Dairy Buffalo Behavior: Calving, Imprinting and Allosuckling

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Maternal behavior, in water buffalo and other ruminants, is a set of patterns of a determined species, including calving, imprinting, and suckling. Since the success of dairy farms depends on parturition, lactation, and the welfare of both the dam and the calf, calving behavior in water buffalo is a research area that could help researchers understand this process.

maternal behaviour water buffalo offspring imprinting

1. Introduction

Water buffalo (*Bubalus bubalis*) are a species domesticated as a draught animal [1] and dual-purpose animal for meat and milk production [2]. In 2020, the global population of water buffalo was around 202 million, concentrated in Asia (97%), with 69% in India [1]. In particular, buffalo dairy farms are gaining importance due to the properties of buffalo milk, such as its high content of fat and proteins [3]. Since the success of dairy farms depends on parturition, lactation, and the welfare of both the dam and the calf [4], calving behavior in water buffalo is a research area that could help researchers understand this process, although it has rarely been studied in the species [5].

Currently, most of the available information regarding behavioral aspects during parturition can be deduced from other ruminant species, such as cattle, sheep, or goats [6][7]. Studies focusing on buffaloes describe behavioral patterns such as licking the newborn, water and feed-related activities, abdominal straining, and tail movements as some of the most common behaviors [8][9]. However, calving presentation depends on the parturition stage and the external aspects [10].

Recognizing a normal behavioral repertoire during calving can also help us to identify difficulties at birth for the purpose of preventive intervention in the case of dystocia [11][12], particularly in those cases that require surgical or obstetrical assistance to preserve the health of the mother and the newborn [12][13]. When mentioning calving difficulty, Srinivas et al. [14] mentioned that the majority of dystocia cases are due to maternal causes (59.16%), such as uterine torsion (83.33%), while fetal causes (40.84%) are due to the abnormal presentation of the fetus.

In addition to dystocia, stillbirth can also occur in buffaloes, a phenomenon where the calf dies within the first 48 h after parturition [15]. According to Salem et al. [16], the rate of stillbirths in Egyptian buffaloes increases due to factors such as the gestation length, birth weight, or parity. In this regard, in the same breed of buffaloes, the percentage of stillbirth in primiparous and multiparous females was 12.4% and 9.2%, respectively, and the

backcrossing of Italian and Egyptian animals could diminish the presentation of stillbirths [17]. Therefore, since the success of dairy farms includes the reproductive health of females [18], studying calving behavior is part of the welfare protocol, not only during parturition but also in the first days of the life of the newborn.

For instance, after parturition, during the first six hours [19][20], imprinting and development of the mother–young bond are essential for neonatal survival and maternal care [21]. The presence of the calf, its vocalizations, and the placental fluids impregnated in the newborn's coat are the cues that both the dam and the newborn use to establish the link and initiate maternal care [22]. Since one of the objectives of the selective care of ruminants is to provide the offspring with alternatives to decrease the mortality rate, calculated as 15.89% [23], 19.5% [24], and as high as 84% during the first month of the calf's life [25], bonding is also related to early standing (preventing predator attacks or heat loss) [26], searching for the udder for prompt colostrum intake [27], and passive immunity transfer through feeding [28][29]. Moreover, although imprinting represents "exclusive maternal care for a biological calf", in water buffalo, allosuckling and allonursing, known as the feeding and care of non-filial offspring, are regular practices observed in dairy farms [30]. Allonursing, although considered as a common event in other wild and domestic ruminants [31][32], has not been reported in numerous cases among water buffalo. The expression of these behaviors is still under study, but it could be due to maternal and offspring benefits that are more significant than the physiological cost they represent.

Thus, from an economic and welfare point of view [33][34][35], recognizing the buffalo's behavior at calving can help us to promptly intervene when the expected repertoire is not present in order to prevent the consequences for the dam or the calf [36].

2. Calving Behavior

Maternal behavior is triggered by the onset of parturition, a period in which a set of particular behaviors are present due to hormonal stimuli and neuronal pathways [5]. It is essential to know which behaviors can be considered normal in the water buffalo during parturition, since this species may exhibit differences when compared to domestic cattle.

According to Tulloc [8] and Das et al. [9], the most notable changes in the appearance of the buffalo occur two days before calving. Roberts [37] and Singh et al. [38] describe the licking of the newborn, interest in water and feed, abdominal straining, and tail movements as some of the most common behaviors (**Figure 1**). Days before the onset of the calving date, the spine and tail are highly flexible [8][9]. For these reason, Górriz-Martín et al. [39] highlight tail movements as an effective parameter to predict calving in cows.

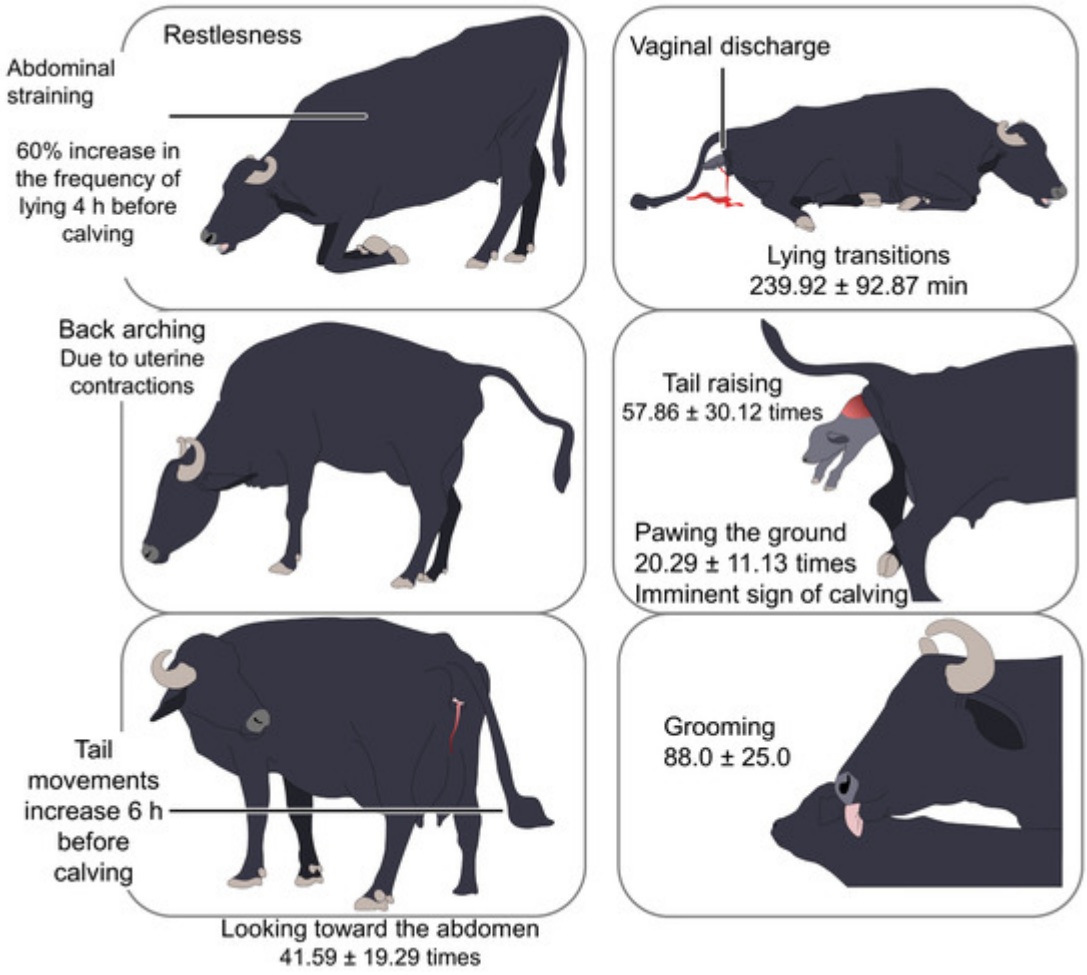

Figure 1. Main behavioral patterns during parturition in water buffalo. The exhibition of restlessness, back arching, and tail movements are considered good behavioral signs of the onset of parturition. Lying transitions, tail raising, or grooming are patterns observed during the last parturition stage, and their frequency or time of duration (assessed for 11 h pre-calving and expressed as number of times or min in the pictures) increases during calving.

The exhibition of these changes depends on the parturition phase. As stated by Deka et al. [40], during the first phase, restlessness, reduced interest in feed and water, lying transitions, tail raising, abdominal straining, back arching, vaginal discharge, and frequent urination predominate. The animal's habit of looking towards its flanks, pawing the ground, and reduced feed intake are also present during this stage [8][9], and are associated with the onset of pain [41].

Water buffalo are a gregarious species with large groups; however, a buffalo cow isolates itself from the herd in order to look for a site that it considers protected [42]. This behavior, similar to cattle, helps to insure the survival of this species [30] and to guarantee two events after calving: imprinting and lactation [43]. Therefore, all these events can be considered as indicators that can be used to recognize the expected course of calving.

During the second phase, frequent urination is observed due to vaginal wall relaxation and bladder hypermotility [44], as well as the release of the placental fluids, after which the feet and/or head of the calf appear. Finally, in the

third stage, the licking of the newborn, interest in food and water, and occasional abdominal straining are observed [40].

Lanzoni et al. [45] described the behavior of 20 Mediterranean Italian buffaloes monitored by video. They found that there was a 60% increase in the frequency of lying transitions from the control to the prepartum period. The walking frequency increased significantly until the prepartum period, which was most noticeable in the last eight hours before the parturition. In addition, the frequency of tail flicks or kicks against the ground and head-to-abdomen movements increased during the third, fourth, and sixth hours before calving. With these observations, it can be seen that the change in activity may be an early indicator of parturition in this species. In the domestic bovine, there is an 80% increase the standing periods among females housed indoors [46], and in this species, too, the change in activity may be an early indicator of parturition [47].

The behaviors described above may be due to pain perception [43]. Martínez-Burnes et al. [26] explain that during childbirth, inflammation of the myometrium and the release of proinflammatory substances help to maintain violent contractions for the expulsion of the product. However, the transmission of nociceptive stimuli through type C and type A fibers also occurs, resulting from the distension of the lower uterine segment and cervical dilatation [48][49]. Thus, the change in the activity level of the animals is also indicative of pain [50], and it may be used to assess the level of stress that cows and calves undergo during calving [36][51].

Currently, behavior during parturition in Holstein heifers and cows can be automatically evaluated using accelerometer-based devices placed on the tail of the animals before the onset of parturition [39]. In water buffalo, there are no reports on the use of these types of technologies to aid in the recognition of postural and activity changes, although this could aid dairy buffalo farms in predicting calving dates.

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