Scientific Electronic Archives | Volume 4 | p. 1-4 | 2013

Effect of Lactation Yield on First Follicular Wave Surge After Calving of Crossbred Dairy Cattle

O Efeito da Lactação Sobre o Surgimento da Primeira Onda Folicular no Pós Parto de Vacas Leiteiras Mestiças

R.C.A. Berber[1]; H.A.Z. Biavatti[1]; J. Fornazieri[1] ; G. C. M. Berber[1]; L.G.R. Sturaro[2]; G.F. Santos[2]; M. A. Silva[2]

[1]Universidade Federal de Mato Grosso – Campus de Sinop; [2] Universidade Estadual do Norte do Paraná – Campus Bandeirantes

[+] **Autor correspondente**: berber@ufmt.br

Resumo

Este estudo objetivou avaliar o efeito da lactação sobre o surgimento da primeira onda folicular de vacas mestiças (Gir x Holandês). Nove vacas multíparas leiteiras mestiças foram agrupadas conforme a produção diária de leite (Grupo 1 = produção de leite superior à média, n = 5; Grupo 2 = produção de leite menor do que a média, n = 4). Do parto (dia 0) até divergência da primeira onda folicular ovariana, foi monitorado diariamente por meio de exames de ultrassom para observar o surgimento folicular, taxa de crescimento, diâmetro máximo folicular, dia da divergência folicular e ovulação. A média de produção de leite foi de 17,4 + 6,4 L / dia (n = 9). Grupo 1 tinha uma produção diária de leite mais elevada do que o Grupo 2 (21,8 + 3,8 L / dia vs 11,9 + 3,9 L / dia, P <0,001). Dados da emergência folicular foram semelhantes em ambos os grupos (P> 0,05). A taxa de crescimento folicular foi maior no Grupo 2 do que no Grupo 1 (2,0 ± 0,0 mm / dia vs 1,2 ± 0,6 mm / dia, P <0,05). O diâmetro máximo folicular foi de 11,6 + 0,9 mm (Grupo 1) e de 13,5 + 1,7 mm (Grupo 2), P < 0,05. A divergência folicular ocorreu mais cedo no Grupo 1 do que no Grupo 2 (12,2 + 0,8 dias vs 13,7 + 0,6 dias, P < 0,05). Um animal do Grupo 2 ovulou. Em conclusão, os dados sugerem que a produção de leite influenciou a dinâmica folicular ovariana após o parto.

Palavras-chave: *folículo, pós-parto, lactação, vacas leiteiras*

Abstract

This study aimed to evaluate the effect of lactation on first follicular wave surge of crossbred (Gir x Holstein) dairy cattle. Nine multiparous crossbred dairy cattle were divided according to daily milk production (Group 1 = milk production higher than average, n = 5; Group 2 = milk production lower than average, n = 4). From calving (Day 0) until divergence of first follicular wave, ovaries was monitored daily by ultrasound exams to observed the follicular emergence, growth rate, maximum follicular diameter, day of follicular divergence and ovulation. The mean of milk production was 17.4 + 6.4 L/day (n= 9). Group 1 had higher daily milk production than Group 2 (21.8 + 3.8 L/day vs. 11.9 + 3.9 L/day, P< 0.001). Data of follicular emergence were similar in both groups (P >0.05). The growth rate of first follicular surge was higher in Group 2 than Group 1 (2.0 ± 0.0 mm/day vs 1.2 ± 0.6 mm/day, P< 0.05). The maximum follicular diameter was 11.6 ± 0.9 mm (Group 1) and 13.5 ± 1.7 mm (Group 2); P< 0.05. The follicular divergence occurred earlier in Group 1 than Group 2 (12.2 ± 0.8 days vs 13.7 ± 0.6 days; P< 0.05). One animal of Group 2 ovulated. In conclusion, data suggested that milk production had influence on ovarian follicular dynamic after calving.

Keywords: Follicle, post-partum, lactation, dairy cattle

Introduction

Several researchers had studied the effect of lactation on fertility of cattle (Butler et al., 2006; Cavalieri et al., 2006). Many factors have negative effect on follicular surge in early post-partum of dairy cattle.

Ovarian recrudescence with normal re-occurring estrous cycles and restoration of fertility to first service are associated with a reduced occurrence of periparturient metabolic and reproductive disorders. Marked negative changes in energy balance and reduced immunocompetence influence gonadotropic and metabolic hormones (Thatcher et al., 2006).

After parturition, dairy cows experience a rapid increase in milk yield, and increased mobilization of body adipose tissue (Lederman, 2004). It is normal for dairy cows to undergo a process of adipose tissue mobilization in early lactation because energy demand for milk production is greater than the energy provided by the diet (Koltes et al., 2011). The severity and duration of the negative energy balance may be influenced by genetic merit for milk yield (Gross et al., 2011). The reproductive performance of cattles, particularly the probability of conception, may be negatively associated with the magnitude and duration of negative energy balance in early lactation (Walsh et al., 2011)

In addition, much of the effort has focused on the nature of the signal (endocrine or otherwise) that controls pituitary secretion of LH and FSH, the response of the ovary to LH and FSH (Lucy, 2003). Plasma FSH levels rise in most cows 5-10 days after calving and thereafter the random changes observed have little relationship to the onset of cycles. Recovery of FSH release therefore is earlier post partum than recovery of LH release. Plasma LH concentrations undergo significant changes directly related to the initiation of ovarian cycles, with low plasma levels immediately post-partum, followed by an increase in basal secretion and the development of clear LH episodes. (Jorritsma et al., 2005)

There is much information about physiologic patterns during early post-partum period. However, there are few publications about the lactation effect on follicular surge in crossbred dairy cattle at field condition. Thus, the aim of this study was to evaluate the effect of milk production on first follicular wave surge of crossbred (Gir x Holstein) dairy cattle.

Methods

Animals and groups

Nine multiparous crossbred dairy cattle (½ Gir x ½ Holstein) with body condition score (BCS) = 3.0 (scale 1 to 5; very fin = 1 and very fat = 5) were divided in two groups according to daily milk production (Group 1 = milk production higher than average, n = 5; Group 2 = milk production lower than average, n = 4). All animals were maintained in pasture regimen with mineral salt support and milked twice/day (at 7h00min and 16h00min).

Follicular evaluation

From calving (Day 0), the ovaries was evaluated daily by ultrasound exams (Pie Medical 480, Maastricht, Netherlands) with a rectal 5 MHz probe. All exams were performed after morning milk. Data of follicular emergence, growth rate, maximum diameter, moment of divergence and ovulation were recorded and analyzed according to milk production of animals.

Statistical analysis

The ANOVA was used to evaluate the continuous variables (follicular emergence, growth rate, maximum diameter, moment of divergence or atresia and ovulation) for repeated measure. The T-test was used to evaluate the differences between means.

Results and Discussion

The mean of daily milk production was 17.4 + 6.4 L/day (n = 9). Animals of Group 1 had higher daily milk production than Group 2 (21.8 + 3.8 L/day vs. 11.9 + 3.9

L/day, P < 0.001). Data of follicular emergence was similar in both groups (P > 0.05). The growth rate of first follicular surge was higher in Group 2 than Group 1 (2.0 + 0.0 mm/day vs. 1.2 + 0.6 mm/day, P < 0.05). The maximum follicular diameter observed was 11.6 + 0.9 mm (Group 1) and 13.5 + 1.7 mm (Group 2); P < 0.05. The follicular divergence occurred earlier in Group 1 than Group 2 (12.2 + 0.8 days vs. 13.7 + 0.6 days; P < 0.05). Only one animal (25%) of Group 2 presented ovulation.

Gutierrez et al. (2006) reported that the first ovulation and commencement of normal luteal function occurred significantly earlier in low (L) line cows than high (H) line cows. The average daily milk production during the study period did not differ (P>0.10) between cows in either the H (= 31.0+/-1.5kg/day) or L (= 30.2+/-1.7kg/day) PBV lines although, 305 days milk production was significantly different (P < 0.01; H = 6880 ±164kg versus L = 5795 ± 317kg). In both studies the first ovulation postpartum occurred earlier (P<0.01) in the L (day 19) versus the H line (day 28). At day 15 postpartum all cows had follicles of all three-size categories (small, medium-sized and large). Small (P<0.07) and medium-sized follicle numbers increased (P<0.01) with day postpartum. However, the inclusion of predicted changes in body weight as a covariate in the analysis, demonstrated that changes in number of small and medium-sized follicles were associated with changes in body weight.

The numbers of cows showing ovulation and anovulation within 3 weeks postpartum were 31 (70.5%) and 13 (29.5%) in the primiparous cows and 35 (53.0%) and 31 (47.0%) in the multiparous cows, respectively. The patterns of ovarian resumption after calving were classified into two types (normal ovarian cycles and abnormal ovarian cycles) on the basis of milk P4 concentrations. Initiation of normal ovarian function in cows ovulated within 3 weeks postpartum occurred earlier than in anovulation cows regardless of the number of calvings (primiparous, 27.8 days vs. 44.4 days; multiparous, 30.6 days vs. 55.7 days; P<0.01). (Kawashima et al., 2006)

In cattle, treatment with recombinant bovine somatotrophin (rGH) significantly increases the population of small ovarian follicles. This is associated with increases in circulating concentrations of insulin and insulin-like growth factor-I (IGF-I). Subsequent studies, both in vitro and in vivo, have highlighted the importance of IGF-I and/or insulin acting in synergy with FSH and LH. More recently, we demonstrated that feeding heifers with 200% maintenance requirements for a short period significantly increases circulating insulin concentrations and population of small ovarian follicles. (Gong, 2002)

Increasing the suckling intensity further delayed the onset of ovarian cyclicity, probably by increasing the frequency or strength of its inhibitory influence on hypothalamic activity. Plasma FSH levels rise in most cows 5-10 days after calving and thereafter the random changes observed have little relationship to the onset of cycles. Recovery of FSH release therefore occurs earlier post partum than recovery of LH release. Hyperprolactinaemia is not a cause of reproductive failure in milked or suckling cows because there is no correlation between plasma prolactin levels and the onset of ovarian cycles. Plasma LH concentrations suffer significant changes directly related to the initiation of ovarian cycles, with low plasma levels immediately post partum, followed by an increase in basal secretion and the development of clear LH episodes. This pulsate pattern appears earlier in dairy than in beef cows and is further delayed by suckling compared to milking. Before the first ovulation there is an increased frequency and peak height of LH episodes leading to a rise in plasma LH levels and eventually to a preovulatory LH surge which results in the first ovulation. These changes in the pattern of LH release appear definitive in the initiation of ovarian activity in post-partum cows. (Crowe, 2008).

Conclusion

Data of this experiment suggested that daily milk production had influence on

dynamics follicular of first follicle postpartum.

References

BUTLER, S.T.; PELTON S.H.; BUTLER, W.R. Energy balance, metabolic status, and the first postpartum ovarian follicle wave in cows administered propylene glycol. **Journal Dairy Science**. 89:2938-51,2006.

CAVALIERI, J.; HEPWORTH, G.; FITZPATRICK, L.A.; SHEPHARD, R.W.; MACMILLAN, K.L. Manipulation and control of the estrous cycle in pasture-based dairy cows. **Theriogenology.** 65:45-64, 2006.

CROWE, M.A. Resumption of ovarian cyclicity in post-partum beef and dairy cows. **Reproduction of Domestic Animal.** 5:20-8, 2008.

GONG, J.G. Influence of metabolic hormones and nutrition on ovarian follicle development in cattle: practical implications. **Domestic Animal Endocrinology**. 23:229-41,2002.

GROSS, J.; VAN DORLAND, H.A.; BRUCKMAIER, R.M.; SCHWARZ, F.J. Milk fatty acid profile related to energy balance in dairy cows. **Journal Dairy Research**. 16:1-10, 2011.

GUTIERREZ, C.G.; GONG, J.G.; BRAMLEY, T.A.; WEBB, R. Selection on predicted breeding value for milk production delays ovulation independently of changes in follicular development, milk production and body weight. **Animal Reproduction Science**.95:193-205, 2006.

JORRITSMA, R.; LANGENDIJK, P.; KRUIP, T.A, WENSING, T.H.; NOORDHUIZEN, J.P. Associations between energy metabolism, LH pulsatility and first ovulation in early lactating cows. **Reproduction Domestic Animal**. 40: 68-72, 2005.

KAWASHIMA, C.; KANEKO, E.; AMAYA, M. C.; MATSUI, M.; YAMAGISHI, N.; MATSUNAGA, N.; ISHII, M.; KIDA, K.; MIYAKE, Y.; MIYAMOTO, A. Relationship between the first ovulation within three weeks postpartum and subsequent ovarian cycles and fertility in high producing dairy cows. Journal of **Reproduction Development**. 52:479-86, 2006.

KOLTES, D.A.; SPURLOCK, D.M. Coordination of lipid droplet-associated proteins during the transition period of Holstein dairy cows. **Journal Dairy Science**. 94:1839-48, 2011.

LEDERMA, S.A. Influence of lactation on body weight regulation. Nutrition Reviews. 62:112-9, 2004.

LUCY, M.C. Mechanisms linking nutrition and reproduction in postpartum cows. **Reproduction Supplement**. 61:415-27, 2003.

LUCY, M.C. Regulation of ovarian follicular growth by somatotropin and insulin-like growth factors in cattle. **Journal of Dairy Science**. 83:1635-47,2000.

THATCHER, W.W.; BILBY, T.R.; BARTOLOME, J,A.; SILVESTRE, F.; STAPLES, C.R.; SANTOS, J.E. Strategies for improving fertility in the modern dairy cow. **Theriogenology.** 65:30-44,2006.

WALSH, S.W.; WILLIAMS, E.J.; EVANS, A.C. A review of the causes of poor fertility in high milk producing dairy cows. **Animal Reproduction Science**. 123:127-38, 2011.