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Effect of Body Condition Score at Calving on Ovarian Activity and Subsequent Reproductive Characteristics during Postpartum Period in Crossbred Cows

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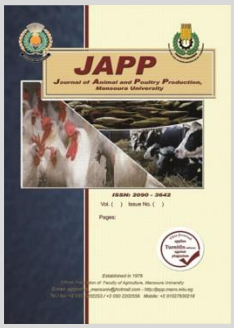

ABSTRACT

The present investigation aims to determine the effect of body condition score (BCS) at calving on ovarian activity and subsequent reproductive characteristics during postpartum period in crossbred cows. Thirty-six crossbred cows (Baladi cows x Friesian cows) week post-calving were used and divided into three groups of 12 cows for each group (BCS: less than 3 equal to 3 and more than 3) according to BCS. The results demonstrated that, uterine involution period, first ovulation and estrous was significantly longer, than (P <0.05) (38.4±3.4, 51.2±3.8 and 65.6±2.5, days) in cows with BCS <3, compared to cows with BCS equal 3 (30.2±2.2, 38.4±3.4 and 45.9±7.1, days), or more than 3 score (28.4±3.9, 30.5±2.6 and 43.2±5.3, days), respectively. The first service and conception was significantly longer (P <0.05) than (95.3±9.3 and 123.5 ±12.4, days) in cows with BCS <3 compared to cows with BCS equal 3 (71.2 ±6.6 and 102.3±13.1, days) to or more than 3 score (68.1±8.5 and 96.3±11.6, days), respectively. Lower NS/C in BCS >3 was (1.7±0.6, service) and equal 3 was (1.9±0.5, service) in comparison with those cows had BCS <3 was (2.7±0.4, service). The CR was significantly higher *(P <0.05*) than 50 and 60% in cows with a BCS equal 3 to or higher than 3 score compared to in cows with BCS less (30%) than 3, respectively. In conclusion, the current results indicated a significant effect of BCS at calving on recovery of ovarian activity and subsequent reproductive characteristics, during postpartum period in crossbred cows.

Keywords: BCS, ovarian activity, reproductive characteristics, crossbred cows.

INTRODUCTION

Body condition scoring (BCS) is an effective management tool and easy method to determined the energy reserves and negative energy (NE) balance conducting appropriate nutrition programs of a cow (Lassen *et al*., 2003, Samarütel *et al*., 2006 and Walker and Perry, 2007)). Nutrition has a considerable effect on many reproductive functions such as hormone production, folliculogenesis, fertilization, and development of embryos (Boland *et al.*, 2001, Armstrong *et al.*, 2003 and Boland and Lonergan, 2005). Garnsworthy *et al.* (2008), Ospina *et al.* (2010) and Chapinal *et al.* (2012) found that there was low postpartum reproductive success in dairy cows with a negative energy balance (NEB). The body condition score (BCS) losses between parturition and first service result in decreasing postpartum reproductive efficiency in dairy cows (López-Gatius *et al*., 2003 and Santos *et al*., 2009). Gümen *et al*. (2003), Lopez *et al*. (2005) and Santos *et al*. (2009) increase the percentage of non-cycling cows observed in cows with severe BCS loss following calving. Kim and Suh (2003), Santos *et al*. (2008) and Hoedemaker *et al*. (2009) indicated that cows with acute body loss during the dry period displayed longer periods between calving and first insemination. Roche *et al*. (2013) reported that cows with negative energy balance (NEB) delayed the start of the ovarian development, reduced the amount of estrous and extended the days open. Bayram *et al*. (2012), Abunna *et al.* (2018) and Patel *et al*. (2018) found that in the first month of lactation, the number of services per conception with high BCS was lower than the other group. Umaña Sedó et *al*. (2018), Kim and Jeong (2019) and Meier *et al.* (2020) suggested that a severe post-calving negative energy balance (NEB) would lead to a reduction in the dairy cow's conception rate. Richardson *et al.* (2016), Silper *et al.* (2017) and Burnett *et al.* (2017) documented a positive relationship between BCS and the expression of estrus in dairy cows. Many local stockholders of cows who live in villages of Aswan governorate have been reduction of knowledge about a good practices and nutritional management of herds during different stages of animal life. Hence, the present investigation was planned to study the effect of body condition score (BCS) at calving on ovarian activity and subsequent reproductive characteristics during postpartum period in crossbred cows.

MATERIALS AND METHODS

Farm location and climatic conditions:

The research performed in traditional farm situated in Kom Ombou city (32°, 31' 23" East and 22°, 28' 09" North), Aswan governorate. The experimental cows were kept in traditional farm conditions under semi shade system. Mean of the ambient temperature was (*Min*. 13.2 – 20.1 ºC) and (*Max.* 21.2 - 33.0 ºC), relative humidity (13 – 23) and temperature humidity index (64.9 - 75.8) throughout the experimental period which extended from November to April 2020. The temperature humidity index

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(THI) was calculated according to the formula proposed by Mader *et al*. (2006):

THI= (0.8×Tmax db) + [(RH/100) × (T max db −14.4)] +46.4

Temperature-humidity index (THI) = 0.8 x ambient temperature + [(% relative humidity) 100) x (ambient temperature -14.4)] + 46.4

Animals and feeding:

In the current study, 36 crossbred cows (1/4Baladi cows x3/4 Friesian cows) were used. Parity for Cows ranged from 2nd to 5th. Age and body weight of cows presented at calving in table (1). Alongside the concentrates mixture, cows were fed on Alfa-Alfa and hay wheat was provided during the experimental phase according to BCS.

Table 1. (Mean ± SE) of body weight and age of cows at calving

Status of cow	BCS		
	<3	3	>3
	No.		
Body weight (kg)	12 325.8± 10.3	12 380.6± 12.4	12 410.9± 5.3
Age (year)	7.53± 1.4	5.5± 1.1	6.3± 1.6

Experiment design:

Thirty-six crossbred cows (Baladi cows x Friesian cows) were divided into three groups of 12 cows for each group (BCS: less than 3, equal to 3 and more than 3) according to body condition score (BCS). The BCS estimates based on the characteristics of cows proposed in table (2) by Matthew (1993). During the November to April interval, the cows calved and were followed up for a one-week postpartum.

Table 2. Body condition score in cows adapted to Matthew (1993)

BCS	Characteristics
1	(Very poor body condition) individual short ribs have a thin covering of flesh
2	(poor body condition), individual short ribs can be felt but are not prominent
3	(good body condition), ends of short ribs can be felt by applying slight pressure
4	(fat), individual short ribs are distinguishable only by firm palpation
5	(very fat), bony structures of backbone, short ribs, and hook and pin bones are not apparent

Detection of heat and pregnancy diagnosis:

Regular visual monitoring for cows were conducted at 6:0 am and 6:0 pm for heat detection, and follow up the signs of sexual behavior. Expert bull naturally matted the cows, when symptoms of heat were on standing. Age of bull ranged between (3 - 5 year) and from the same breed. Rectal palpation was used to diagnose the pregnancy established (60 days post-mating).

Estrus intensity:

According to the display, the estrus sings during the estrus phase, the cows were classified into two categories: strong expression of estrus intensity, these cows, which appeared at least three estrus signs during the estrus and weak expression of estrus intensity, these cows, which appeared only one estrus sign during the estrus phase.

Postpartum reproductive parameters estimation

Conception rate: calculated as the percentage of cows, which conceived from the first mating post-partum

Conception rate = Number of pregnant cows/Total number of mated cows x 100

Uterine involution: The uterus is considered complete involutes when both uterine horns had recover to equal or almost equal non-gravid size in their normal position and location in the pelvic floor, and their normal tone and consistency according to Landaeta- Hernandez *et al*. (2004) and El-metwally *et al*. (2016)

Quiet ovulation: Cows were diagnosed as quiet ovulation if a corpus luteum was found on at least one of the ovaries and plasma progesterone concentration rise up to the basal line (1ng/ml) blood; hence, the ovary started its activity (Kamal *et al*., 2012).

Blood samples collection and hormones assay

Blood samples (10 ml) were collected from cows two times weekly and at estrus and d 7 post-estrus in heparinized tubes from the jugular vein. For plasma harvesting, the blood samples were centrrifuged at 3000 rpm for 20 minutes. Before analysis time, plasma was isolated and deposited at -18 o C. Hormone progesterone (P4) and estradiol-17β (E2) were determined using radioimmunoassay (Immunotech, France) kit. The sensitivity values for progesterone and estradiol-17β were stated to be 0.03 ng / ml and 4.0 pg / ml, according to the manufacturer's information respectively. The coefficient of variation intra-assay was 7.4 % and 12.7 % respectively for progesterone (P4) and estradiol-17β (E2)

Statistical analysis:

The statistical design included one factor (effect of body condition score (BCS) on postpartum reproductive parameters of cows). Chi Squire was used to test the significance of the percentage values. Statistical analysis was carried out using software (SAS, 2002). The following model was used:

$$Yij = \mu + Ti + Rj + eij$$

Where:

Yij = the observation trait
μ = overall mean
Ti = effect of BCS (<3, equal 3 and > 3)
Rj= effect of replicates (1,2,…eg)
eij = experimental error

Duncan's Multiple Range test (Duncan, 1955) was used to test the significance of the differences between means.

RESULTS AND DISCUSSION

Effect of body condition score at calving on uterine involution in crossbred cows

Table (3) shows that the time between calving and uterine involution in crossbred cows was significantly longer than ($P < 0.05$) 38.4±3.4 days in cows with body condition score <3 compared to cows with body condition score equal 3 to or greater than 3 score. The present result indicates that the cows require more days to recover their uterus to normal size to score body condition. This result matches that stated by Huzzey *et al*. (2007) and Wathes *et al*. (2009) a acute negative energy balance (NEB) has been found to inhibits effective immune response to post-calving microbial challenges, extend the time required for uterine involution and threaten subsequent fertility. McDougall *et al*. (2011) and Roche *et al*. (2013) indicated

that low pre-calving BCS is associated with increased cases of endometritis leading to an extended uterine recovery time in dairy cows and an extended post-calving anovulatory duration. Wathes *et al.* (2011) reported that cows exposed to an acute negative energy balance (NEB) undergo changes in insulin and IGF- 1 signaling pathways in the postpartum endometrium, influencing tissue repair levels in the uterus with likely adverse effects on subsequent fertility. Wathes *et al.* (2007) indicated that cows with negative energy balance (NEB) display a delay in the clearance and involution of the uterus.

Effect of body condition score at calving on post-partum 1st ovulation in crossbred cows

Table (3) shows that the interval between calving and first ovulation in crossbred cows was significantly longer *(P <0.05)* than 51.2±3.8 days in cows with body condition score <3. Observed, cows with higher body condition score >3 resumed their ovarian operation earlier than lower body condition score as well as 3 from the tests. The present finding was similar to that proposed by Meikle *et al.* (2004) that the time from calving to first ovulation was longer in BCS cows at parturition 3, but less in BCS cows more than 3. The current finding is in accordance with that reported by Diskin *et al.* (2003) found that the lower body condition score (BCS) is related, at any time during early lactation and postpartum ovarian activity delays, decline in LH pulses frequency, decreased in follicular response to gonadotropin stimulation, and low in oocytes functionality. Matthews *et al.* (2012) found a negative association between dry matter intake (DMI) and BCS on the parturition day and induced negative energy balance (NEB). Chagas *et al.* (2007) reported that the body condition score (BCS) estimates the dairy cows stored energy fat reserves and the energy balance status and fertility related. Butler (2005) suggested that in cows with a more acute negative energy balance (NEB) longer intervals to first ovulation lose more BCS during the first 30 days of lactation. Drackley and Cardoso (2014) documented the adverse effect of negative energy balance (NEB) on reproduction caused by delayed ovarian cyclicity resumption. Garnsworthy *et al.* (2008), Ospina *et al.* (2010) and Chapinal *et al.* (2012) found that there was low postpartum reproductive success in dairy cows with a negative energy balance (NEB). The body condition score (BCS) losses between parturition and first service result in decreasing postpartum reproductive efficiency in dairy cows (López-Gatius *et al*., 2003 and Santos *et al*., 2009). Buckley *et al.* (2003) and Rojas Canadas *et al.* (2020) stated that the reproductive performance of cows with low body condition score (BCS) at week 3 and week 7 post-calving was lower than that of cows with optimum BCS. Cartmill *et al.* (2001), Moreira *et al.* (2001) and Gumen *et al.* (2003) reported that a postpartum ovarian activity was delayed by cows with low body conditions.

Effect of body condition score at calving on post-partum 1st estrous in crossbred cows

Table (3) shows that the time between calving and first estrous in crossbred cows was significantly longer, (P <0.05) than 65.6±2.5 days in cows with body condition score <3. The present result agrees with that stated by Hoedemaker *et al.* (2009) found that during post- calving cows with lower body condition score (BCS) had a delayed cyclicity onset as compared to cows with higher BCS values. Similar findings found by, Looper *et al.* (2003) stated that low calving BCS results in longer intervals to the first estrous compared to moderately condition cows in beef cows. Delgado *et al.* (2004) reported that in calving cows with BCS low had cyclicity odds between 5 to 9 times lower than BCS high cows. Mirzaei *et al.* (2007) stated that dairy cows who lost more than 0.5 units of BCS within 70 days postpartum had longer intervals between the calving and the first estrous. Gümen *et al.* (2003), Lopez *et al.* (2005) and Santos *et al.* (2009) increase the percentage of non-cycling cows observed in cows with severe BCS loss following calving. Lucy (2000) and Garnsworthy *et al.* (2008) reported that declining insulin and IGF-1 in day's cows during the period of negative energy balance (NEB) resulted in increases in days leading to first estrus. Chagas *et al.* (2007) stated that postpartum body condition variations result in prolonged days to the first estrus due to their negative effect on delayed ovarian activity, rare luteinizing hormone (LH) pulses, impair gonadotropins follicular response and low follicle functional competence.

Table 3. Effect of body condition score at calving on uterine involution and post-partum ovarian activity in crossbred cows

Trait	BCS		
	3<	3	3>
Uterine involution period (UIP) (day)	38.4±3.4[a]	30.2±2.2[b]	28.4±3.9[b]
Post-partum 1st ovulation (PPFO) (day)	51.2±3.8[a]	38.4±3.4[b]	30.5±2.6[c]
Post-partum 1st estrous (PPFE) (day)	65.6±2.5[a]	45.9±7.1[b]	43.2±5.3[b]

a, b: values within the same row having different superscripts are significantly different at (P <0.05)

Effect of body condition score on post-partum 1st service in crossbred cows

Table (4) shows that the time between calving and first service in crossbred cows was significantly longer *(P <0.05*) than 95.3±9.3 days in cows with body condition score <3**.** The sitting result agrees with that reported by Meikle *et al.* (2004) found that cows had BCS <3 recorded longer interval to first service at calving than those cows had BCS ≥3 at calving. Similar trend, observed by Jilek *et al.* (2008) who found that the cows low BCS in the first month after calving appeared to display longer periods from calving to the first service than the cows with BCS > 3.5. Walsh *et al.* (2007) reported that the time from calving to first insemination reflects the effects of management on the prolongation of this interval in dairy cows. Kim and Suh (2003), Santos *et al.* (2008) and Hoedemaker *et al.* (2009) indicated that cows with acute body loss during the dry period displayed longer periods between calving and first insemination.

Effect of body condition score at calving on days open in crossbred cows

Table (4) shows that in crossbred cows the interval from calving to conception was significantly longer *(P <0.05*) than 123.5 ±12.4 days in cows with body condition score <3 compared to BCS 3 or more. In agreement with that reported by Jilek *et al.* (2008) the current result found that cows had lower (BCS < 3.5) recorded longer intervals

from calving to conception 114.7 days compared with higher (BCS > 3.5) 98.8 days. Similar findings showed by Stefańska *et al.*(2016) that cows with BCS ≤3.5 (144.57 days) have longer days open than cows with BCS ranging from (3.51-3.75) 102.8 days of dairy cows. In Holstein-Friesian cows, Patton *et al.* (2007) found a positive association between extended calving at periods of conception and low BCS during seven weeks postpartum. In addition, Hoedemaker *et al.* (2009) suggested that BCS cows <3.0 recorded longer days open (136.8 days) than BCS cows ≥3 (113.3 days) in German Holstein cows in Germany. Lopez- Gatius *et al.* (2003) showed that, at calving, cows with high BCS had less days open. Roche *et al.* (2013) reported that cows display negative energy balance (NEB) had low BCS delayed the start of the ovarian development and extended the days open. The causes of extended pregnancy among cows with low body condition cows delayed postpartum ovarian recovery (Cartmill *et al.* 2001, Moreira *et al*., 2001, Gumen *et al.*, 2003).

Effect of body condition score at calving on number of services per conception in crossbred cows

Table (4) indicates a decline in the number of services per conception in BCS >3 and equal 3 comparison with those cows had BCS <3. The current finding was similar to that reported by Bayram *et al.* (2012) found that in the first month of lactation, the number of services per conception with high BCS was lower than the other group. The findings agree with those found by Abunna *et al.* (2018) suggested that in cows with bad BCS (2.3, service) the higher number services per conception compared to medium BCS (1.56, service) and best BCS (1.69, service). Furthermore, Jilek *et al.* (2008) indicated that in postpartum period cows with cows with BCS < 3.5 reported number services per conception (2.19, service) than other cows BCS equivalent, 3.5 and BCS > 3.5 (2.12 and 1.96, service, respectively). Increased number of services per conception, in calving cows with low BCS, due to late postpartum ovulation, or excessive inactive ovum (Lopez-Gatius *et al*., 2003 and Roche *et al*., 2007). Patel *et al.* (2018) reported that the higher number of BCS Murrah buffaloes per conception (2.8 services) ranging from (2.5 and 3) at calving than those BCS buffaloes (3.25 to 3.75) was 1.68.

Effect of body condition score at calving on conception rate in crossbred cows

Table (4) shows that the conception rate in crossbred cows from the first service was significantly higher *(P <0.05*) than 50 and 60% in cows with a body condition score equal to or higher than 3 score compared to in cows with body condition score less than 3, respectively. The present result showed the negative effect of reduction of BCS in cows at calving on the conception rate in crossbred cows from the first service. Roche *et al.* (2007) and Chapinal *et al.* (2012) showed a positive correlation between BCS and a gradually increase in pregnancy rates in beef and dairy cows at first insemination. Butler (2001) and Santos *et al*. (2009) reported that when BCS losses 0.5 unit in dairy cows, the conception rate decreased by about 10%. Meier *et al.* (2020) stated that 61% higher conception rates for first mating in overfed dairy cows compared to 44% in control fed cows. Walsh et *al.* (2007) and Umaña Sedó et *al.* (2018) suggested that a severe post-calving negative energy balance (NEB) would lead to a reduction in the dairy cow's conception rate. Roche *et al.* (2007) reported that the low pre-partum BCS is associated with lower dairy cattle pregnancy rates. Pancarci *et al.* (2002) showed an increase in pregnancy rates in multiparous cows with BCS>3, and that increase occurred in dairy with BCS of 3.25 and 3.50. Esmaili-Tazangi and Mirzaei (2015) stated that in multiparous cows with BCS >3 (53.8%) pregnancy rates were higher than those cows with BCS=3 and <3 (32.4 and 16.7%, respectively). Kim and Jeong (2019) found that in dairy cows with BCS at first service <3.0 the conception rate was lower (33.9%) compared to those cows that had BCS least 3.0 (44.8%). Patton *et al.* (2007) indicated that Holstein-Friesian cows, cows with BCS≤2.25 were less likely to be pregnant at first service than cows with BCS ≥3.25. Furthermore, Haque *et al.* (2015) recorded that the first service conception rate was higher in cows with 3-4 BCS than in cows with 1.5 - 2 BCS values. Siddiqui et *al.* (2013) found that in cows with BCS from 1.5 to 2.0 the conception rate from first service was lower than in cows with BCS from 2.5 to 3.5 in dairy cows. Santos (2008) suggested that the negative energy balance (NEB) reduces ovulatory cycle's recovery, oocyte and embryo quality and pregnancy establishment and maintenance in dairy cattle. Gillund *et al*. (2001), Pryce *et al*. (2001) and Lopez-Gatius *et al*. (2003) Correlated significant loss of body condition with decreasing rates of pregnancy and increased mortality rates for embryos.

Table 4. Effect of body condition score at calving on reproductive efficiency parameters of crossbred cows

Trait	BCS		
	3<	3	3>
Post-partum 1st service (PPFS) (day)	95.3±9.3[a]	71.2 ±6.6[b]	68.1±8.5[b]
Days open (DO) (day)	123.5 ±12.4 [a]	102.3±13.1[b]	96.3±11.6[b]
Number of services per conception (NS/C)	2.7±0.4[a]	1.9±0.5[b]	1.7±0.6[b]
Conception rate (CR) (%)[1]	30[a]	50[b]	60[b]

a, b: values within the same row having different superscripts are significantly different at (P <0.05)

1-Conception rate calculate from first service

Effect of BCS level on estrus intensity expression in crossbred cows

Table (5) shows that the estrus sings were more likely to appear in BCS >3 cows compared to <3 BCS. Positive association with estrus intensity expression in crossbred cows had disappeared with BCS level in cows. The current results matched those reported by Madureira *et al.* (2015) and Richardson *et al.* (2016) documented a positive relationship between BCS and the expression and strength of estrus in dairy cows. In addition, Aungier *et al.* (2015) reported that a 0.25 increase in BCS was positively correlated with a rise in pre-ovulation physical activity in dairy cows. Lovendahl and Chagunda (2010), Silper *et al.* (2017) and Burnett *et al.* (2017) suggested that BCS considered one of the key factors related to the relative increase in estrus physical activity and duration. Roche *et al.* (2009) reported that low BCS was correlated with delayed post-calving estrus display, longer conceptional

intervals, and reduced pregnancy to first insemination. Perry and Perry (2008) and Pohler *et al*. (2012) found that positive association of estrus expression with pregnancy rate is primarily attributable to increased pre-ovulation circulating estradiol, which regulates a number of physiological events that are responsible for fertility and pregnancy. Davoodi *et al.* (2016) and Pereira *et al*. (2016) found that positive association with enhanced ovarian function resulted in increased fertility, development of embryos, and the rate of pregnancy and expression of estrus near mating. The cows that have reduced the LH pulse frequency with negative energy balance, which declines estradiol synthesis through the pre-ovulatory follicle (Butler, 2003).

Table 5. Percentage of estrus intensity expression at different BCS levels in crossbred cows

Estrus intensity %	No.	BCS		
		<3	3	>3
Weak estrus intensity expression[1]	10	50(5)[a]	30(3)[b]	20(2)[b]
Strong estrus intensity expression[2]	10	-	30 (3)[a]	70(7)[b]

a, b: values within the same row having different superscripts are significantly at (P <0.05), 1-Weak estrus intensity expression: These cows, which appeared one sign only during the estrus. 2-Strong estrus intensity expression: These cows, which appeared ≥3 signs at least during the estrus.

Effect of body condition score at calving on concentrations of progesterone during estrus period in crossbred cows

Table (6) clarify concentrations of progesterone in blood plasma in estrus and d 7 post-mating were lower *(P <0.05)* (0.14±0.01 ng/ml) and (2.4± 0.2 ng/ml) in cows with BCS<3 compared to cows had BCS equal to or greater than 3 in crossbred cows. Positive association has been observed in crossbred cows between progesterone concentrations at estrus and d7 post-mating and BCS level. According to the present finding, Madureira *et al*. (2019) reported that lower concentrations of progesterone d 7 post-mating in cows with BCS <2.75 (2.5 ± 0.2 ng/ml) compared to cows with BCS ≥3.0 (3.2 ± 0.1 ng/ml) were found. Positive associations between post-mating and BCS concentrations of progesterone d 7 and the pregnancy rate in cows (Madureira *et al*., 2019). Spencer and Bazer (2002) stated that post-service progesterone concentrations were positively associated with cows conception rates maybe progesterone is vital for pregnancy maintenance. Lopez-Gatius *et al*. (2004) indicated that cows with higher concentrations of progesterone or supplemented with exogenous sources post-service progesterone had higher levels of pregnancy relative to non- supplemented or cows with decreasing concentrations of progesterone in the blood. Demetrio *et al.* (2007) found a positive association between d 7 progesterone concentrations and d 28 post-insemination pregnancy levels in dairy cattle. Stronge *et al.* (2005) reported that decreased concentrations of progesterone from day5 to day 7 post-mating had been associated with reduced fertility in dairy cows.

Effect of body condition score at calving on concentrations of estradiol-17β at estrus period in crossbred cows

Table (6) shows a lower concentrations of estradiol-17β in estrus *(P <0.05)* (18.8±2.5 pg/ml) in cows with BCS<3 compared to cows with BCS equivalent 3 or > 3 in pregnant crossbred cows. Results showed that concentrations of estradiol-17β at estrus were lower in non-pregnant cows (12.4±3.2, 15.8±3.1 and 17.2±2.6 pg/ml) compared to those of pregnant cows (18.8±2.5, 25.6±4.3 and 28.4±2.4 pg/ml) in cows with BCS<3, equal to 3 and >3, respectively. Van Eerdenburg *et al.* (2000), Gillies and McArthur (2010) indicated that estradiol concentration at estrus plays a significant role in estrous activity as it activates hypothalamus-regulating sexual behavioral estrogen receptors. Buhi (2002), Ozturk and Demir (2010) and Atkins *et al.* (2013) stated that the production of the oviductal secretory glycoproteins and uterine receptivity required for exposure estradiol-17β increases fertilization success and improves embryo quality and viability. Madureira *et al.* (2015) and Denis-Robichaud *et al*. (2018) reported that sexual behavior intensity in BCS ≤ 2.5 cows was lower than BCS ≥ 2.75 cows. Wiltbank *et al*. (2014) stated that inadequate circulation of estradiol-17β in cows with low BCS could limit fertility and increase pregnancy loss. Keskin *et al*. (2016) suggested that higher concentrations of estradiol-17β would facilitate transport of sperm and oocytes into the reproductive tract and improve uterine lumen for early embryonic development.

Table 6. Concentrations of progesterone in blood plasma (ng /ml), and estradiol-17β (pg/ml), during estrus period in pregnant and non-pregnant crossbred cows.

Hormone	BCS level		
	<3	3	>3
Pregnant cow			
Progesterone at estrus	0.14±0.01[a]	0.22±0.02[b]	0.23±0.02[b]
Progesterone at 7day of estrus	2.4± 0.20[a]	3.2±0.40[b]	3.4±0.30[b]
Estradiol-17β at estrus	18.8±2.50[a]	25.6±4.30[b]	28.4±2.40[b]
Non-pregnant cow			
Progesterone at estrus	0.20±0.03[a]	0.26±0.01[b]	0.25±0.02[b]
Progesterone at 7day of estrus	1.8± 0.20[a]	2.1± 0.20[a]	2.2± 0.20[a]
Estradiol-17β at estrus	12.4±3.20[a]	15.8±3.10[b]	17.2±2.60[b]

a, b: values within the same row having different superscripts are significantly at (P <0.05).

CONCLUSION

the current results indicated a significant effect of BCS at calving on recovery of ovarian activity and subsequent reproductive characteristics, during postpartum period in crossbred cows. From the present study, it could be recommended that great attention must be paid to the body condition score of the crossbred cows less than level 3 to enhancing improving postpartum reproductive performance.

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تأثير حالة الجسم عند الولادة على النشاط المبيضى والخصائص التناسلية اثناء فترة مابعد الولادة فى الأبقار الخليطة

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أجريت هذه الدراسة لبحث تأثير حالة الجسم عند الولادة على النشاط المبيضى والخصائص التناسلية بعد الولادة فى الأبقار الخليطة. أستخدم فى هذا البحث عدد 36 بقرة خليط فريزيان (أبقار بلدى x أبقار فريزيان) قسمت الى ثلاثة مجاميع كل مجموعة تتكون من 12 بقرة بناأ على حالة الجسم (<3 ، 3 و >3). أظهرت النتائج أن الفترة من الولادة الى عودة الرحم الى وضعة الطبيعى، والتبويض الأول و الشياع الأول كانت أطول معنويا *(P<0.05)* (38.4±3.4 ، 51.2±3.8 و 65.6±2.5 يوم) فى الأبقار التى كانت حالة جسمها أقل من <3 بالمقارنة بالأبقار التى كانت حالة جسمها يساوى 3 (30.2±2.2 ، 38.4±3.4 و 45.9±7.1 يوم) أو الأبقار التى كانت حالة جسمها أكبر من >3 (28.4±3.9 ، 30.5±2.6 و 43.2±5.3 يوم) على التوالى. كانت الفترة بين الولادة و التلقيح الأول و الاخصاب أطول معنويا *(P<0.05)* (95.3±9.3 و 123.5±12.4 يوم) فى الأبقار التى كانت حالة جسمها أقل من <3 بالمقارنة بالابقار التى كانت حالة جسمها يساوى 3 (71.2±6.6 و 102.3±13.1 يوم) أو الأبقار التى كانت حالة جسمها أكبر من >3 (68.1±8.5 و 96.3±11.6يوم) على التوالى. كان عدد التلقيحات اللازمة لحدوث الحمل أقل (1.7±0.6 تلقيحة) فى الأبقار التى كانت حالة جسمها أكبر من >3 والابقار التى كانت حالة جسمها يساوى 3 (1.9±0.5 تلقيحة) بالمقارنة بالأبقار التى كانت حالة جسمها أكبر من <3 (2.7±0.4 تلقيحة). كان معدل الحمل من التلقيح الأول أعلى معنويا (P<0.05) 50 و 60% فى الأبقار التى كانت حالة جسمها يساوى 3 أو الأبقار التى كانت حالة جسمها أكبر من >3 على التوالى, بالمقارنة الأبقار التى كانت حالة جسمها أقل من <3، حيث كانت 30%. أظهرت النتائج الحالية وجود تأثير معنوى لحالة الجسم عند الولادة على استعادة النشاط المبيضى و الخصائص التناسلية بعد الولادة في الأبقار الخليطة. من النتائج الحالية يوصى البحث بأهمية الحالة الجسمانية عند الولادة بحيث لاتقل عن المستوى 3 من أجل تحسين الأداء التناسلى بعد الولادة فى الأبقار الخليطة.