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Summer anestrus and it's management in buffaloes

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Abstract
The buffalo is the most significant animal species in the agricultural system because of its milk and meat production. Although buffalo can adapt to severe habitats and thrive on low-quality feed, these conditions frequently impair reproductive efficiency, leading to late sexual maturation, protracted postpartum anoestrus, poor oestrus expression, and low conception rates. Devices that adjust the microenvironment to improve heat dissipation mechanisms and decrease heat stress are useful management tools like ceiling fans, sprinklers, ceiling fans combined with sprinklers, and cooling ponds. Furthermore, hormonal treatment plays a significant role to overcome anestrus condition in buffalo.

Keywords: Anestrus, buffalo, hormone, management, summer

Introduction
Domestic buffalos provide an invaluable livestock resource to millions of smallholder farmers in India. Buffaloes are raised mainly for their milk with higher fat content and meat. In almost every part of the world, domestic buffaloes exhibit a seasonal breeding pattern, with reducing sexual activity during summer. During summer, buffaloes remain sexually inactive without showing any signs of oestrus like frequent urination, bellowing, acceptance of the male buffalo bull, vulvar swelling, riding on other buffaloes or allowing other buffaloes to mount on her etc. This condition is known as summer anestrus (Kumar *et al.*, 2013) [8]. Low reproductive efficiency in buffalo remains a big economic issue worldwide. The different causes for reduced reproductive effectiveness in buffaloes include delayed sexual maturity, postpartum anestrus, silent estrus, and the seasonal breeding schedule. From an endocrinological perspective, summer anestrus in buffalo is characterized by low plasma circulating concentrations of pituitary and gonadal hormones. There are several factors responsible for summer anestrus, including environmental, nutritional, hormonal, and management factors. The prevalence of summer anoestrus varies from 9.1% to 82.5% (Nanda *et al.*, 2003; Kumar *et al.*, 2014) [11, 14]. Anestrus causes economic losses because to extended inter-calving intervals, low net calf crops, productivity loss, treatment costs, and the cost of replacing older animals with first calving heifers (Kumar *et al.*, 2014) [14].

Factors influencing summer anestrus
Summer anestrus is a multifactorial condition, caused by environmental, nutritional, hormonal and managemental factors. In the summer, buffaloes are particularly prone to heat stress, since their low density of sweat glands makes them less susceptible to cutaneous evaporative cooling. Animals' nutritional state has an impact on the development, maturity, and ovulation of follicles (Sartori *et al.*, 2018) [13]. Under the conditions of excess heat, buffaloes exhibit a series of drastic changes in their biological systems including a decrease in feed intake, a decrease in efficiency and utilization, disruptions in mineral balances, enzymatic reactions, hormonal secretions, and metabolic disturbances, among others.
Reduced feed intake during late gestation or/and early postpartum period or negative energy balance (NEB) due to very high metabolic load following parturition especially in high yielders delays postpartum restoration of luteinizing hormone (LH) pulsatility, resulting in prolonged postpartum anestrus (Kalasariya *et al.*, 2017) [7]. Such changes result in impairment of reproduction and production performances. Extreme weather circumstances, such as heat, suppress sexual activity, with fewer conceptions occurring when the temperature is high. Heat stress can result in a negative nitrogen balance as well as a decrease in total nutrient consumption in summer. Dietary stress alters the feedback mechanism between oestradiol and LH surge, reducing follicle sensitivity to gonadotropins. Anestrus buffaloes show a lower level

of iron and copper than cycling animals. Iron and copper are used routinely as an indicator for follicle stimulating hormone (FSH), LH, and estrogen activity (Mudgel *et al.*, 2012).

The ovary is more inactivity during the summer (41–46%) than in other seasons (7–33%) (Kumar *et al.*, 2014) [14]. Silent estrus is also more prevalent in the hotter months and ovarian cyclicity takes longer to restart after calving in the summer (Warriach *et al.*, 2015) [15]. Heat stress has an impact on folliculogenesis, the microenvironment of follicular fluid, and oocyte quality. Summer heat stress often results in abnormal reproduction in buffaloes due to hormonal changes. Hormones like prolactin (PRL), FSH, LH, progesterone and estradiol-β are directly influenced by heat stress. During the hot summer months, buffaloes exhibit hyperprolactinemia that may be related to seasonal changes in pineal metabolism and may be a possible cause of their summer anestrus. An increased plasma prolactin (PRL) concentration results in anestrus due to refractory ovaries to FSH and LH, and in turn weakens breeding performance in summer due to anovulatory oestrous cycles. Similarly, high level of serum corticoids was reported in buffaloes exposed to thermal stress during the summer and a higher level of serum corticoids leads to an altered gonadotropin secretion, which ultimately triggers the state of anestrus. In summer, buffaloes have low reproductive efficiency due to low luteal activity, and mean progesterone levels remain lower than during the normal breeding season.

Diagnosis

The history and clinical examination are used to diagnose anestrus. Transrectal palpation is the most feasible and cost-effective method for determining bovine ovarian cyclicity and pregnancy status. Ultrasonography can show ovarian pathology that is not reliably diagnosed by per rectal palpation. Ultrasonography can easily identify different phases of follicular development and types of anestrus (Kumar *et al.*, 2014) [14]. Hormonal profiling like progesterone and estradiol also plays a significant role in the diagnosis of anestrus.

Strategies to overcome summer anestrus

The management of farms can be amended to achieve successful buffalo breeding in the summer. It is essential that during the summer months the animals are protected from direct solar radiation, which also includes managing stress and improving their nutritional status. Providing shade, loose accommodation systems, and spraying, washing, and providing the opportunity for wallowing in water can significantly reduce heat stress in summer (Neglia *et al.*, 2009) [12]. Heat detection measures used on buffaloes during the summer are not effective in detecting oestrus. Buffaloes are nocturnal in onset of oestrus. It may therefore be more efficient to detect oestrus using the male during cooler part of the day or at night. In the summer, high temperatures reduce feed intake (Aggarwal and Upadhyay, 2013) [2]. Roughage feeding during night to buffaloes reduce the heat stress in buffaloes. Furthermore, feeding green fodders, ad-libitum water and mineral mixture supplementation improve the efficiency of reproduction during summer.

Hormonal approaches to overcome anestrus

The majority of anestrous cases are caused by dietary deficits. A variety of hormonal therapies are used for reducing anestrus and triggering ovarian activity, as well as for inducing or synchronizing behavioral estrus. Different hormones were used either alone or in combinations producing varied degrees of success. Progesterone-based treatment regimens (PRID, CIDR, CRESTAR and progesterone injections) either alone or in combination with gonadotropins and PGF2α are very effective in inducing ovarian activity in the summer (De Rensis and Lopez-Gatius, 2007) [4]. Progesterone vaginal implants (CIDR and PRID) are commercially available and have been widely used in buffaloes. Ovulation and the commencement of estrus begin 2–8 days after the end of therapy, and the concentration of progesterone drops sharply upon withdrawal (Agarwal and Tomar, 2003; Hafez and Hafez, 2008) [1, 5]. The estrus response and the subsequent conception rates depend upon the reproductive status, days postpartum, ovarian follicular status and season etc. Norgestomet is a synthetic progesterone ear implant that is administered subcutaneously to synchronize estrus. Buffaloes show estrus within 24-48 hr of withdrawal of the ear implant (Singh *et al.*, 2010) [14]. Melengestrol acetate (MGA; 1-2 mg daily for 10-14 days) as an oral progesterone analogue has been reported as being able to induce estrus in buffalo heifers. The use of antioxidants (selenium, vitamin E and zinc-methionine) have been shown to increase fertility during summer time.

According to several publications, herbal remedies including Sajani (Sarabhai), Prajana HS (Indian Herbs), Janova (Dabur), and others are successful in restoring cyclicity with high success rates (Hussain *et al.*, 2009; Chaudhiry *et al.*, 2019) [6, 3]. The majority of the farmers use herbal treatment to overcome the anestrus problems in buffaloes during the summer. It was observed that the majority of animals (53.33%) overcome anestrus by keeping male with the female in practice; 45% by using boiled Maithi (Trigonella foenum graecum) with Wheat bran for three days; 38.84% by feeding 0.5–1 kg boiled Bajara (Pennisetum typhoides) mixed with Gur (Jaggery) for a week, and 30.24% by feeding 0.5–1 kg Masurdaal in evening time. Additionally, it has been claimed that utero-ovarian massage is the most traditional, straightforward, affordable, and efficient way to make anestrous cows and buffaloes go into estrus.

Conclusion

Summer anestrus is one of the main factors impeding buffalo reproduction and losing the dairy sector and buffalo breeders a great deal of money. Buffaloes exhibit poor reproductive performance in the summer, which is characterized by silent estrus and infertility. This problem is caused by a number of environmental, dietary, endocrine, and managerial variables. The best way to deal with summer fertility problems is through excellent management, however additional interventions like hormone therapies can be used with various degrees of success.

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