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Managing the transition period in Mithun (*Bos frontalis*) cows: Parity, body condition score and reproductive performance

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Abstract

This is the first research done to study the influence of parity on performance of Mithun (*Bos frontalis*) cows during the transition period. A total of 25 mithun cows in advanced pregnant stage were studied during the transition period (14 days prepartum to 56 days postpartum) and until the next postpartum estrous. The animals were grouped based on their parity, i.e. 1 to > 3, and body condition was scored along with body weight on fortnightly days. Postpartum estrous was observed by parading a teaser bull after calving. Significant difference ($p < 0.05$) was observed in the body condition score and body weight of different parities (1 to >3). The results showed a decreasing trend in BCS after calving till stage VII. The study also found a significant difference ($p < 0.05$) in mean body weight at stage I between different parities, with parity >3 animals having significantly higher body weight than parities 1 and 2 at all stages. There was no significant difference in calf birth weight and subsequent growth rate. Additionally, the first postpartum interval to estrous days was found to be longer in primiparous cows than in multiparous cows. It was concluded that body condition score and body weight of Mithun cows were significantly influenced by parity, with higher parity animals having higher BCS and body weight however, it had no significant effect on calf growth rate. High parity had early first postpartum estrous days than cows with low parity.

Keywords: BCS, parity, body weight, calf weight, postpartum estrous, mithun.

Introduction

The transition period from 3 weeks before to 3 weeks after parturition is a critical period for cows (Drackley 1999) [6], and it is characterized by a dynamic balance of nutrients and metabolic response markers (Piccione *et al.*, 2011; Kenéz *et al.*, 2015; Sun *et al.*, 2020) [24, 19, 31]. During this period, the dynamics of nutrient balance and metabolic response markers are not synchronous, and transition cows face several challenges, including disturbed energy metabolism, disproportional mineral metabolism, and impaired immunity. These challenges result in lipid accumulation, loss of body condition, uterine infection, reduced fertility, and reduced profits. To overcome these challenges, specific management tools should be employed to identify and address these issues (Esposito *et al.*, 2014) [7].

Body condition scoring is a viable management tool that portrays the general fatness of a cow using a numerical scale and is used to assess the dietary status of the herd. The body condition scoring framework permits producers to visually evaluate their dairy animals group utilizing a number system that depicts the measure of condition or fat reserve of an animal (Pfeiffer and Seefeldt 2015) [23].

The Mithun (*Bos frontalis*) is a unique ruminant species that is found in the North Eastern Hilly states of India, including Arunachal Pradesh, Manipur, Mizoram, and Nagaland. It is a significant part of the social, cultural, religious, and economic life of the tribal population in the region (Joshi *et al.*, 2021 and Prakash *et al.*, 2013) [17, 25]. A large portion of the investigations on BCS were done on cattle and buffaloes but no BCS study has been done on Mithun. As mithun inhabits remote forests with undulating topography and adverse climatic conditions, it remains as one of the neglected and least studied bovines (Mondal *et al.*, 2004 and Mondal *et al.*, 2006) [21, 22]. Therefore, the current study aims to provide a simple understanding of the influence of parity on body condition score, body weight, calf growth rate and reproductive performance of Mithun cows during the transition period.

Materials and Methods

The present study was conducted at ICAR-National Research Centre on Mithun, Medziphema Chumoukedima district of Nagaland, situated between 25.75° N latitude and 93.86° E longitude and at an altitude range of 360 m above the mean sea level (MSL).

25 Mithun cows of advanced pregnancy stage were selected 14 days before their expected calving. These animals were divided into four groups according to parity, i.e. 1 to > 3 and above, respectively. All these animals were studied during the per parturient period of 2 weeks (14 days) prior to the expected date of calving to 8 weeks (56 days) onwards from the date of calving. The animals were examined to record body condition score (BCS) at fortnightly intervals on days 14 (Stage I) and seven days (Stage II) before the expected calving and, on days 3 (Stage III), 14 (Stage IV), 28 (Stage V), 42 (Stage VI), and 56 days (Stage VII) after calving. The experimental animals were maintained under a semi-intensive system. The body condition score of the cattle was recorded through palpation and visual as per the body condition scoring chart formulated by Prasad (1994) [26]. This score chart is a 6-point scale (1-6), with 1 indicating under condition and 6 representing over condition of the dairy cows. The body weight of animals was recorded on the same day the body condition score was recorded. The animals were weighed early in the morning before providing them with any feed or water. The number of days postpartum after which the cow will show first heat was recorded for the study. The animals were evaluated daily after calving by parading teaser bull to detect postpartum estrous.

Statistical analysis

Statistical data analysis was done using the least squares method (Harvey 1966) [11]. To see the periodical variations of BCS during the transition period, a one-way analysis of variance was applied as per the procedure of Snedecor and

Cochran (1994) [29], followed by Duncan's multiple range test. Statistical analysis was performed using SPSS 21.0 software.

Results and Discussion

Body condition score

Body condition scores of Mithun cows belonging to different parities were recorded at stage I to VII (Table 1). Significant difference ($p < 0.05$) was observed in the body condition score of different parities (1 to > 3). The mean BCS at stage 1 were, 3.03 ± 0.07 , 3.49 ± 0.11 and 4.32 ± 0.11 for parity 1, 2, and > 3, respectively, and declined after calving. After calving, there was a general decline of BCS in all the parities till stage VII. The unit decrease in pre-calving BCS was maximum in the animals of parity-1 followed by parity-2, and parity > 3 at calving. This shows the increasing trend of BCS from parity 1 to parity > 3. The increasing trend might be due to the process of body growth as well as gestational requirements in parity 1, whereas animals were supposed to be fully grown in parity > 3 and conceded only towards gestational requirements during stage I to III.

The impact of parity on body condition score (BCS) in cows has been studied by multiple researchers. While some studies have found no significant difference in BCS between primiparous and multiparous cows on different test days, overall mean BCS has been found to be lower in primiparous animals compared to multiparous animals (Sriranga *et al.*, 2022) [30]. Studies have also shown that BCS tends to increase up until the third lactation and then decrease. However, there are variations in BCS trends among different parities, with some studies showing a rising trend in BCS post-calving with an increase in parity (Hossein-Zadeh and Akbarian 2015; Chacha *et al.*, 2018; Gallo *et al.*, 1996; Huda *et al.*, 2019; Singh 2005 and Meikle *et al.*, 2004) [13, 5, 9, 14, 28, 20]. The decrease in BCS in primiparous cows is likely due to their increased needs for growth occurring simultaneously with the demands of lactation and their lower feed intake capacity.

Table 1: Mean BCS across different stages of lactation in different parities

Parity	Stage I	Stage II	Stage III	Stage IV	Stage V	Stage VI	Stage VII
1(7)	3.03 ± 0.07^c	3.00 ± 0.07^c	2.89 ± 0.08^c	2.80 ± 0.07^c	2.76 ± 0.08^c	2.67 ± 0.07^c	2.59 ± 0.06^c
2(8)	3.49 ± 0.11^b	3.46 ± 0.11^b	3.37 ± 0.12^b	3.28 ± 0.11^b	3.17 ± 0.10^b	3.08 ± 0.11^b	2.98 ± 0.11^b
> 3(10)	4.32 ± 0.11^a	4.28 ± 0.11^a	4.22 ± 0.11^a	4.10 ± 0.11^a	3.98 ± 0.12^a	3.83 ± 0.11^a	3.60 ± 0.10^a

^{abc} Mean showing different superscripts in a column differ significantly ($p < 0.05$)

Figure in parentheses show sample number

Body weight

Mean body weight of animals belonging to different parities-1, 2 and > 3 were recorded from Stage I - VII and has been shown in the Table 2. The mean body weight was highest for parity > 3 (426.90 ± 13.71 kg) and lowest for parity 1 (326.71 ± 9.61 kg) at stage 1. The body weight declined after calving in all parities and further declined till stage VI for parity 1, 2 and > 3 however, at stage VII it showed first sign of increase in all the parities. The result revealed that mean body weight of parity > 3 animals were significantly ($p < 0.05$) higher than parity 1 and 2 at all stages.

The present study's findings are consistent with previous research conducted by Berry *et al.*, (2011) [2], Singh (2005) [28], Huda *et al.*, (2019) [14] and Meikle *et al.*, (2004) [20], which all investigated the relationship between parity and body weight in different cattle breeds. In most of these studies, the authors found that higher parity was associated with increased body weight, with the highest weight generally observed 14

days before calving. However, there was significant variation in weight changes during the postpartum period, with some studies reporting significant weight loss in the first two months postpartum, particularly among cows in their first parity. Overall, these studies highlight the importance of understanding how parity affects body weight changes in cattle, particularly in the postpartum period, to ensure optimal health and productivity.

Calf birth weight and subsequent growth rate

The data on mean birth weight of calves born to different parity groups are presented in Table 3. The mean birth weight of calves in parity 1, 2 and > 3 are 20.43 ± 1.29 , 19.88 ± 0.95 and 20.55 ± 0.54 kg, respectively. Statistically, the difference was non-significant in all the parities. The subsequent growth rate till six months remained statistically non-significant showing that there was no parity influence on calf growth rate. Hoka *et al.*, 2019 [12] found that cows of higher parity

gave birth to calves with heavier birth weight while the cow at low parity recorded the least birth weight. However, these differences in calf weights were not statistically significant from each other. Contrary to the present findings, it differed with the results of Adeneye *et al.*, (1977) [11] that Friesian dams with three or more parities and Holstein dams that were 3 years old and above produced calves that were significantly

($p < 0.01$) heavier at birth than calves of younger dams.

Post-Partum Interval to Estrus (PPIE)

Table 4 shows that the first post-partum interval to estrous days were 111.29 ± 3.58 , 104.13 ± 4.24 and 98.70 ± 2.38 days in parity 1, 2 and > 3 respectively. There were significantly higher ($p < 0.05$) PPIE days in parity 1 than in parity 2 and > 3.

Table 2: Mean bodyweight across different stages of lactation in different parities

Parity	Stage I	Stage II	Stage III	Stage IV	Stage V	Stage VI	Stage VII
1(7)	326.71 ± 9.61^c	324.29 ± 9.63^c	305.14 ± 9.86^c	292.29 ± 9.28^c	284.00 ± 9.50^c	279.71 ± 9.11^c	282.14 ± 9.11^c
2(8)	363.50 ± 9.70^b	360.88 ± 9.61^b	347.50 ± 7.21^b	342.38 ± 6.93^b	337.13 ± 6.58^b	329.88 ± 6.44^b	332.00 ± 6.51^b
> 3(10)	426.90 ± 13.71^a	429.90 ± 13.79^a	406.40 ± 12.84^a	392.40 ± 10.29^a	380.80 ± 10.64^a	371.70 ± 11.14^a	374.10 ± 11.14^a

^{abc} Mean showing different superscripts in a column differ significantly ($p < 0.05$)

Figure in parentheses show sample number

Table 3: Mean calf body weight up to 6 months in different parity groups

Parity	Birth Weight	1 Month	2 Month	3 Month	4 Month	5 Month	6 Month
1(7)	20.43 ± 1.29^{NS}	30.00 ± 1.60^{NS}	40.71 ± 3.83^{NS}	51.00 ± 5.31^{NS}	62.00 ± 6.25^{NS}	69.71 ± 7.42^{NS}	80.00 ± 7.54^{NS}
2(4)	19.88 ± 0.95^{NS}	29.13 ± 1.91^{NS}	36.94 ± 2.88^{NS}	44.50 ± 4.29^{NS}	52.81 ± 5.65^{NS}	62.31 ± 7.30^{NS}	75.19 ± 9.78^{NS}
> 3(3)	20.55 ± 0.54^{NS}	33.85 ± 2.29^{NS}	45.90 ± 3.67^{NS}	55.95 ± 4.73^{NS}	66.75 ± 5.83^{NS}	76.25 ± 7.24^{NS}	86.95 ± 7.68^{NS}

*NS- non significant difference

Table 4: Mean values of postpartum interval to estrus (PPIE) in different parities

Parity	PPIE
1	111.29 ± 3.58^a
2	104.13 ± 4.24^{ab}
> m3	98.70 ± 2.38^b

^{ab} Mean showing different superscripts in a column differ significantly ($p < 0.05$)

The studies on Holstein cows by Meikle *et al.*, (2004) [20] and Santos *et al.*, (2009) [27] found that postpartum anestrus was longer in primiparous cows as compared to multiparous cows. Additionally, primiparous lean cows had a longer interval from parturition to first ovulation than their fat counterparts. However, this difference was not observed in multiparous cows. In a study on Murrah buffaloes, Kalsotra *et al.*, (2016) [18] found that the incidence of postpartum anestrus was non-significantly higher in first and sixth or higher parity as compared to second to fifth parity. Hafez and Hafez (2000) [10] and Folnožić *et al.*, (2016) [8], concluded that primiparous cows are more susceptible to metabolic stress during the transition period, and that their metabolic and endocrine profiles are more unbalanced as compared to the multiparous cows, which results in more severe and prolonged recovery from negative energy balance. Butler & Smith 1989, observed that the reinitiation of ovarian cyclicity was delayed in primiparous cows and in lean animals and this was consistent with longer intervals from parturition to first service and to conception in these animals. The anestrus duration was associated with BCS loss and was longer in primiparous cows. Huszenicza *et al.*, (1987, 1988) [15, 16], demonstrated that the sooner the cows restore the energy balance, the sooner they will start cycling and become pregnant.

Conclusions

The present study found that body condition score and body weight of Mithun cows were significantly influenced by parity, with higher parity animals having higher BCS and body weight. The difference in calf weight and subsequent growth rate was non-significant in all the parities. The

postpartum interval to estrus was also found to be longer in primiparous cows compared to multiparous cows. These findings are consistent with previous research conducted on cattle breeds and highlight the importance of understanding the impact of parity on reproductive and productive performance. Overall, these results can be useful for developing management strategies to optimize the health, productivity, and reproductive performance of Mithun cows.

Conflict of interest statement

Authors declare that there is no conflict of interest involved in the present work.

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