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INVESTIGATION ON SEMINAL ATTRIBUTES AND FERTILITY OF BLACK BENGAL GOAT

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Abstract

A total of 120 ejaculates from six adult Black Bengal bucks were studied to determine the semen attributes and evaluate their fertility. The various semen attributes of fresh semen were volume, sperm concentration, mass motility, live spermatozoa and normal spermatozoa percentage. All the semen attributes differed significantly ($P<0.05$) except normal spermatozoa percentage between the bucks. A total of 129 goats were inseminated with diluted semen to assess the fertility rate of Black Bengal buck. The mean values for the various semen attributes were: volume 0.58 ± 0.03 ml; sperm concentration 2797.22 ± 18.73 × 10^6/ml; mass motility 77.82 ± 0.61%; live spermatozoa 86.72 ± 0.54% and normal spermatozoa 91.39 ± 0.24%, respectively in fresh semen. With regard to the diluted semen, individual bucks showed significant difference ($P<0.05$) on motility, live and normal spermatozoa percentages. The diluted semen motility varied from 68.64 ± 1.66 to 74.55 ± 1.06%. On the other hand, the live and normal spermatozoa percentages of the diluted semen varied from 83.73 ± 0.94 to 89.27 ± 1.40% and 88.73 ± 0.54 to 91.91 ± 0.78%, respectively. From the insemination trial, the average kidding rate obtained was 58.9% in Black Bengal goat. It is suggested that selection of good quality buck semen could improve the overall fertility of Black Bengal goat.

Key words : Buck, Semen, Mobility, Viability, Fertility

Introduction

Goats are regarded as an intimate and integral part of rural farming systems in Bangladesh. The country has only one goat breed, popularly known as the Black Bengal goat. It is estimated that more than 90% of goat population in Bangladesh comprised the Black Bengal goats, the remainder being Jamnapari and their crosses (Husain, 1993). It is dwarf in size and noted to be famous for its high adaptability, prolificacy, delicious meat and superior skin (Devendra and Burns, 1983 and Husain *et al.*, 1996). It has also been observed that there exists sizeable genetic variation in traits between individuals within and between locations (Amin *et al*., 2000). These variations can be exploited for genetic improvement using

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selective breeding within the breed (Husain *et al*., 1996; Akhter *et al*., 2000 and Husain, 2007).

But unfortunately, there is severe shortfall of stud bucks all over the country. In most situations, bucks are being kept by only the few lower cast people and same buck has been used generation after generation which has created greater chance of increasing inbreeding and hence lowering reproductive performances along with disseminating various venereal and infectious diseases (Husain, 2007). On the other hand, unlike cattle, goat raisers castrate almost all the male kids at an earlier age for economic and social reasons. Therefore, there remains no chance for judging breeding soundness and fertility of the buck. However, it is well established that the selection of good quality bucks and their widespread use could improve the overall potential production of goats (Husain, 2007). The selected best quality bucks could only be exploited rapidly through using artificial insemination (AI). Though AI has gained widespread acceptance in dairy cattle industries of most developed countries and is now-a-days also popular in Bangladesh. But it has not yet received such popularity in Bangladesh. However, interest in AI in goats has increased day by day after achieving its outstanding success in cattle. Fertilizing capacity of semen has always been regarded as one of the key factors in running an AI program. So, to bring any AI program into economic success, use of poor quality semen of buck must be avoided in AI. For this, it is important to evaluate morphology and fertilizing capacity of sperm as there is limited information on the various semen attributes of Black Bengal goat. Therefore, the present study was designed to evaluate the fresh and diluted semen quality and determine the fertility following AI in Black Bengal goats.

Materials and Methods

Selection of breeding animals and their management

The study was conducted at the Artificial Insemination (AI) Center under the Department of Animal Breeding and Genetics, Bangladesh Agricultural University, Mymensingh. Six adult Black Bengal bucks of 18 to 22 months old were selected. The body weight and scrotal circumference of bucks were 19.0 to 25.0 kg and 17.0 to 22.0 cm, respectively. The bucks were reared in individual pen (4×2.5 sq.ft) and fed 100 gm/head/day pelleted commercial concentrate (crude protein content: 120 gm/kg DM and energy content: 10.4 MJ ME/kg DM) twice daily. Napier and/or German grass was also supplied twice daily. The breeding bucks were also supplied germinated gram at the rate of 20 gm/buck/day. They were allowed grazing for 1 to 2 hours daily. Clean and safe water was made available at all the time. All bucks were vaccinated against *Peste des Petits Ruminants* (PPR) and dewormed with *Ivermectin* twice yearly.

Preparation of extender

A stock solution of 2.94% of sodium citrate in 100 ml of distilled water was made in which 100000 IU of penicillin and 100000 µg of streptomycin were added per 100 ml. One part of

egg yolk by volume was added with three parts of the citrate solution and mixed thoroughly. The egg yolk-citrate diluter was prepared according to Herman and Madden (1963).

Semen collection and evaluation

The bucks were trained to ejaculate in artificial vagina (AV) at homosexual mount. Semen was collected using AV twice a week between 8.00 to 8.30 A.M. The graduated collection vial with the freshly collected semen was immediately transferred to the laboratory and emerged in a water bath at 37^{o}C. Twenty ejaculates from each buck were taken for investigation of different seminal attributes. The volume of semen was measured directly with the help of a graduated collection vial and sperm motility of fresh semen was estimated under microscope. The total number of sperm per ml of fresh semen was counted by haemocytometer method. Rose Bengal Stain was used for counting the normal spermatozoa whereas eosin-nigrosin stain was used for counting live spermatozoa in semen according to Herman and Madden (1963). The collected semen samples were extended with egg yolk-citrate diluter to provide a concentration of 200×10^{6} spermatozoa and evaluated for motility, normal and live spermatozoa percentage (Herman and Madden, 1963).

Artificial Insemination

A total of 129 does were inseminated after 24 hours of onset of estrus to assess the fertility. Fertility rate was calculated as the percentage of kidding by total number of inseminated does.

Statistical analysis

Data were analyzed using SAS (1998) package program in accordance with the principles of CRD (Steel and Torrie, 1980). Duncun's Multiple Range Test (DMRT) was also performed to identify the significant differences between the mean values (Snedecor and Cochran, 1980). However, the percentage of kidding was compared by Chi-square analysis (Steel and Torrie, 1980).

Results and Discussion

Volume per ejaculation

The semen characteristics for fresh ejaculates of the breeding bucks are presented in Table 1. Semen volume per ejaculate differed significantly ($P<0.05$) among the bucks. The mean volume per ejaculate of buck was 0.58 ± 0.03 ml. Khandoker *et al.* (2006) reported the mean volume per ejaculate of Black Bengal buck was 0.43 ± 0.03 to 0.45 ± 0.22 ml and Singh *et al.* (1985) reported 0.46 ml which were closed to the result of the present study. The present result also coincided with the findings of many other investigators (Das *et al.*, 2006; Vilar *et al*., 1993 and Mittal, 1982). However, comparatively lower semen volume was reported by Khan (1999). This difference could be due to variation between animals and season, as seasonal variation affects sexual glands and libido in goats (Karatzas *et al*., 1997; Karagiannidis *et al*., 2000). Semen production also largely depends on several factors such

as the age, maturity, nutritional status, general health condition, endocrine balance and soundness of the sex organs (Peters, 2002). In the present study, the bucks were of same breed and almost of same age and reared in same management system. Despite of this, the differences in semen volume between the bucks might have reflected to their genetic potential to produce higher volume of semen.

Sperm concentration

Sperm concentration of Black Bengal buck semen varied from 2678.33 ± 30.59 to 2913.33 ± 46.23 × 10^6/ml and the difference was highly significant (P<0.01) among the bucks (Table 1). The results of the present study were in agreement with the findings of Singh *et al.* (1985) and Faruque *et al.* (2007) who obtained average sperm concentration of 2619.58 to 2910.33 × 10^6/ml and 2828 ± 11.8 to 2988±9.6×10^6/ml, respectively in Black Bengal buck semen. However, Khan (1999) reported comparatively higher sperm concentration (3777.93 ± 142.76 × 10^6/ml) than those of the present study. This difference in sperm concentration might be due to the variation in age and maturity of bucks, frequency of semen collection, feeding regime and climatic condition.

Fresh semen motility

Sperm motility of fresh semen differed significantly (p<0.05) among the bucks. The mean sperm motility of fresh semen of Black Bengal buck was 77.82 ± 0.61% (Table 1). This result coincided with the findings of Afroz (2005) who obtained 76.00 ± 1.45 to 78.00 ± 1.11% motile sperm in fresh semen. Present result also corroborated with the other findings of other published works (Das *et al.* 2006; Shamsuddin and Chanda, 1998 and Karatzas *et al*., 1997). However, the present observation differed from that of Sevinc *et al.* (1985) who reported comparatively higher mass motility in buck semen. This variation of mass motility in different bucks might be due to the variation of age, body weight, scrotal circumference and individual potentiality of bucks.

Live spermatozoa

The live spermatozoa of the fresh semen varied from 84.33±0.88 to 89.58±0.98% which differed significantly (P<0.05) among the bucks (Table 1). This result is in agreement with the findings of Husain (2007) who found 84.99 ± 0.38 to 85.62 ± 0.57% live spermatozoa in Black Bengal buck semen. Moreover, the present result also agreed with the findings of Mittal (1982) and Pandey *et al.* (1985).

Normal spermatozoa

From Table 1 it appeared that the mean normal spermatozoa of buck semen was 91.39 ± 0.24% which was in agreement with the results of Singh *et al.* (1985) and Afroz (2005) who reported 91.07% and 89.72 ± 0.35 to 91.16±0.36% normal spermatozoa, respectively in Black Bengal buck semen. The findings of the present study also corroborated results of other investigators (Bakshi *et al*., 1987; Khan, 1999 and Das *et al.,* 2006).

Table 1. Characteristics of fresh semen of Black Bengal bucks (± SE)

Buck No.	Volume (ml)	Sperm concentration ($\times 10^6$/ml)	Mass motility (%)	Live spermatozoa (%)	Normal spermatozoa (%)
1	$0.55^{ab} \pm 0.07$	$2825.83^{ab} \pm 35.15$	$77.67^{abc} \pm 1.43$	$87.75^{ab} \pm 1.66$	92.08 ± 0.39
2	$0.52^{b} \pm 0.04$	$2678.33^{c} \pm 30.59$	$75.58^{bc} \pm 1.15$	$84.58^{b} \pm 1.32$	91.32 ± 0.47
3	$0.74^{a} \pm 0.07$	$2913.33^{a} \pm 46.23$	$80.83^{a} \pm 1.70$	$89.58^{a} \pm 0.98$	91.48 ± 0.37
4	$0.63^{ab} \pm 0.06$	$2748.33^{bc} \pm 37.72$	$78.83^{abc} \pm 1.59$	$87.67^{ab} \pm 1.15$	91.75 ± 0.46
6	$0.47^{b} \pm 0.05$	$2841.67^{ab} \pm 45.19$	$74.58^{c} \pm 1.29$	$84.33^{b} \pm 0.88$	90.48 ± 1.09
11	$0.58^{ab} \pm 0.08$	$2775.83^{bc} \pm 52.82$	$79.42^{ab} \pm 1.25$	$86.42^{ab} \pm 1.37$	91.27 ± 0.47
Pooled	**0.58 ± 0.03**	**2797.22 ± 18.73**	**77.82 ± 0.61**	**86.72 ± 0.54**	**91.39 ± 0.24**

^{abc} Means with different superscripts within the same column differ significantly (P<0.05)

Evaluation of diluted semen

Individual bucks showed significant difference (P<0.05) on diluted semen motility, live and normal spermatozoa percentages (Table 2). The average diluted semen motility was 71.82 ± 0.59% which was in agreement with the findings of Islam *et al.* (2007) who reported 70.00 ± 2.89 to 73.33 ±1.67% motility in diluted buck semen. Similar result was also observed in other published works (Banu *et al*., 1988 and Das *et al*., 2006). Egg yolk-citrate diluter provided a higher percentage of sperm motility which might be due to good buffering system of citric acid and/or chelating function of citrate on heavy metal contaminants (Foote, 1978 and Lafluf *et al*., 1990).

Table 2. Characteristics of semen diluted with egg yolk-citrate diluter

Buck No.	Diluted semen motility (%)	Live spermatozoa (%)	Normal spermatozoa (%)
1	$71.36^{ab} \pm 0.97$	$87.09^{ab} \pm 1.67$	$91.91^{a} \pm 0.78$
2	$70.45^{ab} \pm 1.71$	$84.18^{b} \pm 1.41$	$90.55^{abc} \pm 0.68$
3	$74.55^{a} \pm 1.06$	$89.27^{a} \pm 1.40$	$91.09^{ab} \pm 0.65$
4	$73.64^{a} \pm 1.52$	$87.36^{ab} \pm 1.02$	$91.27^{ab} \pm 0.84$
6	$68.64^{b} \pm 1.66$	$83.73^{b} \pm 0.94$	$88.73^{c} \pm 0.54$
11	$72.27^{ab} \pm 1.24$	$85.36^{ab} \pm 1.54$	$89.64^{bc} \pm 0.49$
Pooled	**71.82 ± 0.59**	**86.17 ± 0.58**	**90.53 ± 0.29**

^{abc} Means with different superscripts within the same column differ significantly (P<0.05)

The live spermatozoa of the diluted semen differed from 83.73 ± 0.94 to 89.27 ± 1.40% which corroborated with the findings of Samsuddin and Chanda (1998) who found 84.4 ± 4.0% live spermatozoa in semen diluted with the same diluter. Present findings were also similar to that of the findings of Banu *et al*. (1988) and Das *et al*. (2006). The normal

spermatozoa percentage of the diluted semen was 90.53 ± 0.29% (Table 2). This was close to 93.38 ± 1.34% reported by Banu *et al.* (1988) for normal spermatozoa in diluted buck semen.

Fertility

The fertility of different Black Bengal bucks was assessed through kidding rate in using diluted semen which is shown in Table 3. The kidding rate did not differ significantly among the bucks. On average 58.9% kid were born using semen of Black Bengal buck which was almost similar with the findings of Pandey *et al.* (1985) who reported 59% conception rate. This result also coincided with the findings of many other investigators (Sinha *et al*., 1996; Gacitua and Arav, 2005 and Husain, 2007). On the other hand, Karatzas *et al.* (1997) and Mara *et al.* (2007) reported higher conception rate than the result of the present study. Higher conception rate recorded by these workers could be due to the evaluation of conception rate on non-return basis, whereas in this study fertility rate has been recorded by actual kidding rates.

Table 3. Kidding rate of Black Bengal goat using diluted semen

Buck No.	No. of AI done in goats	No. of kidding	Kidding (%)
1	24	14	58.3
2	20	10	50.0
3	36	25	69.4
4	16	10	62.5
6	17	8	47.1
11	16	9	56.3
Pooled	**129**	**76**	**58.9**

Conclusion

Significant variation of different semen attributes were observed between buck to buck. The average fertility rate obtained was 58.9% in Black Bengal goat. So, emphasis should be given on the selection of good quality breeding bucks to improve the overall fertility of Black Bengal goat.

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