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Full Length Research Paper

Ex situ productive and reproductive performances of Munshiganj Cattle

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Munshiganj cattle (MC) are one of the promising varieties of indigenous cattle genetic resources in Bangladesh generally found in the Munshiganj district and its surrounding areas. Farmers are replacing MC with high yielding crossbred cattle and population of MC is rapidly declining in their breeding tract. Considering the facts steps has been taken by BLRI for conservation, characterization and subsequent improvement of this valuable germplasmin BLRI. A mini nucleus herd was established in BLRI and this herd has been enlarged with a total population of 30 animals including 10 cows, 4 breeding bulls, 8 heifer calves and 8 bull calves. Different productive and reproductive performance was recorded in ex situ condition. Semen was collected form 3 sexually matured Munsiganj bull and collected semen was analyzed and diluted with Tris- egg -yolk citrate diluter with proper ratio considering the concentration and motility of the fresh semen . After 4hr equilibration semen was frozen with liquid nitrogen vapor with a programmable bio freezer (Minitube, Germany) at -140ºc and finally stored at -196ºc liquid nitrogen and were observed after 24 hr of storage for post thaw semen quality evaluation. The average birth weights of male calves (17.79±1.0 kg) were higher than average of those of female calves (17.28±0.95 kg). The survivability of both sexes was 100% in the herd. Average gestation length (GL), postpartum heat period (PPH) and number of services for each conception (NSPC) were 279.17± 3.76 days, 63.42± 22.08 days and 1.58± 0.79 respectively. In BLRI nucleus herd, average lactation length, yield/lactation and daily milk yield/cow was found 176.25±26.47days, 731.53±140.61 L and 4.13±0.39 L respectively. The fresh semen was thick creamy colour with an average volume and concentration of 4.273±0.54 ml and 1796 ±122.29 milion/ml respectively. Total, progressive, static and slow motility of the fresh and post thawed semen samples were (84.69 ±4.28, 52.97±3.13), (72.53 ± 2.91, 43.71±1.57), (15.31±4.28, 47.03 ±3.13) and (1.23± 0.60, 0.58± 0.18) respectively. Fat(%), protein (%), lactose (%) and SNF (%)was 5.61±0.29, 4.31±0.04, 6.19±0.05 and 11.43±0.09 respectively where fat and protein content varies significantly between morning and evening milk. Considering the results it can be concluded that Munsiganj cattle is a very promising and potential cattle variety of Bangladesh. Long term conservation and multiplication programme in grater scale should be taken immediately to save this variety before extinction.

Keyword: Conservation, Munshiganj cattle, Nucleus herd, Community

INTRODUCTION

Indigenous cattle (*Bosindicus)* constitute about 90% of the total cattle population of Bangladesh. The available cattle genetic resources of the country may be classified as i) Native cattle ii) Pabna cattle iii) Red Chittagong Cattle iv) Munshiganj cattle (MC) v) North Bengal Grey cattle vi) Crossbred cattle and vii) Exotic breeds (Holstein Friesian, Sahiwal, Sindhi and Jersey). The indigenous cattle are of various sizes and possess varied coat color such as red, grey, white, black or mixture of these in different proportion. Although this type of cattle are of low potential in terms of production but possess beneficial characteristics such as heat tolerance, adapted to humid climate, high rainfall, flood and swampy condition, ability to maintain body condition on poor quality feedstuffs mainly rice straw, good degree of resistance to local diseases and early puberty. Traditionally, cost of maintaining these animals by the smallholders is minimal and feeds are mostly derived from home grown crops, crop residues, road side grasses and grasses from fallow lands between cuttings**.**

Munshiganj Cattle is one of the improved varieties of cattle found in Munshiganj, Manikganj and adjunct areas of the districts. This is a typical milk type variety, mostly of creamy to dull pinkish in coat colour and looks different from other varieties. The cows are good milker and have great demand as milk cows in the surrounding localities and Dhaka city (Nasim, 1965). In spite of having good potentiality, Munshiganj cattle variety is almost extinct due to indiscriminate use of exotic animal genetic resources and poorly designed breeding schemes and lack of initiation for conservation and development programs. Munsiganj cattle are not addressed properly and very scanty and preliminary works has so far been conducted on Munshiganj Cattle. Uzzaman et al. (2011) observed phenotypic characterization of Munshiganj cattle and found better productive and reproductive performances than other non-descript indigenous cattle of Bangladesh. Considering the potential threat of extinction of this valuable indigenous germplasm this present research was deigned to collect the potential Munshiganj cattle for*ex-situ* conservation and evaluation of performance for subsequent improvement and multiplication for future use.

MATERIALS AND METHODS

Study place and time:

This experiment was conducted in cattle breeding farm of Bangladesh Livestock Research Institute (BLRI), savar, Dhaka from July 2014 to January 2018.

Mini nucleus herd establishment:

A mini nucleus herd was established in BLRI for characterization, conservation and subsequent development of Munsiganj cattle. Morphometric pure Munsiganj cows and bulls were purchased from their original breeding tract and brought to nucleus herd. The nucleus herd has been enlarged with a total population of 30 animals including 10 cows, 4 breeding bulls, 8 heifer calves and 8 bull calves. Different productive and reproductive performance was recorded and evaluated throughout the experimental period. To study the *ex-situ* performance of MC cows, the following economic important parameters were considered:

i) Birth weight of calves (kg)
ii) Age at first heat and first calving (month)
iii) Number of services per conception (no.)
iv) Postpartum heat period (days)
v) Calving interval (days)
vi) Milk yield (kg)
vii) Lactation length (days)
viii) Dry period (days)

Semen collection and evaluation

The bulls (n=3) were under regular twice a week semen collection schedule using an artificial vagina (Walton, 1945). Semen collections were made in the early morning between 7.30 h and 8.30 h. six ejaculates from each bull was observed, so the number of observation was 18. After collection the ejaculates were immediately transferred in to a water bath around at 37°C and evaluated for gross quality, motility, morphology and kinematics using a Computer Assisted Semen Analysis system (Hamilton Throne, Ivos II). Fresh semen drop was diluted with saline solution (NaCl) in a ratio of 1:100 and then put into 20 micron standard count 4 chamber slide for analysis.

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Preparation of extenders

Tris-egg yolk-citrate extender with the following composition was used for semen cryopreservation:

Tris-egg yolk-citrate extender	
Components	Percentage (%)
Tris (w/v)	3.028
citric acid (w/v)	1.678
Fructose (w/v)	1.2
Egg yolk (v/v)	20
Glycerol (v/v)	6.4
Streptomycin	660 µl

Freezing Protocol

After mixing with the extenders, diluted semen was placed in a cold handling cabinet (Minitube, Germany) for 4 hr at 4°C for equilibration. The semen was diluted with the extender to give a sperm concentration of 20 million/dose. The semen samples were filled and sealed in standard printed straws (0.25 ml) using an automated sealing filling machine. After equilibration, freezing of straws was carried out in liquid nitrogen (LN_2) vapor using a programmable bio-freezer (Minitube, Germany). The straws were then plunged in LN_2 (–196°C) for overnight storage.

Post Thaw evaluation of semen

Semen straws were thawed next day in a water bath at 37°C for 30 s and the sperm quality was further evaluated using the same protocol as described for fresh semen.

RESULTS AND DISCUSSION

Productive performances:

Birth weight:

Productive performances of Munsiganj cattle are described in Table 1. From Table 1, the average birth weights of male calves (19.47±0.79 kg) were significantly ($p<0.05$) higher than average of those of female calves (16.14±0.52). The survivability of both sex were 100% in the herd. Uzzaman et al.(2011) found 14.83±0.79 kg sex pooled birth weight of Munsiganj calf in in- situ condition. In this study the birth weight of both sexes found were above than in situ condition. This is may be due to improved feeding and management in ex situ condition. Al-amin et al. (2007) reported 18.35±0.52 kg average birth weight of North Bengal Grey calves. Khan et al. (2000) observed the birth weight of Red Chittagong calves in farm and rural condition to be 17.28±0.76 and 16.0 ±l.52 kg respectively which was almost similar to the findings of Habib et al. (2003) who also found 16.7±0.48 kg birth weight of Red Chittagong calves.

Daily milk yield:

Munsiganj cattle are highly popular for its higher milk production potentiality rather than other indigenous variety. In BLRI nucleus herd, average daily milk yield/cow was found 4.13±0.39 L (Table1). Mean lactation yield and milk yield per day of Red Chittagong cattle were found 805.08±2.07 liters and 2.70±0.09 liters respectively by Bhuiyan (2008), whereas an average daily milk yield under farm and rural conditions was found 2.0±0.65 kg and 1.80±0.87 kg respectively by Khan *et al.* (2000) which is much lower than the average daily milk yield of present study. Al-amin (2007) reported that the highest peak milk yield of NBG cows was of 3.46±0.18 liters per day which is also lower than Munsiganj cow. All of this information indicates that Munsiganj cattle have almost higher daily milk yield than other indigenous cattle varieties of Bangladesh. From available studies a wide variation in milk yield of indigenous cows has been noticed and providing hints for an opportunity of selection among the indigenous cattle resources to increase milk yield in Bangladesh. Difference in genetic architecture, feeding system, quality and quantity of ration, milk man and time of milking may be affecting the daily milk yield of indigenous cow.

Lactation length and yield:

In BLRI nucleus herd, average lactation length and yield/lactation was found 176.25±26.47days, and 731.53±140.61 L respectively (Table 1). Different research was carried out to find out the milk production potentiality of indigenous cattle, whereas overall lactation length was found 253.68±12.89 days in Munsiganj cattle by Uzzaman et al. (2011). Bhuiyan (2008) and Habib et al (2003) found 208.08±3.11 days and 218.58±6.11 days lactation length of Red Chittagong and North Bengal grey cattle. Hoque et al. (1999) and Khan and Khatun (1998) studied the performance of Pabna local cattle and in that lactation length ranged from 198.9±11.52 to 208.75±18.15 days. These results are higher than the results of present study.

Milk composition:

Milk fat, protein, lactose and SNF contents of Munsiganj cows are presented in table 2. From the table 2, it can be illustrated that milk fat, protein, lactose and SNF in morning and evening milk were 4.89 and 6.34%, 4.23 and 4.38%, 6.11 and 6.28% and 11.25 and 11.60%, respectively with overall mean of 5.61, 4.31, 6.19 and 11.43%, respectively

Table 1: Productive performances of Munsiganj cow

Characteristics	(Mean±SD)
Male calf	19.47[a]±0.79
Female calf	16.14[b]±0.52
Lactation length (Days)	176.25±26.47
Lactation yield (Days)	731.53±140.61
Daily milk yield (L)	4.13±0.39

Table 2: Milk composition of Munshiganj cows

Properties	Morning	Evening	Sig level	Overall
%Fat	4.89[b]±0.28	6.34[a]±0.35	**	5.61±0.29
%Protein	4.23[b]±0.04	4.38[a]±0.05	*	4.31±0.04
%Lactose	6.11±0.06	6.28±0.07	NS	6.19±0.05
%SNF	11.25±0.11	11.60±0.13	NS	11.43±0.09

***-significant at 5% level (p<0.05); **-significant at 1% level (p<0.01); NS-non significant (p>0.05)**

Table 3: Reproductive performances of Munshiganj cows

Characteristics	(Mean±SD)
Gestation period	279.17± 3.76
Postpartum heat period	63.42± 22.08
Service per conception	1.58± 0.79

(Table 2). Fat and protein contained in evening milk were significantly higher than morning milk, while no significant differences were found for lactose and SNF content. Islam (2008) found the fat, protein and SNF content of Red Chittagong Cow to be 5.60±0.91, 4.06±0.29, and 8.70±0.25% respectively. Talukder (1989) observed that the average SNF content of milk collected from farmers and local market of Trishalthana under Mymensingh district were 8.61 and 7.13% respectively. Hossain (1968) found that milk fat of indigenous cows was 4.60%±0.64.

Reproductive performance:

Gestation period

The mean of gestation length along with SD of Munshiganj cow is presented in Table 3. Average gestation length (GL) was found 279.17± 3.76 days for Munsiganj cows (Table 3).The gestation period of North Bengal Grey cows is 281±1.3 days (Amin et al. 2007) and Red Chittagong cow 281.30±1.43 days (Kahn et al. 1999). The gestation length is a species characteristic. The duration of gestation is genetically determined. Variation may be due to maternal influence. A little variation in gestation length within the individual in different animals may be contributed mainly by maternal and fetal factors. Ages of the dam, nutritional body conditions of the dam are maternal factors. On the other hand, fetal factors include the sex and genetic makeup of the fetus, twining and hormonal functions of the fetus. However variation in the gestation length might be due to genetic variation along with environmental factors such as season, temperature, feeding and management to a little extent (Al Amin et al. 2007).

Post-partum heat period (PPHP)

The mean along with SD for post-partum heat period are shown in Table 3. Average gestation length (GL) was found 63.42± 22.08 days for Munsiganj cows (Table 3). Nahar et al. (1989) reported PPHP of different breed groups ranged from 150.71±4.42 to 113.33±5.45 days. In RCC cattle PPHP was found 121.13±5.50 days (Bhuiyan, 2008). Al-amin et al. (2007) reported 109.72±4.15 days of PPHP for NBG cows. Ashraf (1998) reported PPHP of indigenous cattle in Khulna region was 3.61±1.50 months. In the present study post-partum heat period is lower than RCC and NBG cows.

Service per conception

The mean service per conception along with SD of Munshiganj cow is presented in Table 3. Average Service

Table 4: Fresh and frozen semen quality of Munsiganj bull

Parameter	Fresh semen (Mean±SD)	Frozen semen(Mean±SD)
Volume	4.273±0.54	-
Concentration	1796 ±122.29	-
Total motility	84.69 ±4.28	52.97± 3.13
Progressive motility	72.53 ± 2.91	43.71±1.57
Static motility	15.31±4.2	47.03 ±3.13
Slow motility	1.23± 0.60	.58± 0.18

Figure 1: Mini nucleus herd of Munsiganj cattle at BLRI

Figure 2: semen collection from Munsiganj Bull

per conception was found 1.58± 0.79 for Munsiganj cows (Table 3). In Red Chittagong cattle, Bhuiyan (2008) reported a service per conception of 1.55±0.08 and 1.43±0.10 respectively in-situ and ex-situ. Al-amin (2007) reported 1.36 of service per conception of NBG cows. Khan et al. (1999) studied the performance of RCC and Pabna cattle and reported that SPC were 1.61±0.09 and 1.57±0.07 respectively. Habib et al. (2003) observed the average number of services required per conception for the RCC was 1.25±0.12. In this study the service per conception is almost similar with available data of indigenous cattle. A number of factors which might have influenced for the variation of service per conception such as the quality and quantity of semen, improper detection of heat, failure to inseminate at appropriate time, the level of fertility which might be influenced by the age of bull and cow, season of the year, diseases and other environmental factors.

Semen quality:

The semen quality characteristics of Munsiganj bulls are presented in table 4. From table 4, it can be illustrated that, fresh semen was thick creamy colour with an average volume and concentration of 4.273±0.54 ml and 1796 ± 122.29 million/ml respectively. Total, progressive, static

and slow motility of the fresh and post thawed semen samples were (84.69 ±4.28, 52.97±3.13), (72.53 ± 2.91, 43.71±1.57), (15.31±4.28, 47.03 ±3.13) and (1.23± 0.60, 0.58± 0.18) respectively (Table 4). Mean value of semen ejaculate volume, sperm motility, mass activity, sperm concentration, percentage of live and dead sperm and pH of Holstein-Friesian × Zebu, Sahiwal × Zebu, Sindhi × Zebu and Red Chittagong Bull were 5.81± 0.16ml, 66.64± 0.50%, 3.59± 0.05,1115.97± 16.08 million/mm3, 77.62 ± 0.63 %, 15% to 45%, 6.48± 0.01 respectively Rahman et al.(2014).The highest (7.19± 0.19ml) mean value of volume of semen was found in Holstein-Friesianx Zebubulls and lowest (4.41±0.21ml) in Red Chittagong bulls. According to Rahman et al.(2014), semen ejaculate volume, sperm motility, mass activity, sperm concentration, percentage of live and dead sperm of Red Chittagong bulls are 4.41±0.21ml, 62.12±0.97%, 3.12±0.04, 1020.96± 20.83 million/mm3, 69.62±1.29% respectively. C.R. Sane et al.(1994)found that the mean volume of the ejaculate in adult dairy and buffalo bull was 5.4 to 6.5 ml. Hoque et al. (1997)reported that average motility of bovine fresh semen as 63.3% and the range was 50-80%. This variation could be caused by the age of animals, climate and management. Hafez (1993) stated that the concentration of bull sperm ranges from 800-2000 million/mm3. Season had no effect on buffalo bull sperm concentration but it increased significantly with the age of the animals Kim et al.(1983). Rao and Rao (1979)observed that, the average live sperm percentage for Holstein bull 83.5% and with a range from 70%-90%.The findings of present study are almost close to the semen quality of Red Chittagong bulls reported by Rahman et al.(2014). The prepared frozen semen is now using in Munsiganj rearing community for artificial insemination to increase the population of purebred animal.

CONCLUSION

In conclusion Munsiganj cattle are highly potential form most of the productive and reproductive point of view. This valuable endangered germplasm needs to be conserved for future multiplication. The ongoing artifitial insemination (AI) programme may be a potential tool to increase the population size of Munsiganj cattle in their habitat.

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