Impact of body condition score and back fat thickness on resumption of ovarian cyclicity after parturition in dairy cows

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Abstract

The present study was conducted to investigate the effect of body condition score (BCS) and back fat thickness on resumption of ovarian cyclicity in Jersey cross bred cows. Thirty four (N=34) cows having normal parturition were monitored for recording the body condition score on the day of calving and divided into two groups i.e. low BCS (n=15) i.e. <2.5 and high BCS (n=19) i.e.   2.5. For monitoring the back fat thickness, trans-abdominal ultrasonography of thurl area was done on the day of calving. Trans-rectal ultrasonography was done on a weekly interval to adjudge the resumption of ovarian cyclicity i.e. first ovulation post-partum. As a part of results, low BCS cows had a significantly lower back fat thickness (9.92±0.48 mm; P<0.05) as compared to high BCS cows (12.14±0.82 mm). Similarly, low BCS cows had a significantly longer interval (42.47±2.14 days; P<0.05) to first post-partum ovulation in comparison to high BCS cows (32.42±1.82 days). In conclusion, metabolic status of cows had an important role in resumption of ovarian cyclicity after parturition.

Key words: Body condition score; back fat thickness; dairy cows; ovarian cyclicity; trans-rectal ultrasonography.

One of the major and most important factors in determining the profitability of cattle farming is reproductive performance (Rekwot *et al.* 2000; Sharma *et al.* 2018). Each cow need to calve regularly in order to maximize the economic output of milk production (Sharma *et al.* 2019). Various factors such as breed, parity, nutrition, metabolism, body condition score (BCS), stage of lactation, reproductive health and season of calving is required for resumption of ovarian activity in post-partum cows (Tomomi *et al.* 2008). Body condition score at calving is also important in determining the length of anestrous period (De Rensis *et al.* 2008). Similarly, another accurate objective indicator of subcutaneous fat and reliable predictor of body energy reserves which has been used recently is back fat thickness (Ayres *et al.* 2009; Galindo *et al.* 2013). Therefore, post-partum ovarian cyclic activity is mainly affected by fluctuations in metabolic reserves and ultimately, downplays the successive fertility (Sharma *et al.* 2018). The objective of present study was to investigate the effect of BCS and back fat thickness on resumption of ovarian cyclicity after calving in Jersey cross bred cows.

Materials and Methods

The present study was carried out on dairy cattle having normal parturition (Jersey crossbred cows; N=34; parity 2-4) at University Dairy Farm, Himachal Pradesh Agricultural University, Palampur (32.6ºN, 76.3ºE, altitude 1290.8 m). Cows were reared in a loose housing system under standard management conditions, fed a total mixed ration, once daily, ad libitum, and had unrestricted access to water. BCS of all the cows was recorded immediately after calving using five point scale of scoring (Edmonson *et al.* 1989; Sharma *et al.* 2019). Cows were milked twice daily (04:00 and 15:00 h) and were divided into two groups on the basis of BCS i.e. low BCS (n=15) i.e. <2.5 and high BCS (n=19) i.e.   2.5. Back fat thickness of thurl area (Fig.1), located midway between the tuber coxae (hooks) and the tuber ischiae (pins), 2–3 cm above the greater trochanter of the femur (Schroder and Staufenbiel 2006; Diaz *et al.* 2017), was recorded using micro-convex transducer at

frequency 5.0 MHz. Trans-rectal ultrasonography (TRUS) was performed to assess the ovarian rebound using linear transducer at frequency 7.5 MHz (Mindray Z5 Vet), on a weekly interval basis between day 0 (calving) to 56 post-partum (Fig. 2). Numeric data for all the parameters are expressed as mean ± SD and statistical analysis was carried out. Statistical analysis was performed using Student's t-test with SAS (Statistical Analysis Software), SAS® 9.2 TS Level version 2M2 for windows.

Results and Discussion

Mean body condition score, mean back fat thickness (mm) and resumption of ovarian cyclicity/ first post-partum ovulation (Figure 1) has been shown in Table 1.

In our study, mean back fat thickness (BFT) at calving was significantly lower (P<0.05) in cows with BCS <2.5 in comparison to cows with BCS   2.5. Similar results to our research were reported by Diaz *et al.* (2017) where cows with low BFT at the time of calving had delayed resumption of ovarian cyclicity. As the body weight of cows is affected by many factors such as age, parity, changes in body fat, feeding management, stage of lactation, and breed, BFT serves as an accurate indicator of metabolic reserves during peri- and postpartum period (Mishra *et al.* 2016). Also, ovarian follicular growth can be compromised by decreased Insulin Like Growth Factor- I (IGF-I) in the

post-partum cows, which as a consequence produces prolonged interval to first ovulation after calving (Hemanta *et al.* 2005).

Mean time taken for first ovulation (resumption of ovarian cyclicity) was significantly longer (P<0.01) in cows with low BCS. Delayed ovulation after parturition occurred cows having poor condition score was recorded by other researchers which is similar to our findings (Kamimura *et al.* 1993; Diaz *et al.* 2017; Sharma *et al.* 2018). Body condition score is a subjective method for analysis of metabolic reserves and is directly correlated with resumption of post-partum ovarian cyclicity (Kavya *et al.* 2018; Sharma *et al.* 2018). As the negative energy balance during peri- and post-partum period suppresses the hypothalamo-pituitary and gonadal axis, resumption of ovarian cyclicity does not occur (Diaz *et al.* 2017; Sharma *et al.* 2019). Also, the number and size of large ovarian follicles are affected due to NEB which leads to lowering of plasma progesterone and estradiol-17β concentrations (Justyna *et al.* 2011).

As a part of peroration, metabolic reserves of cows, reflected by body condition score and back fat thickness, play an important role in resuming the post-partum ovarian function. Therefore, proper nutrition must be provided during peri- and post-partum period in order to achieve desirable fertility goals in dairy

Table 1 . Body condition score (BCS), back fat thickness and resumption of ovarian cyclicity after parturition in dairy cows (Mean±S.D.)

Categories of cows	BCS at calving	Back fat thickness (mm)	Resumption of ovarian cyclicity (d)
Low BCS (n=15)	2.18 ± 0.15^b	9.92 ± 0.48^b	42.47 ± 2.14^x
High BCS (n=19)	2.69 ± 0.12^a	12.14 ± 0.82^a	32.42 ± 1.82^y

[x,y] Values with different superscripts within the same column differ significantly(P<0.01)
[a,b] Values with different superscripts within the same column differ significantly (P<0.05)

Figure 1: Back fat thickness (black arrow) in thurl area during post-partum period

Figure 2: First ovulation post-partum (marked by yellow outline)

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