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EFFECT OF DIFFERENT DOSES OF SODIUM CLOPROSTENOL AT POST-PARTUM PERIOD OF BEEF COWS

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ABSTRACT

Reestablishment of reproductive activity after parturition is dependent on two physiological processes, uterine involution and reestablishment of the ovarian luteal cyclic activity. Impaired or delayed uterine involution can affect ovarian activity. Prostaglandin F2α (PGF2α) has an important function in uterine involution. The use of PGF2α synthetic analogous in bovine postpartum, however, has been limited. The aim of this study was to compare the effect of two different doses of a racemic cloprostenol mixture (D+L-Cloprostenol) given in the postpartum period, on reproductive performance of crossbred beef cows. Beef cows with normal parturition were randomly distributed into three groups: G1 (n=144), Control Group; G2 (n=145), 0.530mg of D+L-Cloprostenol, given IM at three to five days after parturition, and G3 (n=145), 1.060 mg of D-Cloprostenol, in the same schedule of group 2. The following parameters were evaluated: services per conception (χ^2), days from parturition to first estrus, and open days (Tukey test). There was no difference in body score condition among groups at parturition or during postpartum period (P>0.05). There was also no difference in the number of services per conception. The average number of days from parturition to first estrus was 88.77 $\pm$ 23.64^a; 77.59 $\pm$ 26.95^b and 76.22 $\pm$ 26.28^b, and the average number of open days open was 97.34±26.54^a, 86.38±28.81^b and 85.23±30.12^b for groups 1, 2 and 3, respectively (P<0.05). Regardless cloprostenol doses, the treatments anticipated the beginning of reproductive activity in more than 10 days. The treatment with sodium cloprostenol in the post-partum period of zebu beef cows is an alternative to reduce anestrous postpartum and open days.

KEYWORDS: bovine; prostaglandins; uterine involution.

EFEITO DE DIFERENTES DOSES DE CLOPROSTENOL SÓDICO NO PERÍODO PÓS-PARTO DE VACAS DE CORTE

RESUMO

O restabelecimento da atividade reprodutiva pós-parto é dependente de dois processos fisiológicos, a involução uterina e o restabelecimento da atividade luteal cíclica. Problemas ou atrasos na involução uterina podem afetar diretamente a atividade ovariana pós-parto. As prostaglandinas F2α (PGF2α) exercem uma importante função no processo de involução uterina. Entretanto, a utilização dos análogos sintéticos da PGF2α para estimular involução uterina em bovinos tem sido pequena. O objetivo deste estudo foi avaliar o efeito de duas doses de uma mistura racêmica de cloprostenol (D+L-Cloprostenol), aplicadas no pós-parto imediato, sobre o desempenho reprodutivo de vacas mestiças de corte. Vacas de corte com parto normal foram divididas aleatoriamente em três grupos: G1(n=144), grupo controle; G2 (n=145), 0.530mg de D+L-Cloprostenol, aplicados IM de três a cinco dias após o parto, e G3 (n=145), 1.060 mg de D+L-Cloprostenol, no mesmo protocolo de G2. Foram analisados os serviços por concepção (χ^2), dias do parto à primeira inseminação e

período de serviço. Não foram observadas diferenças no número de serviços por concepção nos três grupos (P>0.05). A média de dias do parto à primeira inseminação foi de 88,77 ± 23,64[a]; 77,59 ± 26,95[b] e 76,22 ± 26,28[b], e o intervalo parto-concepção foi de 97.34±26.54[a]; 86,38 ± 28,81[b]; 85,23 ± 30,12[b], para os grupos 1, 2 e 3, respectivamente (P<0.05). O tratamento, independente da dose de cloprostenol, antecipou o reinicio da atividade reprodutiva em mais de 10 dias. A aplicação de cloprostenol sódico no pós-parto pode melhorar a eficiência reprodutiva de vacas de corte. Não existem diferenças entre as duas doses comparadas.

PALAVRAS-CHAVE: bovino; involução uterina; prostaglandinas.

INTRODUCTION

The period from calving to resumption of reproductive activity depends basically on two physiological processes, related to the period of uterine involution and also the time required for the resumption of cyclic ovarian activity. This period is defined as postpartum (FERREIRA et al. 1999). For the cow, postpartum has been defined as the period from delivery to the onset of the first estrus, in which new pregnancy can be established, implying complete uterine involution and return of endocrine activity, with full reactivation and synchrony of the hypothalamic-pituitary-ovarian axis, allowing follicular growth, estrus, ovulation, conception, development of the corpus luteum and pregnancy (MARQUES JÚNIOR, 1993).

There is no synchrony between the onset of ovarian activity, which restarts and can be completed in about two to three weeks after delivery, and uterine involution, which appears to be complete in about 45 days (MARQUES JÚNIOR, 1993). Some authors, however, report that a rapid uterine involution is important to the return to reproductive activity. According to SHELDON et al. (2000), there is a correlation between uterine involution and return to postpartum ovarian activity. These authors claim that the delay in uterine involution may delay the presence of functional activity in the ovaries, postponing the onset of the first estrus.

According to MARQUES JÚNIOR (1993), the postpartum period is the most important in the context of management, because it represents the period of greatest vulnerability of animal to problems that affect future fertility and reproductive efficiency. The uterine involution of the cow is quite complex, partly because of the type of placenta of this species. After parturition, the fetal cotyledons are separated from maternal caruncles. The caruncles and the rest of the uterine wall undergo a process similar to an inflammation. The uterine mass, after normal parturition, weighs about 10 kg, and decreases to 0.7-0.8 kg until the sixth week after delivery, when the involution is completed. Thus, in the period immediately after parturition, there is an alteration in the uterine tissue mass 10 times greater than its regular size (KASK et al., 1999).

The process of involution involves modification in the inner coating layer and also in the contractile activity of the myometrium to expel the remaining contents after parturition and to reduce the size of the uterus. The uterine involution can be linked to a process of inflammation (SHELDON et al., 2000). CHAGAS et al. (1998) carried out the histological evaluation of the uterus in cows in the postpartum, and found that the animals that showed more evident signs of inflammatory process had faster involution.

As in cases of inflammation, prostaglandins play an important role in the uterine involution (BENCHARIF et al., 2000). In addition to accelerating the process of involution, prostaglandin F2 α (PGF2 α) stimulates the activity of the uterine muscle layer (myometrium) after parturition. This substance is normally produced by the uterus and it is responsible for proper postpartum uterine involution within normal time. TANIKAWA et al. (2005) indicated that prostaglandins, besides having an important role in the immediate postpartum period, also act after complete uterine involution, participating in various physiological events.

Synthetic analogues of PGF2 α have been widely used to control the functional activity of the corpus luteum. Although its application in postpartum of cows has been rarely used in Brazil (FERNANDES & FIGUEIREDO, 2007), it is routine in other countries (BENCHARIF et al. 2000). ALBUQUERQUE et al. (1997) reported a beneficial effect on uterine involution in cows treated with the same synthetic analogue. These authors' results showed improved reproductive performance when cloprostenol was applied between 12 and 18 days after parturition.

FERNANDES (1999), studying animals with retained placenta, found beneficial effects of the application of cloprostenol. Treated cows showed faster uterine involution and also a shorter interval from parturition to first estrus, compared to those presenting the same condition, but not treated with the drug. ZAIEM et al. (1997) verified that cows that

received an application of a synthetic analogue of prostaglandin in the postpartum showed faster uterine involution than the control group.

From the work originally published by FERNANDES et al. (2002ab), the use of sodium cloprostenol in postpartum of dairy cows has become viable. The studies showed that in addition to accelerate uterine involution, the drug decreased the incidence of infections, the number of services per conception and the service period. Several other studies in different management systems subsequently corroborated these findings (FIGUEIREDO et al., 2000; ZANCHET, 2005).

The use of prostaglandin analogues in the postpartum period of beef cattle also proved to be a very efficient protocol in two applications (FERNANDES et al.2005). Besides being simple, it presents a great cost-benefit relation. This type of protocol, however, has met resistance for use in cattle, due to the management difficulties related to two applications. A viable alternative to the use of this protocol in a common management system of beef cattle would be to use higher doses in a single application.

The aim of this study was to evaluate the application of two doses of cloprostenol (analogue prostaglandin F2α) in the immediate postpartum period on reproductive performance of beef cows.

MATERIAL AND METHODS

This study was conducted over a period of six months in the southwest of the state of Minas Gerais, on a beef cattle farm, where artificial insemination was the only way to cover the cows. The herd was composed of Nellore crossbred with European breeds. In the farm, the breeding season of 90 days was adopted for the insemination of females. There are three cores (herds, staff and infrastructure) that function as distinct properties, in which the workforce and the animal management are independent.

To avoid the influence of other variables such as management and nutritional and climatic aspects, we conducted the experiment in each of the cores, and evaluated the different treatment groups simultaneously.

We used 461 beef cows, which had normal parturition (without any intervention or occurrence of problems). After parturition, the animals were randomly divided into three treatment groups as described in Table 1.

An employee from each of the cores was trained to take notes (type of treatment, date of birth, body score, among others), to carry out additional procedures and apply the products, besides receiving a sheet for notes, with pre-determined treatments, where females were distributed after delivery. A group of cows was used as control, i.e. they were not treated, and the variables were compared with the other groups. The females of the control group were treated with saline solution.

Table 1: Scheme of treatment of animals after parturition

Group.	N	Treatment
Group 1 - control	152	2 mL of intramuscular saline solution- Control Group
Group 2	151	0.530 mg of cloprostenol intramuscularly on the day of delivery or on the next day
Group 3	158	1.060 mg of cloprostenol intramuscularly on the day of delivery or on the next day

We assessed the body condition score, on a scale of 1 to 5, as cited by FERNANDES et al. (2002a), at the time of application and between 30 and 45 days after parturition. A comparison of these variables means was used to define homogeneity pattern regarding the nutritional aspects between groups.

For treatments, all intramuscularly in the gluteal region, we used 3ml syringes and 40x8 needles, both disposable. During the experimental period, the property was visited regularly at monthly intervals for gynecological examinations of the animals and data collection.

Regarding reproductive performance, we evaluated and compared the following variables: interval from parturition to first AI; number of services / conception; and period of services. These data were submitted to analysis of variance (ANOVA), and, in case of difference, the means were compared by Tukey test. The body condition score (BCS) after parturition and 30-45 days postpartum was assessed by non-parametric

Wilcoxon test. For statistical analysis we used the program SAEG.

RESULTS AND DISCUSSION

The mean body condition score of the animals did not differ among the evaluated cores or the different treatments (P> 0.05), within the same period (pre or postpartum). Differences were observed in body condition score (BCS) between the two periods. The mean BCS of females in the assessment between 30 and 45 days postpartum was lower than the mean of this variable in prepartum (P <.05). It is a common situation, even in beef cows, because, although they do not present a large dairy production, they undergo a period of negative energy balance after calving, which leads to the consumption of body reserves, influencing the BCS (DISKIN et al., 2003).

In all herds and treatments the occurrence of problems was low (4.32%), with no differences in the occurrence of postpartum problems among the different cores or treatment groups. FERNANDES et al. (2002b) reported a lower incidence of uterine infection in dairy cows treated with cloprostenol compared with untreated animals. This difference probably occurred because of the significantly higher incidence of this kind of pathology in dairy cattle: 32.3% (MILLER & DORN 1990); 25.3% (LOEFFLER et al. 1999); 18.8% (FERNANDES et al. 2000).

There were no differences (P> 0.05) of reproductive performance (none of the variables) among all animals in different cores or between production cores within the same treatment group (Tables 2-4). Because of that, the analysis of all treatments was carried out joining the animals coming from the three locations.

The effect of different treatments was similar in the three cores. The difference in performance of the treated animals compared with control animals shows the repeatability of the treatments. FERNANDES et al. (2005) worked with beef cattle, and reported similar results, confirming that the use of cloprostenol in the immediate postpartum can improve reproductive efficiency.

Regarding dairy cattle, FERNANDES et al. (2002ab) found greater improvement of the reproductive performance of treated animals than the one observed in this study, which is probably due to the differences in management and genetics among beef and dairy herds. In the case of beef cattle, the presence of the calf near the cows, throughout the postpartum period, may influence the return of ovarian activity (BUTLER, 2005).Other studies with beef cattle (FERNANDES et al., 2005) showed very similar effects to those found in the present study (Table 2).

Table 2: Overall mean interval from parturition to first insemination in the different production cores and different treatment groups

Treatment			Cores		
	N	Overall mean	1	2	3
Control	152	88.77 ± 23.64 [a]	92.16 ± 25.35 [a1]	85.66 ± 28.90 [a1]	90.40 ± 26.84 [a1]
0.530 mg	151	77.59 ± 26.95 [b]	81.52 26.07 ± [b1]	75.78 27.12 ± [b1]	78.30 26.61 ± [b1]
1.060 mg	158	76.22 ± 26.28 [b]	80.55 24.75 ± [b1]	74.32 23.33 ± [b1]	75.60 31.25 ± [b1]
Core Average			85.11 ± 31.35 [1]	78.61 ± 28.46 [1]	82.95 ± 29.54 [1]

Means followed by the same letter in the column do not differ at 5% probability.
Means followed by the same number in the line do not differ at 5% probability.

According to SHELDON et al. (2000), there is a positive correlation between uterine involution and return to postpartum ovarian activity. These authors claimed that the delay in uterine involution may delay the presence of functional activity in the ovaries, retarding the onset of the first estrus. Although we did not assess the degree of uterine involution in this study, the mechanism previously described probably occurred because the animals treated with cloprostenol showed accelerated uterine involution, enabling faster return to postpartum reproductive activity. These findings corroborate the results of ALBUQUERQUE et al. (1997) who applied the same synthetic analog during a different postpartum period (12 to 18 days) and reported similar results, i.e., faster uterine involution in the animals that received the treatment. HENDRICKS et al. (2005), using analogues of PGF2 α during a more advanced postpartum period did not verify benefits to reproductive efficiency. During the same period, three to five weeks after birth, HIRSBRUNNER et al. (2006) also saw no beneficial effects of using only one dose of PGF2 α for dairy cows. It is difficult to compare results of different studies conducted in animals under different conditions, considering the range of related variables.

According to MARQUES JÚNIOR (1993), prostaglandina2α is one of the most important substances for uterine involution in cows. Synthetic analogues, in this case cloprostenol, can also show beneficial results in this process. FERNANDES et al. (2001) observed a similar situation for cows with retained placenta that showed a delay in uterine involution and return to postpartum ovarian activity.

We did not verify any differences regarding the number of services per conception in the different groups and herds evaluated (Table 3).

Table 3: Overall mean of the number of services per conception in the different production cores in the different treatment groups

Treatment		Treatment Mean	Cores		
	N		1	2	3
Control	152	1.41 ± 0.62 [a]	1.40 ± 0.62 [a1]	1.42 ± 0.62 [a1]	1.41 ± 0.59 [a1]
0.530 mg	151	1.36 ±0.54 [a]	1.37 ± 0.67 [a1]	1.37 ± 0.49 [a1]	1.35 ± 0.64 [a1]
1.060 mg	158	1.38 ± 0.70 [a]	1.37 ± 0.72 [a1]	1.39 ± 0.77 [a1]	1.39 ± 0.71 [a1]
Core Mean			1.39 ± 0.71 [1]	1.41 ± 0.58 [1]	1.37 ± 0.66 [1]

Means followed by the same letter in the column do not differ at 5% probability.
Means followed by the same number in the line do not differ at 5% probability.

FERNANDES et al. (2005) did not find differences between treated and control groups regarding the number of services per conception in a study using cloprostenol in postpartum of beef cattle. In dairy cattle, however, FERNANDES et al. (2002b) showed that this variable was lower in cows from the group treated with two doses of cloprostenol. This difference probably occurred because the animals in this study showed a lower incidence of uterine infection. The uterine infections may leave sequelae in the endometrium that affect fertility (SHELDON et al., 2000).

As there was no difference in the number of services per conception, the treated animals showed lower service period ($p < 0.05$ - Table 4) due to the shorter interval between parturition and first estrus,
The treatment with cloprostenol, regardless of the dose, was effective in accelerating the return of postpartum reproductive activity and also the interval from parturition to conception, called service period. The results (Table 4) showed that, on average, the animals that received a dose of 0.530 mg of cloprostenol became pregnant 11 days earlier than the control group, while the animals that received 1.060 mg became pregnant about 12.1 days earlier; therefore, there was no difference ($p > 0.05$) between the different doses. Assuming an average pregnancy period of 290 days for Zebu females to produce a calf / year, the interval between parturition and the next conception must not exceed 75 days (FERREIRA et al. 1,999); therefore the 10-day anticipation obtained in this work is a valuable tool to increase reproductive efficiency of cattle.

Table 4: Overall mean of service period in different production cores and in the different treatment groups

Treatment		Treatment Mean	Cores		
	N		1	2	3
Control	152	97.34 ± 26.54 [a]	99.96 ± 30.07 [a1]	94.89 ± 32.73 [a1]	98.44 ± 29.98 [a1]
0.530 mg	151	86.38 ± 28.81 [b]	89.79 29.73 ± [b1]	83.77 31.11 ± [b1]	86.69 28.69 ± [b1]
1060 mg	158	85.23 ± 30.12 [b]	88.97 28.74 ± [b1]	83.05 28.42 ± [b1]	85.78 33.01 ± [b1]
Core Mean			92.98 ± 32.12 [1]	85.85 ± 33.18 [1]	90.34 ± 32.19 [1]

Means followed by the same letter in the column do not differ at 5% probability.
Means followed by the same number in the line do not differ at 5% probability.

According to FERNANDES et al. (2002ab), animals receiving higher doses of cloprostenol (1.060 mg) divided into two applications (0.530 + 0.530 mg) exhibited higher reproductive performance than animals receiving a single application of 0.530 mg. This effect was not observed in the current work because cloprostenol has short half-life, and the highest dose (1,060 mg)

in a single application may have saturated the receptors and some of it was metabolized without producing any effect. However, this is an assumption that should be evaluated in further studies.

CONCLUSIONS

The application of cloprostenol in two doses used in the immediate postpartum of beef cows accelerates the return to reproductive activity and the period of service. There is no difference in reproductive performance of animals receiving any of the tested doses of cloprostenol, 0.530 or 1.060 mg. We recommend the dose of 0.530 mg because of the lower cost.

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