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Comparative study on the libido, semen quality and fertility of Brahman cross, Holstein Friesian cross and Red Chittagong breeding bulls

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Abstract

The present study was undertaken to compare the performance of 8 (eight) breeding bulls of three different genetic groups such as Brahman × local (4 bulls), Holstein Friesian × local (2 bulls) and Red Chittagong (2 bulls) based on *libido*, semen quality and fertility. Semen parameters were evaluated from 30 ejaculates from each bull and fertility rate was calculated based on 60-days non-return rate via AI using these semen samples. Genetic group of breeding bulls had significant ($p<0.05$) effect on *libido*. Holstein Friesian cross breeding bulls showed significantly ($p<0.05$) highest *libido* (3.77±0.15) followed by Brahman cross (3.38±0.07) and lowest in Red Chittagong (RC) breeding bulls (2.96±0.11). Semen attributes also significantly affected by the different genetic group of bulls. Holstein Friesian crossbred breeding bulls with highest *libido* provided significantly ($p<0.01$) highest volume of semen (5.63±0.16 ml) per ejaculate, progressive motility (74.73±0.76%), live sperm (84.18±0.62%) and normal sperm (83.18±1.47%) whereas these parameters were significantly ($p<0.01$) lowest in RC breeding bulls. Moreover, *libido* showed a strong and positive correlation with all these semen parameters. The fertility rate was also significantly highest ($p<0.05$) in Holstein Friesian crossbred breeding bull (63.67±1.46%), followed by Brahman crossbred (58.86±1.05%) and lowest in RC breeding bulls (53.42±0.85%). These results suggested that semen quality is positively correlated with the *libido* of breeding bulls and quality is important for higher fertility. Therefore, *libido* as well as semen quality evaluation may be important criteria to discard the breeding bulls with poor fertility in an AI program.

Key words: libido, semen quality, sperm morphology, non-return rate

Introduction

Animals showing high libido and appropriate mating capability are the desirable characteristics for a successful breeding program (Chenoweth, 1983; Ahmad *et al*., 2005). Libido is the desire and excitement of a male animal to mount and do mating with a female animal (Chenoweth, 1981). It is a helpful parameter of measuring reproductive competence (Ahmad *et al*., 2005) which is calculated by means of the reaction time, defined as the elapsed time between exposure to stimuli and first service (Ott and Memon, 1980). The level of sexual excitement and performance can affect the ejaculatory performance and semen quality (Pound *et al.,* 2002; Levis and Reicks, 2005; Kondracki *et al*., 2013).

Bulls with high libido can produce satisfactorily higher number of viable spermatozoa through multiple ejaculates in a relatively short time (Ahmad *et al*., 2005). Selection of bulls on the basis of sexual behavior and semen quality are more important and economical (Anzar *et al*., 1993). A bull has a great impact on herd productivity than a single female. So, a bull is aptly said to be "half of the herd". Semen quality of a breeding bull encompasses a package of parameters that represent the inner picture of semen related to fertility which consist volume of semen (ml), mass motility (%), sperm livability (%), normal sperm (%), sperm concentration (million/ml) and non-return rate (%). In our country, the criteria for the selection of bull comprise the milk yield of the dam, phenotypic characteristics, and evaluation of semen characteristics (Ahmad *et al*., 2003; Khan *et al.*, 2007). The criteria adopted to select a bull of enough reproductive

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ability are seen in latest areas by introducing modern laborious techniques. However, assessment of libido is still a reliable technique to assess the soundness of a bull for selection in breeding program (Mahmood *et al.*, 2014). Testing animals on the basis of libido could provide an easy assessment to select a bull for breeding program. Parkinson (2004) postulated that a bull requires the following criteria to be fertile: physically soundness, good libido, and good quality semen. It is well known that characteristics of semen vary widely between bulls. The differences in semen parameters among bulls may be due to variations in scrotal circumference, breed, age, body size and body weight (Leon *et al*., 1991 and Sharma *et al.,* 1991). Quality of the semen is affected by both health and nutritional status of the bulls (Soeparna *et al.,* 2013). It is also affected by collection and subsequent handling. In tropical countries, low reproductive performance is a major problem which is associated with semen quality of the stud bull (Annual report of DAPH, 2011).

Andersson *et al.* (2002) observed a high variability in fertility among bulls using different sperm concentrations per dose at AI. Generally, the non-return rates used as a measure of fertility. In order to evaluate the fertilizing capacity of semen sample a reasonable number of cows is to be inseminated and after 60 days the non-return rate of the cows can be calculated. The non-return rate of bulls depends on holistic semen characteristics of bull, breeding soundness of cows and appropriateness of time and site for semen deposition. The continuous evaluation of semen quality and quantity is required, to achieve higher non return rates.

From the previous review of literatures, it was revealed that no study was conducted to compare the libido, semen quality and fertility rate of our available genetic group of breeding bulls such as Brahman × Local, Holstein Friesian × Local and RC breeding bulls in Bangladesh. Therefore, the purpose of the present study was to evaluate and compare the libido, semen quality and fertility of these three genetic groups.

Materials and Methods

Animals and management system

The present study was conducted at Bangladesh Agricultural University AI Center. Eight (8) bulls of three different genetic groups were used as experimental materials. Experimental bulls were Brahman × Local bull ID. ABG011, ABG012, ABG013 and ABG014, Holstein Friesian × Local bull ID 80 and 81. Brahman cross and Holstein Friesian cross bulls were 50% crossbred and Red Chittagong Bull ID. 136 and 178 were 100% purebred. The age of the bulls ranged from 3-5 years. Bulls were maintained under identical feeding and management system throughout the study period.

Measurement of Libido

Libido of the breeding bull was measured according to Adamczyk *et al.* (2013) (Table 1).

Table 1: Assessment of bull libido

Scale	Description of behaviour
0	Lack of sex drive. Complete lack of interest. Bull does not sniff or attempt to mount; it stands next to the teaser animal or attempts to retreat.
1	Very weak sex drive. During 10-minute waiting, bull only sniffs the teaser animal with no attempt to mount.
2	Weak sex drive. Taken to the teaser animal, the bull sniffs it, retreats, sniffs again, makes a hesitant attempt at mounting, sniffs again, and makes another mount attempt within 10 minutes.
3	Moderate sex drive. Taken to the teaser animal, the bull sniffs it and begins mount attempts after 2-3 minutes.
4	Strong sex drive. Taken to the teaser animal, the bull attempts to mount it at once but remains calm and is manageable for the handler.
5	Very strong sex drive. Taken to the teaser animal, the bull begins mount attempts at once and becomes unmanageable for the handler.

Semen collection and evaluation

Semen was collected from each bull twice a week by AV (Artificial Vagina) method. A total of 30 ejaculates was collected from each bull and analyzed. Evaluation of fresh semen was performed immediately just after collection using the method described by Herman and Madden (1963). The volume (ml), progressive motility (%), sperm concentration (million/ml), live sperm count (%) and normal sperm count (%) were recorded. Volume was measured directly from the graduated collection vial. Progressive motility was evaluated in a small drop of semen under cover slip with higher magnification. Sperm moving forward were included in the motility count while sperm moving in rotatory or oscillatory motion were excluded (Herman *et al.*, 1994). Sperm concentration was determined by using haemocytometer method. To measure live sperm count, one drop of Eosin-Nigrosin stain was mixed with a small drop of semen on a pre-warmed slide. After smearing it was placed on microscope and counted under 40x. On the other hand, after staining with Rose-Bengal Stain, the slide was observed for normal sperm count. All values relating to semen evaluation parameter were expressed as mean ± standard error (SE).

Fertility

Fertility of breeding bull was calculated based on the non-return rate of breeding bulls. Fertility was calculated by the number of cows conceived out of the total number of cows inseminated by the semen of respective breeding bulls and inseminated cows not return to estrus within a period of 60 days.

Statistical analyses

All data were recorded in Excel data sheet and One-way ANOVA test was performed to obtain the difference in volume per ejaculate, mass motility, sperm concentration, live sperm and normal sperm percentage of three genetic groups. Correlation analysis was performed to find the relationship between libido and semen parameters. All statistical analysis were performed by using graph pad prism 5.0 software.

Results and Discussion

Libido

The present study was undertaken to evaluate and compare the libido of different breeds and its effect on semen quality and their inter relationships. Libido measurement is a useful tool to judge the reproductive efficiency in a bull. In the current study, we found that breed significantly affected the libido and semen quality of breeding bulls. Holstein Friesian crossbred showed significantly ($p<0.05$) highest libido (3.77±0.15) followed by Brahman crossbred bull (3.38±0.07) and the lowest in RCC Breeding bull (2.96±0.11) (Figure 1). Similar findings were reported by Rehman *et al.* (2016). Several other authors also reported varying level of libido in farm animals (Rhen and Crews, 2002; Younis *et al*., 2003; Ahmad *et al*., 2005; Kondracki *et al*., 2013). However, we also found that bulls with higher libido exhibit better semen quality in different breeds. This result also coincides with the findings of Ahmad *et al*. (2005) who concluded that a bull exhibiting higher libido may carry better semen quality.

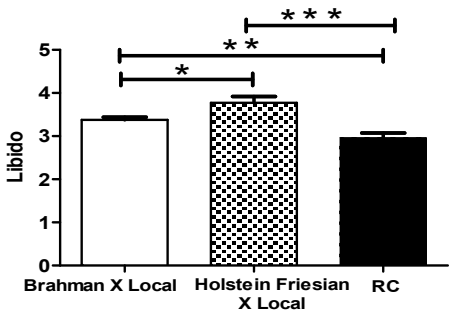

Figure 1: Libido of Brahman cross, Holstein Friesian cross and RC breeding bulls

Semen quality

Volume

The volume of the ejaculate significantly ($p<0.01$) differed among three genetic group of breeding bulls. The highest volume per ejaculate was observed in Holstein Friesian cross bull (5.63±0.16 ml) and lowest was found in Red Chittagong bull (3.86±0.15 ml) (Table 2). Similar observation was found by Raju and Rao (1982) and Nasrin *et al.* (2008). Christensen *et al.* (1999) reported the volume of Holstein Friesian breeding bull was 5.1 with a range of 3.0-8.6. Rashid *et al.* (2015) and Fatematuzzohora *et al.* (2016) found 4.00±0.06 ml semen per ejaculate, respectively in Brahman crossbred bull. On the other hand Habib *et al.* (2003) reported 3.25±0.042 ml semen per ejaculate in RC breeding bull. These results coincide with the results of the present study.

Table 2: Semen quality of Brahman cross, Holstein Friesian cross and RC breeding bull

Semen parameters	Brahman × Local	Holstein-Friesian× Local	RC	Level of significance
Volume (ml)	4.93±0.10[b]	5.63±0.16[a]	3.86±0.15[c]	**
Progressive Motility (%)	69.07±0.66[b]	74.73±0.76[a]	63.96±0.76[c]	**
Sperm concentration (million/ml)	1147.00±28.75[a]	1087.00±54.41[a]	946.40±6.18[b]	*
Live Spermatozoa (%)	76.96±0.72[b]	84.18±0.62[a]	71.64±0.68[c]	**
Normal Spermatozoa (%)	83.14±0.72[a]	83.18±1.47[a]	74.29±0.90[b]	**

*P<0.05, **p<0.01

Progressive motility

The highest progressive motility of fresh semen was found in Holstein cross (74.73±0.76) followed by Brahman cross (69.07±0.66) and lowest in RC (63.96±0.76) breeding bull. This study also revealed that individual motility of fresh semen varied significantly (p<0.01) among the different genetic group of breeding bulls (Table 2). Rahman *et al.* (2014) reported that the motility of Holstein × Zebu and RCC were 66.72±0.99% and 62.12±0.97%, respectively and also found the motility was significantly lowest in RCC breeding bull than other breeds which is in line with our present study. Other studies also showed that the percentage of motile sperm was 66.2-76.0% in Holstein × Zebu bull (Shaha *et al*. 2008, Saxena and Tripathi, 1981) whereas Rashid *et al.* (2015) and Fatematuzzohora *et al.* (2016) found 67.1±0.85% and 69.19±0.29% motility in Brahman crossbred bull. These results are in agreement with present study.

Sperm concentration

Sperm concentration varied significantly among the three genetic group of breeding bulls where the highest sperm concentration was found in Brahman crossbred breeding bull (1147.00±28.75 million/ml) and lowest in RC (946.40±6.18 million/ml) though the sperm concentration did not vary significantly between Brahman crossbred and Holstein Frisian crossbred (1087.00±54.41 million/ml) breeding bull (Table 2). Everett and Bean (1982) found 1000 million/mm^3 in Holstein Friesian crossbred bull. Fatematuzzohora *et al.* (2016) reported 1144.59±5.73 million/ml in Brahman crossbred bull and Habib *et al.* (2003) observed 1247.72±7.64 million/ml spermatozoa in RCC bull semen. These results are in line with present study. But the little variation in value might be due to the difference in age, breed, collection frequency, feeding regime (Al-Hakim *et al.*, 1984).

Live spermatozoa percentage

Analysis of variance shows that genetic group of breeding bull had a significant effect (p<0.01) on live spermatozoa percentage. The highest live sperm percentage was found in Holstein Friesian cross (84.18±0.62) whereas lowest in RC breeding bull (71.64±0.68) (Table 2). Nasrin *et al.* (2008) also reported that live spermatozoa percentage was consistently lower in RCC than any other bull. The results of the present study also do agree with the previous studies of Hahn *et al.* (1969) who found 83.5% live sperm in Holstein bull and Fatematuzzohora *et al.* (2016) who found 83.55±0.97% live spermatozoa in fresh semen of Brahman crossbred breeding bull.

Normal spermatozoa percentage

In the present study, morphologically highest normal sperm percentage was observed in Holstein Friesian cross breeding bull (83.18±1.47%) and lowest in RC breeding bull (74.29±0.90%). Significant variation (p<0.01) was revealed between Holstein Friesian cross and RC breeding bull but no significant variation was observed in Holstein Friesian and Brahman crossbred breeding bulls (Table 2). Habib *et al*. (2003) reported that the normal sperm percentage in RCC was 82.24±0.49% which is higher than the present study. Nasrin *et al.* (2008) reported that normal spermatozoa in fresh semen varied significantly with an order of Holstein cross followed by Sindhi and Sahiwal cross and Red Chittagong bulls. Red Chittagong

bulls had lowest normal sperm percentage compared to other bulls.

Pearson's correlation between libido and semen parameters

In the present study, it was revealed that libido had a strong and positive correlation with volume (0.133), progressive motility (0.238. p<0.01), sperm concentration (0.379, p<0.001), live spermatozoa percentage (0.087) and normal spermatozoa percentage (0.179, p<0.05) (Table 3). These results are in agreement with the findings of Singh *et al.* (2015) who observed a positive correlation of libido score with volume, motility and sperm concentration in Sahiwal bulls. Our result also agreed with the findings of Javed *et al*. (2000) who reported positive correlation between sperm concentration and mass motility and progressive motility. Wahid and Yunus (1994) reported that there is a positive correlation between libido, semen volume per ejaculates and testicular length.

Fertility

The fertility of different breeds is shown in Figure 2. From the present study, it was revealed that the fertility rate was significantly (p<0.05) highest in Holstein Friesian crossbred (63.67±1.46%) followed by Brahman crossbred (58.86±1.05%) and lowest in RC (53.42±0.85) breeding bull (Figure 2).

Rahman *et al.* (2014) found an average fertility of 67.00±0.15% in Holstein × Zebu cattle which is in line with the present study. The present findings on fertility of RC bulls also agreed with the results of Habib *et al.* (2012) who found the mean non-return rate to first service of RCC bulls was 58.7±5.1%. On the other hand, Fatematuzzohora *et al.* (2016) reported conception rate using Brahman crossbred semen was 56.24% in Douhakhula region of Mymensingh district. This result coincides with finding of the present study.

Table 3: Correlation coefficient of libido with semen parameters of breeding bulls

	Libido	Volume	Progressive motility (%)	Sperm concentration	Live sperm (%)	Normal sperm (%)
Libido	1					
Volume	0.133	1				
Progressive motility (%)	0.238**	0.110	1			
Sperm concentration	0.379***	0.135	0.285**	1		
Live sperm (%)	0.087	0.238**	0.226**	0.130	1	
Normal sperm (%)	0.179*	0.258**	0.270***	0.176*	0.254**	1

*p<0.05, **p<0.01, ***p<0.001

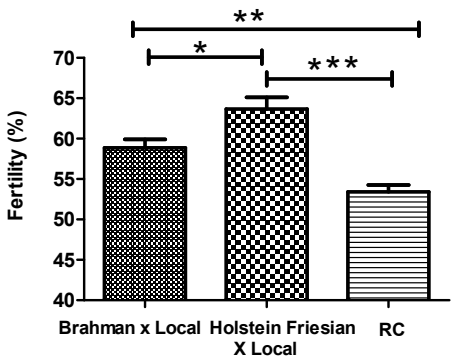

Figure 2: Fertility of Brahman cross, Holstein Friesian cross and RC breeding bulls

Conclusion

It can be concluded that libido, semen quality and fertility are linked together. Holstein Friesian crossbred breeding bulls have significantly higher libido and better sperm quality than that of Brahman and RCC. Therefore, libido and semen quality should be taken into consideration during breeding bull selection for the higher fertility in AI program.

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