

EFFECTS OF AGE AND TIME OF COLLECTION ON RAMS' SEMEN CHARACTERISTICS IN A HUMID TROPICAL ENVIRONMENT

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Summary

Two groups of three Yankasa rams aged 12-14 months (yearlings) and 24-48 months (adults) were used for this study. The animals were kept under semi-intensive management system. Scrotal circumference (SC) of rams were taken at the beginning and end of the experiment. The rams were ejaculated twice per day (AM and PM) every other day, for sixty days using an electroejaculator. The semen were evaluated after each collection for sperm concentration, percent sperm motility, percent live spermatozoa and percent sperm abnormalities.

Adult and yearling scrotal circumference were 22.0 ± 0.5 and 20.5 ± 0.5 cm, respectively. The mean sperm concentration, percent motility, percent live spermatozoa and percent sperm abnormalities for the two age groups (yearling and adults) were $2.07 \pm 5.33 \times 10^6$ /ml and $2.31 \pm 4.14 \times 10^6$ /ml; 72.06 ± 1.64 and 77.68 ± 0.98 ; 79.81 ± 1.72 and 85.03 ± 1.00 ; 8.33 ± 0.82 and 8.47 ± 0.67 , respectively. The Fisher's Least Significant Difference (LSD) showed that there was significant difference ($P < 0.05$) in age for the sperm concentration, while the percent sperm abnormalities was not significantly different. The adult rams were significantly superior in their semen characteristics compared to those of the yearlings.

The mean rams semen characteristics viz: sperm concentration, percent sperm motility, percent live-spermatozoa and percent sperm abnormalities at AM and PM were $2.28 \pm 4.75 \times 10^6$ /ml and $2.10 \pm 4.61 \times 10^6$ /ml; 77.50 ± 1.23 and 72.24 ± 1.39 ; 85.24 ± 1.20 and 79.60 ± 1.52 ; 6.94 ± 0.69 and 10.37 ± 0.81 for the two periods, respectively. Differences between the two periods of collection were significant ($P < 0.05$) for all the semen characteristics. Semen collected at AM were significantly superior in their characteristics compared to ejaculates collected at PM. This study therefore suggests that semen collection be done in the morning hour (7.00 – 10.00 am) from adult rams, since more yearlings will be needed per flock than older rams.

Introduction

The indiscriminate use of rams for mating without considering the age and the effect of ageing on potency has a high set-back on the future of sheep production and artificial insemination (A.I) in sheep. Some rams are used for breeding as early as 6 months of age and could be highly fertile at that

However, the testis size and total production of spermatozoa increases until about 18 months of age (at least 3 years in bulls). The high correlation between the size of the testes and total spermatozoa production (Rathje *et al.*, 1992) is a reflection of the gradual increases in testicular size with age. Cameron *et al.* (1985) attributed the increase in total sperm output per ejaculate with increasing ram age to be due to the increase in testicular size.

The period of semen collection could be influenced by various environmental factors such as management, seasons and ambient temperatures. These have varying effects on semen production. The provision of good housing in terms of adequate spacing, sheltering from environmental stress and exposure to exercise yard increase reproductive performance (Colas, 1983). Season of semen collection has significant effect on sperm concentration but not on semen volume and progressive motility in rams (Akpokodje *et al.*, 1988). According to Amann and Schanbacher

(1983), detailed longitudinal studies of changes in the pituitary-gonadal axis or of spermatogenesis with advancing age have not been made for domestic animals. The purpose of this study was to investigate the effect of age on sperm concentration, sperm motility, live-dead ratio, sperm morphology and to assess the effect of the period of semen collection on semen quality.

Materials and methods

The study was carried out at the Small Ruminant Unit of the Federal University of Technology Akure, Teaching and Research Farm. A total of six Yankasa rams were used for the study. Three were yearlings (12-14 months of age) while the other three were mature adult (above 24 months of age). The animal were managed under the semi-intensive system where they were taken out for grazing in the morning after semen collection and later brought back in the afternoon for the second semen collection. No supplementary feed was given.

Semen collection was done by electro-ejaculation every other day i.e. leaving a day in-between for a period of sixty days covering the spermatogenic circle (Bearden and Fuquay, 1980). The scrotal circumference was also measured at the beginning and end of the experiment using a measuring tape. The rams were ejaculated twice, that is in the

morning (AM) and afternoon (PM) on the day of semen collection. Semen was collected into graduated test-tubes in flask containing warm water (37°C) with which it was taken to the laboratory. The semen samples were analysed for the following characteristics: semen volume, sperm concentration, sperm motility, live-dead ratio and sperm abnormalities.

Semen volume was measured directly from the graduated test-tube but only used in concentration calculation due to established inconsistency of volume in electro-ejaculation method of collection. Sperm concentration was measured with an haemocytometer using the steps outlined by Sorensen (1979) and Bearden and Fuquay (1980). Sperm motility was estimated by observing the movement of the spermatozoa under the X40 objective microscope (Sorensen, 1979). Semen smears stained with eosin-nigrosin (Bearden and Fuquay, 1980) were made for live-dead ratio and sperm abnormalities. The percentage of normal morphology was determined by using the uncleared slides (Osinowo *et al.*, 1988), under the X40 objective microscope.

All parametric data, were subjected to analysis of variance (ANOVA) using MINITAB (V.10.1, Minitab Inc. USA) statistical package while comparisons between means were by Fisher's Least Significant Difference (LSD) (Steel and Torrie, 1980).

Results and discussion

The average SC of the rams at the beginning and end of the experiment were 22.67 ± 3.48 cm and 25.67 ± 3.84 cm; 27.67 ± 0.33 cm and 29.67 ± 0.33 cm for the yearling and adult rams respectively. The change in SC were 3.00cm and 2.00cm for the yearling and adult rams respectively for the period of study. The age of the animal significantly affected all the semen characteristics under study (Table 1). The higher sperm concentration, percent motility and live-spermatozoa observed in the adult rams were in line with other studies (Colas, 1983; Osinowo *et al.*, 1988; Rathje, 1992). However, the percent sperm abnormalities were higher in the yearling, albeit not significant. These significant effects of semen characteristics in relation to age have been attributed to the larger scrotal circumference in the adult rams. Semen characteristics increase appreciably with increase in scrotal size (Amann and Schanbacher, 1983). The low sperm production in yearling rams as compared with older rams corroborates the work of Osinowo *et al.* (1988) which showed significant differences between yearling and adult rams semen for ejaculate volume, sperm concentration, sperm motility and total sperm output per ejaculate except for percent morphologically normal sperm. Unlike most of these workers, the reports by Garner *et al.*

(1996) revealed that there was no significant change in sperm concentration, sperm number per ejaculate and sperm motility for the yearling and mature bulls with the exception of ejaculate volume.

The observed higher increase in scrotal circumference in the yearling rams than in the adult though not significant, is expected. This can be attributed to the fact that the yearling rams are still in the early stage of growth during which the growth of various body parts are occurring at a faster rate. The observed smaller rate of change in scrotal size of the adult rams is in line with the report of Harman (1981), corroborated by Rastogi (1990) showing that as organisms mature in age, there is progressive decline in vital capacities, terminating in death. Therefore, from this result it could be seen that the small scrotal circumference of the yearling rams could be responsible for their poorer semen characteristics compared to those of the adult rams.

The period of collection effect were significantly different ($P < 0.05$) in all the sperm characteristics studied. The observed differences in semen characteristics (concentration, percent motility, percent live-spermatozoa and percent sperm abnormalities) in relation to the period of collection in the both the yearling and adult rams could be due to the effects of environmental factors on sperm production and sperm metabolic activities. The spermatozoa concentration, percent motility, percent live-spermatozoa and sperm abnormalities were highest in the morning (AM) collections. These superior spermatozoa (semen) characteristics in the AM ejaculates can not be easily explained. However, this superiority could be attributable to a number of factors of the environment. First, in the AM collections the animals have just passed through the cool night and this probably explains the superior semen characteristics in the AM collections. Whereas in the afternoon (PM) collections in addition to probable uncontrolled sexual encounters, high ambient temperatures could exert stress on the animal which could adversely affect sperm qualities. This is in line with the report of some workers which have shown that increased ambient temperature decrease sperm production and modifies the characteristics of sperm (Rathore, 1970; Wettemann *et al.*, 1978; Lincoln and Short, 1980). However, the degree of change in semen characteristics is dependent on the duration and intensity of the thermal stress (Rathore, 1970).

Conclusion

This study showed that the age of ram and period of semen collection significantly affect most of the semen characteristics in rams. The semen characteristics were better in adult than in yearling rams and that semen collected in the morning (AM) were significantly superior in their characteristics

seminal fluid collected in the afternoon (PM) in both sexes. It is therefore suggested that semen collection be done in the morning hour when the climate is cool and should be done with adult rams, though yearling rams could be used on the basis of their

sperm output per ejaculate (Osinowo *et al.*, 1988) since more yearlings will be needed per flock than older rams. Further studies are suggested to establish the ideal time of the day for semen collection in rams under tropical conditions

Table 1: Effect of age and period of collection on some semen characteristics (Mean $\pm$ SE)

Semen characteristics	Period of collection	Age		Mean
		Yearling	Adult	
Sperm concentration ($\times 10^9$ /ml)	A.M.	2.18 $\pm$ 0.53 ^a	2.39 $\pm$ 0.42 ^a	2.28 $\pm$ 0.48*
	P.M.	2.00 $\pm$ 0.52 ^b	2.24 $\pm$ 0.41 ^d	2.10 $\pm$ 0.46
	Mean	2.07 $\pm$ 0.52	2.31 $\pm$ 0.41 ^c	4.39 $\pm$ 0.91
Progressive motility (%)	A.M.	73.96 $\pm$ 1.66 ^a	81.04 $\pm$ 0.80 ^c	77.50 $\pm$ 1.23*
	P.M.	70.16 $\pm$ 1.62 ^b	74.32 $\pm$ 1.15 ^d	72.24 $\pm$ 1.39
	Mean	72.06 $\pm$ 1.64	77.68 $\pm$ 0.98	149.74 $\pm$ 2.62
Spermatozoa (%)	A.M.	81.90 $\pm$ 1.67 ^a	88.58 $\pm$ 0.73 ^c	85.24 $\pm$ 1.20*
	P.M.	77.72 $\pm$ 1.77 ^b	81.48 $\pm$ 1.27 ^d	79.60 $\pm$ 1.52
	Mean	79.81 $\pm$ 1.72	85.03 $\pm$ 1.00	164.84 $\pm$ 2.72
Sperm abnormality (%)	A.M.	7.33 $\pm$ 0.80 ^a	6.54 $\pm$ 0.57 ^c	6.94 $\pm$ 0.69*
	P.M.	10.33 $\pm$ 0.84 ^b	10.41 $\pm$ 0.77 ^d	10.37 $\pm$ 0.81
	Mean	8.83 $\pm$ 0.82	8.47 $\pm$ 0.67	17.31 $\pm$ 1.50

a, c, d means along the same column with different superscripts differ significantly ($P < 0.05$)

* Overall mean of each semen characteristics during AM collections were significantly ($P < 0.05$) superior.

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