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Estrus Characteristics of Black Bengal Does Under Intensive Condition

Research Article

M. Fakruzzaman[1], Q.S. Akter[1], S.S. Husain[2], M.A.M.Y. Khandoker[2], A.S. Apu[2] and M.R. Islam[3*]

[1] Department of Animal Breeding and Genetics, Faculty of Animal Science and Veterinary Medicine, Patuakhali Science and Technology University, Babuganj, Barisal-8210, Bangladesh
[2] Department of Animal Breeding and Genetics, Reproductive Biotechnology Laboratory, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
[3] Department of Genetics and Animal Breeding, Faculty of Veterinary and Animal Science, Hajee Mohammad Danesh Science and Technology University, Dinajpur-5200, Bangladesh

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*Correspondence E-mail: mrislambiotech@gmail.com

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ABSTRACT

The present study was carried out to investigate the effect of different seasons on length and duration of estrus as well as to observe the behavioral changes and physiological peculiarities during estrus period. Three climatic seasons and age groups were considered: summer (March-June), rainy (July-October) and winter (November-February); A (6-9 month), B (9-12 month) and C (>12 month). Estrus behavior was monitored twice a day, using a teaser buck. The estrus were quantified within each season and classified as short (<17 days), normal (17-25 days) and long (>25 days). In case of seasonal effect, the length of estrous cycle did not differ significantly (P>0.05). The higher length of estrous cycle was found in summer (23.50±1.57 days) followed by winter (21.33±1.01 days) and rainy season (20.79±0.61 days), respectively. On the other hand, duration of estrus showed significant (P≤0.05) differences among the three different seasons. The longer duration was observed in winter (44.00±1.95 hours) followed by summer (36.00±0.70 hours) and rainy season (35.54±0.80 hours), respectively. Higher percentage of normal estrus was observed during rainy season (79.31%) when compared to winter (72.73%) and summer (53.33%). On the other hand, a greater percentage of short and long estrous cycle was reported in summer followed by winter and rainy season. Moreover, length of estrus and its duration did not differ significantly (P>0.05) with age. The mean of rectal and vaginal temperature during estrus were recorded as 39.30±0.05 °C and 39.60±0.03 °C, respectively. However, seasonal variation on post-partum heat period did not differ significantly (P>0.05). The mean post-partum heat period of Black Bengal does among the seasons was observed as 84.56±3.28 days. The present result on estrus behavior of Black Bengal goat could help to boost up effective artificial insemination of goat population for optimizing productivity under intensive condition.

KEY WORDS black bengal goat, estrus, intensive condition, season.

INTRODUCTION

Bangladesh has a huge pressure of population of 160 million of which more than 80 percent live in the rural areas and about 70 percent are directly or indirectly engaged in agricultural operation (Husain *et al.* 1996). Bangladesh has 34.5 million of the Black Bengal goat population (FAO, 2003). In the livestock sector Black Bengal (BB) goat is the only recognized breed amongst the domestic species available throughout Bangladesh. More than 90% of the goat population in Bangladesh is comprised of Black Bengal goats and the majority of the remainder are crosses of Indian long eared goats (Husain, 1993). Black Bengal goat is a dwarf breed and famous for high fertility, prolificacy, superior quality chevron, best quality skin, early sexual maturity, resistance against common diseases, low kidding

interval and very good tropical adaptability (Devendra and Burns, 1983; Husain, 1993; Amin *et al.* 2000; Islam *et al.* 1991; Singh *et al.* 1991). However, the productivity of goats in Bangladesh is comparatively low. A partial explanation of this situation is that goats (eg. *Capra hircus*), although it represenst a perfect adaptability to environmental conditions, have a low dressing percentage when compared to many other meat type breed of goats (Malan, 2000), or they show a low milk production, when compared to Saanen goats (Knights and Garcia, 1997) when managed intensively. Regularity in reproduction in goat flock is essential in order to obtain highest return at the earliest time. The level of reproductive performance depends on the interaction of genetic and environmental factors but this performance is particularly susceptible to latter, for example, the seasonal availability of nutrients can affect reproduction considerably (Riera, 1982).

Different processes are involved to determine the reproductive efficiency in does. These processes are the length of breeding season, cyclic activity, ovulation rate, fertilization rate, post-partum anoestrous period and the growth and viability of offspring. Reproductive efficiency can be measured and expressed as the kidding rate, weaning rate, kidding interval, live weight of kids and the length of reproductive cycle (Greyling, 2000). Age at puberty is the crucial determinant of the total reproductive life of does.

Puberty is the exhibition of first behavioral sings of estrus accompanied by ovulation and normal development of corpus luteum in ovary. First detection of estrous cycle is usually preceded by one or more ovarian cycles without showing behavioral estrus (Entwistle, 1978). Age at puberty in does like other domestic species is the most important economic indicator of productive behavior (Horst and Husain, 1991). Restall (1991) opined that tropical goat exhibits first estrus when they acquire 60 to 70% of their adult body weight. Amin *et al.* (2001) observed 7.31 to 14.63% Black Bengal does to be manifested first estrus within 6-month of age in contrast to only 0 to 1.59% in Jamnapari×Black Bengal does.

They further reported that nearly 93% of Black Bengal goat comes into first estrus within 1 year of age,while only 56% Jamnapari×Black Bengal were shown to do so at the same age. Restall (1991) found 60% of Thai native does to be conceived before 7-month of age. Amin *et al.* (2001) noticed Black Bengal does to be attained at first heat at 9-11 kg live weight in contrast to 13 kg in Jamnapari×Black Bengal F_1 and F_2 crosses. Estrus detection is important for a successful artificial insemination and controlled breeding programme, which could be treated as the first step to enter into the production life. The knowledge of estrus behavior particularly under different climate and physiological conditions is highly essential. The considerable knowledge on the detection of estrus and the changes during the period of estrus is desirable to carry out breeding practices efficiently. Estrus behavior becomes even more important when exhibits in the absence of the male, as is the case with cows/does (Hafez, 1996). Even though estrus exhibition is under the endocrine regulation especially under the influence of estrogen hormone (Dieleman *et al.* 1986) and factors such as heat stress (Epperson and Zalesky, 1995) and method of estrus synchronization (Selvaraju *et al*. 1997) or detection have been reported to influence its exhibition (Oyediji *et al*. 1992). In contrast, the native breeds of Bangladesh (Black Bengal goat) show sexual activity round the year. Therefore, the objective of this investigation was to verify the estrus activity and to observe the body weight change of Black Bengal goats. However, in Bangladesh no systematic research work has been performed to know the actual length of estrous cycles, duration of estrous cycle as well as physiological behavior shown during estrus in Black Bengal goat. From this point of view, the present research was designed to measure length of estrous cycle and duration of estrus, observe the behavioral changes and physiological peculiarities during estrus as well as to observe the effect of different seasons on length of estrous cycle and duration of estrus.

MATERIALS AND METHODS

The research was conducted at the Artificial Insemination (AI) Center under the Department of Animal Breeding and Genetics, Bangladesh Agricultural University, Mymensingh-5200, Bangladesh. Three climatic seasons were considered in this study such as summer: March to June, Rainy: July to October and winter: November to February.

Animal selection and management

Does (60) were selected on the basis of their age and body weight from the breeding flock. The does aged between six (6) to twenty two (22) months were included in this experiment. The body weights of does were 8.0 to 16.0 kg. The does were reared in the stall-feeding system and they were fed Napier and/or German grass twice-daily *ad libitum*. The commercial concentrate, wheat bran, maize crust, mustard oil cake, etc., feed was supplemented (18% of crude protein) once in the morning and another in the evening at the rate of 120 gm/doe. They were allowed for grazing and exercise in a confinement area for 1 to 2 hours daily. Clean and safe water was made available all the time. Feeding regime was almost identical for all the goats under experimentation. The does were weighed every month, during the whole experiment. In this research, all the does were divided into three age groups: Group A: (6-9 month), Group B: (9-12 month) and Group C: (>12 month).

Parameters envisaged

Body weights of all does were measured in every month. The body weight of doe was measured with the help of a digital balance. The length of estrous cycle in days was calculated from the interval between onsets of one estrous cycle to another. The estrous cycles were classified as short (<17 days), normal (17-25 days) or long (>25 days) as suggested by Chemineau *et al.* (1992). The estrous cycle duration was measured in hours. It was the interval between the start up time of one estrus and the time at which it ended up in the same estrous cycle. Estrus behavior was monitored twice daily (6:00 am and 5:00 pm) using teaser buck. Immobilization of the female when mounted by the male was considered to be sign of occurrence of estrus (Mauleon and Dauzier, 1965). The numbers of each estrous cycle, as well as its length was recorded during each season. Two categories estrus behaviors were recorded during the whole experimental period such as Physiological changes during estrus and Behavioral changes during estrus. Rectal and vaginal temperatures were taken with the help of the clinical thermometer during estrous cycle and at normal condition of the does. This work was performed by inserting a clinical thermometer into the rectum and vagina. Before inserting the thermometer, it was disinfected with a disinfectant. Several types of behavioral changes occurred during the whole estrus period. The differential behavioral changes that were found during the time of the experiment are mounting flock mates or willing to be mounted, mucus discharge from the vulva, tail flagging, mock fighting, licking and rubbing each other, sniffing the vulva, increased vocal activity, interest in male or male pen, restlessness and Nervousness (Figure 3). Post-partum heat period (PPHP) was measured as the time between the date of kidding and the date shown heat after the corresponding kidding.

Statistical analysis

The data generated from this experiment were entered in Microsoft Excel worksheet, organized and processed for further analysis. Data were analyzed using (SAS, 1998) package program in accordance with the principles of RBD (Steel and Torrie, 1980) and Duncan's Multiple Range Test (DMRT) was also done to identify the significant differences between the mean values when analysis of variance (ANOVA) showed significant differences (Snedecor and Cochran, 1980).

RESULTS AND DISCUSSION

Effect of season on body weight during estrus

During the rainy season, body weight of the animal as 10.99±0.63 kg tended to decrease as compared to summer (12.81±0.61 kg) and winter (12.90±0.43 kg) season (Figure 1). The difference of mean body weight (12.23±0.43 kg) did not differ significantly (P>0.05) among the seasons.

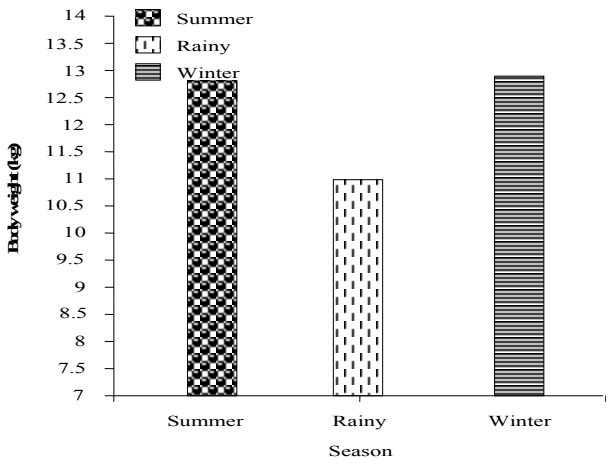

Figure 1 Effect of season on body weight

Ogebe *et al.* (1996) reported that Nigerian dwarf goats have reduced rumination rates during the rainy season, when compared to those of the dry season, due to the smaller amount of forage ingested, inducing a smaller absorption of nutrients and hence fall of the body weight. Similarly Knights and Garcia (1997) and Singh *et al.* (1991) also recommended that goats do not like forage with high moisture content, which results in a decrease of the feed intake and consequently a decrease of the body weight during rainy season. These results are in the same line as reported in the present study. This hypothesis can be confirmed by the fact that the experimental animals recovered a great part of their body weight during summer and winter.

Effect of season on estrous cycle of Black Bengal does

Tables 1 and 2 shows that the season had no apparent effect on the average length of the estrous cycle (P>0.05), but significantly (P<0.01) affected duration of estrous cycle. The mean length of estrous cycles was 23.50±1.57, 20.79±0.61 and 21.33±1.01 days in summer, rainy and winter respectively, with a mean of 21.87±0.58 days. On the other hand, the highest duration of estrus was recorded 44.00±1.95 hours in winter season as followed by 36.00±0.70 and 35.54±0.80 hours respectively in summer and rainy season. Similar result was reported by Greyling (2003) who observed the duration of estrus in Boer doe as 37.4±8.6 hours. However, an approximately 36 hour's estrus duration was reported from the study of several investigators (Bliss, 1980; Mishra and Biswas, 1966). On the other hand Chemineau *et al.* (1992) found an average of 30 hours duration in Alpine goats.

Table 1 Effect of season on length and duration of oestrous cycle

Season	No of oestrus observed	Length of oestrous cycle (Days) (Mean±SE)	Duration of estrus (Hours) (Mean±SE)
Summer	20	23.50±1.57	36.00±0.70[b]
Rainy	22	20.79±0.61	35.54±0.80[b]
Winter	15	21.33±1.01	44.00±1.95[a]
Pooled	57	21.62±0.58	37.35±0.78
F-value		NS	**

Mean with different superscripts within the same column differ significantly (P<0.05).
** (P<0.01).
NS= Non-significant (P>0.05).
SE= Standard error of mean.

Table 2 Frequency of oestrous cycle in different seasons

Season	Frequency	Normal (%) (17-25 days)	Short (%) (<17 days)	Long (%) (>25 days)
Summer	15	53.33	20.00	26.67
Rainy	29	79.31	6.90	13.79
Winter	11	72.73	9.09	18.18
Pooled	55	68.45	12.01	19.54

A lower estimate of 30 hours duration in Barbari goats were reported by Sahni and Roy (1967). This little variation might be due to variation in breed, season, parity and feeding regime and/or physiological profile of the animals. In spite of length of estrous cycle, the present result strongly agreed with findings of Simplicio *et al.* (1986) who reported an average length of 21.2±0.45 days in goats. Chemineau *et al.* (1992) observed that the estrous cycle were 20.2±1.0 days for Alpine goats. The average length of estrous cycles in goats was 20.9±6.9 days (Aurion *et al.* 1980). Babumathi and Mukherjee (1981) reported an average length of estrous cycle as 19.6±0.04 days. The length of estrous cycle for Boer doe was 20.7±0.70 days (Greyling, 2003). This result also coincided with the findings of the present study. Lopes *et al.* (2001) conducted a study with Saanen goats before who found the average length of estrous cycles as 19.1±0.35 days.

Frequency of estrous cycle in different seasons

A large percentage (79.31%) of normal cycles was observed in the rainy season followed by summer (53.33%) and winter (72.73%). The higher percentage of long estrous cycle showed in summer season (26.67%) than those of winter (18.18%) and rainy season (13.79%) respectively (Figure 2). The frequency of normal estrous cycles found in rainy season were higher than the other two and the reasons behind during the rainy season is that the ambient temperature remains suitable than the other two seasons. This result strongly supports the finding of Simplicio *et al.* (1986) who obtained 76.5% of normal cycles, 11% of short cycles and 12.5% long cycles in goats of Northeast Brazil. On the other hand, respectively 76, 16 and 8% of estrous cycles were normal, short and long of Saanen goats were also reported. Cerbito *et al.* (1995) reported that does exhibit 72, 15 and 13% of estrous cycles were normal, short and long, respectively. Aurino *et al.* (1980) obtained 76.9, 10.6 and 12.5% of estrous cycles respectively as normal (15-24 days), short (<15 days) and long (>25 days) almost round the year.

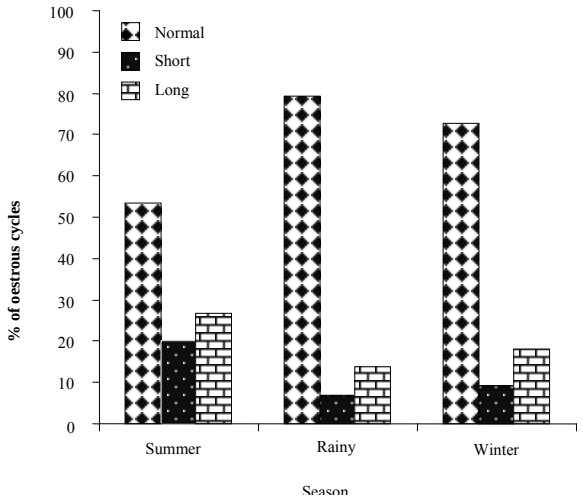

Figure 2 Frequency of oestrous cycles in different seasons

Lopes *et al.* (2001) reported that a large percentage of estrous cycle of goats were observed during the rainy season than that of the summer and winter and the animals showed 50.3, 12.0 and 37.7% as considered as normal (17-25 days), short (<17 days) and long (>25 days).

Effect of age on estrous cycle in Black Bengal goat

Analysis of variance showed that the effect of age on the length and duration of estrous cycle did not differ significantly (P>0.05) among the age group (Table 3).

Table 3 Effect of age on the length of oestrous cycle and duration of estrus

Age group (month)	Number of oestrus observed	Length of oestrus (days) (mean±SE)	Duration of estrus (hours) (mean±SE)
A (6-9)	12	20.92±0.47	34.50±1.41
B (9-12)	24	20.63±0.54	36.04±1.08
C (> 12)	9	21.56±1.37	34.56±1.08
Pooled	45	20.83±0.41	35.33±0.72

NS= Non significant (P>0.05).
SE= Standard error of mean.

Does in group C (>12 months) showed the higher length of estrous cycle (21.56±1.37 days) followed by group A (6-9 months) (20.92±0.47 days) and group B (9-12 months) (20.63±0.54 days) respectively. On the other hand, the duration of estrous of group B showed higher (36.04±1.08 hours) than those of C (34.56±1.08 hours) and A groups (34.50±1.41 hours).

Sign of estrus characteristics

In this experiment, the does showed different signs of estrus

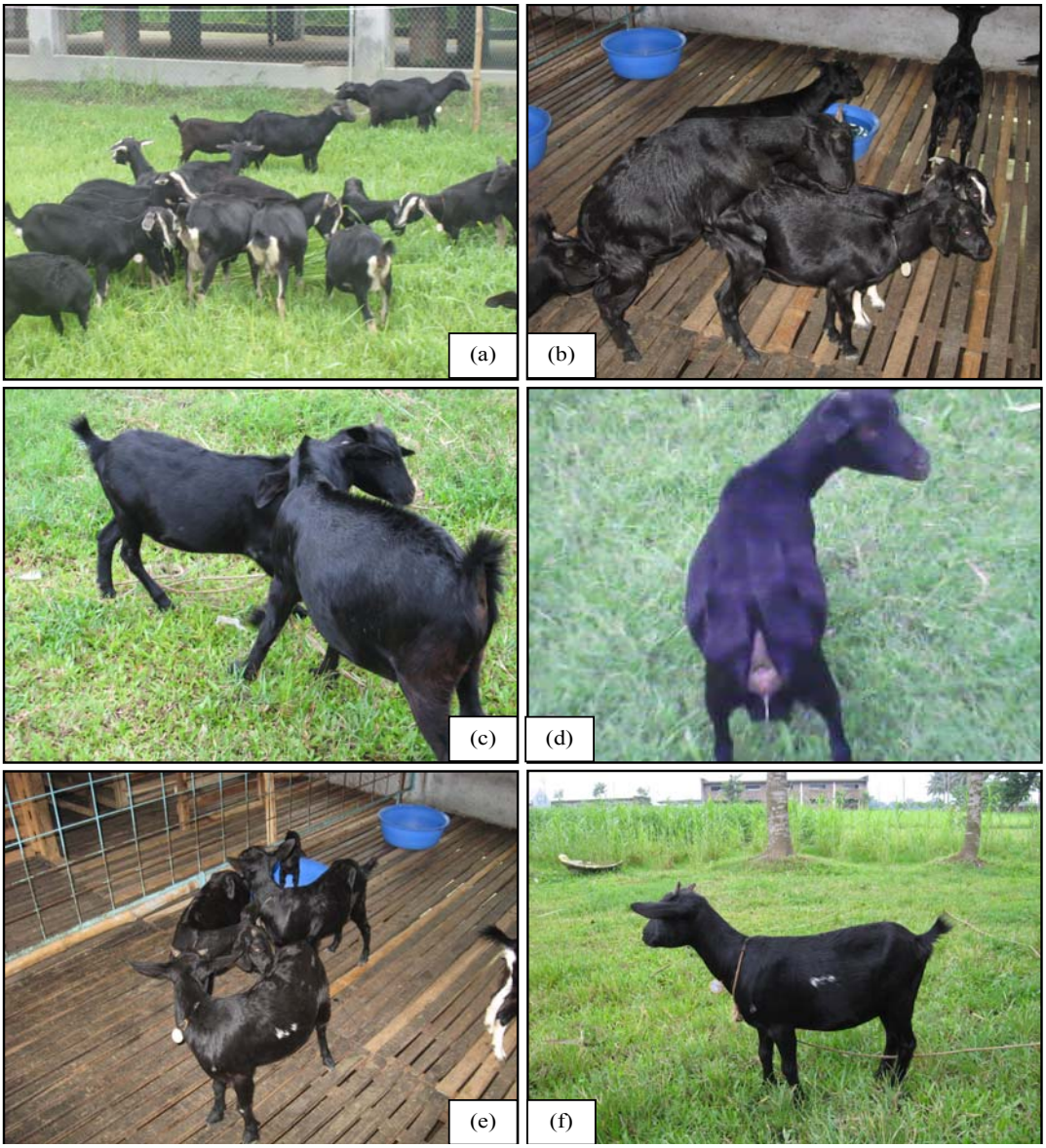

Figure 3 Photos showing estrus behavior in does (a) Breeding flock, (b) Mounting flock mates during estrus, (c) Licking and rubbing each other, (d) Mucus discharge from the vulva, (e) Sniffing the vulva and (f) Tail flagging of doe

during her estrous cycle, such as: mounting flock mates or willing to be mounted, mucus discharge from the vulva, tail flagging, increased vocal activity, interest in male or male pen, restlessness and nervousness, mock fighting, licking and rubbing each other and sniffing the vulva (Figure 3). This observation all supported Restalls, (1991) who re ported that goats showed following signs during estrous cycle as may mount or fight others, tail flagging, vulva discharge, vocalizing, nervousness, interested to the buck pen, general attitude change, increased activity rate, reduced appetite, which was more or less similar with the finding of the present study.

Body and vaginal temperature during estrus in Black Bengal does

The statistical analysis showed that the temperature of rectum and vagina during estrus and normal condition was significantly different ($P<0.01$) among the does (Table 4). The highest temperature in rectum during normal cycle recorded in doe 121 (39.40±0.13 °C) followed by the doe 101 (38.97±0.38 °C), doe 102 (38.87±0.29 °C), doe 103 (38.70±0.21 °C) and doe 117 (38.33±0.13 °C). On the other hand, higher rectal temperature during estrus recorded in doe 103 (39.40±0.06 °C) followed by doe 101 (39.26±0.12 °C), doe 102 (39.17±0.13 °C), doe 117 (39.30±0.11 °C) and doe 121 (39.37±0.15 °C). The mean rectal temperature during normal condition and estrus were respectively 38.85±0.13 °C and 39.30±0.05 °C. Moreover, the higher vaginal temperature during normal condition recorded in doe 102 and doe 117 (39.13±0.18 °C) followed by doe 101 (38.43±0.09 °C), doe 103 and doe 121 (38.73±0.28 °C). The higher temperature in vagina during estrous cycle re-

corded in doe 103 and 121 (39.67±0.03 °C) followed by doe 101 (39.57±0.09 °C), doe 102 (39.50±0.06 °C) and doe 117 (39.60±0.06 °C). The mean temperature in vagina during normal and estrus were respectively 38.83±0.11 °C and 39.60±0.03 °C.

Table 4 Temperature change of Black Bengal does during estrus

Doe ID	Temperature (°C)			
	Rectal		Vaginal	
	Normal (mean±SE)	Estrus (mean±SE)	Normal (mean±SE)	Estrus (mean±SE)
101	38.97±0.38	39.26±0.12	38.43±0.09	39.57±0.09
102	38.87±0.29	39.17±0.13	39.13±0.18	39.50±0.06
103	38.70±0.21	39.40±0.06	38.73±0.28	39.67±0.03
117	38.33±0.13	39.30±0.11	39.13±0.18	39.60±0.06
121	39.40±0.12	39.37±0.15	38.73±0.28	39.67±0.03
Overall	38.85±0.13	39.30±0.05	38.83±0.11	39.60±0.03
T-test	**	**	**	**

**= (P<0.01).
SE= Standard error of mean.

Hossain *et al.* (1986) obtained the rectal and vaginal temperature of Black Bengal Nanny goat were 39.4 °C and 39.6 °C respectively. They obtained that the rectal temperature of the animals during estrus varied from 39.2 °C to 39.4 °C. The vaginal temperature varied from 39.5 °C to 39.6 °C during the period of estrus, which was more or less similar with the finding of the present study.

Effect of season on post-partum heat period (PPHP)

The post-partum heat period varied within the different seasons. Table 5 showed that post-partum heat period of does is comparatively higher in winter (94.00±2.31 days) than those of summer (83.33±2.03 days) and rainy season (76.33±6.36 days) but these differences were not significant (P>0.05).

Table 5 Effect of season on post-partum heat period (PPHP) of Black Bengal does

Season	Number of observations	Post-artum heat period (days) (mean±SE)
Summer	8	83.33±2.03
Rainy	7	76.33±6.36
Winter	9	94.00±2.31
Pooled	24	84.56±3.28
F-value		NS

NS= Non significant (P>0.05).
SE= Standard error of mean.

This result was similar to the finding of Husain (1993) who obtained post-partum heat period of Black Bengal goat as (85.2±1.37 days) in winter followed by summer (77.8±1.66 days) and rainy season (68.9±1.54 days). A little higher post-partum heat period of 89.9 days was reported for Bengal goat in India (Acharya, 1987; Arora, 1992). Moreover, Otchere and Nimo (1978) showed 83.5 days post-partum heat period in West African Dwarf goat a similar trend as reported in the present study.

CONCLUSION

To sum up, season had a little effect (non significant) on the length of estrous cycle but had a significant (p<0.05) effect on the duration of estrus. Thus the acquired knowledge of length and duration of estrous cycle will help farmers to inseminate their does in right time, which will play a vital role for increasing the efficiency of artificial insemination (AI).

Another important point which can not but be mentioned is that the present result on estrus behavior of Black Bengal goat could help to boost up effective artificial insemination of goat population for optimizing productivity under intensive condition.

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