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SEMEN CHARACTERISTICS OF SAHIWAL BULLS IN RELATION TO AGE AND SEASON

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ABSTRACT

This study was undertaken to investigate the effects of age and season on the semen quality of 21 Sahiwal bulls kept under similar managemental conditions at the Semen Production Unit, Qadirabad, District Sahiwal. These bulls were divided into 3 age groups i.e. group-I (upto 3 years), group-II (3-5 years) and group-III (above five years). Semen from experimental bulls was collected weekly and evaluated for physical characteristics including ejaculatory volume, mass activity, motility percentage, pH, sperm concentration, post-thaw motility and the number of doses produced per ejaculate. Depending on the photoperiod, months of the year were grouped into 4 seasons i.e. Winter (November, December, January), Spring (February, March, April), Summer (May, June, July) and Autumn (August, September, October). The results indicated that ejaculatory volume, motility percentage and doses produced by bulls of group-II were significantly higher($P<0.05$) than that of bulls of group I and III. However, mass activity, sperm concentration, pH and post thaw motility differed non significantly among bulls of three age groups. Generally all bulls showed better performance during Spring than other seasons of the year. It may be concluded that semen collected from mature bulls (adult bulls) is of better quality than the semen of young and old bulls and also in Spring the quality of semen is better than the other seasons of the year.

Key words: Shaiwal bulls, semen characteristics, age, season.

INTRODUCTION

Semen quality and quantity of breeding bulls is influenced by several non-genetic factors including age of the bulls and season of the year. Semen quality improves with increasing age of bulls (Barbosa *et al*., 1991). High ambient temperature during Summer adversely affects testicular size, libido and semen quality (Soderquist *et al*., 1996). Similarly, epididymal spermatozoa are adversely affected by elevated testicular temperature, resulting in a decreased ability of spermatozoa to maintain motility and acrosomal integrity after freezing (Vogler *et al*., 1991).

In Pakistan, research work on semen production of Sahiwal bulls with respect to age and season has been done in segments, yet comprehensive information about the influence of these and other factors on semen production/quality in Sahiwal bulls is lacking. The present study was, therefore, carried out to investigate semen quality in different seasons and age groups of Sahiwal bulls maintained at the Semen Production Unit, Qadirabad, District Sahiwal.

MATERIALS AND METHODS

Animals

A total of 21 adult bulls of Sahiwal breed with clinically normal reproductive tract and maintained under similar managemental conditions at the Semen Production Unit, Qadirabad, District Sahiwal were used in this study. These bulls were divided equally into three age groups i.e. group-I (upto 3 years of age), group-II (3-5 years of age) and group-III (above 5 years of age).

In order to determine the effect of season on various seminal attributes, months of the year were grouped into four seasons based on the photoperiodicity i.e. Winter (November, December, January), Spring (February, March, April), Summer (May, June, July) and Autumn (August, September, October).

Semen collection and processing

Semen from experimental bulls was collected once a week with the help of an artificial vagina, using an intact bull as a teaser. Two ejaculates per animal were collected on each collection day. Immediately after

collection, each ejaculate was kept at 37°C and evaluated for physical characteristics including ejaculatory volume, mass activity, motility percentage, pH and sperm concentration, following the method described by Settergen (1967). Semen samples were diluted at 37°C by slow and one step dilution method, and the straw method of freezing was adopted, as described by Ahmad *et al.* (1980). The frozen straws were then transferred to liquid nitrogen storage containers. For the evaluation of frozen semen, four straws of semen from each bull were thawed at 37°C for 15-20 seconds in a water bath, the semen was pooled and examined for post thaw motility. Number of doses produced by each bull was also recorded.

Statistical analysis

Mean values (± SE) were computed for various parameters of semen quality with regard to various groups. The data were subjected to analysis of variance under completely randomized design (Snedecor and Cochran, 1989). Duncan multiple range test (Duncan, 1955) was applied for multiple mean comparisons, where necessary.

RESULTS AND DISCUSSION

The effects of age and season on various seminal traits are presented in Table 1.

Ejaculatory volume

In the present study, overall mean ejaculatory volume for 21 Sahiwal bulls of 3 age groups was 4.59 ± 0.15 ml, the range was 1.5-10 ml. The bulls in the group-II had significantly higher ($P<0.05$) volume (4.87 ± 0.35 ml) than the bulls in group-I and group-III. The difference between the latter two groups was non significant. These results are supported by the findings of Everett and Bean (1982), who reported that semen production of bulls peaked in Spring and at 4-5 years of age. However, Fonesca *et al.* (1992) noted that although seasonal effects may influence semen quality but they were less important for bulls fed adequately and well adopted to high temperature. The ejaculatory volume was lower during Summer than in other seasons (Table 1).

Mass activity and motility percentage

The overall mean mass activity was 2.61 ± 0.04, the range was 0.5 to 4.5. The highest value (2.91 ± 0.04) was recorded in bulls of group-II and the lowest in group-III (2.35 ± 0.01). When the data were pooled for semen samples taken from bulls during four seasons of the year, high mass activity (3.38 ± 0.03) was recorded during Spring and low (2.05 ± 0.02) during Summer. Results revealed that season and age had non significant effect on the mass activity of the ejaculate. However, Everett and Bean (1982) reported the age related changes in semen characteristics and concluded that semen production of bulls peaked on average at 4-5 years of age.

The overall mean motility percentage of ejaculates collected from 21 Sahiwal bulls was 65.14 ± 0.21, the range was 60-75. The semen samples collected from bulls of group-I and III had lower ($P<0.05$) percent motility (65.25 ± 0.39 and 64.46 ± 0.25, respectively) than that of group-II (65.71 ± 0.34). The difference in motility percentage between the bulls of former two groups was non significant.

Significant seasonal effects on sperm motility percentage were observed during this study. It averaged 65.95 ± 0.39, 66.12 ± 0.25 and 64.81 ± 0.25 respectively for Autumn, Winter and Spring which differed ($P<0.05$) from that of Summer (63.68 ± 0.29) which agree with the results reported by Fonesca *et al.* (1992). However, Mathevon *et al.* (1998), while analyzing the semen production data from 198 bulls (young bulls upto 30 months and mature between 4 and 6 years of age), concluded that semen characteristics (volume, sperm concentration, sperm motility) improved significantly with age of young bulls. Season significantly affected all semen traits in young bulls but did not significantly affect volume and sperm motility in mature bulls. Performance was better in Winter than in Summer.

pH and sperm concentration

Overall mean pH of semen samples collected from bulls of 3 age groups during four seasons of the year was 6.89 ± 0.03. Effect of age and season on pH was non significant. These findings are supported by those reported by Terezenha *et al.* (1991), who recorded non significant variations in pH of semen from bulls of young, adult and old age groups and within each age group. Bhosreker *et al.* (1992) reported that in bovines semen quality was better in Winter than in other seasons.

The pH of semen depends upon the sperm concentration of semen and samples with thick density have lower pH value. According to Younis (1996), the pH of semen was higher in low breeding season (6.33 ± 0.06) than during the peak breeding season (6.18 ± 0.77), probably due to higher sperm concentration noted in peak breeding season than low breeding season. The pH of semen is also closely related to mass activity and frequency of collection (Barnabe *et al.*, 1992).

Table1: Mean values (±SEM) of characteristics of semen collected from bulls of three age groups during various seasons of the year

Parameters	Spring	Summer	Autumn	Winter	Overall mean
Ejaculatory vol. (ml)					
Group-I	4.76±0.13	4.36±0.11	4.61±0.12	4.42±0.15	4.53±0.21b
Group-II	5.72±0.11	4.41±0.09	4.91±0.12	4.47±0.09	4.87±0.35a
Group-III	4.21±0.10	4.12±0.09	4.82±0.15	4.38±0.09	4.38±0.19b
Mean	4.89±0.22A	4.29±0.26B	4.78±0.17A	4.42±0.10A	4.59±0.15
Mass activity					
Group-I	3.47±0.05	2.13±0.04	2.45±0.04	2.33±0.06	2.59±0.03a
Group-II	3.70±0.04	2.30±0.03	2.57±0.04	3.07±0.03	2.91±0.04a
Group-III	2.97±0.04	1.74±0.03	2.40±0.05	2.29±0.03	2.35±0.01a
Mean	3.38±0.03A	2.05±0.02A	2.47±0.06A	2.56±0.07A	2.61±0.04A
Motility (%)					
Group-I	64.38±0.58	63.79±0.40	66.36±0.44	66.49±0.58	65.25±0.39b
Group-II	65.41±0.38	64.05±0.35	66.65±0.55	66.73±0.41	65.71±0.34a
Group-III	64.66±0.41	63.21±0.34	64.66±0.37	65.14±0.34	64.46±0.25b
Mean	64.81±0.25A	63.68±0.29B	65.95±0.39A	66.12±0.25A	65.14±0.21
PH					
Group-I	6.94±0.02	6.90±0.01	6.98±0.02	6.86±0.02	6.89±0.01a
Group-II	6.93±0.01	6.90±0.01	6.90±0.01	6.85±0.01	6.89±0.01a
Group-III	6.92±0.01	6.89±0.01	6.99±0.02	6.87±0.01	6.81±0.02a
Mean	6.93±0.01A	6.89±0.01A	6.92±0.01A	6.86±0.01A	6.89±0.03
Sperm conc. (10^9) per ml					
Group-I	1.01±0.01	0.90±0.01	0.97±0.01	0.98±0.01	0.96±0.01a
Group-II	1.09±0.01	0.91±0.01	1.08±0.01	1.02±0.01	1.00±0.01a
Group-III	1.03±0.01	0.90±0.01	0.97±0.01	0.99±0.01	0.97±0.01a
Mean	1.04±0.01A	0.90±0.01A	1.00±0.01A	0.99±0.01A	0.98±0.01
Post thaw Motility (%)					
Group-I	43.06±0.51	42.37±0.41	43.89±0.46	43.34±0.19	43.16±0.31a
Group-II	43.65±0.43	42.62±0.35	44.08±0.35	43.67±0.38	43.50±0.21a
Group-III	43.28±0.39	42.52±0.36	43.25±0.57	43.20±0.35	43.06±0.51a
Mean	43.33±0.31A	42.50±0.23A	43.47±0.43A	43.40±0.29A	43.24±0.35
Doses produced					
Group-I	162.35±5.16	151.97±4.20	137.80±4.62	145.41±6.02	149.38±5.25b
Group-II	183.85±4.35	166.81±3.60	174.23±3.90	173.65±3.56	174.63±3.29a
Group-III	149.35±3.97	149.85±3.65	152.18±5.75	159.07±3.55	152.61±2.35b
Mean	165.18±3.25A	156.21±3.33B	154.73±4.82B	159.37±4.02B	158.87±4.05

Values with different lower case letters in a column or upper case letters in a row for each parameter differ significantly ($P<0.05$).

The overall mean sperm concentration was 0.98 ± 0.01 billions/ml, the range being 0.6 to 1.85 billions per ml. There was no significant difference in sperm concentration of bulls in different age groups and during four seasons of the year, although it was the highest (1.00 ± 0.01) for ejaculates collected from bulls in group-II and the lowest in group-I (0.96 ± 0.01). The highest sperm concentration was found during the Spring (1.04 ± 0.01), while lowest in Summer (0.90 ± 0.01). Mathevon *et al.* (1998) reported mean sperm concentration of 1.03 ± 0.02 billions/ml in cross bred bulls.

Post thaw motility percentage

Higher post thaw motility percentage was observed during Spring (43.33 ± 0.31), Autumn (43.47 ± 0.43) and Winter (43.40 ± 0.29) as compared to Summer (42.50 ± 0.23), however, the difference was non significant. Similarly, bulls of 3 age groups did not differ significantly from one another. These findings differed with the findings of Muhuyi (1988), who reported that motility after thawing was 55.7% and concluded that the young bulls should be re-evaluated before regular production.

Doses produced per ejaculate

Overall mean doses produced per ejaculate from bulls of three age groups were 158.87 ± 4.05. Higher ($P<0.05$) doses produced per ejaculate were recorded in group-II (174.63 ± 3.29) as compared to group-I (149.38 ± 5.25) and group-III (152.61 ± 2.35). However, the latter two groups differed non significantly from each other. Significantly higher doses were produced per ejaculate during the Spring (165.18 ± 3.25) as compared to Summer (156.21 ± 3.33), Autumn (154.73 ± 4.82) and Winter (159.37 ± 4.02) seasons, the latter three seasons differed non significantly from one another. The number of doses which can be obtained from an ejaculate depends on the volume, rate of motility, concentration of spermatozoa per ml of ejaculate, percentage of normal spermatozoa in the ejaculate and concentration of spermatozoa required per AI dose (Salisbury *et al.*, 1978).

In this study, seminal parameters including ejaculatory volume, sperm motility and number of doses produced were better during Spring than the other seasons and in bulls of age group-II than groups-I and III. Better results of seminal parameters in Sahiwal bulls in Spring could be due to many factors such as mild environmental temperature, optimum humidity and excessive availability of fodder. In this context, Mathevon *et al.* (1998) reported that temperature, photoperiod, humidity, feed quality and housing are the factors affecting the semen production and quality. Difference in the quantity of feed (Siratskii, 1990) or in feed composition (Castillo *et al*, 1987) could also affect semen output.

Based on the findings of the present study, it may be concluded that in Sahiwal bulls the seminal parameters including volume, percent motility and number of doses produced were influenced by age and season. Semen from adult bulls had better quality than that from young and old bulls. Similarly, these bulls produced better quality semen during Spring than in other seasons. It is suggested that morphological studies, transaminase activities along with biochemical aspects and fertility of frozen semen in Sahiwal bulls should be conducted in different age groups and seasons of the year for better understanding.

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