



Effect of Kidding Season and Parity on Maternal Care, Neonatal Behaviour, Kid Survivability and Growth Performance of Black Bengal Goats

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ABSTRACT

Background: Maternal behaviour and neonatal responses are key factors for kid survival and growth in goats. This study was carried out with an objective to evaluate the influence of parity and season on maternal care, neonatal behaviour, growth performance and survivability of Black Bengal goat kids in eastern India.

Methods: Pre and post parturition behaviour of goats (N=70) and neo-natal behaviour of their kids were studied during a period of 15 months. A systematical record of maternal care indices, including latency to groom, nursing, licking, sniffing and acceptance of suckling attempts, along with neonatal behavioural responses such as latency to stand, udder-seeking behaviour and suckling attempts were observed. Growth and kid survivability were evaluated up to weaning and data were analyzed.

Result: Parity of does and season of kidding significantly influenced some of the maternal and neonatal behaviours. First-parity goats showed more maternal separation ($p < 0.001$), their kids had fewer suckling bouts and shorter suckling durations as compared to those of higher order parities. Maternal care improved with the increase in parities. Kids' from primiparous does took longer time to stand and locate the udder compared to those from multiparous does ($p < 0.05$). Kids from multiparous mothers showed quicker neonatal behavioral development as compared to kids of nulliparous goat. Kids' born from nulliparous does had the lowest survival rate (78.57%), while $\geq 4^{\text{th}}$ parity had the highest (91.30%). Winter born kids' had higher birth weight (14.45%) and more growth rate (13.85%) and better kid survivability (90.77% vs 80.85%) compared to summer season. Maternal behaviours like grooming and nursing were exhibited better in summer, while winter provided better conditions for kid survival, neonatal behavioural development, body growth and successful suckling. The results indicate that multiparous mothers' kidding and nursing experience and good weather conditions during winter are key factors for mother-kid bonding, neonatal survival, post-natal growth and development of kids.

Key words: Growth performance, Kid survivability, Maternal care, Neonatal behaviour, Parity, Season.

INTRODUCTION

In goats, as in other domestic mammals, the birth process and mothering ability are very important aspects in animal production. In domestic mammals, maternal behaviour (licking, grooming, sniffing and suckling) is crucial for the optimal rearing of the offspring (Nowak *et al.*, 2000). For survivability of the offsprings, quality maternal behaviour and mother-kid bonding are of great significance (Mandal *et al.*, 2022). Understanding the reproductive physiology of *Capra hircus* is essential for effective planning and improving reproductive management (Bhardwaj *et al.*, 2018; Hoque *et al.*, 2021). Very less information is available on pre- and post-partum behavioural factors influencing doe-kid bond formation in Black Bengal Goats.

Domestic goats exhibit different maternal and neonatal behaviours at and after birth, with mothers licking and guarding their offsprings frantically in minutes following birth. The first hour after parturition is a very important period because behavioural communication between mother and offspring is established during this period (Gonzalez and Goddard, 1998; Mandal *et al.*, 2022). Interactions by vocal means between dam and her young in early life and the care-seeking behaviour shown by the

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offspring towards the dam (making attempts to stand, exploring and sucking the udder, sniffing and vocalizations) are determinants to ensure neonatal vitality (Poindron *et al.*, 2007; Das *et al.*, 2024; Das *et al.*, 2025). Maternal care disruption, maternal selectivity, or reciprocal recognition may have negative consequences on the survival of kids during the first week of life (Poindron *et al.*, 2007;

Nowak *et al.*, 2007). Limited studies are available on the patterns of maternal care and neonatal behaviour of Indian breeds of goats. To the best knowledge of authors, this is the first systematically reported study in Black Bengal goats managed under intensive system on the factors affecting maternal and neonatal behaviours and its post-natal implications on kids' vitality. With the above background, present study was conducted on Black Bengal goats to investigate the factors influencing the maternal and neonatal behaviour after parturition and its impact on offspring survivability and future growth performance of kids.

MATERIALS AND METHODS

Study location

The study was conducted at the Experimental goat shed of Eastern Regional Station (ERS) of ICAR-National Dairy Research Institute, Kalyani, Nadia district of West Bengal.

Experimental design, animals and management practices

For the purpose of the study, 70 female Black Bengal goats were randomly selected in advance stages of pregnancy. The duration of study period was December 2023 to March 2025. Management, feeding, watering, housing *etc.* for the experimental animals were followed as per the routine guidelines of the farm and kept similar for all animals. The pregnant goats were isolated from general flock 10 days prior to their expected date of parturition and kept in small groups of four to five animals under stall-feeding conditions. The parturition behaviour, maternal care and neo-natal behaviour of kids were recorded both manually and with the help of pre-installed close circuit video camera. The selected animals were categorized as per their parity for data analysis. Depending upon stages of production and reproduction, pregnant goats were categorized into four parities *viz.* 1 (first time kidder), 2, 3 and ≥ 4 . Keeping in mind the seasonality of breeding and local weather

conditions, year was divided into two seasons *viz.* summer /hot-humid (March-October) and winter/dry-cooler (November-February).

The behaviour of does were monitored during pre-parturition, parturition and post-parturient periods. The behavioural parameters recorded in this study are described in Table 1. Kids and does were allowed to remain together after birth and the behavioural patterns of kids and does were noticed for first two hours of parturition and thereafter for a period of 96 hours at specific time intervals (three times of a day- morning, afternoon, evening) after kidding by visual observations. In each episode, at least one-hour observations were recorded. For noting the behavioural patterns video recording was also done. The observer's physical distance of 2-3 meters from the animals were maintained to minimize the disturbances to animals. Single observer had recorded all the observation to avoid individual biasness.

Body weight and kid survivability

Birth weights of kids were recorded within 1 hour of kidding using a digital weighing machine (50 kg \pm 5 g). Thereafter, the body weight of kids was recorded at fortnight intervals, separating kids at least two hours from mother at early morning to avoid the weight of ingested milk. The body weight of kids was monitored up to 3 months age. The kid survivability/mortality was recorded up to 60 days of age.

Statistical analysis

Collected data was subjected to statistical analysis by Univariate Linear Model using SPSS version 26.0 (IBM Inc.) keeping parity and season as fixed factor. Data recording, tabulation and graphical representation was carried out using the MS Excel 2007 version. For multiple pairwise comparisons among groups, Tukey's honestly significant difference (HSD) test was performed. Significant difference

Table 1: Behavioural categories and their description.

Behaviour	Description
Mother separation from the kid	The propensity of leaving of mother from kid after birth.
Maternal sniffing of kids	Inhalation through the nose by mother to kid.
Maternal licking of kids	Mother licks her young within a certain period after birth.
Grooming and nursing of kids	Licking and nibbling of kid by dam.
Maternal acceptance of suckling attempts	Dam voluntarily allows the kid to suck without avoidance.
Maternal rejection of suckling attempts	Dam actively avoids, moves away or physically prevents the kid suckling.
Latency to stand after birth	The time interval between birth and the first successful attempt by the kid to stand completely by itself without falling.
Latency to udder seeking after birth	Time duration between the birth of the kid and the onset of its active attempts to locate the dam's udder.
Neonatal separation from the dam	A newborn kid separates itself from mother.
Frequency of standing by the kid after birth	Number of times a kid able to stand successfully after birth.
Frequency of suckling attempts by kids	Number of attempts made by a kid to suckle onto the dam's teat within a specified period
Suckling bout	A single and distinct episode during which a young animal attaches to its mother's teat and actively suckles milk.
Average duration of suckling per bout	Time taken to suckle the dam by kid per single episode.

among the parameters were accepted at 5% ($P<0.05$) and 1% ($P<0.01$) levels of significance.

RESULTS AND DISCUSSION

The present investigation depicts the maternal care of Black Bengal goats and neonatal behaviour of kids varied across different parities of does and seasons of kidding. While there was non-significant differences found ($P>0.05$) in grooming, nursing, sniffing, licking, or acceptance to suckling, however, a significant difference ($P<0.001$) was noted in how often dams left their kids, number of suckling bouts and suckling duration of kids. Allowing of suckling bouts to kids reached peak in dams of $\geq 4^{\text{th}}$ parity kidding. The average duration of suckling per bout also varied significantly ($P<0.001$) across parities, with the longest duration in multiparous dams and shortest in nulliparous. These results indicated that the certain maternal behaviours, especially suckling patterns and dam-kid separation change with parity. Previous experiences of dams favour better expression of mothering ability in

multiparous does than primiparous ones. This better mothering ability of goats of higher parietal orders has consequential positive effects on the kid survivability and future growth performance.

Effect of parity on maternal care

In the present study it was observed that the grooming and nursing of kids, sniffing and licking of kids, allowing the kids to suckle to teats by favourable position changes were some of the very important behavioural features of doe immediately after parturition and continuation of maternal care in subsequent days. Table 2 presents the effect of parity on maternal care of dams and suckling behaviours of kids. The variations in maternal care depends upon the parity of the doe. The frequency of maternal separation from the kids was significantly differed by parity. It was the lowest in third parity and the highest in first parity. The first kidder goats showed 29.13% higher incidence of maternal separation from kids as compared to experienced does having more than one parity. Parity of does significantly ($P<0.01$) affect the number of suckling bouts by their respective kids. The kids of first parity mothers had the lowest (5.00 ± 0.09 bouts / hour) suckling bouts. The highest suckling bouts were found in kids born from $\geq 4^{\text{th}}$ parity does. Suckling bouts per hour was 2-5% higher in kids of multiparous does as compared to primiparous ones. The average suckling duration per bouts was the highest in kids of $\geq 4^{\text{th}}$ parity does and lowest in first kidder does. The duration of suckling bouts (in seconds) was 4.8-6.1% higher in kids born from multiparous does as compared to those of primiparous goats. The other maternal care behaviours such as grooming, sniffing, licking and acceptance to suckling attempts did not differ significantly among parities of Black Bengal does.

Consistent with previous findings (Poindron *et al.*, 2007; Buranakarl *et al.*, 2021; Mandal *et al.*, 2022; Cano-Suarez *et al.*, 2024), primiparous does were observed to display insufficient nursing patterns with shorter durations and increased frequencies of rejections, whereas multiparous does were observed to display more consistent and efficient nursing patterns. Though primiparous does showed increased frequencies of grooming, licking and accepting behaviours, these increased activities did

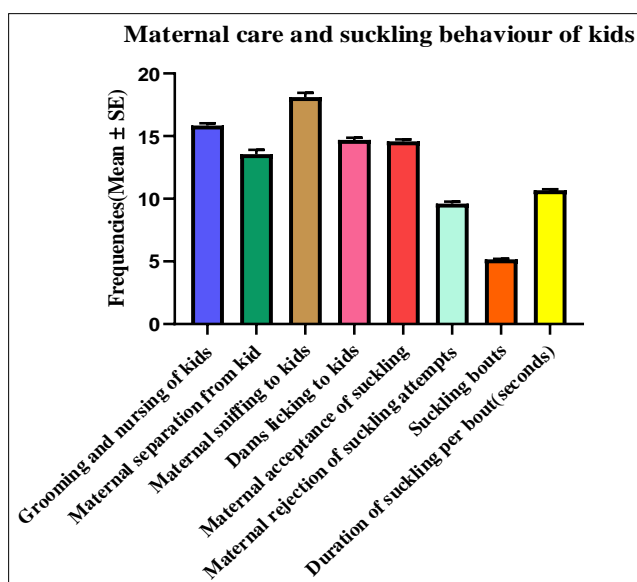


Fig 1: Distribution of maternal care of Black Bengal goats and suckling behaviour of kids.

Table 2: Effect of Dam's parity on its maternal care and suckling behaviour of Black Bengal goat kids (frequencies/hour).

Parity	Grooming and nursing	Maternal separation	Maternal sniffing	Licking kids	Maternal acceptance of suckling attempts	Maternal rejection of suckling attempts	Suckling bouts	Duration of suckling /bout (seconds)
1 st	16.33±0.34	15.07 ^a ±0.71	19.14±0.68	15.21±0.34	15.18±0.32	9.94±0.31	5.00 ^a ±0.09	10.25 ^a ±0.14
2 nd	15.70±0.25	13.87 ^a ±0.57	17.95±0.54	14.49±0.24	14.38±0.23	9.27±0.06	5.23 ^b ±0.06	10.85 ^b ±0.10
3 rd	15.66±0.21	11.67 ^b ±0.55	17.39±0.53	14.48±0.21	14.45±0.20	9.62±0.19	5.11 ^{ab} ±0.05	10.74 ^b ±0.09
≥4 th	15.69±0.29	13.60 ^a ±0.67	17.96±0.64	14.57±0.29	14.28±0.27	9.55±0.26	5.24 ^{ab} ±0.07	10.88 ^b ±0.12
P-value	0.258	0.000	0.221	0.178	0.075	0.183	0.024	0.000

Means with different superscripts (^a, ^b) within the same column differ significantly ($P<0.05$).

not contribute to an effective increase in nursing durations, possibly due to a lack of experience with behaviours rather than a lack of maternal instincts, as observed in previous studies (Poindron *et al.*, 2007; Mandal *et al.*, 2022; Das *et al.*, 2025). Taken together, current findings depict the fact that parity improvement always leads to enhanced maternal stability as well as nursing efficiency.

The overall patterns of expression of maternal care of does and suckling behaviour of Black Bengal kids were presented in Fig 1. Results indicated that enduring of does in close proximity to new born kids is one of the most important mothering attributes in addition to other physical cares like nursing and grooming.

Effect of parity on neonatal behaviour

The effect of dams' parity on the early postnatal behaviour of kids was studied and is summarized in the Table 3. A significant impact of parity of does was found on the latency to stand after birth (standing time of kids after birth; $P = 0.009$), the time from birth to udder seeking ($P = 0.029$), the number of times kids leaving the dam and birth site ($P < 0.001$), the frequency of suckling attempts ($P = 0.028$) and the number

of successful suckling events ($P < 0.001$). Kids born from primiparous goats (first time kidder) had the longest standing latency (35.73 ± 1.37 min) and the longest udder-seeking time (35.85 ± 1.52 min) as compared to kids born from experienced multiparous does (2nd parity and above). Overall basis, obtained results suggest that greater maternal experience may lead to better neonatal behaviour.

Present results differ from the findings reported by Martinez *et al.* (2009). Though in the previous study birth type and the duration of birth emerged as important determinants of standing, the results of the current study indicate parity as the major determining factor that postpones the standing response, as kids born to primiparous does took long to exhibit the standing response. Iyasere *et al.* (2019), reported significant effect of parity upon standing latency in West African Dwarf goats. Therefore, it appears that parity is an important determinant for neonatal standing behaviour. However, the effect of certain breed differences, as well as differences in the surrounding environment and management system cannot be ignored.

The bar graph in Fig 2 shows the overall neonatal behavioural parameters (Mean \pm S.E.) of Black Bengal goat kids. Among the observed behaviours, the latency to udder seeking and latency to stand after birth had the longer durations. This indicates that these activities take the most time in the immediate post-natal period of life.

Effect of season on maternal care

The maternal behaviour of dams varied significantly with the seasons of kidding (Table 4). Grooming and nursing frequencies were higher in summer than in winter ($P < 0.001$). During summer, dams left their kids less often compared to winter ($P < 0.001$). Licking behaviour was more common in summer than in winter ($P < 0.001$). Likewise, the frequency of acceptance to suckling was significantly higher in summer compared to winter ($P < 0.001$), while rejection frequency was higher in summer (10.71 ± 0.22) than in winter (8.49 ± 0.19) ($P < 0.001$). The number of suckling bouts was slightly higher in summer (2.6%) than in winter. Overall basis, results indicated that summer kidding had more favorable expressions of maternal care behaviours than that of winter kidding.

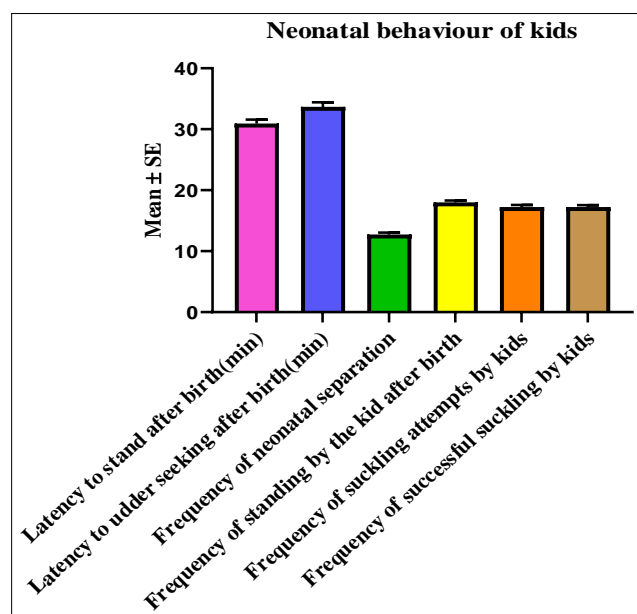


Fig 2: Neonatal behaviour of kids of Black Bengal goats.

Table 3: Influence of parity on neonatal behaviours of Black Bengal goat kids.

Parity	Latency to stand (min)	Latency to udder-seeking (min)	Neonatal separation	Standing frequency	Suckling attempts	Successful suckling frequency
1 st	35.73 ^a \pm 1.37	35.85 ^a \pm 1.52	13.64 ^a \pm 0.67	19.16 \pm 0.68	19.61 ^a \pm 0.72	19.57 ^a \pm 0.64
2 nd	29.15 ^b \pm 1.10	31.90 ^b \pm 1.23	12.91 ^a \pm 0.54	17.65 \pm 0.55	16.42 ^b \pm 0.58	16.77 ^a \pm 0.52
3 rd	28.96 ^b \pm 1.07	32.14 ^b \pm 1.19	11.37 ^b \pm 0.52	17.83 \pm 0.54	16.62 ^b \pm 0.56	15.88 ^b \pm 0.5
$\geq 4^{\text{th}}$	29.74 ^b \pm 1.29	34.71 ^a \pm 1.44	12.93 ^a \pm 0.63	17.30 \pm 0.65	16.27 ^b \pm 0.68	16.64 ^{ab} \pm 0.60
P-value	0.009	0.029	0.000	0.369	0.028	0.000

Means with different superscripts (^a, ^b) within the same column differ significantly ($P < 0.05$).

Table 4: Effect of season on maternal care and kids' suckling behaviour.

Season	Grooming and nursing	Maternal separation	Maternal sniffing	Licking kids	Maternal acceptance of suckling attempts	Maternal rejection of suckling attempts	Suckling bouts	Duration of suckling/ bout (seconds)
Summer	16.56±0.24	12.58±0.45	18.06±0.43	15.66±0.24	15.12±0.22	10.71±0.22	5.21±0.06	10.77±0.10
Winter	15.13±0.21	14.53±0.37	18.16±0.36	13.72±0.20	14.02±0.19	8.49±0.19	5.08±0.05	10.59±0.08
P-value	0.000	0.000	0.788	0.000	0.000	0.000	0.045	0.062

Table 5: Effect of season neonatal behaviour of Black Bengal goat kids.

Season	Latency to stand (min)	Latency to udder-seeking (min)	Neonatal separation	Standing frequency	Suckling attempts	Successful suckling frequency
Summer	33.18±0.86	35.68±0.96	12.03±0.42	17.74±0.43	17.41±0.45	16.82±0.4
Winter	28.61±0.72	31.62±0.80	13.39±0.35	18.23±0.36	17.05±0.38	17.62±0.34
P-value	0.000	0.000	0.001	0.233	0.398	0.036

Table 6: Effect of parity and season of kidding on birth weight (kg) and growth rate (g/day) of Black Bengal goat kids.

Particulars		Birth weight (kg)	Growth rate (gram/day)
Effect of parity	Parity		
	1 st	1.00 ^a ±0.03	24.43 ^{ab} ±0.50
	2 nd	1.20 ^b ±0.021	26.13 ^c ±0.42
	3 rd	1.27 ^b ±0.02	24.84 ^a ±0.36
	≥4 th	1.26 ^b ±0.02	24.91 ^{bc} ±0.45
	P-value	0.000	0.000
Effect of season	Seasons		
	Summer	1.10±0.02	23.45±0.34
	Winter	1.27±0.01	26.70±0.32
	P-value	0.000	0.000

Means with different superscripts (a, b, c) within the same column differ significantly (P<0.05).

Khan *et al.* (2019) and El-Raghi and Hashem (2022), reported seasonal effects on maternal behaviour in other breeds of goats. Similar to present findings, Orihuela and Galina (2021), stated that seasonal stress factors such as changes in nutritional levels, climatic conditions and energy, among others, act as a stimulant for maternal separation in an indirect manner, since it increases stress levels during certain seasons.

Effect of season on neonatal behaviour

Seasonal variation had a notable effect on certain behaviours of neonatal kids and it is summarized in Table 5. The standing time required after birth was longer (15.97%) in summer as compared to winter (P<0.001). The time from birth to udder seeking was also longer in summer (12.84%) compared to winter (P<0.001). The rate of successful suckling was higher in winter, averaging as compared to summer season (P<0.05). Therefore, the

results indicated that winter season born kids showed more active neonatal behaviour as compared to those born in summer. Similar to present findings, Toinon *et al.* (2021), reported that favourable seasons increase the neonatal vigour and motor activity of the goat kids. Dhaoui *et al.* (2020), also observed that the lambs born during the favourable season reached the udder faster than those experiencing suboptimal conditions.

Effect of parity and season on birth weight, growth rate and kid survivability

The results showed significant (P<0.001) differences on birth weight and pre-weaning growth rate depending upon parity of doe and season of kidding (Table 6). Kids from 3rd parity goats had the highest average birth weight at 1.27±0.02 kg. Kids of 2nd parity goats showed the highest growth rate (26.13±0.42 g/day). The lowest birth weight and growth rate was obtained from kids born of nulliparous does. Overall basis, results suggest that second parity dam offers better maternal conditions for enhanced growth rate in kids.

The kidding season significantly affected both the birth weight and growth rate of the kids. Kids born in winter had a higher (15.45%) birth weight compared to those born in summer. Likewise, the average daily growth rate was significantly higher (13.86%) for winter-born kids than summer-born kids (P<0.001). These differences indicate strong seasonal influence on early age growth performance of Black Bengal Goat kids.

Overall birth weight and growth rate of Black Bengal kids were almost similar to that of reported earlier in this breed (Mandal *et al.*, 2022; Das *et al.*, 2023; Debbarma *et al.*, 2025). This study also agrees with the findings of Kumar *et al.* (2021), where it is reported that variation in birth weight due to parity is significant. Present study is also in consistent with the findings of Paul *et al.* (2014) and Hasan *et al.* (2015). In consistent with present report,

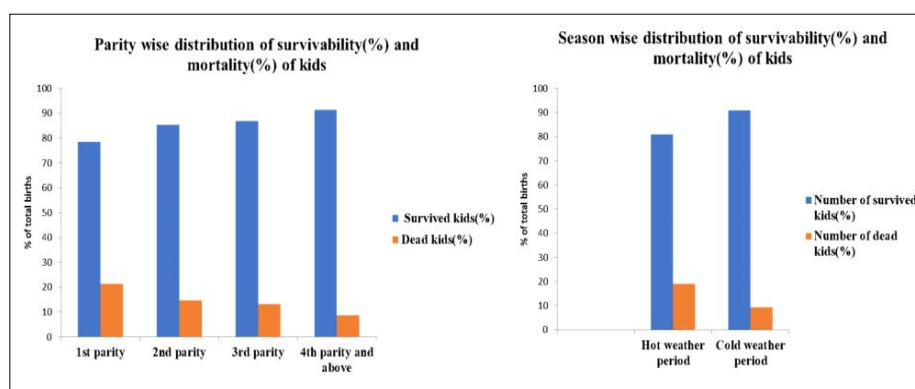


Fig 3: Kid survivability of Black Bengal Goats in different parity and seasons.

Dudhe *et al.* (2015) opined that winter provides a more stable and cooler environment.

Fig 3 illustrates the survivability percentage of Black Bengal goat (BBG) kids based on their mothers' parity and season of kidding. The highest kid survivability was observed in kids born to goats of $\geq 4^{\text{th}}$ parity. This was followed by 3^{rd} and 2^{nd} parity. The lowest kid survivability was found in 1^{st} parity does. The higher mortality rates found in the kids from primiparous does in this study are consistent with findings by Srivastava *et al.* (2025), who reported that the greatest mortality occurred in kids from primiparous mothers and the lowest mortality was seen in the kids born from second to fourth parity dams reared under organized farm conditions. This suggests that maternal experience of birth, care and nursing of kids may significantly influence neonatal survival. Maternal care behaviours of dams were more prominent in summer as compared to those of winter season. In spite of higher maternal cares in summer, kid mortality was higher in summer (19.15%) as compared to winter (9.23%). Probably, basic instinct might play major roles to provide more maternal care to kids during critical months of the year when climatic factors induce stress and negatively impact kid survivability.

CONCLUSION

The current study shows that both parity and season have a significant impact on some of the maternal care, neonatal behaviour, growth performance and survival rates of Black Bengal goat kids. Multiparous does displayed better maternal behaviours. Seasonal variations also impacted maternal and neonatal behaviour. Winter-born kids had higher birth weights, better growth rates and higher survival compared to summer-born kids. It was concluded that maternal care and experience (parity) and favourable climatic conditions (winter) play a major role in neonatal survival, growth performance and the successful bonding between mother and kid. These insights emphasize the need to consider parity and season for devising management and breeding strategies in Black Bengal goats to boost productivity and kid survivability.

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Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this article no funding or sponsorship influenced the design of the study, data collection, analysis decision to publish or preparation of the manuscript.

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