Anim. Reprod., v.2, n.2, p.135-138, April/June, 2005

Feed intake restriction, conception rate and parturition to conception interval in crossbred Gir-Holstein cows[1]

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Abstract

The purpose of this study was to evaluate the effects of feed restriction and subsequent body weight loss on the number of services per conception in crossbred, Gir-Holstein cows with body condition scores (BCS) ranging from 3.5 to 4.1 (1 = very thin and 5 = fat). The mean milk production during the first month of lactation was 11.9 kg/milk/day. Cows received either a post-partum diet to meet maintenance and production needs (Group I, n=25) or were submitted to feed restriction from parturition to conception (Group II, n=25), which consisted of 1 AU/ha of *Brachiaria decumbens* pasture, during the dry season, without concentrate supplementation. All animals were inseminated in the first estrus 45 days post-parturition. Ovarian cyclic luteal activity (OCLA) was evaluated by rectal palpation, observation of estrous behavior (twice daily) and blood progesterone levels. The difference in the interval from parturition to first estrus was greater in the Group II (46.3 days) than Group I (55.4 days). In conclusion, feed restriction and subsequent body weight loss (13.2%) did not retard the reestablishment of OCLA in Gir-Holstein crossbred cows with a high BCS at parturition. The first estrus occurred before 56 days post-partum in the feed-restricted group and this group had a greater number of services per conception and days to first service compared to the control group.

Keywords: Post-partum, feed restriction, services per conception, service period

Introduction

Reproductive performance is one of the main factors affecting efficiency of dairy and beef herds (Diskin *et al*., 2003). A negative energy balance (NEB), alters reproductive performance affecting age at puberty (Kinder *et al*., 1995) and the duration of the post-parturition anestrous period (Dunne *et al*., 1999; Sinclair *et al*., 2002). The low productivity of Brazilian dairy herds, considering milk production by area or by a cow per year basis (Ferreira, 1991), is essentially related to: 1) low reproductive performance due to inadequate management (nutritional, sanitary and housing) and 2) low genetic merit of cows (lactation yield, duration and length). The long calving interval observed in the national dairy herds, 18 to 20 months according to studies carried out in Minas Gerais (Carneiro, 1992) and Rio de Janeiro (Ferreira *et al*., 1997), characterizes the low reproductive efficiency of herds associated with an increased age at first parturition.

There are many possible causes of reproductive problems (Ferreira, 1985b) including but not limited to any disturbance or pathology that affects normal reproductive function of heifers and/or cows and will be reflected by one of these symptoms: anestrous period (absence of estrous cycle and/or estrus); return to service after AI or breed); and abortion (infectious or not), as described by Ferreira (1997). Wiltbank *et al*. (1962) affirmed that cows that lost weight from parturition to breeding had lower conception rates than those that had not (43% vs. 67%, respectively). Many studies have shown that weight loss prior to breeding or AI may reduce fertility (Perkins, 1985; Spicer *et al*, 1990; Pedron, 1993; Whitaker *et al*, 1993; Ferguson, 1996), probably because follicles growing under a state of NEB may have lower quality due to the effects of metabolic unbalance (Britt, 1992; 1994).

The purpose of the present study was to evaluate the effect of feed restriction and subsequent weight loss (implying a NEB) on the interval from parturition to conception, the number of services per conception, and service period length in Gir-Holstein cows with a high body condition score (BCS) at parturition.

Materials and Methods

This study was performed at Embrapa´s Experimental Farm of Santa Mônica, in Valença, RJ, Brazil. Crossbred Gir-Holstein cows (n=50) with a BCS at parturition ranging from 3.5 to 4.1 (1 = very thin and 5 = fat; Ferreira, 1997) and mean milk production during the first month of lactation of 11.9 kg milk per day. Half of these cows received a post-partum diet to meet maintenance and production needs (Group I, n=25), and the other half (Group 2, n=25) was submitted to feed restriction from parturition to conception and received a diet consisting of 1AU/ha of *Brachiaria decumbens* pasture during the dry season without concentrate supplementation to induce weight loss. Parturitions occurred from March to April (beginning of dry season), and all cows were inseminated at the first estrus 45 days post-partum.

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Received: June 4, 2004
Accepted: July 8, 2005

Weight measurement and BCS evaluation were carried out 24h after parturition and weekly thereafter, in the morning, after milking, and before the feeding of Group I. Milk production was also assessed weekly after the 10th day post-partum. Post-partum ovarian cyclic luteal activity (OCLA) was evaluated weekly after Day 20 post-partum by rectal palpation, twice-daily observation of estrous behavior, and by twice-weekly blood-progesterone levels. Blood samples were collected by coccigeal tail vein or artery puncture, using Vacutainer heparinized tubes. Plasma was separated by centrifugation at 484.4g for 20 minutes under refrigeration (4 ^{o}C) and stored at -20 ^{o}C. Progesterone concentrations were measured by radioimmunoassay, using a commercially available I125 solid-phase RIA Kit (Coat-a-Count, MedLab, Brazil), with a sensitivity of 0.03 ng/mL, and intra- and interassay coefficients of variation of 0.57% and 6.42%, respectively.

The percentage of observed estruses in each group was evaluated by the Chi-square method. All other parameters compared by Student´s T test, considering a significance level $P<0.05$. Data is presented as means ± standard deviation.

Results

Means of the interval from parturition to first estrus for treatment groups are depicted in Table 1. The mean live weight loss during this period was –6.0 and –55.3 kg for Group I and II, respectively. Cows under feed restriction presented a loss of 0.9 units of BCS between parturition and conception (mean of 3.8 at parturition and 2.9 at conception). Among the four animals that lost the most weight from parturition to first estrus (14.6 to 14.9%), estrus occurred 50 to 71 days post-parturition.

There was no difference (P>0.05) in interval parturition to first estrus between Groups I and II, but service periods for these groups were different (74.7±17.7 vs. 114.6±15.7 days, respectively; P<0.001). The number of services per conception in the group under feed restriction was higher compared to control group (2.12 vs. 1.44, P<0.05).

The percentage of unidentified estruses for the Ferreira *et al.* Feed intake restriction, conception rate and parturition to conception interval in crossbred Gir-Holstein cows group under feed restriction was 39.51%, not different from the 36.3% observed in the control group (P>0.05). There was no difference (P>0.05) in progesterone levels for the two groups studied (4.9±3.2 and 5.1±2.6 ng/mL for Groups I and II, respectively) during the estrous cycles before and after the AI performed after Day 45 post-partum.

Table 1. Effect of feed restriction from parturition to conception on reproductive parameters of Gir-Holstein cows

Parameters	Groups	
	Control (I)	Feed Restriction (II)
Number of animals	25	25
Interval from parturition to 1st estrus (days)	46.3±11.0 ^{a}	55.4±11.3 ^{a}
Service Period (days)	74.7 ^{a}	114.6 ^{b}
Number of services per conception	1.44 ^{a}	2.12 ^{b}
Live Weight (kg)		
Parturition	462.0±18.8 ^{a}	470.8±21.5 ^{a}
1st Estrus	456.0±17.5 ^{a}	415.2±18.5 ^{b}
WLRP (%)	6.0 (1.3)	55.3 (11.8)
DWL	0.13	1.00
Conception	453.8	408.4
WLRP (%)	8.2 (1.8)	62.2 (13.2)
DWL	0.11	0.54
Body Condition Score		
Parturition	3.73±0.23 ^{a}	3.82±0.21 ^{a}
1.º Estrus	3.64±0.21 ^{a}	3.0±0.19 ^{b}
Conception	3.63±0.21 ^{a}	2.92±0.20 ^{b}
Unidentified estrus or ovulations without estrus signs (%)	36.3	39.5

WLRP = Mean weight loss related to weight at parturition (kg and %).
DWL= Mean weight loss by day (kg).
^{a,b} Values followed by different letters, in the same row, differ (P<0.01).

Discussion

The mean weight loss of 11.8% from parturition to first estrus was not sufficient to increase the time to 1st estrus past the desired period of 85 days post-parturition, considering a 12 month calving interval. These results are in agreement with those of Rhodes *et al*. (1995; 1996), Bossis *et al*. (1999), Stagg (2000) and Diskin *et al*. (2003), which showed that cows started an anestrous condition when the average loss of initial body weight was around 22 to 24%. A low BCS at the beginning of feed restriction may be one of the factors that affected the interval to anestrus (Diskin *et al*., 2003). For this reason, cows used in the present study were selected for a high BCS at parturition.

The length of service periods for Groups I and II were different and may be related to the higher number of services per conception in the group under feed restriction. Lower conception rates associated with follicles, which grew under a NEB, may be due to an effect of a metabolic imbalance on oocyte or follicle (Britt, 1992 and 1994). Ferguson (1996) also suggested that cows in a NEB had lower conception rates. The higher number of services per conception for the group under feed restriction might explain the difference of 39.9 days in service period between the two groups. Differences in estrus detection rate may be a consequence of animals under feed restriction having lower expression or intensity of estrus behavior (Ferreira, 1990; Ferguson, 1996). The causes of silent or undetected estruses in relation to a NEB have been discussed by Spicer *et al*. (1990) who verified that 40% of first post-partum ovulations were not associated with estrus in cows under NEB, when compared to 16.7% of those under positive energy balance (PEB). However, these latter authors observed no difference in the interval from parturition to first estrus for cows under either PEB or NEB, which is also in agreement with the results of the present study. Pedroso and Roller (1997) also mentioned the occurrence of silent estrus or ovulation without visible signs of estrus in animals under feed restriction.

Another factor that could explain the lower conception rate of cows under feed restriction is the lower level of progesterone produced by the corpus luteum of cows under a NEB (Britt, 1994). Spicer *et al*. (1990) observed that progesterone levels of the first estrous cycle (32±2 days postpartum) were two fold greater in cows under PEB than under NEB (13.1±3.0 and 6.4±2.8 ng/mL, respectively). However, in the present study, this fact does not appear to be a cause of lower conception rates since no difference in progesterone levels during the estrous cycles before and after AI were observed between the two groups.

The loss of 0.9 units of BCS between parturition and conception seemed to affect fertility as demonstrated by the greater number of services per conception in the feed-restricted group. According to Ferguson (1996), cows can tolerate the loss of 0.67 units of BCS without affecting fertility. However, Perkins (1985) and Britt (1992) affirmed that cows losing more than 0.5 units of BCS had a reduction in conception rate, in agreement with the results of the present experiment.

Harris (1993) and Ruegg and Milton (1995) stated that fertility is affected when animals lost more than 1.0 units of BCS post-parturition but did not mention the BCS at parturition. Pedron (1993) however mentioned that a loss of 0.8 and 1.05 units of BCS for cows with scores of 3.5 and 4.0 soon after parturition, respectively, did not affect service period and the number of services per conception. This inconsistency between the current and previous studies may be explained by the different numeric values attributed to the BCS systems used between experiments. The former authors defined fat cows as presenting a BCS of 4.0, and very fat cows as 5.0, while in the present study the same grades of BCS were attributed, respectively. Furthermore, our study deals with cows with higher milk production potential, and capable of mobilizing more fat from internal stores at the beginning of lactation which is less evident in BCS evaluation. There is also the fact that BCS evaluation, although being an efficient auxiliary technique for nutritional, reproductive, and health management is subjective, which can result in variations in scoring (Ferguson *et al*., 1994; Hady *et al*., 1994).

When considering the rate of return to estrus in Gir-Holstein crossbred cows after breeding or AI, weight loss or a NEB should be considered as possible causes of repeat breeder syndrome, as occurs with heat stress (Gonzalez *et al*., 1993; Valtorta and Gallardo, 1996). Appropriate attention must be given to these two factors along with many other possible causes when diagnosing low reproductive performance (Ferreira, 1985a).

In summary, for Gir-Holstein cows kept under post-partum feed restriction and with a high BCS, the mean live weight loss of 11.7 and 13.2% from parturition to first estrus and to conception, respectively, did not affect the interval from parturition to first estrus interval while the number of services per conception and length of service period increased.

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