

Influence of non-genetic factors on pre-parturient behaviours in Black Bengal goats

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Abstract

Pre-parturient behaviour can display as an index of successful reproductive management. The objective of the present study was therefore carried out to determine the effects of parity, season and diurnal variation on pre-parturient behaviour patterns and signs associated with parturition in Black Bengal goats (BBG; N=70). Pre-parturient behaviours (Frequency/hour) and physiological parameters (day-5 to day 0 prior to kidding) were recorded using close-circuit camera and also by some manual observations. Enlarged abdomen (100.0%) and enlargement of udder with engorgement of teat (96.7%) were the most prominent signs approaching parturition. Parity significantly impacted on enlargement of udder and engorgement of teat ($\chi^2=8.41$, $df=3$, $P=0.04$) and pre-parturient behaviours viz. standing and lying ($P<0.001$). Goats in first parity displayed higher frequencies of standing, lying, short grunt and high-pitched bleating than higher parity orders. Season had significant effect on pacing, seclusion, aggression such as lunging and vocalization pattern. Diurnal variation was also observed with increased activity and vocalization in morning hours and decreasing trend in afternoon. These results suggested that parity, seasons and diurnal variations play an important role in the expression of pre-parturient behaviours and their consideration may help developing season and parity-specific management practices for effective kidding supervision and perinatal care in BBG.

Keywords: Black Bengal goats; Diurnal variation; Parity; Parturition; Pre-parturient behaviour; Season

Introduction

In the eastern part of India, the most vulnerable segments of the society primarily raise goats, making goat rearing a rural enterprise. Because potential qualities viz. prolificacy, disease resistance, ability to use and survive in poor natural vegetations, excellent meat and skin quality—Black Bengal goats (BBG) are highly valued small ruminant species (Mandal et al., 2022a; Debbarma et al., 2024; Debbarma et al., 2025). Rate of reproduction is one of the most important factors that determine success in animal farming. Parturition directly influences the dams' health, productivity, and survival of both the dam and the newborn. Thus, parturition is one of the most important events in animals' life and farm management. A fundamental knowledge of behaviour associated with parturition can lead to management applications which can enhance reproductive success. Any abnormalities in behaviour prior to parturition can indicate for probable difficulties during parturition and reproductive failures. Moreover, the pre-parturient behaviour in mammals greatly affects the survival of the offsprings.

The survival and welfare of offspring in domestic livestock species depends heavily on the maternal behaviour, mother kid bonding and quality of care provided by the female prior to parturition (Awotwi et al., 1999; Mandal et al. 2022b; Das et al., 2022; Das et al., 2025). Very little information exists regarding the behavioural characteristics involved in parturition in goats (Yilmaz et al., 2012) under intensive management conditions. Therefore, studies on factors influencing pre-parturient behaviour in goats can provide an opportunity to develop suitable management practices to enhance maternal welfare and kidding outcomes. With the above background, present study was conducted with the aim to characterize the pre-parturient behaviours and to investigate the effect of major non-genetic factors affecting these traits in Black Bengal goats.

Materials and Methods

Study location

The study was carried out at the Eastern Regional Station (ERS) Experimental Goat Shed of the ICAR-National Dairy Research Institute in Kalyani, West Bengal. India.

Experimental design, animals and management practices

Seventy Black Bengal female goats were chosen at random during the early stages of pregnancy for the study. The study period lasted from December 2023 to March 2025. Ten days before the anticipated date of parturition, the pregnant goats were separated from the rest of the flock and housed in small groups of four to five animals while being fed in stalls. Both manually and with the use of a pre-installed closed-circuit television camera, the parturition behaviors were observed.

Goats were housed in a loose housing system. Animals were fed farm grown seasonal green fodder *ad libitum* and a concentrate mixture (150–200 gm) every day. Water was made available all day long. The experimental animals' housing, feeding, and watering needs were met in accordance with the farm's standard operating procedures, and all animals received the same levels of general management.

Does' behaviour was observed before, during, and after kid's birth. The physiological signs approaching parturition were noted (day-5 to day 0) prior to parturition. The pre-parturient behavioural observations were recorded thrice a day viz. morning (7 to 8 am), noon (12 to 1 pm) and afternoon (4 to 5 pm) through visual observations. A video recording was also done in order to document the behavioral patterns. The observer maintained a distance of 2-3 m from the animal to minimize disturbance. The descriptions of parturition-associated signs and behaviours recorded in this study are provided in Table1.

Statistical analysis

For data analysis, the chosen animals were grouped according to their parity. Pregnant goats were divided into four parities based on their reproductive and production stages: parity 1 (first time kidder), parity 2, parity 3, and parity ≥ 4 . The experiment's duration was split into two seasons, namely summer/hot-humid periods (March to October) and winter/dry-cooler periods of the year (November to February), taking into account the seasonality of breeding and local weather conditions. Frequency data were expressed in percentage and analyzed by Chi-square. Data recording, tabulation, and graphical representation done by using Microsoft Excel 2007 version. Data were subjected to analysis by General Linear Model with SPSS version 26.0 (IBM Inc.). Pairwise comparison of means among groups was determined by Tukey's Honestly Significant Difference (HSD) test. Level of significance was set at 5% ($P < 0.05$) and 1% ($P < 0.01$) levels of significance.

Results

Prominent visible signs during the pre-kidding period (day -5 to day 0)

The most consistently observed symptoms of goats approaching parturition were enlarged abdomen (100.0%) and enlarged udder and engorgement of the teat (96.7%). Parity showed a statistically significant influence (Table 2)

on the incidence of enlargement of udder and engorgement of teat ($\chi^2 = 8.41$, $p = 0.04$). Season significantly influenced a number of pre-parturient behavioural indicators (Table 3). Frequent wagging of the tail ($\chi^2 = 4.61$, $p = 0.03$), feeling restless ($\chi^2 = 8.95$, $p = 0.01$), and frequent bleating ($\chi^2 = 8.93$, $p = 0.003$) were all significantly more observed in the summer, indicating that environmental factors play some roles in the expression of pre-parturient behaviour.

Frequencies of occurrence of pre-parturient behavioural indicators before kidding (day -5 to day 0)

Pre-parturient indicators showed a distinct progression over the last five days prior to kidding, according to a longitudinal analysis (Table 4). The enlarged abdomen, and enlargement of udder and engorgement of teat were not appropriate for accurate timing prediction because they were continuously present at maximum intensity during the whole period. By day 3, more informative symptoms like redness and swelling of vulva and loosening of pelvic ligaments had steadily increased to their highest level. The most important short-term indicators of impending parturition were the appearance of the water bag at the vulva, the onset of mucous discharge from vulva, labour and abdominal contractions, and the flow of liquefied cervical seal. These indicators were concentrated in the last 48 hours, and culminated to the highest intensity on the day 0 (day of kidding).

Effect of parity on pre-parturient behaviour

The impact of parity on different pre-parturient behavioural parameters is presented in Table 5. Parity had a highly significant effect on standing up and lying down behaviours ($P < 0.001$). First parity goats recorded the highest frequencies of standing up and lying down, showing 38.0% and 40.5% higher frequencies, respectively, compared with second parity does. Vocalization patterns were significantly influenced by parity ($P < 0.001$). Short grunts were higher in fourth & above parity does, with a 25.1% increase compared with second parity does. High-pitched bleats were highest in first parity does, showing 45.1% higher frequency than third parity does. Low-pitched bleats were highest in fourth & above parity does, showing 20.9% and 19.5% higher frequencies than second and third parity does, respectively. Butting behaviour was significantly affected by parity ($P < 0.01$), with first parity does showing highest frequency, which was 38.5% higher than second parity does. However, parity did not significantly influence pawing the ground, frequency of seclusion, lunging, and chasing behaviour ($P > 0.05$).

Effect of season

Present study showed that the season had significant impact on a number of prepartum behaviours in Black Bengal does. Seasonal factors (Table 6) modulate both physical activity and vocalization patterns, as evidenced by the higher proportion of short grunts (56.5%; $P = 0.000$), low-pitched bleats (57.3%; $P = 0.000$), and high-pitched bleats (53.7%; $P = 0.005$) in summer kidding and the higher frequency of seclusion (59.0%; $P = 0.03$) and pacing (52.7%; $P = 0.000$) in winter kidding. Season had no discernible effect on butting, pawing, standing up, or lying down. However, aggressive interactions like lunging and chasing were more prevalent in the summer (62.5% vs 60.0%, respectively) than in the winter (40% vs 37.5%) seasons.

Behavioural changes from 96 to 0 hours before parturition

The majority of observed actions exhibited high temporal stability. During the four time points, there was no statistically significant change in most of the behaviours that were evaluated, such as agonistic interactions (lunging, butting, chasing), short grunts, postural changes (standing up, lying down), or seclusion (Table 7).

Influence of diurnal variations

The diurnal variations in the various behavioural activities of the animals are shown in the Table 8. Pacing behaviour showed a highly significant difference ($P < 0.001$), with the highest frequency during morning (19.14), followed by evening (17.56) and noon (15.57). High-pitched bleats were significantly higher during evening (10.82), showing 18.6% higher frequency than noon (9.12). Low-pitched bleats showed a significant effect ($P = 0.010$), with morning frequency (16.35) being 12.9% and 4.1% higher than noon and evening, respectively. However, diurnal variation had no significant effect on pawing the ground, lying down, frequency of seclusion, lunging, butting, and chasing behaviour ($P > 0.05$).

Discussion

The current study illustrates that parity and season play important roles in pre-parturient behaviour of Black Bengal goats. The results obtained from the present study indicated that enlarged abdomen (100%) and enlargement of udder and engorgement of teat (96.7%) were the most commonly observed signs within 5 days prior to kidding (day-5 to day 0) in Black Bengal goats. Similar results were obtained by Ghosh and Das (2000), where udder development (92.5%), loosening of sacrosciatic ligaments (82.5%), vulval swelling (97.5%), and mucus secretion

Table 1. Behavioural categories and their description

Behaviours	Description
Redness and swelling of vulva	Vulval inflammation and reddening that takes place before delivery
Loosening of pelvic ligaments	The pelvic bones spread apart as a result of the hormone relaxin softening the pelvic ligaments and joints, opening the birth canal for the fetus. Ligaments loosen and drop of abdomen.
Frequent wagging of tail	Because of the pressure from the enlarged uterus and the loosening of the pelvic area, this may indicate discomfort, restlessness, or a change in posture.
Enlarged abdomen	As the fetus develops inside the uterus, the abdomen observably grows larger.
Mucous discharge from vulva	As the cervix dilates, a clear mucous discharge from the vulva is normal and a crucial indicator of the progression of labor.
Feeling restlessness	Animals may exhibit symptoms of discomfort, pace, become nervous, and look for a quiet place to give birth.
Reduced feed intake	Hormonal changes and discomfort from the developing fetus and udder can cause an animal's appetite to decline as labor draws near.
Frequent urination	The urge to urinate frequently as the parturition approaches
Frequent bleating	Bleating & other vocalizations may become more frequent as a symptom of discomfort or anxiety.
Enlargement of udder and engorgement of teat	To get ready to feed the newborn, the udder swells and the teats fill up and solidify with milk.
Labour and contractions	The fetus is forced toward the birth canal as the uterus contracts, causing tightness or cramping in the abdomen.
Water bag appears at vulva	Amniotic sac (water bag) visible at vulva, is a clear sign that delivery is about to happen.
Flow of liquefied cervical seal	During estrus (heat) and the days preceding parturition, the thick, protective cervical mucus changes into a clear, watery discharge.
Pacing	In captive mammals, pacing is a common behavior that is operationally defined as repetitive movement in a predetermined pattern
Pawing the ground	A behaviour where the doe raises one foreleg and repeatedly digs or scrapes, usually by dragging her hoof over the ground.
Standing up	Without changing its overall posture or body position, the animal continues to bear weight on all four limbs or on three limbs when one leg is raised
Lying down	An animal is said to be lying down when its torso is in contact with the ground and its forelimbs are either not bearing any weight at all or are only partially supporting it during transitional movements
Short grunts	Short grunts are low-frequency, pulsatile, and brief calls.
High pitched bleats	Loud calls made with the mouth open
Low pitched bleats	Silent vocalizations made with the mouth shut
Frequency of seclusion	The frequency of keeping a safe distance from a close neighbor
Lunging	To advance abruptly and forcefully, especially when attacking someone
Butting	Pushing the head against another goat's head or body with force
Chasing	Swiftly pursuing another goat that makes an attempt to flee

(Echeverri et al., 1992; Das and Tomer, 1997; Sèbe et al., 2010; Maigrot et al., 2018)

Table 2. Parity-wise distribution in the expression of signs approaching parturition (%) in Black Bengal goats

Particulars \ Parity	1	2	3	4 & above	Overall	Chi-square, df and p-value
Loosening of pelvic ligaments	81.5	89.8	89.9	91.7	88	$\chi^2=6.06$; df=3; p=0.109
Redness & swelling of vulva	78.7	82.4	79	86.1	81	$\chi^2=2.09$; df=3; p=0.553
Frequent wagging of tail	24.1	27.8	18.8	15.3	21.8	$\chi^2=5.09$; df=3; p=0.165
Enlarged abdomen	100	100	100	100	100	-
Mucous release from vulva	16.7	15.7	16.7	19.4	16.9	$\chi^2=0.445$; df=3; p=0.931
Feeling restlessness	70.4	71.3	75.4	79.2	73.7	$\chi^2=3.81$; df=6; p=0.702
Reduced feed intake	85.2	86.1	86.2	88.9	86.4	$\chi^2=0.53$; df=3; p=0.91
Frequent urination	3.7	2.8	3.6	0	2.8	$\chi^2=2.73$; df=3; p=0.42
Frequent bleating	25.9	23.1	32.6	30.6	28.2	$\chi^2=3.16$; df=3; p=0.37
Enlargement of udder & engorgement of teat*	98.1	99.1	96.4	91.7	96.7	$\chi^2=8.41$; df=3; p=0.04
Labour and contractions	17.6	19.4	19.6	16.7	18.5	$\chi^2=0.39$; df=3; p=0.94
Water bag appears at vulva	16.7	16.7	16.7	16.7	16.7	$\chi^2=0$; df=3; p=1.00
Liquefaction of cervical seal	19.4	18.5	16.7	18.1	18.1	$\chi^2=0.34$; df=3; p=0.95

*Significant (P<0.05)

Table 3. Season-wise distribution in the expression of signs approaching parturition (%) in Black Bengal goats

Particulars	Summer	Winter	Overall	Chi-square, df and p-value
Loosening of pelvic ligaments	88.4	87.3	88	$\chi^2=0.106$; df=1; p=0.745
Redness and swelling of vulva	83	77.3	81	$\chi^2=2$; df=1; p=0.16
Frequent wagging of tail*	25	16	21.8	$\chi^2=4.61$; df=1; p=0.03
Enlarged abdomen	100	100	100	-
Mucous discharge from vulva	17.4	16	16.9	$\chi^2=0.134$; df=1; p=0.71
Feeling restlessness*	77.9	66	73.7	$\chi^2=8.95$; df=2; p=0.01
Reduced feed intake	88.8	82	86.4	$\chi^2=3.785$; df=1; p=0.05
Frequent urination*	4.3	0	2.8	$\chi^2=6.71$; df=1; p=0.01
Frequent bleating**	33	19.3	28.2	$\chi^2=8.93$; df=1; p=0.003
Enlargement of udder and Engorgement of teat	96	98	96.7	$\chi^2=1.205$; df=1; p=0.27
Labour and contractions	19.2	17.3	18.5	$\chi^2=0.225$; df=1; p=0.63
Water bag appears at vulva	16.7	16.7	16.7	$\chi^2=0$; df=1; p=1.00
Liquefaction of cervical seal	17.8	18.7	18.1	$\chi^2=0.055$; df=1; p=1.00

*Significant (P<0.05); ** Significant (P<0.01)

Table 4. Progression of observable physiological signs in goats during the pre-kidding period (day -5 to day 0)

Days before kidding	5	4	3	2	1	0	Overall
Loosening of pelvic ligaments	✓✓✓	✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓
Redness & swelling of vulva	✓✓	✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓
Frequent tail wagging	X	✓	✓	✓✓	✓✓✓	✓	✓
Enlarged abdomen	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓
Mucous from vulva	X	X	X	✓	✓	✓✓✓✓	✓
Feeling restlessness	✓	✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓
Reduced feed intake	✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓
Frequent urination	X	X	X	✓	✓	✓	✓
Frequent bleating	X	✓	✓	✓✓	✓✓✓	✓✓✓	✓✓
Enlarged udder and engorgement of teat	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓
Labour and abdominal contractions	X	X	X	✓	✓	✓✓✓✓	✓
Water bag appears at the vulva	X	X	X	X	X	✓✓✓✓	✓
Flow of liquefied cervical seal	X	X	X	X	✓	✓✓✓✓	✓

[N.B. The table's symbols represent the observed sign's relative frequency or severity, with 'x' signifying absence. The following approximate percentage ranges of occurrence are represented by the tick marks: 1-25%=✓, 26-50%=✓✓, 51-75%=✓✓✓, and 76-100%=✓✓✓✓]

Table 5. Effect of parity on the pre-partum behaviour of Black Bengal goats(frequencies/hour)

Parity	First	Second	Third	4 th & above	P-Value
Pacing*	18.18 ^{ab} ±0.42	16.66 ^c ±0.34	16.89 ^{bc} ±0.36	17.96 ^a ±0.47	0.013
Pawing the ground	4.65±0.31	4.43±0.25	4.22±0.26	4.14±0.35	0.631
Standing up***	12.58 ^a ±0.51	9.12 ^b ±0.42	9.75 ^{bc} ±0.43	10.70 ^c ±0.57	0.000
Lying down***	13.01 ^a ±0.51	9.27 ^b ±0.42	10.00 ^{bc} ±0.44	10.89 ^c ±0.58	0.000
Short grunts***	14.11 ^a ±0.57	11.87 ^b ±0.47	12.56 ^b ±0.49	14.85 ^a ±0.65	0.000
High pitched bleats***	11.55 ^a ±0.51	9.70 ^a ±0.42	7.96 ^b ±0.44	10.94 ^a ±0.58	0.000
Low pitched bleats***	15.86 ^b ±0.56	14.34 ^a ±0.46	14.51 ^a ±0.48	17.34 ^b ±0.64	0.000
Frequency of seclusion	1.03±0.15	1.10±0.12	0.74±0.13	0.78±0.17	0.147
Lunging	2.61±0.21	1.90±0.17	2.14±0.18	2.26±0.24	0.076
Butting**	4.50 ^a ±0.28	3.25 ^b ±0.23	3.81 ^{ab} ±0.24	3.34 ^b ±0.31	0.003
Chasing	2.43±0.24	1.91±0.20	1.73±0.20	2.19±0.27	0.128

Row-wise means with different superscripts differ significantly; * (P<0.05); ** (P<0.01); *** (P<0.001)

(50%) were considered as significant signs indicating nearing to parturition in Black Bengal goats. The gradual increase in the incidence of reddening and swelling of vulva, loosening of pelvic ligaments, mucous discharge, labour contractions, appearance of water bag, and flow of liquefied cervical seal till delivery coincided with previous results obtained from other ruminants (Underwood et al., 2015).

Table 6. Seasonal variation in pre-partum behaviour of Black Bengal goats

Season	Summer	Winter	P-Value
Pacing***	16.47±0.35	18.38±0.24	0.000
Pawing the ground	4.34±0.26	4.39±0.17	0.864
Standing up	10.31±0.42	10.76±0.29	0.391
Lying down	10.57±0.43	11.02±0.29	0.392
Short grunts***	15.07±0.48	11.63±0.32	0.000
High pitched bleats**	10.78±0.43	9.29±0.29	0.005
Low pitched bleats***	17.78±0.47	13.25±0.32	0.000
Frequency of seclusion*	0.75±0.13	1.08±0.08	0.034
Lunging***	2.78±0.18	1.67±0.12	0.000
Butting	3.84±0.23	3.61±0.16	0.424
Chasing**	2.47±0.20	1.65±0.13	0.001

Row-wise means with different superscripts differ significantly; *Significant (P<0.05); ** Significant (P<0.01); *** Significant (P<0.001)

Table 7. Behavioural features observed (frequency/ hour) in Black Bengal goats at different time intervals (96-24 h) before parturition

Particulars	Hours close to parturition				P-value
	96 hours	72 hours	48 hours	24 hours	
Pacing	17.53±0.38	16.97±0.39	17.42±0.38	17.77±0.40	0.512
Pawing the ground	4.72±0.28	4.13±0.29	4.09±0.28	4.51±0.29	0.319
Standing up	10.59±0.47	10.29±0.47	10.06±0.46	11.21±0.48	0.321
Lying down	10.90±0.47	10.62±0.47	10.15±0.47	11.51±0.48	0.212
Short grunts	13.28±0.53	13.68±0.53	13.13±0.52	13.31±0.54	0.896
High pitched bleats*	10.16 ^{ab} ±0.47	9.87 ^{ab} ±0.48	9.12 ^b ±0.47	10.99 ^a ±0.49	0.042
Low pitched bleats	15.24±0.52	15.82±0.52	14.61±0.52	16.38±0.53	0.086
Frequency of seclusion	0.95±0.14	0.76±0.14	0.88±0.14	1.05±0.14	0.484
Lunging	2.39±0.19	2.01±0.19	2.15±0.19	2.35±0.20	0.463
Butting	3.51±0.25	3.46±0.26	4.00±0.25	3.93±0.26	0.284
Chasing	2.21±0.22	2.04±0.22	1.83±0.22	2.17±0.23	0.588

Row-wise means with different superscripts differ significantly; *Significant (P<0.05)

Table 8. Diurnal influence on the behavioural expression (frequency/ hour) in Black Bengal goats during the pre-kidding period

Diurnal variations	Morning (6 to 7 am)	Noon (12 to 1 pm)	Evening (5 to 6 pm)	P-Value
Pacing***	19.14 ^a ±0.34	15.57 ^b ±0.34	17.56 ^c ±0.34	0.000
Pawing the ground	4.79±0.25	4.09±0.25	4.21±0.25	0.092
Standing up*	11.21 ^a ±0.41	9.78 ^b ±0.41	10.62 ^{ab} ±0.41	0.040
Lying down	11.40±0.41	10.11±0.41	10.87±0.41	0.074
Short grunts*	14.24 ^a ±0.47	12.66 ^b ±0.46	13.15 ^{ab} ±0.46	0.041
High pitched bleats	10.17 ^{ab} ±0.42	9.12 ^b ±0.41	10.82 ^a ±0.41	0.011
Low pitched bleats*	16.35 ^a ±0.46	14.48 ^b ±0.46	15.71 ^{ab} ±0.46	0.010
Frequency of seclusion	1.07±0.12	0.74±0.12	0.91±0.12	0.142
Lunging	2.09±0.17	2.45±0.17	2.13±0.17	0.238
Butting	3.31±0.22	3.82±0.22	4.04±0.22	0.053
Chasing	1.90±0.19	2.33±0.19	1.96±0.19	0.210

Row-wise means with different superscripts differ significantly; *Significant (P<0.05); *** Significant (P<0.001)

The impact of parity on pre-parturient behavior seen in the current study was partially in agreement with earlier findings. Das and Tomer (1997) found higher levels of isolation-seeking behavior in multiparous Beetal and (Alpine x Saanen) crossbred does, whereas primiparous mothers showed higher levels of behaviors related to restlessness such as pawing, standing, and lying down. Similarly, Malfatti et al. (1991) and Lickliter (1985) have found increased restlessness behaviors in primiparous females and increased isolation-seeking behaviors in multiparous does prior to parturition. In the current study, it is found that primiparous does show significantly higher levels of standing up, lying down, short grunting, and high-pitched bleating behaviors, signifying higher behavioral intensity because of lack of experience during first kidding.

It is evident from our study that frequency of isolation/seclusion is more prominent in primiparous goats than multiparous. The present study suggests that the basic instinct of preparedness (Allan et al., 1991; Awotwi et al., 1999)

of parturition before kidding might have continued as prominent pre-parturient behaviour even under intensive management. Higher frequencies of pacing, pawing the ground, standing up, lying down and high-pitched bleats were observed in primiparous goats due to maternal inexperience and nervousness, whereas higher parity goats appeared calmer due to previous kidding experience and adaptation to the management system.

In Iberian Ibex bucks, Ungerfeld et al. (2016) observed maximum frequencies of agonistic interactions during summer compared to spring. Current findings regarding increased agonistic behaviour during hot periods of the day are consistent with previous findings (Bozkurt et al., 2006; Pilatti et al., 2019), which indicated increased levels of pushing and competitiveness among heat-stressed multiparous cattle because of space competition or cooling off.

Present study reported that both standing up and lying down behavioural signs were frequently observed in morning time, followed by evening and noon time. Nguni goats and Merino sheep spent more time lying at nighttime compared to daytime and animals spent more time standing longer during the day than at night (Moyo et al., 2018). However, the diurnal circadian rhythm in BBG was prominent for lying down/standing up activity and vocalization, peaking in the morning, declining at mid-day, and reaching moderate levels in the evening.

Conclusion

This study has provided the characterization of pre-parturient behaviours and signs associated with parturition in Black Bengal goats kept in intensive rearing conditions. The most frequently occurring cardinal signs approaching parturition in chronological orders, were enlarged abdomen, enlargement of udder with engorgement of teat, reduced feed intake, loosening of pelvic ligaments, increased restlessness, and redness and swelling of vulva. Thereafter, impending parturition indicators were restlessness, labour pain and abdominal contractions, liquefied cervical seal and appearance of water bag at vulva. Parity, season of kidding and diurnal variations significantly affected some of the important pre-parturition behaviours. The results have implied that pre-parturient behaviour is influenced by both intrinsic (parity) and extrinsic (seasonal and diurnal) factors, which should be taken into account in devising management practices to enhance maternal welfare and kidding outcomes.

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Ethical consideration

No special ethical approval for this study was deemed necessary.

Conflicts of Interest

The authors declare that they have no conflict of interest.

References

- 1) Allan, C. J., Hinch, G. N., and Holst, P.J., 1991. Behaviour of parturient Australian bush goats. II. Spatial relationships and activity patterns. *Applied Animal Behaviour Science*, 32(1), 65-74. [https://doi.org/10.1016/S0168-1591\(05\)80164-9](https://doi.org/10.1016/S0168-1591(05)80164-9)
- 2) Awotwi, E. K., Agboda, S., Oppong-Anane, K., and Fianu, F. K., 1999. Periparturient behaviour of the West African Dwarf goat. *Ghana Journal of Agricultural Science*, 32(1), 95-100. <http://doi.org/10.4314/gjas.v32i1.1919>
- 3) Bozkurt, Y., Ozkaya, S., and Ap Dewi, I., 2006. Association between aggressive behaviour and high-energy feeding level in beef cattle. *Czech Journal of Animal Science*, 51(4), 151-156. <https://doi.org/10.17221/3922-CJAS>
- 4) Das, N., and Tomer, O. S., 1997. Time pattern on parturition sequences in Beetal goats and crosses: comparison between primiparous and multiparous does. *Small Ruminant Research*, 26(1-2), 157-161. [https://doi.org/10.1016/S0921-4488\(96\)00997-2](https://doi.org/10.1016/S0921-4488(96)00997-2)
- 5) Das, A., Debbarma, A., Mandal, D. K., Karunakaran, M., Sheikh, S. A., and Rai, S., 2022. Strategies to improve mother-kid bonding of goat for kid survivability. *Agri-India Today*, 11, 01-06.
- 6) Das, A., Mandal, D. K., Debbarma, A., Singh, B., and Debnath, A., 2025. Improving Welfare in Suckling Goat Kids During Winter: Impact of Heat-Retentive Kid Nest on Hiding, Playing, Suckling, and Nursing Behaviors. *Journal of Applied Animal Welfare Science*, 1-14. <http://doi.org/10.1080/10888705.2025.2531966>
- 7) Debbarma, A., Mandal, D. K., Das, A., Tripura, S., Sarkar, D., and Swain, S. K., 2024. Evaluation of rearing system on body condition score and mortality rate of Black Bengal goats. *Journal of Scientific Research and Reports*, 30(5), 889-893. <http://doi.org/10.9734/JSRR/2024/v30i52006>
- 8) Debbarma, A., Mandal, D.K., Das, A., Sarkar, D., Tripura, S., Roy, A., and Rai, S., 2025. Socio-demographic Status, Rearing System and Prevalence of Diseases in Black Bengal Goats Maintained in Nadia District of West Bengal. *Indian Journal of Animal Research*, 60(6), 1116-1121. <http://doi.org/10.18805/IJAR.B-5485>

- 9) Echeverri, A.C., Gonyou, H.W., and Ghent, A.W., 1992. Parturient behavior of confined ewes: time budgets, frequencies, spatial distribution and sequential analysis. *Applied Animal Behaviour Science*, 34(4), 329-344. [http://doi.org/10.1016/S0168-1591\(05\)80093-0](http://doi.org/10.1016/S0168-1591(05)80093-0)
- 10) Ghosh, S. K., and Das, A., 2000. Observations during parturition in Black Bengal goats. *The Indian Journal of Animal Sciences*, 70(4), 413-415.
- 11) IBM Corp., 2019. IBM SPSS Statistics for Windows, Version 26.0. IBM Corp., Armonk, NY, USA.
- 12) Lickliter, R. E., 1985. Behavior associated with parturition in the domestic goat. *Applied, Animal Behaviour Science*, 13(4), 335-345. [http://doi.org/10.1016/0168-1591\(85\)90013-9](http://doi.org/10.1016/0168-1591(85)90013-9)
- 13) Maigrot, A. L., Hillmann, E., and Briefer, E. F., 2018. Encoding of emotional valence in wild boar (*Sus scrofa*) calls. *Animals*, 8(6), 85. <https://doi.org/10.3390/ani8060085>
- 14) Malfatti, A., Lucaroni, A., and Debenedetti, A., 1991. Behaviour associated with parturition in goats. *Applied Animal Behaviour Science*, 30(1-2), 191. [http://doi.org/10.1016/0168-1591\(91\)90120-M](http://doi.org/10.1016/0168-1591(91)90120-M)
- 15) Mandal, D. K., Karunakaran, M., Debbarma, A., Swain, S. K., Santra, A., Dutta, T. K., Chatterjee, A., and Rai, S., 2022a. Black Bengal goat husbandry-An appraisal of productive and reproductive performance under intensive management system. *Journal of Livestock Science*, 13, 227-233. <http://doi.org/10.33259/JLivestSci.2022.227-233>
- 16) Mandal, D. K., Das, A., Debbarma, A., and Rai, S., 2022b. Mother-kid bonding in goats: A very important issue for kids' survival and performance. *Corpus Journal of Veterinary and Dairy Science*, 3(2), 1-5. <https://doi.org/10.54026/CJDVS1040>
- 17) Moyo, M., Adebayo, R. A., and Nsahlai, I. V., 2018. Effects of diet and roughage quality, and period of the day on diurnal feeding behaviour patterns of sheep and goats under subtropical conditions. *Asian-Australasian Journal of Animal Sciences*, 32(5), 675-690. <https://doi.org/10.5713/ajas.17.0901>
- 18) Pilatti, J. A., Vieira, F. M. C., Rankrape, F., and Vismara, E. S., 2019. Diurnal behaviors and herd characteristics of dairy cows housed in a compost-bedded pack barn system under hot and humid conditions. *Animal*, 13(2), 399–406. <https://doi.org/10.1017/S1751731118001088>
- 19) Sèbe, F., Duboscq, J., Aubin, T., Ligout, S., and Poindron, P., 2010. Early vocal recognition of mother by lambs: contribution of low-and high-frequency vocalizations. *Animal Behaviour*, 79(5), 1055-1066. <https://doi.org/10.1016/j.anbehav.2010.01.021>
- 20) Underwood, W. J., Blauwiel, R., Delano, M. L., Gillesby, R., Mischler, S. A., and Schoell, A., 2015. Biology and diseases of ruminants (sheep, goats, and cattle). In J. G. Fox, L. C. Anderson, G. M. Otto, K. R. Pritchett-Corning, & M. T. Whary (Eds.), *Laboratory animal medicine*, 3rd Edition. Academic Press, Boston, pp. 623–694. <https://doi.org/10.1016/B978-0-12-409527-4.00015-8>
- 21) Ungerfeld, R., Freitas-de-Melo, A., Giriboni, J., Lacuesta, L., Toledano-Díaz, A., and Santiago-Moreno, J., 2016. Influence of seasonality and stimulus of oestrous does in bucks' aggressiveness. *Behavioural Processes*, 133, 1-5. <https://doi.org/10.1016/j.beproc.2016.10.008>
- 22) Yilmaz, A., Karaca, S., Kor, A., and Bingol, M., 2012. Determination of pre-parturition and post-parturition behaviors of Norduz goats. *Kafkas Üniversitesi Veteriner Fakültesi Dergisi*, 18(2), 215-219. <https://doi.org/10.9775/kvfd.2011.5292>