

## Studies on seminal attributes of Patanwadi rams during breeding and non-breeding seasons\*

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### ABSTRACT

Semen ejaculates (90) collected in artificial vagina from 5 mature Patanwadi rams covering breeding and non-breeding seasons (one year) were evaluated for the biophysical attributes. The overall means of various seminal attributes observed were: ejaculate volume  $0.91 \pm 0.11$  ml, mass activity  $3.80 \pm 0.09$ , pH  $6.97 \pm 0.02$ , sperm concentration  $2730.44 \pm 50.50$  million/ml, live sperm count  $88.49 \pm 0.54$  %, morphologically abnormal sperms  $5.93 \pm 0.12$  % and abnormal acrosome score  $4.57 \pm 0.13$  %. Variation between rams was highly significant ( $P < 0.01$ ) for volume and pH and significant ( $P < 0.05$ ) for all other attributes. The effect of season and ram x season interaction was however, non-significant for all the attributes, except mass activity, which was higher ( $P < 0.05$ ) during non-breeding season ( $3.93 \pm 0.14$  vs.  $3.67 \pm 0.12$ ). The ejaculate volume had significant negative correlation with mass activity ( $-0.226$ ) and positive correlation with abnormal sperm % ( $+0.211$ ). The mass motility was significantly correlated with sperm concentration ( $+0.619$ ) and live sperm % ( $+0.568$ ) and negatively with pH ( $-0.588$ ). Seminal pH had significant negative correlation with sperm concentration ( $-0.882$ ) and abnormal acrosome score ( $-0.229$ ). These findings suggested that Patanwadi rams donate good quality semen throughout the year that is suitable for use in artificial breeding programme.

**Key words:** Patanwadi ram, Season, Seminal attributes, Interrelationships.

### INTRODUCTION

Sheep husbandry provides lifeline to the downtrodden farmers from the desert and hilly tract of our country. Patanwadi sheep is a superior carpet wool breed with best survivability in the semi-arid zone of Gujarat State. Hence conservation of superior germplasm of this breed in frozen state and its propagation through AI technique is the present day need. In spite of seasonality in the breeding behaviour in sheep, good quality semen, suitable for breeding purpose has been obtained from indigenous and

halfbred rams throughout the year (Sahni and Roy, 1969; Tiwari, 1978; Kakadia, 1993; El-Malak *et al.*, 1999; Janett *et al.*, 2001). Scanty literature is available on the quality of Patanwadi ram semen (Patel and Dugwekar, 1999) and effect of breeding or non-breeding season (Dabas *et al.*, 1997). Hence, the present study was conducted to evaluate the effect of season on the quality of semen of Patanwadi rams managed under the semi-arid climate of Gujarat.

### MATERIALS AND METHODS

The study was conducted on 5 mature Patanwadi rams maintained under a semi-intensive system at AICRP centre on Sheep breeding, GAU, SKNagar, North Gujarat. The monthly maximum and minimum air temperature varied from 27.38

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to 40.70°C and 10.10 to 27.30°C, respectively. The rams were sheared twice a year during winter and summer followed by dipping, while, deworming was done before and after monsoon.

Semen collections were taken in separate AVs with collection cups at weekly interval from each ram during breeding (12th April to 21st May and 16th August to 14th September) and non-breeding (rest of the period) seasons. Immediately after collection, the cups were kept at 30°C in water-bath and semen samples were subjected to routine macro/microscopic evaluation (Herman and Madden, 1953). The pH was recorded with the help of a mono-electrode pocket digital pH meter. Sperm concentration was determined against graph plotted calibrated with haemocytometric method using Systronic spectrophotometer. Live and abnormal sperm percentages and acrosomal abnormalities were estimated using modified eosin-nigrosin (Blom, 1950) and Geimsa (Barth and Oko, 1989) staining techniques, respectively, under oil immersion lens. The data were subjected to statistical analysis using standard 2-factors factorial CRD and correlation matrix among biophysical attributes of semen was worked out (Snedecor and Cochran, 1986).

## RESULTS AND DISCUSSION

The ram- and season-wise mean biophysical attributes of Patanwadi semen are presented in Table 1 and correlation coefficients are given in Table 2. The mean ejaculate volume observed was 0.94±0.03 (range 0.5 to 1.4) ml, which varied significantly ( $P < 0.01$ ) between rams. Similar ejaculate volume was recorded earlier (Sahni and Roy, 1969; Mehta *et al.*, 1972; Saxena *et al.*, 1978; Patel and Dugwekar, 1999) in indigenous breeds of rams. However, Mittal and Ghosh (1981) and El-Malak *et al.* (1999) recorded higher value (1.45 and 1.17 ml) in Marwari and Awassi rams, respectively. Ejaculate volume was non-significantly higher during breeding than non-breeding season, as has been reported by Dabas *et al.* (1997) in Patanwadi and Karagiannidis *et al.* (2000) in other breeds. However, Chahal *et al.*

(1979) recorded significant seasonal variation in ejaculate volume in Corriedale rams. Taha *et al.* (2000) reported significantly higher ejaculate volume during summer than in other months in Barki and Awassi rams.

All the traits differed significantly between rams, and only the mass activity between seasons.

Means carrying similar superscript in a row do not differ significantly.

The mass activity of Patanwadi ram semen averaged 3.80±0.09, with significant ( $P < 0.05$ ) individual variation. These results are in agreement with the findings of Kakadia (1993) and Patel and Dugwekar (1999) in Patanwadi rams. However, Mehta *et al.* (1972) recorded higher values in Malpura breed. The mass activity score was significantly ( $P < 0.05$ ) lower in breeding season as compared to non-breeding season (3.67±0.12 vs 3.93±0.14) and was in agreement to the reports of Singh *et al.* (1976), Simplicio *et al.* (1981) and Karagiannidis *et al.* (2000). However, Dabas *et al.* (1997) found higher mass activity during breeding season in Patanwadi ram semen.

The mean pH of Patanwadi ram semen were 6.97±0.02 (range 6.55-7.40), and it varied highly significant ( $P < 0.01$ ) between rams. This was in close agreement with the reports of Nivsarkar *et al.* (1973) and Kakadia (1993) for indigenous breeds. However, lower pH values in indigenous breeds (Mehta *et al.*, 1972; Tiwari 1978; Dabas *et al.*, 1997) and higher (7.14) in Brazillian woolless rams (Souza and Costa, 1991) have been reported by others. The mean pH values in breeding and non-breeding seasons were identical. Dabas *et al.* (1997) and Kutty and Mathew (2000), however, found significant seasonal variation in seminal pH of rams and bucks, respectively.

The sperm concentration of Patanwadi rams ranged from 1800 to 3600 million/ml with a mean of 2730.44±50.50 million/ml, and with significant individual variation ( $P < 0.05$ ). These findings corroborated with the reports of Sahni and Roy (1969), Mittal and Ghosh (1981) and Patel and Dugwekar (1999) in indigenous breeds, Simplicio *et al.* (1981) in Brazillian Somali and Taha *et al.* (2000) in Awassi breeds. However, Dabas *et al.*



**Table 1. Biophysical attributes of Patanwadiram semen as influenced by season and individual (Mean  $\pm$  SE)**

Physical attributes	Individual Patanwadi ram number					Overall (n = 90)	Season	
	P1 (n=18)	P2 (n=18)	P3 (n=18)	P4 (n=18)	P5 (n=18)		Breeding (n= 48)	Non- Breeding (n = 48)
Ejaculate volume (ml)	0.92 <sup>a</sup> $\pm 0.05$	0.94 <sup>a</sup> $\pm 0.05$	0.74 <sup>b</sup> $\pm 0.04$	1.06 <sup>a</sup> $\pm 0.08$	1.02 <sup>a</sup> $\pm 0.07$	0.94 $\pm$ 0.03	0.97 $\pm$ 0.03	0.90 $\pm$ 0.37
Mass activity (Score 0-5)	3.44 <sup>b</sup> $\pm 0.12$	4.39 <sup>a</sup> $\pm 0.16$	3.44 <sup>b</sup> $\pm 0.12$	4.61 <sup>a</sup> $\pm 0.12$	3.11 <sup>b</sup> $\pm 0.16$	3.80 $\pm$ 0.09	3.67 <sup>b</sup> $\pm 0.12$	3.93 <sup>a</sup> $\pm 0.14$
Seminal pH	7.14 <sup>a</sup> $\pm 0.03$	6.89 <sup>b</sup> $\pm 0.02$	7.09 <sup>a</sup> $\pm 0.04$	6.84 <sup>b</sup> $\pm 0.03$	6.88 <sup>b</sup> $\pm 0.03$	6.97 $\pm$ 0.02	6.99 $\pm$ 0.03	6.95 $\pm$ 0.25
Sperm count (million/ml)	2230.0 <sup>b</sup> $\pm 64.1$	2994.4 <sup>a</sup> $\pm 63.4$	2064.4 <sup>a</sup> $\pm 168.4$	3127.8 <sup>a</sup> $\pm 80.4$	2955.6 <sup>a</sup> $\pm 76.4$	2730.4 $\pm 50.5$	2684.4 $\pm 70.9$	2776.4 $\pm 72.3$
Live sperm (%)	90.36 <sup>b</sup> $\pm 0.57$	91.33 <sup>ab</sup> $\pm 0.67$	86.88 <sup>c</sup> $\pm 1.09$	92.47 <sup>a</sup> $\pm 0.27$	82.52 <sup>d</sup> $\pm 0.86$	88.49 $\pm 0.54$	88.34 $\pm 0.70$	89.09 $\pm 0.73$
Abnormal sperm (%)	5.90 <sup>a</sup> $\pm 0.23$	5.63 <sup>b</sup> $\pm 0.27$	5.72 <sup>b</sup> $\pm 0.26$	5.50 <sup>b</sup> $\pm 0.25$	6.88 <sup>a</sup> $\pm 0.26$	5.93 $\pm$ 0.12	5.86 $\pm$ 0.70	6.00 $\pm$ 0.17
Abnormal acrosome (%)	4.17 <sup>b</sup> $\pm 0.23$	4.24 <sup>b</sup> $\pm 0.30$	4.41 <sup>b</sup> $\pm 0.31$	4.42 <sup>b</sup> $\pm 0.28$	5.60 <sup>a</sup> $\pm 0.26$	4.57 $\pm$ 0.13	4.56 $\pm$ 0.19	4.57 $\pm$ 0.19

(1982), Mathur *et al.* (1989) and Janett *et al.* (2001) reported higher sperm concentration in pure indigenous and exotic breeds of ram. Others (Singh *et al.*, 1976; Simplicio *et al.*, 1981; Karagiannis *et al.*, 2000), however, recorded significant seasonal variation in this trait in different breeds, although classification of season was quite different in these reports than the present one. The present difference may be attributed to breeding stress, over and above the ejaculate donations for study, as the rams were also allotted for project breeding plan.

The live sperm percentage in Patanwadi ram semen averaged  $88.49 \pm 0.54$  (range 76.19-94.97), with significant individual variation ( $P < 0.05$ ). This finding confirmed the reports of Singh *et al.* (1976) and Patel and Dugwekar (1999) in Nali and Patanwadi breeds, respectively. However, Sahni and Roy (1969) and Janett *et al.* (2001) observed comparatively lower percentage of live sperm in other breeds of ram. The mean live sperm per cent in breeding and non-breeding seasons

were identical in rams under study. These findings supported the report of Mittal and Ghosh (1981), however, Dabas *et al.* (1997) and Patel and Dugwekar (1999) found significant seasonal influence over this attribute in Patanwadi rams. The mean percentage of abnormal sperm ( $5.93 \pm 0.12$ ) and significant individual variation observed in Patanwadi rams corroborated with the reports of Kakadia (1993), Dabas *et al.* (1997) and Patel and Dugwekar (1999) in the same breed. Mittal and Ghosh (1981), Dabas *et al.* (1982) and Souza and Costa (1991) and Janett *et al.* (2001), however, found either higher or lower values for morphologically abnormal sperm in exotic and/or indigenous breeds of ram. The values of abnormal sperm in breeding and non-breeding seasons were almost same and agreed to the findings of Kakadia (1993) and Patel and Dugwekar (1999) in Patanwadi rams and of Sahni and Roy (1969) and Mittal and Ghosh (1981) in other breeds. Contrary to this, Dabas *et al.* (1997) observed significantly higher abnormal sperm per cent during non-

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**Table 2. Correlation matrix (r) of seminal attributes in Patanwadi sheep**

Seminal attributes	Ejaculate Volume (ml)	Mass activity (Score)	Semen pH	Sperm Count (million/ml)	Live sperm (%)	Abnormal sperm (%)
Mass activity	-0.226*					
PH	0.099	-0.588**				
Sperm count	-0.124	0.619**	-0.882**			
Live sperm	0.065	0.568**	-0.126	0.119		
Abnormal sperm	0.221*	-0.184	-0.181	0.068	-0.131	
Acrosome score	0.144	-0.144	-0.229*	0.104	-0.152	0.815**

N = 90, \*P &lt; 0.05, \*\* P &lt; 0.01

breeding season in Patanwadi rams.

The mean acrosomal abnormality score was  $4.57 \pm 0.13$  % (range 2.0-7.93), which varied significantly ( $P < 0.05$ ) between rams. Dabas *et al.* (1982) and Kakadia (1993) also reported similar values of abnormal acrosome scores in different breeds, while Janett *et al.* (2001) recorded much higher values. The values in breeding and non-breeding seasons were identical in the present study.

The ejaculate volume was significantly ( $P < 0.05$ ) and negatively correlated with mass activity (-0.226) and positively with sperm abnormalities (0.221; Table 3). Similar but non-significant correlations have also been reported by Kakadia (1993) and Patel and Dugwekar (1999) in Patanwadi ram semen. Mass activity had highly significant negative correlation with pH (-0.588) and positive correlations with sperm concentration (0.619) and live sperm (0.568). Kakadia (1993) reported similar correlations in Patanwadi semen, while Patel and Dugwekar (1999) found these correlations to be non-significant in the same breed. Chahal *et al.* (1979) and Wahid (1988) reported significant positive association between mass activity and live sperm percent. Seminal pH was significantly and negatively correlated with sperm concentration (-0.882,  $P < 0.01$ ) and abnormal acrosomal score (-0.229,  $P < 0.05$ ). The morphological sperm abnormalities had highly significant positive correlations with abnormal

acrosomal score (0.815,  $P < 0.01$ ) and ejaculate volume (0.211,  $P < 0.05$ ), as reported by Kakadia (1993) in the same breed. The results indicate that Patanwadi rams donate semen of good quality uniformly under semi-arid climate of North Gujarat without seasonal influence or ram x season interaction with obvious significant interrelationships among its biophysical attributes.

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