SEASONAL VARIATIONS IN SEMINAL CHARACTERISTICS OF WEST AFRICAN DWARF SHEEP IN THE HUMID TROPICS

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(Received 14 July 1987; accepted for publication 15 January 1988)

ABSTRACT

Semen collected from six mature West African Dwarf (WAD) rams by artificial vagina, twice weekly for one year, early and late rainy season, and early and late dry season, showed no significant difference in volume of ejaculate and progressive motility of sperm. There was significant difference in sperm concentration, total sperm per ejaculate, total motile sperm per ejaculate and abnormal sperm.

Seasonal changes in characteristics of the semen were associated with seasonal changes in temperature, indicating the detrimental effects of heat, even on indigenous stock.

Key Words: Seminal characteristics, seasonal effects, ejaculate concentration, progressive motility.

INTRODUCTION

Season variations in the fertility of the sheep raised in the temperate environment, are well documented. Such variations included the decreased fertility associated with the high ambient temperature and the changes in the annual light cycle (Cups *et al.*, 1957). Dutt *et al.* (1957) reported the detrimental effects of environmental temperatures on the semen volume, sperm concentration, sperm motility and on the live/dead sperm ratio of ram semen. The interactions of breed, season and environmental temperature influencing reproductive activity of the Indian sheep breeds, have been studied (Mittal, 1980) as regards the physical characteristic of semen and the fructose and citric acid concentration. The literature on the reproductive activity of the West African Dwarf (WAD) sheep, is scanty, hence the need to undertake the seasonal pattern of semen production and the seminal characteristics of the WAD in its humid tropical environment.

MATERIALS AND METHOD

Location and Climate

This has been described elsewhere (Dede *et al.*, 1983). This year was divided into four, three-monthly seasons, namely early rainy season (April, May, June), late rainy season (July, August, September), early dry season (October, November, December) and late dry season (January, February, March). The physiological effective temperature (PET) was calculated according to Ingram (1965)

by weighting the dry-bulb and wet-bulb temperatures by 0.6 and 0.4, respectively.

Animals

Six sexually matured West African Dwarf (WAD) rams were trained to mount a dummy ewe for semen collection and evaluation. The rams, aged 2-3 years, had a body weight range of 45-70 kg. They were ejaculated twice weekly with the aid of artificial vagina throughout the year. Immediately after collection, semen was evaluated for concentration per millilitre of ejaculate with the aid of a haemocytometer slide after appropriate dilution.

Percent motile spermatozoa was estimated microscopically with a X40 magnification to the nearest 10% after dilution with 2.9% sodium citrate solution. Total volume of the ejaculate was determined with the graduated collection tube attached to the artificial vagina.

Semen smears on microscope slides were stained (Giemsa stain) and the percentage of abnormal spermatozoa per 200 spermatozoa was estimated. Simple correlation coefficients were calculated for the parameters, which were also used for the analysis of variance (Steel and Torrie, 1960) to determine the degree of significance.

RESULTS AND DISCUSSION

The seasonal variation in the seminal characteristics of the WAD rams, are as shown in Table 1. In general, the volume of semen was consistent except for a slight decrease during the early dry season (EDS). Also the progressive motility was not affected by season and so remained consistent throughout the year.

However, the sperm concentration was significantly ($P < 0.05$) affected by seasonal effects as manifested by a significant decrease during the late dry seasons (LDS). Hence there was a decrease in the total sperm per ejaculate and in the total motile sperm per ejaculate from the EDS to LDS of the year. Variations in the seminal abnormalities are as shown in Table 2. There were significant ($P < 0.05$) seasonal differences in the head, mid piece, tail and proximal droplet abnormalities of the WAD ram semen. These abnormalities increased from the EDS reaching a peak in the LDS with a decline during the Early Rainy Season (ERS). The decline in seminal characteristics is due to the adverse changes in mammalian spermatogenesis under thermally stressful conditions as reported for the rats (Chowdhurry and Steinberger, 1964, 1970) bull (Johnston *et al.*, 1953; Sekoni *et al.*, 1980, Dede *et al.*, 1983), boar (Christenson *et al.*, 1972; Egbunike *et al.*, 1979; 1980) buffalo (Gopalakrishna *et al.*, 1978) and for the temperate rams (Dutt *et al.*, 1957; Cupps *et al.*, 1980). While Gopalakrishna *et al.* (1978) reported significant differences in the per cent of abnormal sperm heads of buffalo bulls, they did not observe significant differences in the other seminal characteristics under tropical conditions. In this study the seasonal variation in seminal abnormalities were much lower than the figure obtained for the buffalo (Gopalakrishna *et al.*, 1978) and the Holstein/Friesian bulls (Dede *et al.*, 1983) under tropical conditions. This low figure for the WAD rams may be due to the fact that the rams are indigenous to the location of experiment and must have acclimatised to the environment over the years.

A summary of the correlation coefficient between the major parameters measured (Table 3) in this study, showed a high correlation between total motile sperm ejaculate and the the four major parameters of total sperm per ejaculate ($r = 0.92$) per cent motility ($r = 0.81$); concentration ($r = 0.90$) and volume ($r = 0.73$). Also, there were significantly high correlation between total sperm per ejaculate and the other three parameters of per cent motility ($r =$

Table 1
Seasonal variation of seminal characteristics of WAD rams in the humid tropics (Mean + S.E.)

	+ Seasons			
	April, May June (ERS)	*July, Aug., Sept., (LRS)*	*Oct., Nov., Dec., (EDS)*	*Jan., Feb., Mar., (LDS)*
Vol. (ml)	0.74 ± 0.18^{a}	0.67 ± 0.12^{a}	0.49 ± 0.16^{b}	0.64 ± 0.14^{a}
Motility (%)	69.77 ± 2.84	68.62 ± 1.51	68.44 ± 2.22	65.57 ± 2.79
Conc. (X 10^6)	1823.14 ± 79.83^{a}	1815.92 ± 81.17^{a}	1971.87 ± 120.87^{a}	1613.14 ± 77.57^{b}
Total Sperm/ejaculate (X 10^9)	1367.86 ± 112.13^{a}	1216.66 ± 63.07^{a}	1000.75 ± 86.97^{b}	1045.43 ± 100.55^{b}
Total motile sperm/ejaculate (X 10^9)	965.00 ± 89.98^{a}	833.65 ± 47.74^{a}	671.19 ± 38.43^{b}	676.0 ± 74.14^{b}

WAD = West African Dwarf.
Difference in the treatment groups were significant ($P < 0.05$).
+ Difference due to seasonal effects were significant ($P < 0.05$)
a-b Value in each row with a common letter or with no letter are not significant ($P < 0.05$).

Table 2
+ Seasonal Variation in abnormal seminal characteristics of WAD rams in the humid tropics (mean + SE)

	Abnormalities			
	Head (%)	Mid Piece (%)	Tail (%)	Proximal droplets (%)
Early Rainy Season	6.42 ± 0.81^{b}	1.07 ± 0.33	5.88 ± 0.51	1.21 ± 0.52
Late Rainy Season	6.52 ± 0.41^{b}	1.34 ± 0.20	4.78 ± 0.49^{b}	0.95 ± 0.35^{b}
Early Dry Season	8.37 ± 1.06^{a}	1.17 ± 0.31	0.82 ± 1.37	1.22 ± 0.42
Late Dry Season	9.12 ± 1.14^{a}	1.72 ± 0.42	7.14 ± 1.50^{a}	1.55 ± 0.76^{a}

WAD = West African Dwarf.
Difference in the treatment groups were significant ($P < 0.05$).
+ Difference due to seasonal effects were significant ($P < 0.05$)
a-b Value in each row with a common letter or with no letter are not significant ($P < 0.05$).

Table 3
Correlation coefficient (r) between the major seminal characteristics of WAD rams in the humid tropics

1.	Vol.	0.73^{x}	0.69^{x}	0.27	0.39	1
2.	Conc.	0.96^{xx}	0.82^{xx}	0.45	—	
3.	Motility	0.81^{xx}	0.55^{xx}	—		
4.	Total Sperm/ ejaculate	0.922^{xx}	—			
5.	Total motile sperm/ejaculate		—			

^{x} $P<0.05$, ^{xx} $P<0.01$

WAD = West African Dwarf.

0.55) concentration (r = 0.82) and volume (r = 0.69).

Variation in seminal characteristics with the seasons of the year are as represented in Fig. 1. These variations were significant $P<0.05$ as shown with the decrease in the volume during the ERS and a decrease in the total sperm per ejaculate and in the total motile sperm per ejaculate at the beginning of the dry season. These declines in seminal characteristics were associated with increased ambient temperatures. Nevertheless, the rams exhibited good seminal characteristics even during the dry season, hence they can be classified as continuous breeders as compared with temperate breeds of sheep, which are seasonal breeders.

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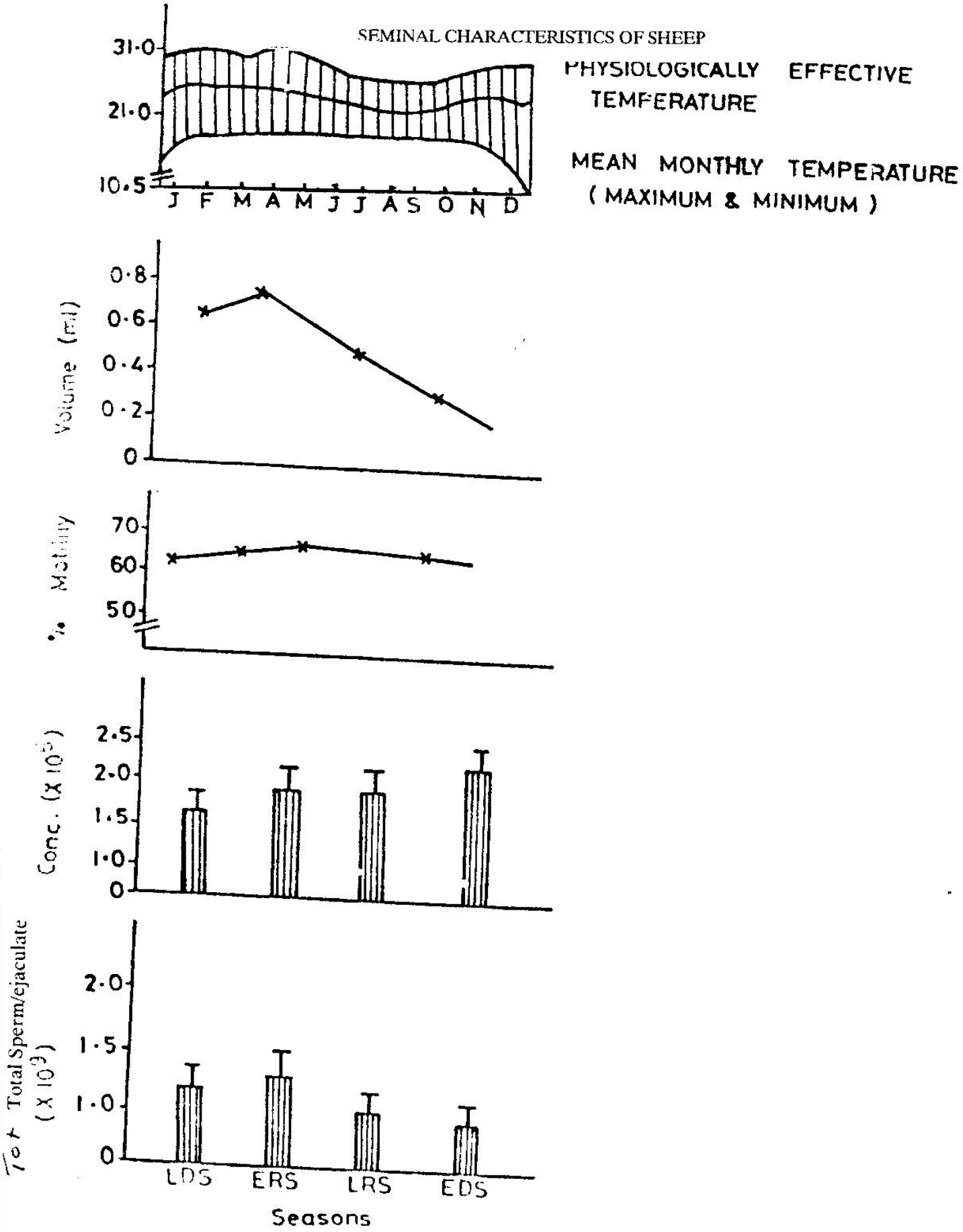

Fig. 1: Seasonal Variation in Seminal Characteristics in Relation to Major Climatic Parameters