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Anoestrus in Bovines (Cattle and Buffalo): Etiology, Diagnostic Approach and Evidence-Based Management

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Anoestrus is a major reproductive constraint in bovines, characterized by absence of overt estrus behavior and/or delayed resumption of cyclic ovarian activity, particularly during the postpartum period. Prolonged anoestrus contributes to extended days open, increased calving interval, reduced conception rate and substantial economic losses in dairy herds. The condition is multifactorial and commonly associated with negative energy balance, metabolic-endocrine suppression, postpartum uterine disease, heat stress and inadequate estrus detection. Accurate differentiation between true anoestrus (ovarian inactivity) and silent estrus (cycling with weak behavioral signs) is essential for rational therapeutic planning. Contemporary diagnostic tools such as ultrasonography and progesterone profiling improve diagnostic accuracy, while evidence-based hormonal programs (e.g., Ovsynch and progesterone-based protocols) can enhance reproductive performance when applied strategically.

Keywords: anoestrus, postpartum anestrus, ovarian inactivity, silent heat, dairy cow

Introduction

Reproductive efficiency is a critical determinant of profitability in dairy production systems. Among the reproductive disorders affecting cattle and buffaloes, anoestrus represents one of the most common causes of subfertility, particularly in the postpartum period (Peter et al., 2009). Clinically, anoestrus is often interpreted as "absence of heat," but in practice it may reflect either true ovarian inactivity or failure to detect estrus due to weak expression and managemental limitations (Roche et al., 2000; Opsomer et al., 1996). Postpartum reproductive recovery is influenced by metabolic adaptation, uterine health and endocrine normalization and disruption of these processes frequently results in delayed resumption of ovarian cyclicity (LeBlanc, 2023).

Classification of Anoestrus

Anoestrus in bovines may be broadly categorized into true and apparent forms.

True anoestrus (ovarian inactivity / anovulatory condition): True anoestrus is characterized by minimal ovarian activity, absence of functional corpus luteum and failure to achieve ovulation due to inadequate endocrine stimulation, especially reduced LH pulsatility (Peter et al., 2009; Opsomer et al., 1996). Although follicular waves may initiate postpartum, the dominant follicle may fail to ovulate under an unfavorable metabolic and hormonal milieu (Peter et al., 2009).

Apparent anoestrus (silent estrus / sub-estrus): In apparent anoestrus, ovarian cyclicity may be normal, but estrus behavior is weak or undetected. This is especially common in buffaloes, where estrus signs are subtle and may occur predominantly during night hours, causing a high risk of missed heats (Hiremath and Ramesha, 2015; Roche et al., 2000).

Etiology and Pathophysiology

Anoestrus is primarily the consequence of disturbances in the hypothalamic–pituitary–ovarian axis, where reduced hypothalamic GnRH stimulation leads to suppressed pituitary LH secretion, impaired follicular development, reduced estradiol production and failure of ovulation and estrus expression (Peter et al., 2009).

Negative energy balance and metabolic suppression: Early lactation is characterized by intense metabolic demands and frequently results in negative energy balance, particularly in high-yielding dairy cows. Under such conditions, reduced feed intake and metabolic hormone alterations compromise ovarian responsiveness, delay postpartum ovulation and prolong anoestrus (Peter et al., 2009; Rhodes et al., 2003).

Postpartum uterine disease: Postpartum uterine disorders significantly impair reproductive performance. Uterine inflammation alters local and systemic signaling, contributing to delayed resumption of cyclicity and suboptimal fertility outcomes (LeBlanc, 2023). Chronic or persistent uterine disease may predispose animals to prolonged days open and poor conception rates at the herd level (LeBlanc, 2023).

Heat stress and environmental impact: Heat stress adversely affects reproductive performance through reduced feed intake, elevated stress response, impaired follicular development and diminished intensity of estrus behavior, ultimately increasing the likelihood of apparent anoestrus and delayed breeding (Roche et al., 2000).

Management-related factors: Field reports of anoestrus often include animals that are cyclic but remain unbred due to inadequate estrus detection. Poor observation routines, lack of heat detection aids and weak behavioral expression, especially in buffaloes, are major contributors to the "anoestrus problem" in dairy herds (Roche et al., 2000; Hiremath and Ramesha, 2015).

Clinical Presentation

Anoestrus is suspected when animals fail to exhibit standing heat, mounting activity, vulvar swelling, or mucus discharge within the expected timeframe postpartum. True ovarian inactivity may present with small inactive ovaries and reduced uterine tone, whereas silent estrus cases may have normal ovarian structures but poor behavioral signs (Opsomer et al., 1996; Peter et al., 2009).

Diagnostic Approach

Accurate diagnosis is essential for selecting appropriate treatment and avoiding unnecessary hormonal use.

History and herd-level evaluation: Key information includes calving date, postpartum health events, nutritional management, body condition score, milk yield and adequacy of heat detection practices (Roche et al., 2000).

Ultrasonographic evaluation: Transrectal ultrasonography provides direct assessment of ovarian follicular activity, presence of corpus luteum and uterine health status, allowing differentiation between ovarian inactivity, cycling animals and cystic ovarian conditions (Rhodes et al., 2003).

Progesterone profiling: Milk or plasma progesterone concentration can confirm luteal function. Persistently low progesterone indicates lack of corpus luteum (supporting true anoestrus), whereas cyclical patterns suggest ongoing cycles with possible silent estrus (Rhodes et al., 2003).

Evidence-Based Management

Management of anoestrus should be based on correcting the underlying causes and applying hormonal interventions only when appropriate.

Nutritional and metabolic correction: Improving dietary energy density, balancing protein intake and ensuring mineral supplementation support restoration of endocrine activity and ovarian responsiveness. Preventing excessive body condition loss during early lactation is central to reducing postpartum anoestrus (Peter et al., 2009; Roche et al., 2000).

Control of postpartum uterine disorders: Effective monitoring and treatment of postpartum uterine disease improves the probability of normal cyclicity resumption and enhances fertility.

Preventive transition management and early postpartum reproductive evaluations are critical at herd level (LeBlanc, 2023).

Hormonal therapies and reproductive protocols: Hormonal interventions should be selected based on ovarian status:

- **Ovsynch protocol:** Synchronization of ovulation enables fixed-time AI and reduces dependence on heat detection. It is one of the most widely implemented protocols in dairy herds (Pursley et al., 1995; Wiltbank and Pursley, 2014).
- **Progesterone-based protocols:** Intravaginal progesterone devices can improve estrus expression and follicular competence and may be especially beneficial in buffaloes with silent estrus (Hiremath and Ramesha, 2015).
- **Rational use of GnRH/PGF$_2\alpha$:** These agents should be used strategically after confirming follicular or luteal status, rather than as empirical treatment in all suspected anoestrus cases (Wiltbank and Pursley, 2014).

Prevention and Herd-Level Control

Long-term control of anoestrus requires integrated herd strategies such as:

- Optimal transition nutrition and energy management
- Prevention and early handling of postpartum uterine disorders
- Improved estrus detection systems and use of heat detection aids
- Heat stress mitigation (cooling, shade, adequate water)
- Structured reproductive monitoring and timed-ai programs where needed

Such approaches reduce the incidence of both true ovarian inactivity and missed heats, improving overall reproductive efficiency (Roche et al., 2000; LeBlanc, 2023; Wiltbank and Pursley, 2014).

Conclusion

Anoestrus in bovines is a multifactorial condition largely driven by metabolic stress, postpartum uterine disease, environmental stressors and managemental failures in estrus detection. Differentiation between true ovarian inactivity and silent estrus remains the cornerstone of successful intervention. Ultrasonography and progesterone profiling enhance diagnostic precision and guide rational therapy. Evidence-based reproductive protocols such as Ovsynch and progesterone-based strategies can significantly improve fertility when implemented alongside sound nutritional and postpartum health management practices (Peter et al., 2009; Rhodes et al., 2003; Pursley et al., 1995; Wiltbank and Pursley, 2014; LeBlanc, 2023).

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