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Effect of age and body weight on semen volume of Murrah bulls

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Abstract
Semen volume and factors influencing the same were analyzed among Murrah bulls under Tamil Nadu environmental conditions. A total of 4563 observations on first and second ejaculate collected from 53 Murrah bulls, maintained at Buffalo Frozen Semen Station, Tamil Nadu Co-operative Milk Producers Federation Ltd, Erode was utilized for this study. The possible factors such as age and body weight which influence the semen volume were studied. The statistical analysis of the data was carried out after angular transformation of the percentage as per Snedecor and Cochran. While expressing the mean and standard error, the angles were reconverted into percentages to a precision of two decimals. The statistical analysis was also carried out by using least-squares procedurewherever unequal and disproportionate numbers were encountered. The overall least-squares means (±S.E) of semen volume (ml) of first ejaculate was 3.24 ± 0.04 and the corresponding value was 2.99 ± 0.03 for the second ejaculate. Semen volume per collection among Murrah bulls increased positively with increase in age and body weight.

Keywords: Age, body weight, murrah bull, semen, volume

Introduction
The livestock sector is an important source of livelihood and income to majority of population world-wide including developing countries like India. Among the dairy animals buffaloes are the major contributors to the milk production in India (Livestock Census, 2019). The Indian subcontinent is home to buffaloes of both swamp and riverine types, spread across the varied agro-climatic conditions. Total 17 breeds of buffaloes have been registered so far in India from diverse habitats, which includes, Murrah, Nili Ravi, Bhadawari, Mehsana, Surti, Jaffarabadi, Banni, Nagpuri, Marathwadi, Pandharpuri, Toda, Chilika, Kalahandi, Luit (Swamp), Burgur, Chhattisgarhi and Gojri (http://www.nbagr.res.in). Artificial insemination using frozen semen is now the most widespread tool employed nationwide for improving the genetic potential of livestock. To satisfy the increasing demand for semen from superior sires, the AI industry has to optimize the number of spermatozoa per dose of semen in order to produce maximum number of straws with optimum conception rate (Bhakat *et al*. 2011) [1]. The objective of the present study was to analyse the effect of age and body weight on semen volume of Murrah buffalo bulls, which will help to use breeding bull at an optimum age and planning management in the breeding station.

Material and Methods
The records of Murrah buffalo bulls kept at Buffalo Frozen Semen Station, Tamil Nadu Co-operative Producers Federation, Erode were used for this study. The station produces frozen semen from genetically superior breeding bulls, to supply the same throughout the state of Tamil Nadu for artificial insemination (A.I) of buffaloes. Erode District lies between 10º 53' and 11º 60' of Northern latitude with 171 m above mean sea level. The climate of this area is generally hot throughout the year except October to December. The annual average rainfall was estimated to be 704.21 mm and about 49 per cent of the total rainfall was received during the northeast monsoon. A mean maximum and minimum temperature of 32.6 and 21.3ºC, respectively were recorded.
The station maintains highly pedigreed Murrah bulls under uniform housing, feeding and managemental conditions.

The animals are housed in a conventional half walled asbestos- roofed shed (24' x 321/2' x 121/2'). Buffalo bulls are supplied with normal farm ration supplemented with two kg of concentrate mixture (17.5 per cent digestible crude protein and 78 per cent total digestible nutrients). In addition, one per cent of common salt and one per cent of mineral mixture are added to the ration.

Green fodder and straw are fed ad libitum. They are washed twice by splashing water on their body during the day in summer and once in winter. Semen is being collected twice a week using female teaser buffalo. The bulls are sexually stimulated by one or two false mounts before their ejaculates are collected in artificial vagina and two consecutive collections are taken from each buffalo bull.

The data on semen production traits like semen volume, initial motility and sperm concentration were collected for first and second normal ejaculates. The first and second ejaculates were pooled for the preparation of total doses of frozen semen per collection. The records of 4563 collections each for first ejaculate and second ejaculate from 53 Murrah bulls, spread over a period of five years from 1996 to 2000 were studied. The physical characteristics of semen i.e., semen volume, initial motility, sperm concentration, pre-freeze motility, post-thaw motility and total doses of frozen semen per collection were taken as semen production traits. The age wise groups of bulls were below 36 months, 36 to 48 months, 48 to 60 months, 60 to 72 months, 72 to 84 months, 84 to 96 months and above 96 months. The bulls were grouped based on body weight as 400 to 450 kg, 450 to 500 kg, 500 to 550 kg and 550 to 600 kg.

The statistical analysis of the data was carried out after angular transformation of the percentage as per Snedecor and Cochran (1994) [12]. While expressing the mean and standard error, the angles were reconverted into percentages to a precision of two decimals. The statistical analysis was carried out by using least-squares procedure (Harvey, 1975) [5] wherever unequal and disproportionate numbers were encountered.

The statistical model for Least – squares procedure used for the analysis of the data on semen production traits is as follows.

$$Y_{ijk} = \mu + A_i + B_j + (AB)_{ij} + E_{ijk}$$

Where

Y_{ijk} = k^{th} observation in the j^{th} body weight of the i^{th} age

μ = overall mean

A_i = effect of i^{th}age on semen production trait i= 1,…7

B_j = effect of j^{th}body weight on semen production trait j= 1,…4

$(AB)_{ij}$ = effect of age and body weight interaction on semen production trait

E_{ijk} = random error assumedto be NID

Results and Discussion

The basic statistics *viz*. mean, standard error and coefficient of variation for the semen production traits and frozen semen production traits are furnished in Table 1 and least squares means of semen volume for the first ejaculate and second ejaculate are presented in Table 2.

Volume

The volume of the first and second ejaculates for Murrah bulls ranged from 0.5 to 9.0 and 0.5 to 8.0 ml with mean values of 3.24 ±0.04 and 2.99 ± 0.03 ml respectively. In general, the mean volume of semen reported in the literatures varied from 1.64 to 5.0 ml for Murrah bulls. The findings of most of the workers on the semen volume in Murrah bulls were higher than the values observed in the present study (Tripathi and Saxena, 1983; Dhami *et al*., 1998; Singh and Singh, 2000) [14, 3, 11] but lower semen volume was also observed by Chaudhary and Gangwar (1977) [2] and Narasimha Rao *et al*., (1996) [8] and comparable semen volume was observed by Kumar *et al*., (1988) [6], Shukla and Mishra, (2005) [10] and Bhakat *et al*., (2011) [1] for the first and second ejaculates. The variation in semen volume observed in this study might be due to differences in age, size of the bulls, frequency of collection, method of sexual preparation and the environment.

Age

The mean volume of semen in the first ejaculate among the age groups differed siginificantly ($P \leq 0.01$). The age groups 36 to 48 (3.22 ± 0.02ml) 48 to 60 (3.23 ± 0.02 ml) 60 to 72 (3.24 ± 0.03 ml) and 72 to 84 months (3.24 ± 0.03 ml) did not differ significantly ($P \geq 0.05$). The highest semen volume was in the age group above 96 months and lowest in the younger age group of below 36 months. In the second ejaculate the age groups 36 to 48 (2.91 ± 0.02), 48 to 60 (2.99 ± 0.03), 60 to 72 (2.99 ± 0.04) and 72 to 84 months (3.05 ± 0.03) did not differ significantly ($P \geq 0.05$).

Gradual increase in semen volume with increase in the age of bulls was recorded in this study (Table 2). These findings were in accordance with the reports of Gupta *et al*. (1978) [4], Nainar (1986) [7] and Veerapandian (1992) [15]. Bulls in the age group of below 36 months had the lowest volume of semen which increased steadily upto the age group above 96 months. There was no significant increase in the volume of semen among the age groups of 36 to 48, 48 to 60, 60 to 72 and 72 to 84 months. Bulls in the age group above 96 months ejaculated greater volume of semen than bulls in the other age groups. This might be due to the fact that only exceptionally proven good bulls for higher semen production were retained till such age.

Body weight

The mean volume of semen in the first ejaculate for the bulls in the body weight groups of 400 to 450 (3.05 ± 0.06 ml), 450 to 500 (3.24 ± 0.05 ml), 500 to 550 (3.24 ± 0.03 ml) and 550 to 600 kg (3.43 ± 0.03 ml) varied significantly between themselves ($P \leq 0.01$) except between the body weight group 450 to 500 and 500 and 550 kg.

Highest semen volume was obtained in heavy body weight group of 400 to 450 kg. In second ejaculate, the mean semen volume for bulls among the body weight group of 400 to 450 (2.73 ± 0.05) and 550 to 600 (3.22 ± 0.04) differed significantly ($P \leq 0.01$) between themselves and with 450 to 500 (2.99 ± 0.03) and 500 to 550 kg (3.03 ± 0.04). There were no significant difference between 450 to 500 and 500 to 550 kg groups.

The volume of semen for the first and second ejaculates increased proportionately and significantly with the increase in the body weight of bulls (Table 2). The present findings were similar to the reports of Rao and Rao (1990) [9].

Murrah bulls with body weight above 450 kg ejaculated significantly greater volume of semen than the bulls in the body weight group of 400 to 450 kg. Sundararaman *et al*. (2000) [13] stated that body weight was an indicator of growth and health status of bulls and observed significant increase of semen production potential of bulls with increase in body weight.

Table 1: Means with standard errors and coefficient of variation for semen volume of Murrah bulls

	Mean	SE	CV (%)
First ejaculate Volume (ml)	3.20	0.01	40.63
Second ejaculate Volume (ml)	2.95	0.01	41.61

Table 2: Least-squares means (+S.E) for semen volume of Murrah bulls

Sources	n	Mean volume ± S.E.	
		First ejaculate	Second ejaculate
Overall	4563	3.24 ± 0.04	2.99 ± 0.33
Age (months)			
Below 36	48	2.58^{d} ± 0.04	2.58^{d} ± 0.04
36 to 48	595	3.22^{c} ± 0.02	2.91^{c} ± 0.02
48 to 60	1100	3.23^{c} ± 0.02	2.99^{c} ± 0.03
60 to 72	1605	3.24^{c} ± 0.03	2.99^{c} ± 0.04
72 to 84	629	3.24^{c} ± 0.03	3.05^{c} ± 0.03
84 to 96	534	3.31^{b} ± 0.03	3.18^{b} ± 0.02
Above 96	52	3.49^{a} ± 0.10	3.28^{a} ± 0.12
Body weight (kg)			
400 to 450	841	3.05^{c} ± 0.06	2.73^{c} ± 0.05
450 to 500	783	3.24^{b} ± 0.05	2.99^{b} ± 0.03
500 to 550	2259	3.24^{b} ± 0.03	3.03^{b} ± 0.04
550 to 600	680	3.43^{a} ± 0.03	3.22^{a} ± 0.04

Means bearing different superscripts in each sub-class differ significantly ($P \leq 0.01$)

Conclusion

The overall least-squares means (±S.E) of semen volume (ml) of first ejaculate was 3.24 ± 0.04 and the corresponding value was 2.99 ± 0.03 for the second ejaculate. Bulls in the age group above 96 months ejaculated greater volume of semen than bulls in the other age groups. Semen volume per collection among Murrah bulls increased positively with increase in age and body weight.

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