

Effect of Exercise on Sexual Behavior and Semen Quality of Sahiwal Bulls

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Abstract—The study was conducted on Sahiwal cattle bulls maintained at the Artificial Breeding Complex, NDRI, Karnal, Hayana, India, to determine the effect of exercise on the sexual behavior and semen quality. Fourteen Sahiwal bulls were classified into two groups of seven each. Group-1, bulls were exercised by walking in a bull exerciser once a week one hour before semen collection, whereas bulls in group-2 were exercised daily. Sexual behavior and semen quality traits studied were: Reaction time (RT), Dismounting time (DMT), Total time taken in mounts (TTTM), Flehmen response (FR), Erection Score (ES), Protrusion Score (PS), Intensity of thrust (ITS), Temperament Score (TS), Libido Score (LS), Semen volume, Physical appearance, Mass activity, Initial progressive motility, Non-eosinophilic spermatozoa count (NESC) and post thaw motility percent. Data were analyzed by least squares technique. Group-2 showed significantly ($p < 0.01$) higher value in RT (sec), DMT (sec), TTTM (sec), ES, PS, ITS, LS, semen volume, semen color density and mass activity.

Keywords—Exercise, Sahiwal bulls, semen quality, sexual behavior.

I. INTRODUCTION

THE production performance of any breed depends on its full expression of its genetic qualities for production for the given ecological region and is considered one of the major selection criteria for breeding.

Management practices and feeding represent the essential part, which constitute the effect of physical environment on sires, and if not paid the due attention can result in poor libido and semen quality. Bulls destined to be useful breeding animals, should be produced in herds, which every effort has been made to maintain proper management so as to maximize the efficiency of preserved semen, it is imperative to obtain high quality ejaculates; accordingly, factors affecting semen quantity and quality should carefully be controlled. Whether or not exercise is beneficial to a bull's fertility and longevity has long been a controversial issue. The question arises as to how much and what kind of exercise mature and stud bulls should receive. Exercise as a management tool has been reported to exert beneficial effect on RT, ejaculate volume, mass activity and semen concentration of bulls. Exercise make the breeding bulls active and thrifty, this may increase their libido and quality as well as the quantity of semen. Bull's exercise keeps them trimmed and in good physical health and reduces RT if given just before collection [2] and also reduces elongated hoof.

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II. MATERIAL AND METHODS

Fourteen bulls were divided into two groups, seven each group. In group-1, bulls were exercised by walking in a machine exerciser one hour daily before semen collection, whereas bulls in group-2 were exercised once a week. All bulls were free from diseases and care, management and the nutrition requirement was controlled

Sexual behavior was recorded at the time of semen collection. Sexual behavior traits such as RT, DMT and TTTM were measured by stopwatch. ES, PS and ITS score card were measured by using (0-4) scale cards as described by [7], TS by using (0-5) scale card as given by [25] and revised by [5], LS by using (1-9) which developed by [4] scale and the frequency of flehman response was recorded.

Semen ejaculates were collected by AV technique once a week (two ejaculates), semen samples were tested for volume (ml), color density viz., watery (1), lemon (2), milky (3), and creamy (4), mass activity in (0 to +5 grades), initial motility and progressive motility (the slide sample was observed under phase contrast microscope), and NESC (live sperm %) by the stain mixture of eosin and nigrosin added to the semen sample.

III. RESULTS AND DISCUSSIONS

A. Sexual Behavior Traits

1) Reaction Time (RT)

Least square means and analysis of variance of RT are presented in Tables I and II, respectively. It was evident from Table I that RT was significantly influenced by exercise by bull exerciser. It was found that the daily exercised group was significantly ($p < 0.05$) higher in RT than the exercise group of one day per week. The overall mean was 20.18 ± 2.30 , which indicated that the one day exercised group took less time to mount than the bulls of the daily exercised group, which might be due to the exposure of stress, energy consumption in exercise, and inheritance and management factors were also considered. A similar record of 24.61 s was found by [10], while slightly higher values of RT were also reported in Sahiwal bulls [11], [1].

2) Dismounting Time (DMT) (Seconds)

Least square means and analysis of variance of DMT are presented in Tables I and II, respectively. It was evident from ANOVA that DMT was significantly ($p < 0.01$) influenced by the exercise by bull exerciser. It was found that, the daily exercised group was significantly higher in DMT than exercise group of one day per week. The overall mean, was (7.22 ± 0.23) . The results showed variation in DMT. Slightly

lower dismount values were reported in Surti buffalo bulls [22] and in Sahiwal bulls [9].

Lower values were reported by [11] in Sahiwal bulls and by [20] in Ongole, Jersey and Jersey x Ongole bulls.

3) Total Time Taken in Mounts (TTTM) (Seconds)

Least square means and analysis of variance of TTTM are presented in Tables I and II, respectively.

It is evident from the tables that TTTM was significantly ($p<0.01$) influenced by the exercise by bull exerciser. It was found that the daily exercised group was significantly higher in TTTM than exercise group of one day per week. The overall mean was 26.63 ± 1.39 , which meant that the one day exercised group took less time to mount and dismount than the bulls of the daily exercised group, which might be due to the variation in consideration of RT, DMT of individual animals, and exposure to the exhaustion stress, because significant variation between the two groups was also recorded. Higher values as 47.48 s and 40.50 s were recorded in Murrah and Sahiwal bulls, respectively, reported by [10], value as 59.67 ± 5.10 s in Sahiwal bulls reported by [11], value as 5.14 minutes in Tharparkar bulls by [14], and value as 3.39 ± 0.089 recorded in cross bulls by [17]. The present study indicated that all bulls reacted quickly and took less time in ejaculation than values reported by earlier workers.

4) Flehmen Response (FR)

Least square means and analysis of variance of FR are presented in Tables I and II, respectively.

TABLE I
LEAST SQUARE MEANS FOR SEXUAL BEHAVIOR CHARACTERS FOR DIFFERENT EXERCISED GROUPS

Groups of exercise	RT (sec)	DMT (sec)	TTTM (sec)	FR
One day per week exercised	17.08 ± 1.96^b	6.25 ± 0.43^b	22.68 ± 2.20^b	0.08 ± 0.04
Daily exercised	23.27 ± 1.69^a	8.18 ± 0.17^a	30.57 ± 1.70^a	0.05 ± 0.03
Overall mean	20.18 ± 2.30	7.22 ± 0.23	26.63 ± 1.39	0.07 ± 0.02

TABLE II
ANALYSIS OF VARIANCE (MS) FOR SEXUAL BEHAVIOR CHARACTERS FOR DIFFERENT EXERCISED GROUPS

Source of variable	Df	Mean sum of squares			FR
		RT	DMT	Total time take in mounting	
Between groups	1	1147.01**	112.13**	1864.41**	0.03
Error		201.17	6.27	232.01	0.063

* Significant ($p<0.05$); ** Significant ($p<0.01$)

It was observed that majority of bulls did not show FR at the time of semen collection and no significant variation was found between exercised groups. The overall mean of FR for different exercised groups was 0.07 ± 0.02 . Similar findings were reported by [25], and higher values were also recorded in literature for Sahiwal and Murrah bulls [9], [10], [16], [17].

5) Erection Score (ES)

Least square means and analysis of variance for ES are

depicted in Tables III and V, respectively.

It was found, ES to be significantly ($p<0.01$) influenced by exercise by bull exerciser. The overall mean of ES was 2.63 ± 0.081 , which revealed between fair to good ES in bulls (0-4 scale) on different types of exercise schedules. Daily exercised group showed significantly higher values of ES (2.92 ± 0.04) than the once a week exercised group (2.35 ± 0.16), which indicated the positive effect of continuous exercise in the bulls of the daily exercised group.

The findings obtained in the present study were similar to the ES observations reported by [9] in Sahiwal bulls. However, a slightly higher score for erection was reported by [7] and lower value (2.49 ± 0.03) was obtained in Sahiwal bulls by [11].

6) Protrusion Score (PS)

Least square means and analysis of variance for PS are depicted in Tables III and V, respectively.

Least square analysis of variance showed that PS was significantly ($p<0.01$) influenced by exercise. The overall mean of ES was 2.63 ± 0.08 , which indicated between fair to good PS in bulls. The daily exercised group showed significantly higher values of ES (2.92 ± 0.04) than the once a week exercised group (2.35 ± 0.16), which indicated positive effect of continuous exercise on the bulls.

The findings obtained in the present study were similar to the observation (2.52 ± 0.03) reported by [11] in Sahiwal bulls. Lower PS was reported in Sahiwal and Murrah bulls [19], whereas, [7] found higher PS.

7) Intensity of Thrust (ITS)

Least square means and analysis of variance for ITS are depicted in Tables III and V, respectively.

The ITS found to be significantly ($p<0.01$) influenced by exercise by bull exerciser. The overall mean was 2.68 ± 0.08 , thereby indicating fair to good thrust in bulls. The daily exercised group has shown significantly higher values of ITS (2.93 ± 0.03) than the once a week exercised group (2.43 ± 0.15), which indicated the positive effect of continuous exercise on the bulls of daily exercised group.

The findings obtained in the present study were higher than values in Sahiwal and Murrah bulls reported by [9] and the value reported by [11] in Sahiwal bulls. Higher values were reported in Nagauri and crossbred bulls [7], [13]

8) Temperament Score (TS)

Least square means and analysis of variance for TS are depicted in Tables IV and VI, respectively.

There was not any significant effect of exercise, between the different exercised groups. The overall means of TS was 0.27 ± 0.05 . The empri score was docile during semen collection.

Different values of behavioral temperament were observed by [15] in Sahiwal bulls and [9] in Sahiwal and Murrah bulls.

9) Libido Score (LS)

Least square means and analysis of variance for LS are depicted in Tables IV and VI, respectively.

It is evident from results presented in the table that, LS was found to be significantly ($p<0.01$), influenced by exercise. The daily exercised group showed significantly higher values of LS (8.03 ± 0.09) than the once a week exercised group (5.15 ± 0.34), which indicated the effect of continuous exercise on the bulls. The overall means of LS was (6.59 ± 0.176), which observed between fair to good libido in bulls on a 0-9 scale.

The results of present study for LS, showing pronounced libido as evident from their libido ratings, was in close agreement with the one reported by [9], [16] in Sahiwal bulls, and they also found significant ($p<0.05$) variation between the libido of bulls.

TABLE III

LEAST SQUARE MEANS FOR SEXUAL BEHAVIOR CHARACTERS OF BULLS FOR DIFFERENT EXERCISED GROUPS

Groups of exercise	ES	Protrusion Score	ITS
One day per week exercised	2.92 ± 0.04^a	2.92 ± 0.04^a	2.93 ± 0.03^a
Daily exercised	2.35 ± 0.16^b	2.35 ± 0.16^b	2.43 ± 0.15^b
Overall mean	2.63 ± 0.081	2.63 ± 0.08	2.68 ± 0.08

TABLE IV

LEAST SQUARE MEANS FOR SEXUAL BEHAVIOR CHARACTERS OF BULLS FOR DIFFERENT EXERCISED GROUPS

Groups of exercise	TS	LS
One day per week exercised	0.18 ± 0.05	8.03 ± 0.09^a
Daily exercised	0.35 ± 0.07	5.15 ± 0.34^b
Overall mean	0.27 ± 0.05	6.59 ± 0.18

TABLE V

ANALYSIS OF VARIANCE (MS) FOR SEXUAL BEHAVIOR CHARACTERS (MS) OF BULLS FOR DIFFERENT EXERCISED GROUPS

Source	df	Mean sum of squares		
		ES	PS	ITS
Between groups		9.63**	9.63**	7.50**
Error		0.78	0.76	0.72

* Significant ($p<0.05$); ** Significant ($p<0.01$)

TABLE VI

ANALYSIS OF VARIANCE (MS) FOR SEXUAL BEHAVIOR CHARACTERS (MS) OF BULLS FOR DIFFERENT EXERCISED GROUPS

Source	df	Mean sum of squares	
		TS	LS
Between groups		0.83**	249.41**
Error		0.24	3.71

* Significant ($p<0.05$); ** Significant ($p<0.01$)

B. Seminal Attributes

1) Volume (ml)

Least square means and analysis of variance of volume are presented in Tables VII and IX, respectively.

Volume was found to be significantly ($p<0.01$) influenced by exercise. The daily exercised group showed significantly higher values of volume (3.59 ± 0.17 ml) than the once a week exercised group (3.08 ± 0.25 ml), which indicated the effect of continuous exercise on the bulls. The overall means of volume value was 3.33 ± 0.15 .

The estimated semen volume values were similar to the

average values varying from 3.36 ± 0.14 to 4.57 ± 0.32 with the range 3-7 ml, reported in the literature [2], [8], [9], [19], [21], [23]-[25]. Slightly higher values (3.48 ± 0.31 and 5.13 ± 0.18 ml) were reported by [5] and lower values (1-3 ml) reported by [16].

2) Physical Appearance

Least square means and analysis of variance of semen color are presented in Tables VII and IX, respectively.

The results indicated that color of semen was significantly ($p<0.01$) influenced by exercise. The daily exercised group showed significantly higher values of color appearance (2.95 ± 0.09) than the once a week exercised group (2.27 ± 0.17), which revealed the effect of continuous exercise on the semen color of the bulls. The overall means of color of semen was (2.61 ± 0.10), which is milky to creamy.

The estimated semen color values of present study were similar to the records reported by [9], [16] in Sahiwal bulls. However, [28] did not find significant differences.

3) Mass Activity

Least square means and analysis of variance of mass activity are presented in Tables VII and IX, respectively.

Mass activity of semen was found significantly ($p<0.01$) influenced by exercise. Daily exercised group showed significantly higher values of mass activity (2.53 ± 0.08) than once a week exercised group (1.96 ± 0.15), which indicated the effect of continuous exercise on semen mass activity of the bulls.

The overall means was 2.24 ± 0.09 of which was in close agreement with the values (2.18 ± 0.266) reported by [9]. Higher average values (2.80 -3.57) were reported in Sahiwal bulls by various workers [2], [15], [19], [26], [6].

4) Initial Progressive Motility (IPM) %

Least square means and analysis of variance of IPM are presented in Tables VIII and X, respectively.

No significant effect was found due to the effect exercise. The overall means of IPM was 54.42 ± 2.80 , which similar to the observations (52.71 ± 1.31) reported by [12] and lower than the value (73.56 ± 0.61) reported by [14] in Sahiwal bulls.

5) Non-Eosinophilic Spermatozoa Count (NESC) %

Least square means and analysis of variance of NESC are presented in Tables VIII and X, respectively.

On perusal of data given in the tables, no significant effect was found due to the effect of exercise. The overall means of IPM was 64.25 ± 3.27 .

The estimated NESC values in the present study were lower than the values recorded by [27] in Sahiwal bulls and [18] in Ongole bulls.

6) Post Thaw Motility (PTM) %

Least square means and analysis of variance of PTM are presented in Tables VIII and X, respectively.

No significant effect was found due to the effect of exercise. The overall means of PTPM was 40.33 ± 2.08 .

The estimated values of present study were in close

agreement with the records reported by [3]. Little higher values were reported by [12], [13], [28] in Sahiwal bulls.

TABLE VII

LEAST SQUARE MEANS FOR SEMEN QUANTITY CHARACTERS OF THE BULLS FOR DIFFERENT EXERCISED GROUPS

Exercise Group	Semen volume (ml)	Semen colour	Mass activity
Group1	3.59±0.17 ^a	2.95±0.09 ^a	2.53±0.08 ^a
Group 2	3.08±0.25 ^b	2.27±0.17 ^b	1.96±0.15 ^b
Overall mean	3.33±0.15	2.61±0.10	2.24±0.09

* Significant (p<0.05); ** Significant (p<0.01)

TABLE VIII

LEAST SQUARE MEANS FOR SEMEN QUANTITY CHARACTERS OF THE BULLS FOR DIFFERENT EXERCISED GROUPS

Exercise Group	Initial progressive motility %	Non eosinophilic Sperm %	Post thaw Motility %
Group1	61.67±4.10	72.50±4.75	45.17±3.00
Group 2	47.17±3.82	56.00±4.49	35.50±2.87
Overall mean	54.42±2.80	64.25±3.27	40.33±2.08

* Significant (p<0.05); ** Significant (p<0.01)

TABLE IX

ANALYSIS OF VARIANCE FOR SEMEN QUALITY CHARACTERS OF THE BULLS FOR DIFFERENT EXERCISED GROUPS

Source	df	Mean sum of squares		
		Semen volume	Semen color	Mass activity
Between groups	1	8.01**	14.01**	9.63**
Error		2.82	1.07	0.89

Significant (p<0.05); ** Significant (p<0.01)

TABLE X

ANALYSIS OF VARIANCE FOR SEMEN QUALITY CHARACTERS OF THE BULLS FOR DIFFERENT EXERCISED GROUPS

Source	df	Mean sum of squares		
		Progressive motility	Non eosinophilic Sperm	Post thaw Motility
Between groups	1	1567.88	2041.87	700.83
Error		942.06	1282.13	516.91

Significant (p<0.05); ** Significant (p<0.01)

IV. CONCLUSIONS

The study outcome concluded that better libido and seminal attributes of bulls whose were given daily exercise.

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