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When Summer Silences the Buffalo

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Summer anoestrus is a major seasonal reproductive constraint in buffaloes resulting from the interaction of heat stress, photoperiod, nutrition and endocrine changes. Reduced gonadotrophin activity altered ovarian steroidogenesis, impaired follicular development and compromised oocyte quality contribute to weak or absent oestrus and reduced reproductive efficiency. Poor heat detection during cooler night and morning hours further increase the problem. Effective management includes reducing heat load through shade, sprinkling or wallowing, maintaining adequate nutrition and improving oestrus detection. Hormonal interventions may be used selectively but their success is variable and should complement not replace the sound summer management.

A seasonal reproductive challenge

Buffaloes are important dairy animals in tropical and subtropical regions, but their reproductive performance is strongly influenced by season. During the hot months, many buffaloes show little or no visible oestrus. This condition is commonly called summer anoestrus. It is not simply a failure of heat detection it also affects animal ovarian activity and endocrine. According to reports an incidence of summer anoestrus generally ranging from 36.6% to 59.5% and in some cited report, incidence was higher in nomadic buffaloes (83%) than in housed rural buffaloes (63%), probably because of greater exposure to direct sunlight. The condition is associated with smooth, inactive ovaries and abnormal hormonal profiles.

Why does summer affect reproduction?

Summer anoestrus develops through the interaction of environment, nutrition, endocrine function and management. Among environmental influences, day length, temperature, relative humidity and rainfall can affect reproductive seasonality. Buffaloes are particularly susceptible to thermal stress because their cutaneous evaporative cooling capacity is poor, owing to a low density of sweat glands and a scant haircoat. High humidity can further intensify heat stress. Photoperiod is another important signal. Information about day and night is conveyed to the neuroendocrine system through melatonin secretion by the pineal gland. Melatonin may consequently participate in seasonal changes in plasma prolactin and reproductive activity.

The hormonal chain: from heat stress to ovarian inactivity

The endocrine system provides a key link between summer conditions and reproductive failure. During hot summer months, buffaloes may develop **hyperprolactinaemia**. Persistently elevated prolactin has been proposed to suppress gonadotrophin secretion and alter ovarian steroidogenesis. Prolactin effects at both hypothalamic and ovarian levels. prolactin may interfere with episodic release or positive feedback mechanisms involving

oestrogen and may alter ovarian LH receptor status. In anoestrus buffaloes, FSH is generally lower than in cycling animals, and the pre-ovulatory FSH peak synchronous with the LH peak may be absent. LH secretion is also lower during summer, and an optimal LH surge may be absent. The resulting endocrine environment is unfavourable for normal follicular maturation and ovulation. Among ovarian steroids Progesterone concentration in anoestrus buffaloes generally remains below 1 ng/ml in the earlier reports whereas oestradiol has been reported to be low in anoestrus rural buffaloes during summer. Because expression of oestrus and LH secretion require an appropriate balance between oestradiol and progesterone thus altered steroid profiles may contribute to weak or absent oestrus.

Effect of summer on ovary

Summer heat does not stop at the level of hormones. It also effects on follicular growth, follicular atresia, follicular fluid and oocyte quality. Various studies indicate that non-cyclic buffaloes may have a lower follicle reserve than cyclic animals. In earlier reports histological observations have shown reduced follicular growth and considerable atresia of primary to tertiary follicles. Ultrasonographic observations have also identified more than one ovarian pattern in postpartum summer anoestrus. Some buffaloes may have a corpus luteum, suggesting silent or unobserved oestrus, whereas true anoestrus may show follicular activity without development of the largest follicle to pre-ovulatory size and without ovulation.

Effect of summer on oocyte

The consequences of summer may extend to the quality of the oocyte. Earlier reports also suggest that season can significantly influence buffalo oocyte yield, quality and subsequent developmental competence in vitro. Earlier studies showed lower average oocyte yield during summer than winter and in vitro maturation was also lower in summer in the reported comparisons. Further buffalo oocytes might be more sensitive to heat stress than cattle oocytes. Thus the reproductive problem is not merely that the buffalo fails to show heat but the cellular environment supporting follicular development and oocyte competence can also be affected during summer.

Nutrition: the second half of the problem

Nutrition interacts closely with summer heat. Tropical forages may become lignified during summer, reducing nutrient availability while high temperature can reduce voluntary feed intake. Together, these effects can produce loss of body condition and reproductive limitations. Anoestrus buffaloes also have lower serum cholesterol and blood glucose concentrations than in cyclic animals. Cholesterol is a precursor for steroid hormone synthesis while hypoglycaemia can depress hypothalamic as well as hypophyseal function and consequently ovarian activity. Thus nutritional management should accompany efforts to control heat stress.

Failure in heat detection by farmer

Even when ovarian activity has resumed detecting oestrus in summer can remain difficult. Buffaloes already show comparatively weak signs of oestrus, and these signs become less intense and shorter in duration during hot weather. Oestrus commonly occurs during night or morning hours and may therefore go unnoticed under routine daytime observation. This can prolong the service period.

Practical management

The central practices should be good management is the foundation. Protection from direct solar radiation during hot months. Shade, loose housing, sprinkling or washing of the body and wallowing facilities such as ponds or pools can reduce heat stress. Showering in addition to wallowing was associated with higher conception possibly through prevention of early embryonic mortality. Management can also include shifting grazing toward cooler periods such as morning late afternoon or night. Night feeding with roughage may reduce heat load. Green fodder, silage or hay adequate energy supply and mineral mixture supplementation are among the nutritional measures which can be done to prevent heat stress.

When management is not enough: hormonal approaches

A range of hormonal approaches has been investigated for summer anoestrus. Progesterone-based regimens such as PRID, CIDR, CRESTAR and progesterone injections alone or combined with gonadotrophins were reported to induce ovarian activity with varying success. In the cited data PRID plus PMSG generally produced better oestrus induction and conception results than PRID alone. PGF2α-based protocols have also been used sometimes with FSH, PMSG or GnRH. GnRH alone showed variable responses while pretreatment with insulin was reported to promote follicular development in some studies. Clomiphene citrate has likewise been tested with a wide range of responses. Antioxidant approaches involving selenium, vitamin E and zinc–methionine can be given as a promising measure but still requiring further evaluation. Importantly hormonal manipulation should not substitute for improvements in environment, nutrition and management.

A key lesson: inducing heat is not the same as achieving pregnancy

One of the most useful messages is that a high oestrus-induction percentage does not automatically mean a high conception rate. For example earlier studies reported PGF2α studies show substantial variation between oestrus induction and conception. Therefore future work should focus on hormonal regimens that improve conception rate rather than simply producing behavioural oestrus.

Conclusion

Summer anoestrus is a multifactorial reproductive problem. Heat stress, longer day length, nutrition and management interact with the hypothalamic–hypophyseal–ovarian axis. Hyperprolactinaemia, reduced gonadotrophin activity, altered ovarian steroidogenesis, impaired follicular development and compromised oocyte quality can combine to reduce reproductive efficiency. For practical buffalo production, the first response should be sound summer management i.e reduce heat load, maintain nutritional status and improve oestrus detection during cooler hours. Hormonal interventions may then be used selectively, recognizing that their success varies. Thus follicular-fluid environment and seasonal follicular dynamics of summer anoestrus much remains to be understood.

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