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PJBS

ISSN 1028-8880

# Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 6 (6): 566-570, 2003
ISSN 1028-8880


# Studies on Semen Characteristics of Some Friesian Cross and Sahiwal Bulls for Artificial Insemination (AI)

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**Abstract:** The present study was to evaluate the effect of breed and intervals between collection on semen characteristics. Semen was collected from eight breeding bulls belonging to four genetic groups (100%SL, 75%F×25%L, 50%SL×50%F and 50%F×50%L). Genetic groups had a significant effect ($P<0.05$) on semen characteristics except motility and total number of semen collection per month. The highest sperm concentration, total number of motile sperm cells/jaculate and total number of semen doses per collection were found in 100%SL and lowest in 50%F×50%L. Similarly, intervals between collection significantly ($P<0.05$) affected all the semen traits except volume of ejaculate and total number of semen doses per ejaculate. The highest sperm concentration (1332±29 mill. $ml^{-1}$), total number of motile sperm cells/jaculate (5621±261.99 million), motility (64±0.24%) and total number of collection per month (5.84±0.23) was obtained with an interval <6 days between collection than the other interval groups. It was concluded that 100% Sahiwal and 50% Sahiwal ×50% Friesian for the genetic group and <6 days for the interval between collection were suitable for most of the semen parameters than all other groups.

**Key words:** Genetic group, collection interval, AI bull, semen characteristics

## Introduction

The semen characteristics are the major factors that influence conception in cattle and therefore, a determinant of efficiency of reproduction. Many studies have reported which affect semen parameters. Raju and Rao (1982) reported significant differences among Jersey, Brown Swiss and 50% Brown Swiss and 50% Ongole breed in terms of ejaculate volume, sperm motility and concentration of spermatozoa.

Contracting the above findings Hussain *et al.* (1985) did not find any difference between 50% Local× 50% Friesian and 50%Sahiwal ×50%Friesian attributable to genetic constitution. Shorter intervals between collections reduce the number of sperm produced by ejaculate (Everett and Bean, 1982; Schwab *et al.,* 1987; Romano *et al.*, 1988; Gerard and Humblot, 1992) but increase the amount of semen produced per unit time (Amann and Almquist, 1976; Almquist, 1982). The limited information are available of the semen characteristics such as volume, sperm concentration, motility, total number of motile sperm cells/ejaculate, total number of semen doses/ejaculate and total number of semen collection/months on the effect of breed and interval between semen collection of the Friesian cross and Sahiwal bulls at District Artificial Insemination (AI) Centre, Rajshahi. A better knowledge about the influence of breed of the bull at collection and frequency of collection on semen production will help the AI industry to adapt management of bulls to improve semen output. The present study was therefore planned with the objectives: to study the effect of breed and frequency of semen collection on semen characteristics and to investigate the correlation between the semen characteristics of different AI bulls at District Artificial Insemination Centre, Rajshahi, Bangladesh.

## Materials and Methods

The information of semen characteristics of eight breeding bulls was collected on the basis of records maintained at District Artificial Insemination (AI) Centre, Rajshahi during the period from 1996 to 2001. The studied bulls were divided into four groups according to their genetic composition and each consist of two bulls. The genetic groups were as 100%Sahiwal (100%SL), 75%Friesian ×25%Local (75%F×25%L), 50%Sahiwal ×50%Friesian(50%SL×50%F)and50%Friesian×50%Local (50%F×50%L). The age of the bulls was determined by inquiring the date of birth from bull register which ranged from 3 to 11 years. Interval between semen collections was divided into 3 groups: 1 to <6 days, 6 to <9 days and 9 days to upwards.

Feeding and management system at District AI centre, Rajshahi were more or less regular and concentrates feeds fed single time daily. Concentrates feed include chickpea, wheat bran, til oil cake, rice bran, and common salts. The green grass like para, napier, jambo, maize and

oats in fresh form supplied on the basis of year round availability. A general management schedule for deworming and disease prevention was followed. Bulls were tested for fertility before putting in breeding herd. Semen was collected early in the morning at 3 to15 days intervals with the aid of an artificial vagina (AV). A total of one/two ejaculates were collected from each bull. The semen collected was brought to the laboratory immediately and was placed in water bath at 37 $^0$C for evaluation. Following semen parameters were recorded: volume of ejaculate (ml), sperm concentration (mill. ml$^{-1}$), motility(%), total number of motile sperm cells per ejaculate, total number of semen doses /ejaculate and total number of semen collection per month. Semen volume was recorded directly from graduated test tubes. Sperm concentration was measured using an improved Neubaur haemocytometer (Salisbury *et al.*, 1978). Motility, as a percentage of individually motile spermatozoa, was estimated by examining a drop of fresh semen on a warm slide (with cover slip) under a microscope at 400×. Motility was scored on the basis of the percentage of spermatozoa with normal forward progressive movement while those showing circling movements or oscillating at one place were regarded as immotile (Ahmad, 1994). Total number of motile sperm cells/ejaculate(millions) was calculated by multiplying spermatozoon concentration (mill. ml$^{-1}$), volume of ejaculate (ml) and percentage of motility divided by 100. Total number of semen doses/ejaculate (million) was calculated by total number of motile sperm cells/ejaculate (millions) divided by 20. Total number of collections per month were direct recorded from semen register from the said AI centre.

**Statistical analysis:** Obtained data were subjected to analysis of variance test by SPSS computer software package (Anonymous, 1996). The means were compared by Duncan's multiple range test, (Steel and Torrie, 1980) and correlation coefficients among different parameters were also worked out. The following model was used for different semen parameters:

$$Y_{ij} = \mu + G\,I + I_j + e_{ij}$$

Where:
$Y_{ij}$ = Individual record
$\mu$ = Overall mean
$G_i$ = Effect of Genotypes of bulls (I=1-4)
$I_j$ = Effect of intervals between collection(j=1-3)
$e_{ij}$ = random error associated with individual observation

## Results and Discussion

**Breeds of bull:** All the semen traits were found affected significantly (P<0.05) with genetic groups of the bulls except motility of the sperm and total number of semen collections per month. The significantly (P<0.05) highest volume (6.99±0.16 ml) was found in 50%SL×50%F and did not differ from 100%SL (6.84±0.22). The lowest volume was found in 75%F×25%L (5.29±0.21). Kibria *et al.* (1997) also noticed significant (P<0.05) breed difference for volume of ejaculate in 100%SL, 100%HF, 75%HF×25%L, 50%F×50%L, 75%SL×25%HF, 50%SL×50%HF and 50%S×50%SL. The highest sperm concentration (1471±37 mill. ml$^{-1}$) was found in 100%SL and lowest was in 50%F×50%L (1131±38 mill. ml$^{-1}$). Sarder *et al.* (2000) also noted (1447±132 mill. ml$^{-1}$) sperm concentration in 50%SL×25%F×25%L and this did not differ from 100%SL and 50%S×50%SL (1428±91 and 1384±172 mill. ml$^{-1}$, respectively) which is more or less close to present study. Laing *et al.* (1988) stated that in case of bull semen, concentration of sperm varied from 500-2500 million/ml, whereas Hafez (1993) reported this concentration range of 1000-2000 and 800-1500 mill. ml$^{-1}$ respectively for dairy and beef cattle which is almost similar to the present study.

The mean initial sperm motility in fresh ejaculate was between 63±0.32 and 64±0.35%. Genetic group had no significant (P>0.05) effect on average initial motility of spermatozoa. Sarder *et al.* (2000) studied that genetic group had no significant effect on average initial motility of fresh semen. They have found the average initial motility range from 61.55 to 65.96%. Kibria *et al.* (1997) also reported that the motility range from 56.9 to 63.95% of different genetic groups. Sugulle (1999) stated that the sperm motility in fresh ejaculate was between 60 and 68%, the differences between bulls were non significant. However, Alim and Hasnath (1977) reported 69.6% motility for fresh semen of Sahiwal and Sindhi bulls which were higher than the range of present study. The difference in initial motility in various reports could be due to variation in judgement of motility and number of bulls studied. The mean total number of motile spermatozoa per ejaculate range from 4418±295 to 6520±296 millions. The total number of motile spermatozoa /ejaculate (million) was affected (P<0.05) by genetic groups (Table 1). Significantly (P<0.05) highest total number of motile spermatozoa/ ejaculate was found in 100%SL with 6520±296 millions and then for 50%SL×50%F with a value 5707±183 millions. The total number of motile spermatozoa/ejaculate was the lowest for 50%F×50%L (4418±285 millions). However, Mathevon *et al.* (1998a)

Table 1: Mean ±S.E. for the semen characteristics of different genetic groups of AI bulls

| Semen characteristics | Genetic group 100% SL n=126 | 75%F×25%L n=188 | 50%SL×50%F n=184 | 50%F×50%L n=182 | Over all N=680 |
|---|---|---|---|---|---|
| Volume of ejaculate(ml) | 6±0.22a | 5±0.21c | 6±0.16a | 5±0.21b | 6±0.11 |
| Sperm concentration $\times 10^6$ | 1471±37a | 1283±47b | 1274±26b | 1131±38c | 1278±21.05 |
| Motility (%) | 64±0.35a | 63±0.36 | 63±0.36 | 63±0.32 | 63±0.17 |
| Total number of motile sperm cells /ejaculate$\times 10^6$ | 6520±296a | 4510±183c | 5707±183b | 4418±285c | 5208±147.57 |
| Total number of semen doses /ejaculate | 314±18a | 230±15.33b | 310±18a | 217±14b | 265±8.90 |
| Total number of semen collection /month | 3±0.23 | 4±0.23 | 40.24 | 4±0.28 | 4±0.12 |

abc= Means for each characteristics on the same row with different exponent differ significantly (P<0.05). SL= Sahiwal, F= Friesian, L= Local.

reported average total number of motile spermatozoa /ejaculate in bovine semen which was 5339±2793 millions of mature bulls and this facts is within the range of present study.

Significantly (P<0.05), the highest number of semen doses per ejaculate was found in100%SL(314±18.0) and lowest in 50%F×50%L (217±14.02). Stalhammar *et al.* (1989) also reported number of semen doses per collection ranging from 340±144 to 500±155 of Swedish Red and White Friesian bulls. The above results fall in accord with present study. Both the total number of motile sperm cells per ejaculate and number of semen doses per ejaculate are closely dependent upon the sexual preparation of the bull before collection (Mathevon *et al.,* 1998b).

The mean total number of semen collection per month ranged from 3.94±0.23 to 4.33±0.28. The total number of semen collection per month was not affected (P>0.05) by genetic groups. The highest number of semen collection per month was found in 50%F×50%L (4.33±0.28) and then for 75%F×25%L(4.25±0.23) and the lowest was in 100%SL (3.94±0.23). However, Sarder *et al.* (2000) reported an average total number of semen collection per month within the range from 2.99±0.33 to 7.58±1.13 for different genetic groups of AI bulls. This fact also corroborates with present study. Variation in semen parameters reported by different workers might be dugenetics, reproductive health status of bulls, age of bulls, nutrition, season and management (Nazir, 1988; Soderquist *et al.,* 1992). Variation can also be due to skill of semen collector/ attendant and temperature of AV.

**Intervals between semen collection:** Length of the interval between two collections significantly (P<0.05) affected all the semen traits except volume of ejaculate and total number of semen doses per ejaculate (Table 2). The highest volume of ejaculate (6.40±0.20 ml) was found in <6 days group and the lowest in >9 days (6.12±0.20ml). The significantly (P<0.05) highest sperm concentration, motility, total number of motile sperm cells/ejaculate and total number semen collections/month was found in <6 days (1332±29 mill. $ml^{-1}$, 64±0.24%, 5621±261 and 5.84±0.23 million respectively) and the lowest in >9 days (1206±33 million $ml^{-1}$, 63±0.28%, 4811±243 million and 2.83±0.10, respectively). The mean total number of semen doses /ejaculate was the highest (275±13.71) with in interval of <6 days between collection. In present study the better performance of semen characteristics were found at the interval groups of <6 days. These results agree with those of Mathevon *et al.* (1998a); Everett and Bean (1982); Seidel and Foote (1969); Everett *et al.* (1978) and Almquist and Amann (1976). Mathevon *et al.* (1998a) reported for volume, sperm concentration, motility, total number of motile sperm cells /ejaculate, were generally the greatest using an interval of 4 to 7 days for young bulls and of 5 days for mature bulls this results are closely related to the present study. In general, sperm concentration was greater from an interval of 5 to 9 days between collections and decreased slightly with a long interval, depending on age and unit of collection (Mathevon *et al.,* 1998b). But, Schwab *et al.* (1987) reported a decrease in semen volume, sperm concentration and total number of motile sperm cells per showed the significant positive correlation between all the semen parameters except number of semen collection /month which was negative. The sperm concentration also observed a significantly positive correlation between all semen traits. Motility a significantly positive correlation ejaculate with an interval shorter than 4 days between collection. To produce more sperms per unit time, a high frequency of collection should be applied, as recommended by Amman and Almquist (1976) and Lorton *et al.* (1984). Variation in different reports with regard to semen parameters in different intervals between semen collection may be due to differences in genetics, age of bulls, number of observation made and length of study period.

Correlation coefficients between various semen characteristics are shown in Table 3. The volume of semen with all semen parameters. Total number of motile sperm cells was found positively correlated with other semen characters and total number of semen doses was of negative correlation with total number of semen collection per month.

Table 2: Mean ±S.E. of semen characteristics considered in an intervals between collection of semen

| | Intervals between semen collection groups | | | |
|---|---|---|---|---|
| Semen characteristics | <6 days n=222 | 6 to <9 days n=274 | > 9days n=184 | Grand total n=680 |
| Volume of ejaculate(ml) | 6±0.20 | 6±0.18 | 6.12±0.20 | 6.21±0.11 |
| Sperm concentration $\times 10^6$ | 1332±29a | 1324±38a | 1206±33b | 1278±21 |
| Motility (%) | 64±0.24a | 64±0.28a | 63±0.28b | 63±0.17 |
| Total number of motile sperm cells /ejaculate$\times 10^6$ | 5621±261a | 5380±275ab | 4811±243b | 5208±147 |
| Total number of semen doses /ejaculate | 275±13 | 262±13 | 261±17.02 | 265±8.90 |
| Total number of semen collection /month | 5.84±0.23a | 4.63±0.12b | 2.83$^c$ ±0.10 | 4±0.12 |

Means for each characteristics on the same row with different exponent differ significantly (P<0.05).

Table 3: Correlation between various semen characteristics of the AI bulls

| Semen characteristics | Correlation coefficient |
|---|---|
| Volume of ejaculate× sperm concentration | 0.388** |
| Volume of ejaculate× motility | 0.831*** |
| Volume of ejaculate× total number of motile sperm cells | 0.653*** |
| Volume of ejaculate× total number of semen doses | 0.366** |
| Volume of ejaculate× total number of semen collection /month | -0.018 |
| Sperm concentration × motility | 0.652*** |
| Sperm concentration × total number of motile sperm cells | 0.815*** |
| Sperm concentration × total number of semen doses | 0.595*** |
| Sperm concentration × total number of semen collection /month | 0.218* |
| Motility × total number of motile sperm cells/ejaculate | 0.644*** |
| Motility × total number of semen doses | 0.473** |
| Motility × total number of semen collection /month | 0.331** |
| Total number of motile sperm cells× total number of semen doses/ejaculate | 0.760*** |
| Total number of motile sperm cells× total number of semen collection /month | 0.112 |
| Total number of semen doses × total number of semen collection /month | -0.032 |

P<0.01; **P<0.05; ***P<0.001;

It can be concluded from the present study that 100% Sahiwal (100%SL) and 50%Sahiwal×50%Friesian(50%SL ×50%F) genetic groups were better for most of the semen parameters and <6 days interval was suitable among all groups.

**Acknowledgement:** The author expresses his thanks to Mr. Azzizul Haque Dhali, Assistant Director and Julfikar Md. Aktar Hossian, Scientific Officer, District Artificial Insemination (AI) Centre, Rajshahi for their direct and indirect assistance in this research work.

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