



Reproductive Physiology and Challenges in Buffaloes: Pathways to Enhanced Milk Production



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INTRODUCTION

Buffaloes have a significant advantage in their ability to adapt to harsh climates and environments, and they can thrive on low-quality forage. However, these factors can negatively impact their reproductive efficiency. When buffaloes are properly managed and fed, they tend to exhibit good fertility. Effective management of buffaloes requires a complete understanding of their puberty, estrous cycle length, and common reproductive issues. The reproductive organs of buffaloes are similar to those of cattle but have some key differences. For instance, the vulva is tightly opposed, the clitoris is well developed, and the uterus is smaller and more tightly coiled. Additionally, the cervix is smaller and narrower, making artificial insemination more challenging compared to that of cattle. Domestic water buffaloes play a crucial role in livestock farming across many countries, particularly in India. They contribute significantly to the agricultural system by providing milk, meat, and draught power, especially in developing nations. These animals are categorized into two main types based on their preferred habitats for wallowing: river buffaloes, which favor running water, and swamp buffaloes, which thrive in stagnant water. Notably, the chromosome counts for these types are 50 for river buffaloes and 48 for swamp buffaloes. River buffaloes are primarily raised for their milk production, while swamp buffaloes are mainly utilized for drafting purposes. Common breeds of river buffaloes include Surti, Murrah, Jafarabadi, and Nili-Ravi, whereas the swamp type does not feature any specialized breeds.



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In this journeying of buffalo reproduction, we know the intricacies of their puberty, the estrus cycle that governs their breeding behaviors, and the various reproductive disorders that can affect their fertility. Understanding these aspects is crucial for effective breeding practices and overall herd management. We will cover the key stages of puberty, the signaling of estrus periods, and the challenges that may arise in reproductive health, equipping you with essential knowledge for successful buffalo breeding.

Puberty

The onset of puberty in buffaloes can vary significantly, ranging from 16 to 46 months, as observed by Jainudeen and Hafez in 1993. Typically, buffalo heifers reach sexual maturity when they achieve approximately 55 to 60% of their adult body weight, a critical threshold influenced by several factors. Among these factors are nutrition, climate, management practices, genetic variations, the season of birth, and the presence of diseases, all of which can impact both the timing of puberty and the overall growth rate of these animals. In general, buffalo heifers are expected to attain puberty around 24 to 30 months of age, weighing between 225 and 275 kg. However, there are notable differences between the two primary types of buffalo. River-type buffalo often reach puberty earlier, typically between 16 to 18 months, and usually weigh around 250 to 300 kg at that time. In contrast, swamp-type buffalo tend to mature later, usually between 21 to 24 months, and have a body weight ranging from 200 to 300 kg. This variation underscores the importance of understanding the specific characteristics and needs of each buffalo type to optimize their growth and reproductive success.

Factors affecting puberty

- ✓ **Nutrition:** Inadequate feeding delays puberty due to poor body condition and growth rate.

- ✓ **Breed Differences:** Genetic variation affects the time to reach sexual maturity.
- ✓ **Management Practices:** Good management and housing can help buffalo attain puberty earlier.
- ✓ **Seasonality:** Buffalo are seasonal breeders in some regions, and environmental cues such as photoperiod and temperature may delay or advance puberty.

Seasonal breeding activity

Buffalo are seasonally polyestrous animals that display reproductive cycles during specific times of the year. In tropical regions, the consistent photoperiod influences these cycles. However, hot summer months can lead to heat stress, affecting the productivity and reproductive capabilities of all livestock species. Buffaloes, in particular, are thought to be more vulnerable to heat stress due to their thick black skin, which absorbs more solar radiation, and their sparse hair coat, which fails to adequately insulate them from high temperatures. Additionally, buffalo have poorly developed sweat glands, making them less effective at regulating their body temperature. These unique morphological and anatomical traits contribute to their challenges in thermoregulation.

Oestrous cycle

The oestrous cycle is a regular rhythmic pattern of sexual activity observed in female buffaloes, which begins after they reach puberty. This cycle typically lasts between 17 to 25 days, with an average duration of approximately 21 days. The oestrous cycle is divided into four distinct phases:

1. **Proestrus:** This initial phase involves physiological preparations for mating. It lasts a few days (three days) and is characterized by the development of ovarian follicles, increased levels of estrogen, and noticeable changes in the female's behavior, such as increased restlessness and interest in male buffaloes.

2. **Estrus:** This phase is often referred to as the heat period, during which the female is receptive to mating. It usually lasts for about 12 to 30 hours, marked by behavioral signs such as vocalizations, mounting, and a willingness to stand for breeding. The peak of estrogen production triggers ovulation at the end of this phase.
3. **Metaestrus:** Following estrus, this phase lasts for a few days (3 to 4) as the female transitions from peak receptivity. The ruptured ovarian follicle forms a structure known as the corpus luteum, which begins to produce progesterone. This hormone is crucial for maintaining pregnancy if fertilization occurs.
4. **Diestrus:** The final phase of the cycle, which lasts until the next proestrus, typically lasts for about 14 days. During diestrus, the corpus luteum remains functional and secretes progesterone to sustain a potential pregnancy. If fertilization does not occur, the corpus luteum degenerates, leading to a decrease in progesterone levels, signaling the start of a new oestrous cycle.

Understanding the oestrous cycle in buffaloes is essential for effective breeding management and improving reproductive performance in herd populations.

Signs of estrus in buffaloes

- a. **Behavioral signs:** Restlessness, bellowing, tail raising, vulvar swelling, decreased feed intake, and frequent voiding of urine are primary signs. It occurs mostly during early morning and late evening, with a peak in the early morning. Heterosexual behaviour and mounting are reliable signs of estrus.

- b. **Expression of signs:** Sign of estrus is more prominent in swamp buffaloes than river breeds. Accurate detection of heat is done by frequent observations (four times a day).
- c. **External genitalia:** Swelling of the vulva, reddening of the vestibular mucosa and disappearance of horizontal wrinkles due to vulval swelling.
- d. **Internal genitalia:** Good uterine tone, coiling of the uterine horns.
- e. **Cervical mucus:** Less copious than in cattle, may not hang as strands but can be observed through transrectal examination.
- f. **Temporary teat engorgement** Some lactating buffaloes may exhibit temporary teat engorgement (Doka) prior to estrus. Doka is a phenomenon where the teats of lactating buffaloes become temporarily engorged or swollen without the stimulus of milk letdown. This engorgement occurs 2-3 days before the onset of estrus. As the animal approaches estrus, hormonal fluctuations, particularly an increase in estrogen, can cause vascular changes in the udder and teats, leading to temporary swelling.

CONCLUSION

Understanding buffalo puberty, estrus cycle, and common reproductive disorders is critical for improving reproductive efficiency and productivity. Proper nutrition, timely intervention, and sound management practices can help address reproductive challenges and ensure optimal breeding outcomes in buffalo.