academicJournals

Vol. 14(28), pp. 2265-2269, 15 July, 2015
DOI: 10.5897/AJB2015.14592
Article Number: 9E9EE1E54154
ISSN 1684-5315

http://www.academicjournals.org/AJB

African Journal of Biotechnology

Full Length Research Paper

Reproductive performance of dairy cows affected by endometritis, pododermatitis and mastitis

Thaisa Campos Marques[1], Karen Martins Leão[2]*, Moraima Castro Rodrigues[2], Natalia do Carmo Silva[1] and Rossane Pereira da Silva[2]

[1]Programa de Pós-graduação em Zootecnia, Universidade Federal de Goiás (UFG), Rod. Goiânia-Nova Veneza, Caixa Postal 131, 74690-900, Goiânia, GO, Brasil.
[2]Programa de Pós-graduação em Zootecnia, Instituto Federal de Educação, Ciência e Tecnologia Goiano (IF GOIANO), Rod. Sul Goiana Km 01, Zona Rural, Rio Verde - GO - Brasil, 75.901-970, Caixa Postal 66, Rio Verde, GO, Brasil.

Received 25 March, 2015; Accepted 3 July, 2015

The effects of endometritis, pododermatitis and clinical mastitis on the conception rate and calving-conception interval of multiparous and primiparous cows after fixed-time artificial insemination (FTAI) were evaluated. Clinical endometritis was diagnosed by ultrasonography 20-40 days postpartum upon observation of fluid in the uterine lumen. Cows with clinical endometritis were treated intramuscularly with 2 mg/kg ceftiofur hydrochloride over three consecutive days. Forty-five days after delivery, multiparous and primiparous cows with normal uteri according to ultrasonography were selected for the study, filed and inseminated by FTAI. To identify animals with hoof problems and clinical mastitis and to define their respective groups, the cows were observed daily during morning and nightly milking for up to 60 days after FTAI, and animals with hoof lesions were treated. Animals with clinical mastitis were treated with intramammary infusion containing 88 mg cefquinome sulphate every 12 h after milking for four days. The conception rate of multiparous cows with clinical endometritis at 30 and 60 days after FTAI was negatively affected compared with that of healthy cows with pododermatitis. However, clinical endometritis did not influence the primiparous category, whereas pododermatitis and clinical mastitis did not influence the conception rate of any category at 30 and 60 days after FTAI. Differences were not observed between primiparous or multiparous cows in the calving-conception interval.

Key words: Lactation, pregnancy, health, fertility.

INTRODUCTION

The postpartum period is critical for the remainder of a cow's reproductive life (Dohmen et al., 2000). Uterine infections correspond to an increase in the calving interval; discard rate and services required per conception and to a reduction in production (Leblanc et al., 2002; Sheldon et al., 2008). Infections of cattle limbs

*Corresponding author. E-mail: karenleao2@yahoo.com.br. Tel: +55-64-3620-5637, Fax: +55-64-3620-5640.

cause stress and reduce fertility and pregnancy rates (Sheldon, 1997). Cows with lameness have a higher number of services per conception, longer period of service and increased incidence of metritis and mastitis than healthy cows (Souza et al., 2006). Another disease that can influence the reproductive performance of cows is mastitis, which is a major concern in dairy cattle production (Carneiro et al., 2004). The mechanisms by which mastitis interferes with embryonic survival and mortality are not fully understood, but studies have shown that there may be a relationship between mastitis and reduced pregnancy rates (Hansen et al., 2004).

This study therefore aimed at evaluating the effects of clinical endometritis, pododermatitis and clinical mastitis on the conception rate and calving-conception interval of primiparous and multiparous lactating dairy cows after fixed-time artificial insemination (FTAI).

MATERIALS AND METHODS

The experiment was conducted on a dairy farm located in the municipality of Montividiu, southwest Goiás State, Brazil (latitude 17°20'5.7" and longitude 51°18'46.7"). During the experiment, lactating Holstein cows were confined in wooded feedlots supplied with drinking troughs. The cows received a complete diet consisting of quality corn silage and a balanced concentrate for milk production, which was distributed four times with the aid of a mixing wagon. The effects of endometritis, pododermatitis and clinical mastitis on the conception rate and calving-conception interval of multiparous and primiparous cows after FTAI were evaluated from May to August, 2013. The experimental animals (n = 356) were divided into two categories: multiparous cows, with an average milk production of 26.7± 3.6 kg milk/day, and primiparous cows, with an average milk production of 20.4 ± 2.8 Kg milk/day. Between 20 and 40 days after birth, the animals were reproductively evaluated by ultrasonography. Cows with clinical endometritis determined by observations of fluid in the uterine lumen were treated with 2 mg/kg ceftiofur hydrochloride (CEF50®, Agenor União Saúde Animal, Embu-Guaçu, SP, Brasil) intramuscularly for three consecutive days.

Animals with uteri without signs of infection upon clinical examination and ultrasonography (Mindray® DP3300 VET) were selected for the study after the voluntary waiting period of 50 days. The age of the experimental animals was 62.3 ± 7.4 days on average after birth, and they had a body condition score between 2.5 and 3.5 on a scale from 1 to 5, with 1 indicating very thin and 5 indicating very fat (Ferguson et al., 1994). The cows were synchronised and inseminated at a fixed time according to the following protocol: on the first day (D0), the cows received an intravaginal progesterone implant (Cronipres®, Biogénesis-Bagó, Garin, Buenos Aires, Argentina) and intramuscular application of 2 mg oestradiol benzoate (Bioestrogen®, Biogénesis-Bagó) After eight days (D8), the implant was removed, and 0.15 mg sodium cloprostenol (Croniben®, Biogénesis-Bagó), 300 UI equine chorionic gonadotropin (Folligon®, Intervet International B.V., Boxmeer, Holland) and 1 mg oestradiol cypionate (ECP®, Pfizer, Pharmacia and Upjohn Company, NY, USA) were administered. Forty-eight hours after implant removal (D10), 0.004 mg buserelin acetate Cows were observed daily during morning and afternoon milking for up to 60 days after FTAI to identify animals with hoof problems and clinical mastitis. Animals with hoof lesions were restrained in a hoof trimming chute for cleaning and corrective treatment. Animals with clinical mastitis were medicated with an intramammary infusion containing 88 mg cefquinome sulphate (Cobactan VL®, Intervet International B.V.) after milking and every 12 h for four days. (Sincroforte®, Ouro Fino, Cravinhos, SP, Brasil) was administered intramuscularly, and the artificial insemination was performed.

Thus, the groups were divided into healthy cows (n = 106), cows treated for clinical endometritis (n = 83), cows affected by pododermatitis (n = 97) and cows suffering from clinical mastitis (n = 70), within each category of multiparous and primiparous. Pregnancy was diagnosed at 30 and 60 days after FTAI through ultrasonography with a 5.0 MHz linear transducer (DP 3300, Mindray, Nanshan, Shenzhen, China).

Data were statistically analysed using R software (R Core Team, 2014). Comparisons of the conception rate were performed by the nonparametric chi-square test, whereas the average calving-conception interval was analysed by Tukey's test, both with a 5% significance level.

RESULTS

The conception rate at 30 days after FTAI of multiparous cows affected by and treated for clinical endometritis (18.8%) was significantly lower than the conception rate of healthy cows (41.6%, P = 0.0262) and cows affected by pododermatitis (41.7%, P = 0.0170). However, multiparous cows affected by and treated for clinical endometritis had the same reproductive performance as cows affected by clinical mastitis (35.3%). For primiparous cows, neither of the evaluated diseases affected the conception rate at 30 days after FTAI compared with healthy cows (Table 1). For the diseases evaluated in this study, only clinical endometritis (15.6%) affected the conception rate at 60 days after the FTAI of multiparous cows compared with that of healthy cows (37.3%, P = 0.0389). Differences were not observed between the other groups of multiparous cows or primiparous cows (Table 2). Table 3 shows that in both categories of cows (multiparous and primiparous); differences were not observed in the calving-conception interval of healthy cows and cows affected by the diseases evaluated here.

DISCUSSION

In the multiparous category, the conception rate at 30 and 60 days after the FTAI of cows affected by endometritis was significantly lower than the conception rate of healthy cows. These results are consistent with a study conducted nearly three decades ago in which more cows with normal puerperium became pregnant in the first service (42%) compared with cows with some postpartum abnormality (24%) (Benmrad and Stevenson, 1986). Similar results were not observed in the primiparous cows of the study. Studies have found that the presence of endometritis has no effect on fertility when considering the conception rate at first insemination (Kasimanickam et al., 2006). The same authors explained that the use of hormonal protocols for FTAI, such as ovsynch or presynch, promotes uterine immune

Table 1. Conception rates at 30 days after the fixed-time artificial insemination of multiparous and primiparous health dairy cows, cows treated for clinical endometritis, cows affected by pododermatitis and cows suffering from clinical mastitis.

Category	Conception rate n (%)			
	Healthy	Endometritis	Pododermatitis	Mastitis
Multiparous (n = 205)	41.6[a] (26/62)	18.8[b] (9/47)	41.7[a] (24/58)	35.3[ab] (13/38)
Primiparous (n = 151)	43.8[a] (19/44)	28.6[a] (10/36)	33.3[a] (13/39)	22.2[a] (7/32)

Values followed by different letters in the same row are significantly different (P < 0.05).

Table 2. Conception rate at 60 days after the fixed-time artificial insemination of multiparous and primiparous health dairy cows, cows treated for clinical endometritis, cows affected by pododermatitis and cows suffering from clinical mastitis.

Category	Conception rate n (%)			
	Healthy	Endometritis	Pododermatitis	Mastitis
Multiparous (n = 205)	37.3[a] (23/62)	15.6[b] (7/47)	33.3[ab] (19/58)	29.4[ab] (11/38)
Primiparous (n = 151)	41.3[a] (18/44)	28.6[a] (10/36)	33.3[a] (13/39)	22.2[a] (13/39)

Values followed by different letters in the same row are significantly different (P < 0.05).

Table 3. Mean (± SD) of the calving-conception interval (in days) of multiparous and primiparous healthy dairy cows, cows treated for clinical endometritis, cows affected by pododermatitis and cows suffering from clinical mastitis.

Category	Average calving-conception interval ± Standard Deviation (days)			
	Healthy	Endometritis	Pododermatitis	Mastitis
Multiparous	149.94 ± 68.46 a	169.37 ± 96.02 a	188.80 ± 104.11 a	174.13 ± 116.46 a
Primiparous	156.69 ± 68.61 a	162.33 ± 111.79 a	181.00 ± 80.01 a	175.62 ± 86.42 a

Averages followed by the same letter on the same row do not differ from each other (P < 0.05).

mechanisms, thereby minimising the effects of endometritis. However, several studies have shown that uterine infections caused economic losses to livestock because they increase the number of services and reduce production (Andrade et al., 2005).

Uterine discharge does not affect the number of services per conception, although the calving interval and first insemination is longer in animals with endometritis (Williams et al., 2005). Differences in the calving-conception interval between healthy cows and cows treated for endometritis in multiparous (149.94 ± 68.46 versus 169.37 ± 96.02) and primiparous (156.69 ± 68.61 versus 162.33 ± 111.79) cows were not observed in this study. These results are consistent with the results of another study in which the calving-conception interval did not change in cows that had endometritis, were treated by intra-uterine infusions of ceftiofur and received PGF2α in the oestrus synchronisation protocol (P >0.05) (Galvão et al., 2009).

Recent studies have shown that cows treated for endometritis experienced an average delay of 28 days in the calving-conception interval, and this delay can cause greater economic losses than what is experienced during disease treatment because a reduction in the conception rate and increase in the calving-conception interval cause a longer calving interval and lower milk production (Marques et al., 2012). These data are consistent with another study that reported a longer calving-conception interval for cows treated for endometritis compared with healthy cows (151 versus 119 days) (Leblanc et al., 2002).

Compared with the results obtained in this study, Melendez et al. (2003) showed that lame cows had lower conception rates than the control group at first service (17.5% versus 42.6%). Studies have shown that hoof problems reduced the ovarian activity of Holstein cows at 60 days postpartum (Gabarino et al., 2004), which is important because cows must experience ovarian cycling

to expel contaminants from the uterus (Benmrad and Stevenson, 1986). Another study observed conception rates at first service of 56 and 46% in cows without hoof problems and cows with lameness, respectively (Collick et al., 1989). These rates are greater than the values observed in this study, and this difference can be explained by the fact that oestrus synchronisation was performed in Collick et al. (1989) and FTAI was performed in the study.

In this study, the calving-conception interval was not affected by hoof lesions in the multiparous (149.94 ± 68.46 versus 188.80 ± 104.11) and primiparous (156.69 ± 68.61 versus 181.00 ± 80.01) cows. However, the multiparous cows with pododermatitis tended (P = 0.0937) to have a longer calving-conception interval, which was 38.86 days greater than that of the healthy cows. When the hoof lesions affected the hindlimbs and forelimbs, the calving interval at first service increased by 2.9 and 4.6 days, respectively (Barkema et al., 1994). Other authors have reported that lame cows showed longer service periods than healthy cows (266 versus 200.5 days, respectively) and an increased incidence of metritis (25% versus 12.5%) and mastitis (60% versus 29%) compared with normal cows (Souza et al., 2006). Lame cows feel pain and stress that may predispose them to certain diseases, such as metritis and mastitis, and increased glucocorticoids, which cause premature luteolysis (Melendez et al., 2003).

In this study, the primiparous cows affected by mastitis (22.2%) tended to have a lower conception rate than healthy cows (43.8%) at 30 days (P = 0.0608). However, the embryonic and foetal mortality between 30 and 60 days was low for multiparous cows and absent in primiparous cows suffering from mastitis. A reduced conception rate in animals with mastitis may be related to the mechanism of maternal recognition because mastitis promotes the production of several bioactive molecules that can disrupt the functioning of the reproductive system (Slebodzinski et al., 2002).

According to the literature, prostaglandins are under the control of a several cytokines, including tumour necrosis factor-α (TNF-α) and interleukin (IL)-1α, which can increase the secretion of prostaglandin F2α (PGF2α) by the endometrium (Skarzynski et al., 2000). It has been shown that there is an increase of mRNA for IL-1α, IL-1β, TNF-α, IL-10 and IL-12 and protein for TNF-α in cells derived from milk that cause an infection of mammary-glands. Thus, the release of cytokines into blood during mastitis can induce the release of PGF2α and premature luteolysis (Waller et al., 2003).

Premature luteolysis was observed in cows suffering from mastitis, although it was not observed in normal cows. Furthermore, the oestrus cycle was longer when mastitis occurred during the follicular phase, and these results indicate that mastitis can affect postpartum ovarian activity in dairy cows (Huszenicza et al., 2005). Differences were not observed in the calving-conception interval of cows that were healthy and affected by mastitis in both the multiparous (149.94 ± 68.46 versus 174.13 ± 116.46, respectively) and primiparous categories (156.69 ± 68.61 versus 175.62 ± 86.42, respectively).

Although significant differences were not observed in the calving-conception interval of the categories evaluated in the study, dairy farmers can suffer economic losses because of disease treatment and lower milk production. Therefore, adequate nutritional, sanitary and reproductive management can help reduce unnecessary expenses that can be converted into revenue.

Conclusion

Based on the results obtained in this study, endometritis was shown to affect the conception rate of multiparous cows at 30 and 60 days after FTAI, although it does not influence the primiparous cows. Pododermatitis and clinical mastitis do not affect the conception rate of either the multiparous or primiparous cows at 30 and 60 days after FTAI.

Conflict of interests

The author(s) did not declare any conflict of interest.

ACKNOWLEDGEMENTS

The authors are grateful to the owners and staff at Fazenda Gamela, who spared no effort in performing these experiments, and appreciate the IF-Goiano - Rio Verde Campus for their support in implementing this study.

Ethics committee

The study was approved by the Ethics Committee of the Goias Federal Institute of Education, Science and Technology (Instituto Federal de Educação, Ciência e Tecnologia Goiano – IF Goiano) and filed under protocol number 033/2012.

REFERENCES

Andrade JRA, Silva N, Silveira W, Teixeira MCC (2005). Estudo epidemiológico de problemas reprodutivos em rebanhos bovinos na bacia leiteira de Goiânia [An epidemiological study of reproductive failure in dairy herds from Goiânia]. Arq. Bras. Med. Vet. Zootec. 57(06):720-725.

Barkema HW, Westrik JD, Keulen KAS, Schukken YH, Brand A (1994). The effects of lameness on reproductive performance, milk production and culling in Dutch dairy farms. Prev. Vet. Med. 20:249-259.

Benmrad MF, Stevenson SJ (1986). Gonadotropin-realising hormone and prostaglandin F2α for postpartum dairy cows: estrous, ovulation, and fertility traits. J. Dairy Sci. 69:800-811.

Carneiro DMVF, Domingues PF, Vaz AK (2009). Imunidade inata da

glândula mamária bovina: resposta a infecção. Cienc. Rural 39(6):1934-1943.
Collick DW, Ward WR, Dobson H (1989). Associations between types of lameness and fertility. Vet. Rec. 125:103-106.
Dohmen MJW, Joop K, Sturk A, Bols PEJ, Lohuis JACM (2000). Relationship between intra-uterine bacterial contamination, endotoxin levels and the development of endometritis in postpartum cows with dystocia or retained placenta. Theriogenology 54(7):1019-1032.
Ferguson JD, Galligan DT, Thomsen N (1994). Principal Descriptors of Body Condition Score in Holstein Cows. J. Dairy Sci. 77(9):2695-2703.
Gabarino EJ, Hernandez JA, Shearer JK, Risco CA, Thatcher WW (2004). Effect of lameness on ovarian activity in postpartum Holstein cows. J. Dairy Sci. 87(12):4123-4131.
Galvão KN, Greco LF, Vilela JM, Sá Filho MF, Santos JE (2009). Effect of intrauterine infusion of ceftiofur on uterine health and fertility in dairy cows. J. Dairy Sci. 92(4):1532-1542.
Hansen PJ, Soto P, Natzke RP (2004). Mastitis and Fertility in Cattle – Possible Involvement of Inflammation or Immune Activation in Embryonic Mortality. Am. J. Reprod. Immunol. 51(4):294-301.
Huszenicza G, Janosi S, Kulcsa M, Korodi P, Reiczigel J, Katai L, Peters AR, De Rensis F (2005). Effects of clinical mastitis on ovarian function in post-partum dairy cows. Reprod. Domest. Anim. 40(3):199-204.
Kasimanickam R, Cornwell JM, Nebel RL (2006). Effect of presence of clinical and subclinical endometritis at the initiation of presynch-ovsynch program on the first service pregnancy in dairy cows. Anim. Rep. Sci. 95(3):214-223.
Leblanc SJ, Duffield TF, Leslie KE, Bateman KG, Keefe GP, Walton JS Johnson WH (2002). Defining and diagnosing postpartum clinical endometritis and its impact on reproductive performance in dairy cows. J. Dairy Sci. 85(9):2223-2236.
Marques TC, Rodrigues MC, Silva NC, Oliveira MC, Leão KM, Viu MAO (2012). Desempenho reprodutivo de vacas leiteiras acometidas e tratadas de endometrite clínica. In: Resumos da 49ª Reunião Anual da Sociedade Brasileira de Zootecnia (Brasília, Brasil). Available at: <http://eventweb.com.br/sbz2012/home-event/schedule.php?sessao=&q=endometrite&area=177&busca_por=tudo>. Access: 11/2014.
Melendez P, Bartolomeu J, Archbald LF, Donavan A (2003). The association between lameness, ovarian cysts and fertility in lactating dairy cows. Theriogenology 59(3):927-937.
R Core Team (2014). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/.
Sheldon IM, Williams EJ, Miller ANA, Nash DM, Herath S (2008). Uterine diseases in cattle after parturition. Vet. J. 176(1):115-121.
Sheldon M (1997). Bovine fertility-practical implications of the maternal recognition of pregnancy. Farm Anim. Pract. 19(10):546-54.
Skarzynski DJ, Miyamoto Y, Okuda K (2000). Production of prostaglandin F2a by cultured bovine endometrial cells in response to tumour necrosis factor a: cell type specificity and intracellular mechanisms. Biol. Reprod. 62:1116-1120.
Slebodzinski AB, Malinowski E, Lipczak W (2002). Concentrations of triidothyronine (T3), tumour necrosis factor-a (TNF-a) and interleukin-6 (IL-6) in milk from healthy and naturally infected quarters of cows. Res. Vet. Sci. 72(1):17-21.
Souza RC, Ferreira PM, Molina LR, Carvalho AU, Facury Filho EJ (2006). Perdas econômicas ocasionadas pelas enfermidades podais em vacas leiteiras confinadas em sistema free stall. Arq. Bras. Med. Vet. Zootec. 58(6):982-987.
Waller KP, Colditz IG, Ostensson K (2003). Cytokines in mammary lymph and milk during endotoxin-induced bovine mastitis. Res. Vet. Sci. 74(1):31-36.
Williams EJ, Fischer DP, Pfeiffer DU, England GCW, Noakes DE, Dobson H, Sheldon IM (2005). Clinical evaluation of postpartum vaginal mucus reflects uterine bacterial infection and the immune response in cattle. Theriogenology 63(1):102-117.