAD ram in Ibadan. The difference may be due to the technique of collection. However, [11] reported a semen volume of 0.80 ± 0.03 ml in Yankasa rams which is comparable to the semen volume of this study. Osinowo [12] reported a range of 0.3-1.2 ml in the Nigerian breeds. The sperm concentration obtained in this study was lower than the 1.82 $x10^9$/ml observed by [10] in the WAD rams, and much lower than the normal range of 2.0 x 10^9/ml to 6.0 x 10^9/ml reported by [13] in the temperate breeds. The low concentration recorded in this study may be attributed to low body weight, low testicular weight and the method of semen collection.

Table 1: Body weight, Scrotal circumference and Ejaculate Characteristics of the West African Dwarf rams (Means ± Sem)

Parameters	Mean ± SEM
Body weight (kg)	17.40 ± 0.81
Scrotal circumference (cm)	21.50 ± 0.61
Colour	Pale cream
Volume (ml)	0.82 ± 0.05
Mass activity (0-5)	4.14 ± 0.09
Progressive motility (%)	70.12 ± 13.73
Concentration ($x10^9$)	0.57 ± 0.05
Total spermatozoa/ejaculate ($x10^9$)	0.48 ± 0.05
Live sperms (%)	81.29 ± 2.37
Dead sperms (%)	18.76 ± 1.28
Morphologically normal sperms (%)	92.35 ± 0.58
Morphologically abnormal sperms (%)	7.80 ± 1.34

SEM = Standard Error of the Mean

Estimate of mean percentage progressive motility, percentage live and morphologically normal spermatozoa were comparable to reports of previous

workers [10, 14, 12] and within the range for good samples reported for temperate breeds [13]. The estimate of total spermatozoa/ejaculate value obtained in this study is within the accepted value of 60 x 10^6 spermatozoa necessary for good conception from a single natural service in sheep estimated by [15] and the minimum dose for artificial insemination necessary for normal conception rate of 120 to 125 x 10^6 estimated by Salamon [16]. The WAD rams in this environment may therefore, be considered suitable for natural mating or artificial insemination on the basis of sperm output per ejaculate obtained in this study.

Table 2: Sperm morphological abnormalities in the ejaculates of West African Dwarf ram (Mean ± SEM)

Abnormalities	**Mean ± Sem (%)**
Small head	0.35 ± 0.05
Tapering head	0.18 ± 0.04
Knobbed acrosome	0.20 ± 0.10
Detached head	1.41 ± 0.24
Proximal cytoplasmic droplets	0.70 ± 0.14
Distal cytoplasmic droplets	0.51 ± 0.11
Bent midpiece	0.93 ± 0.09
Dag defect	1.17 ± 0.09
Coiled tails	0.92 ± 0.23
Bent tails	1.37 ± 0.06

Morphologically abnormal sperm in the ejaculate of WAD rams are shown in Table 2.

Abnormal sperms have important consequences on quality of the spermatozoa and fertility as an excessive ratio of spermatozoa abnormalities indicates damage to the spermtogenic epithelium or pathologic conditions of the excretory duct system [17,18]. Baseline values of sperm morphological abnormalities for WAD rams recorded in this study were within the ranges for normal fertility reported by [13] for temperate breeds and in agreement with values reported by previous workers [19,20] for other Nigerian breeds.

Table 3 shows correlations between body weight (BW), scrotal circumference (SC), and ejaculate characteristics of WAD rams. The correlations between SC and BW, SC and sperm volume, SC and sperm concentration as well as SC and sperm motility were positive ($P < 0.05$). The same trend was observed between BW and SC, BW and sperm motility, BW and sperm volume, BW and sperm concentration.

Table 3: Correlations between body weight, scrotal circumference, and ejaculate characteristics of West African Dwarf rams

	BW	SC	SM	SPC	SV
Body weight	(BW)1.00				
Scrotal circumference	(SC) 0.97*	1.00			
Sperm motility	(SM) 0.65*	0.76*	1.00		
Sperm concentration	(SPC) 0.83*	0.84*	0.91*	1.00	
Sperm volume	(SV) 0.52*	0.70*	0.65*	0.49*	1.00

* Significant (P < 005)

The observed correlations between SC and sperm concentration, sperm motility, sperm volume are similar to the report of [21] in the WAD buck in the sub-humid region. The positive correlations suggest high viable spermatozoa per unit of testes and agree with the report of [22] that sperm production correlates highly with the testicular size. The result also suggests that BW and SC could be used to estimate semen quality in rams.

Conclusions

The results of this study shows that

1. The semen of WAD rams in the Southern Guinea Savannah is qualitatively similar to that of temperate breeds. Semen volume and concentration are lower in this breed than in temperate breeds.
2. The WAD ram is suitable for natural mating or artificial insemination on the basis of their sperm output.
3. Several important relationships among body weight, scrotal circumference and semen quality may be used to improve breeding soundness examination of rams.

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