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Prevalence of Subclinical Ketosis in Early Lactating Deoni Cattle

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Abstract

Subclinical ketosis (SCK) is an economically important yet frequently undetected metabolic disorder of early lactation, and its occurrence in indigenous Indian cattle breeds has received comparatively little attention. This study was therefore designed to establish the prevalence of SCK in early-lactating Deoni cattle. Blood β-hydroxybutyrate (BHBA) concentration, with a diagnostic threshold of ≥ 1.2 mmol/L, was used to screen 147 cows within 8 weeks of calving, yielding an overall prevalence of 28.57% (42/147). Prevalence varied markedly across physiological categories, rising to 14.97% in cows aged 6–8 years, 15.65% in those in their 3rd-4th parity, 11.56% between 10 and 20 days postpartum, and 27.21% among cows yielding 2–4 kg of milk daily. Body condition score was also significantly associated with SCK occurrence, the highest prevalence (15.65%) being recorded in cows with a score exceeding 4. By contrast, neither season nor geographical location showed a statistically significant relationship with disease occurrence. Collectively, these findings establish subclinical ketosis as a common, physiologically driven metabolic disorder in early-lactating Deoni cattle.

INTRODUCTION

Among the metabolic disorders that compromise dairy cattle during early lactation, subclinical ketosis (SCK) arises when negative energy balance drives excessive mobilisation of body fat, elevating circulating ketone bodies, most notably β-hydroxybutyrate (BHBA), beyond physiological norms. Unlike its clinical counterpart, SCK produces no overt signs, yet it exerts a substantial covert toll on milk yield, reproductive performance and overall herd health, making early identification essential to effective transition-period management.

The periparturient period is inherently a time of heightened metabolic stress, as energy intake fails to keep pace with the sharply rising demands of milk synthesis, leaving cows vulnerable to disorders of this kind. While the epidemiology of SCK has been characterised extensively in high-yielding exotic and crossbred populations, comparable data for indigenous breeds such as Deoni cattle remain scarce. To address this gap, the present study was undertaken to determine the prevalence of subclinical ketosis in early-lactating Deoni cows.

MATERIALS AND METHODS

Study design and animals

This study was carried out at the Veterinary Clinical Complex, College of Veterinary and Animal Sciences, Udgir, and in adjoining field areas, between March 2025 and January 2026. A total of 147 lactating Deoni cows within 8 weeks of parturition were enrolled, with no restriction on age, parity or milk yield; the sole exclusion criterion was the presence of overt clinical signs of ketosis.

Diagnosis of subclinical ketosis

Diagnosis relied on blood BHBA concentration, determined in aseptically collected jugular venous samples using a handheld ketometer (Precision Xtra, Abbott Laboratories, USA- Photo 1); cows returning a value of ≥ 1.2 mmol/L were classified as positive. Blood glucose was concurrently measured with a glucometer (Accu-Chek Instant, Roche Diagnostics, Germany- Photo 2), while Rothera's test on urine and the Ross test on milk served as supporting qualitative assays.

Photo 1. Handheld ketometer with BHBA test strips.

Photo 2. Handheld glucometer with glucose test strip.

Data recording and classification

Data were recorded for age, parity, stage of lactation, milk yield, body condition score (BCS), season, month and geographical location, with animals classified into the following categories:

- Age: <4, 4–6, 6–8, > 8 years
- Parity: 1–2, 3–4, 5–6, 7–8, 9–10
- Stage of lactation: 0–10, 10–20, 20–30, 30–40, 40–50, 50–60 days postpartum
- Milk yield: <1, 1–2, 2–4 kg/day
- BCS: <3, 3–4, > 4 (Edmonson et al. 1989)

Statistical analysis

Prevalence was expressed as the percentage of animals testing positive, and associations between categorical variables were evaluated by the chi-square (χ^2) test, with $P < 0.05$ taken as the threshold for statistical significance.

RESULTS AND DISCUSSION

Of the 147 lactating Deoni cows within 8 weeks postpartum screened for subclinical ketosis on the basis of blood BHBA concentration, 42 tested positive, corresponding to an overall prevalence of 28.57% (Table 1).

Table 1
Overall prevalence of subclinical ketosis in Deoni cattle

Sr. No.	Total no. of screened animals	No. of positive animals	% prevalence
1.	147	42	28.57

This figure sits comfortably within the range previously reported for early lactation, spanning 6.90–43.00% (Suthar et al. 2013), and is broadly consistent with global estimates of 22–24% (Brunner 2019; Chanakarn et al. 2022). It also closely matches the 23.50% prevalence reported under Indian field conditions by Mohammed et al. (2022). Somewhat lower values have been documented by Pechova et al. (2018) and Garro et al. (2014), whereas Duffield (2000) and Vanholder et al. (2015) reported higher prevalence; such inter-study variation is likely attributable to differences in breed, production level, diagnostic threshold and management practice. The moderate prevalence recorded here in Deoni cattle may, in part, reflect their comparatively modest milk yield relative to high-yielding exotic breeds.

Age was significantly associated with SCK occurrence ($P < 0.05$; Table 2). Prevalence peaked at 14.97% in cows aged 6–8 years, declining to 9.52% in the 4-6-year group and 4.08% in cows older than 8 years, while no cases were recorded below 4 years of age. This pattern points to heightened metabolic vulnerability in cows at the peak of their productive life, a trend consistent with the observations of Suthar et al. (2013), Nazeer et al. (2019) and Mohammed et al. (2022).

Table 2
Prevalence of subclinical ketosis according to various risk factors in Deoni cattle

Sr. No.	Age (years)	No. of animals examined	Positive cases	% cases	Percent prevalence	Chi square value
Age-wise Prevalence						
1	< 4	12	0	0.00	0.00	8.11*
2	4–6	59	14	33.33	9.52	
3	6–8	61	22	52.38	14.97	
4	> 8	15	6	14.29	4.08	
Total		**147**	**42**	**100.00**	**28.57**	
Parity-wise Prevalence						
1	1st -2nd	27	1	3.70	0.68	19.01***
2	3rd -4th	69	23	33.33	15.65	
3	5th -6th	41	14	34.15	9.52	
4	7th -8th	9	4	44.44	2.72	
5	9th -10th	1	0	0.00	0.00	
Total		**147**	**42**	**100.00**	**28.57**	
Stage of lactation-wise Prevalence						
1	0–10	6	2	33.33	1.36	21.64***
2	10–20	30	17	56.67	11.56	
3	20–30	42	12	28.57	8.16	
4	30–40	33	8	24.24	5.44	
5	40–50	18	2	11.11	1.36	
6	50–60	18	1	5.56	0.68	
Total		**147**	**42**	**100.00**	**28.57**	
Prevalence according to farm management system						
1.	Organized farms	51	16	31.37	10.88	0.31NS
2.	Unorganized farms	96	26	27.08	17.69	
Total		**147**	**42.00**		**28.57**	
Milk yield-wise Prevalence						
1	< 1	0	0	0	0	5.76*
2	1–2	24	2	8.33	1.36	
3	2–4	123	40	32.52	27.21	
Total		**147**	**42**		**28.57**	
Body condition score-wise Prevalence						
1	< 3	43	9	20.93	6.12	33.52***
2	3–4	67	10	14.93	6.80	
3	> 4	37	23	62.16	15.65	
Total		**147**	**42.00**		**28.57**	
Season-wise Prevalence						

*Significant at P < 0.05; ***Highly significant at P < 0.001; NS = Non-significant (P > 0.05)

Sr. No.	Age (years)	No. of animals examined	Positive cases	% cases	Percent prevalence	Chi square value
Age-wise Prevalence						
1	Monsoon	33	10	30.30	6.80	1.06^{NS}
2	Post-monsoon	70	22	31.43	14.97	
3	Winter	44	10	22.73	6.80	
4	Summer	0	0	0.00	0.00	
Total		**147**	**42**		**28.57**	
Month-wise Prevalence						
1	August	6	1	16.67	0.68	4.58^{NS}
2	September	27	9	33.33	6.12	
3	October	3	0	0.00	0.00	
4	November	67	22	32.84	14.97	
5	December	37	8	21.62	5.44	
6	January	7	2	28.57	1.36	
Total		**147**	**42**		**28.57**	

*Significant at P < 0.05; ***Highly significant at P < 0.001; NS = Non-significant (P > 0.05)

Parity exerted a highly significant effect on SCK occurrence (P < 0.001; Table 2). Prevalence was greatest in cows in their 3rd-4th lactation (15.65%), followed by the 5th-6th (9.52%) and 7th -8th (2.72%) lactations, and lowest in 1st -2nd lactation animals (0.68%). The elevated risk among multiparous cows is plausibly linked to their higher milk output and, correspondingly, greater metabolic demand during early lactation, a relationship also noted by Duffield (2000) and Oetzel (2004).

Stage of lactation also had a highly significant influence on SCK occurrence (P < 0.001; Table 2), with prevalence peaking at 11.56% between 10 and 20 days postpartum, then declining progressively through 20–30 days (8.16%) and 30–40 days (5.44%) to lower values thereafter. This temporal pattern underscores early lactation as the period of greatest vulnerability, corroborating the reports of Dohoo and Martin (1984), Geishauser et al. (2001) and McArt et al. (2012), who similarly attributed the concentration of cases within the first few weeks postpartum to the severity of negative energy balance at this stage.

Prevalence differed little between production systems, at 31.37% on organised farms compared with 27.08% on unorganised holdings (Table 2); this difference was not statistically significant (P > 0.05), suggesting that farm management system exerts limited influence on disease occurrence.

Milk yield was significantly associated with SCK occurrence (P < 0.05; Table 2): prevalence reached 27.21% among cows yielding 2–4 kg/day, well above the 1.36% recorded at 1–2 kg/day, indicating that even the comparatively modest yield increments typical of indigenous breeds can predispose cows to metabolic stress, an observation consistent with Andersson (1988) and McArt et al. (2012).

Body condition score (BCS) was highly significantly associated with SCK occurrence (P < 0.001; Table 2), prevalence rising to 15.65% in cows scoring above 4, compared with 6.80% at a BCS of 3–4 and 6.12% below 3. Over-conditioned cows thus appear more prone to SCK, consistent with the excessive fat mobilisation that accompanies early lactation in this group, in line with the findings of Roche et al. (2009) and Vanholder et al. (2015).

Neither season nor month was significantly associated with SCK occurrence (P > 0.05; Table 2), although numerically higher prevalence was apparent during the post-monsoon season and in November. This pattern points to physiological determinants, such as stage of lactation, as the dominant drivers of SCK, rather than prevailing environmental conditions, an interpretation shared by Nazeer et al. (2019) and Mohammed et al. (2022).

The month-wise distribution of prevalence is presented in Table 2 and illustrated in Fig. 1. Values peaked in November (14.97%), followed by September (6.12%) and December (5.44%), and were lowest in January (1.36%) and August (0.68%), with no positive cases recorded in October; the association between month and SCK occurrence was not statistically significant (P > 0.05).

The comparatively higher prevalence in November and September likely reflects a greater proportion of cows in early lactation during these months and hence a more pronounced negative energy balance, consistent with the report of Mohammed et al. (2022). The complete absence of cases in October more plausibly reflects the small number of animals screened in that month than a genuine absence of disease. Taken together, the non-

significant month effect reinforces the conclusion that stage of lactation, rather than seasonal timing, is the principal determinant of subclinical ketosis (McArt et al. 2012).

District of origin showed no significant association with SCK occurrence (P > 0.05; Table 3); the larger absolute number of positive cases recorded in Latur district most likely reflects the greater number of animals screened there rather than a genuine geographical effect.

Table 3
Prevalence of subclinical ketosis according to district in Deoni cattle

Sr. No.	District	Screened animals (n = 147)	Positive Animals (n = 42)	Percent prevalence (%)	Chi Square value
1	Latur	118	36	24.49	1.33^{NS}
2	Bidar	28	6	4.08	
3	Dharashiv	1	0	0.00	
Total		**147**	**42**	**28.57**	
NS = Non-significant (P > 0.05)					

CONCLUSION

This study establishes subclinical ketosis as a significant metabolic disorder of early-lactating Deoni cattle, with an overall prevalence of 28.57% based on blood BHBA estimation (≥ 1.2 mmol/L). Its occurrence was concentrated in the early postpartum period, peaking between 10 and 20 days in milk, which confirms the transition phase as the period of greatest risk.

SCK occurrence was significantly associated with age, parity, stage of lactation, milk yield and body condition score, with greater susceptibility evident in cows aged 6–8 years, in multiparous animals (3rd -4th lactation), and in those with a body condition score exceeding 4. The elevated prevalence among cows yielding 2–4 kg of milk daily further demonstrates that even modest levels of production in indigenous breeds can precipitate negative energy balance and associated metabolic disturbance.

In contrast, season, month, farm management system and geographical location bore no significant relationship to SCK occurrence, indicating that physiological status, rather than environmental context, is the principal determinant of disease risk.

Collectively, these findings underscore subclinical ketosis as a covert but economically consequential disorder in Deoni cattle, for which routine BHBA-based screening and targeted nutritional management during the transition period are essential to safeguarding animal health and productivity.

Declarations

AUTHOR CONTRIBUTION STATEMENT

Objectives of the study, design of the experiment, investigation, data analysis, [Mowade V.S.], [Masare P.S.], and [Jadhav R.K.]; writing original draft and editing, [Mowade V.S.] and [Menon P.R.]; writing –review, [Masare P.S.], [Jadhav R.K.], [Ghoke S.S.], [Chavhan S.G] and [Patil A.D.].

ETHICS STATEMENT

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by IAEC under CCSEA (earlier as CPCSEA) (Date **18/07/2025** No. **X/25**) for the conduction of experiment on the early lactating Deoni cows, clinical assessment and for collection of blood samples for laboratory analysis. The present research methods were conducted in compliance with CCSEA, Ministry of Fisheries, Animal husbandry and Dairying, GoI, guidelines and regulations.

CONFLICT OF INTEREST STATEMENTS

There are no conflict interests stated by authors.

CONSENT TO PUBLISH

The authors have informed consent for publication of all the research data

COMPETING INTEREST

There are no competing interests stated by authors.

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DATA AVAILABILITY

'Not applicable'

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17. STATEMENTS & DECLARATIONS

Figures

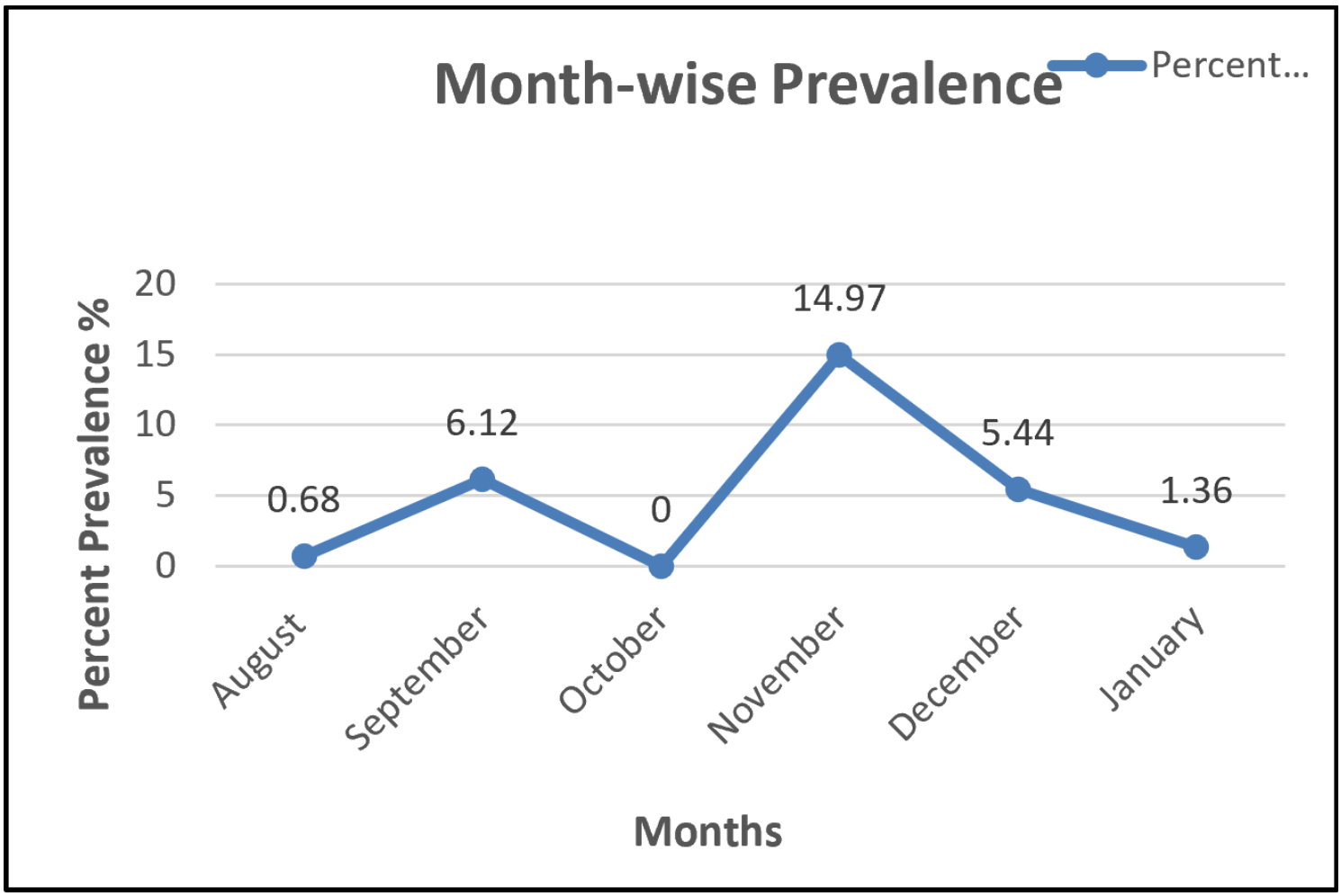


Figure 1

Month-wise trend in the prevalence (%) of subclinical ketosis in Deoni cattle.