

# **The Effect of Administration of PGF<sub>2</sub> During Early Postpartum on Reproductive Efficiency of Cross-bred Dairy Cows in The Sudan**

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## **Abstract**

The present study was designed to investigate the effects of administration of prostaglandin F<sub>2α</sub> (PGF<sub>2α</sub>) during early postpartum on the time taken for uterine involution (UI), length of postpartum interval (PI), the number of services per conception (NS); days open (DO) and calving interval (CI) in dairy cows. A total of 20 cross-bred postpartum dairy cows were employed to execute the effect of PGF<sub>2α</sub> on the above mentioned postpartum parameters. The cows were randomly distributed into 2 groups. Group I (n=15) was intramuscularly injected with 500 μg of PGF<sub>2α</sub> between the 1<sup>st</sup> and the 3<sup>rd</sup> week postpartum. Group II (n=5) was employed as untreated control. The results of this experiment showed that the time taken for UI was not affected ( $p>0.05$ ) by injection of PGF<sub>2α</sub>. However, PI ( $84.0 \pm 7.2$  day), NS ( $1.1 \pm 0.0$ ), DO ( $85.7 \pm 7.9$  day) and CI ( $359.9 \pm 7.3$  day) of the treated cows were less ( $p<0.01$ ) than that of the control. It is concluded that the use of PGF<sub>2α</sub> during early

postpartum improves the reproductive efficiency of dairy cows.

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Key words: Dairy cows; postpartum, Prostaglandin  $F_{2\alpha}$ ; reproductive efficiency.

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## Introduction

Postpartum period is unnecessarily long in crossbred dairy cows in the Sudan (Musa, 2001; Elhag; 2003). This long postpartum period will affect the reproductive and the productive traits of the dairy cows. The reproductive efficiency of the dairy cows is based on uterine involution; the recuperation of ovarian activity postpartum (occurrence of first oestrus postpartum); days open and the number of services per conception (Prandi et al., 1994; Prandi et al.,1999).

Prostaglandin  $F_{2\alpha}$  ( $PG F_{2\alpha}$ ) is widely used for management of postpartum reproductive efficiency (Zemjanis, 1980; Kindahl et al., 1982; Young et al., 1984; Youngquist, 1988; Risco et al., 1995; Michel et al.,1999; Schofield et al., 1999).

Large amount of  $PGF_{2\alpha}$  are produced by the postpartum uterus (Guilbault et al., 1984 and 1987).  $PGF_{2\alpha}$  increases after the end of parturition to reach peak values during the 1<sup>st</sup> wk postpartum and does not return to basal levels until 15 day (Edqvist et al., 1980). The administration of exogenous  $PGF_{2\alpha}$  postpartum improved conception rate (Michel et al., 1999 and reduced the calving to conception interval (Schofield et al., 1999).

$PGF_{2\alpha}$  plays an important role in uterine involution (Kindahl et al., 1982; Young et al., 1984; Youngquist, 1988; Salam, et al. 1994; Toribio et al., 1995). Furthermore,  $PGF_{2\alpha}$  treatment is known to reduce the

number of services per conception and increase the conception rate (Young et al., 1984; Toribio et al., 1995; Schofield et al., 1999).

The aim of the current investigation was to study the effectiveness of PGF<sub>2α</sub> treatment during the first 3 weeks postpartum for management of reproductive efficiency in dairy cows.

### **Materials and methods:**

#### ***Experimental Animals:***

The experiment used the University of Khartoum dairy farm herd. The farm lies within a semi-arid zone at latitude 15:6 ° and longitude 32:32 ° , and 376 meters above sea level. The cows are crossbred (Friesian × Kenana). They were multiparous and their ages were above 4 years. Their body condition scores were estimated between 2.5 to 3.5 at parturition according to the scale of the United States of America (Wildman et al., 1982). The cows calved during the Winter of 2001. All cows were fed Alfalfa ad libidum and were individually fed dairy concentrates (10 kg/cow). The concentrate consists of 37 % sorghum, 21% cotton seed cakes, 40% wheat bran and 2% sodium chloride. Routine testing for brucellosis and vaccination against the major diseases were practiced once a year.

### ***Milk sampling:***

During the experiment milk samples were collected 10 days apart following parturition until the cows were confirmed in the luteal phase of the first postpartum oestrus. Ten milliliters from evening milk is collected from each cow in plastic vials and preserved with one tablet of sodium azide (100mg/10 ml). The preserved milk samples were centrifuged, at 2500 g for 15 minutes within one hour of collection, to skim milk fat. The separated milk samples were placed in a refrigerator (4 ° C) for 15 minutes to harden the fat layer. The fat layer was pierced with a glass rod and the skim milk samples were transferred to cryogenic vials and stored at -20 ° C until assayed for progesterone.

### ***Milk progesterone radio immunoassay (P4 RIA)***

P 4 conc. in the milk was assayed according to FAO/IAEA progesterone RIA protocol version 3.1 (1996). The detection limit (minimal detectable dose) of the assay is approximately 0.02 ng/ml.

### ***Uterine involution (UI):***

Uterine involution was determined by rectal palpation every other day immediately after delivery till complete uterine involution occurred. The uterus is considered involuted when it's horn is equal to two fingers and its body is palpated in the pelvic cavity (Arthur et al., 1998)

***Detection of postpartum oestrus and determination of postpartum interval (PI):***

The recrudescence of oestrus postpartum was determined by observation and P<sub>4</sub> RIA. Well-trained herdsmen observed the animals, for 20 minutes, thrice daily (7:00, 13:00, 19:00). The cow is considered in oestrus when it stands to be mounted by other cows or it mounts others and a clear mucous discharge hangs from its vulva. The recrudescence of oestrus postpartum is confirmed by P<sub>4</sub> RIA. The cow was considered in the luteal phase of the first postpartum oestrus when its milk P<sub>4</sub> concentration is 0.12 ng/ml or more (Gong et al., 2002). The PI was calculated as the time elapsed from parturition to the occurrence of first oestrus postpartum (Arthur et al., 1998).

***The number of services per conception (NS):***

The cows which exhibited oestrous behaviours in a period less than 42 days postpartum were not served. But those, which exhibited oestrous behaviour after that time, were served with a cross-bred bull with a proven fertility. The NS had been calculated according to Arthur et al. (1998) from the number of services given to the experimental animals after recrudescence of the postpartum oestrus and resulted in diagnosed pregnancy.

### ***Days open (DO) and pregnancy diagnosis:***

The DO had been determined by counting the interval, in days, from calving to the subsequent effective service date for those cows that conceived (Arthur et al., 1998). Pregnancy diagnosis was carried out for none return cows by rectal palpation at 42 days after the last service (Arthur et al., 1998).

### ***Calving interval (CI):***

The CI is the period between two consecutive calvings and was calculated according to Arthur et al. (1998)

### ***Experimental design:***

This experiment was designed to study the effects of PGF<sub>2α</sub> treatment during the first 3 wk postpartum on UI; PI; NS; DO; and CI in cross-bred Sudanese dairy cows. Twenty cross-bred postpartum dairy cows were used to examine the effects of PGF<sub>2α</sub> on the above mentioned parameters. Fifteen postpartum dairy cows were intramuscularly injected with 500 μg PGF<sub>2α</sub> (Estrumate, Coopers, England) between the 1<sup>st</sup> and 3<sup>rd</sup> week postpartum. The remaining 5 cows were employed as control. The milk samples were collected as mentioned in the materials and methods. The reproductive traits in question were assessed as mentioned above.

### ***Statistical analysis***

The data were statistically evaluated by ANOVA followed by Fisher's protect least significant difference (PLST). Differences at probability of  $P < 0.05$  were considered to be statistically significant.

## **RESULTS**

### ***Uterine involution (UI)***

The results showed that injection of  $\text{PGF}_{2\alpha}$  between the 1<sup>st</sup> week and the 3<sup>rd</sup> week postpartum has no effect on UI ( $p > 0.05$ ). The mean time taken for UI in treated cows was  $24.1 \pm 0.9$  days and that of the control was  $26.4 \pm 1.4$  days.

### ***Postpartum interval (PI)***

The results also showed that injection of  $\text{PGF}_{2\alpha}$  between the 1<sup>st</sup> and the 3<sup>rd</sup> week postpartum significantly ( $P < 0.01$ ) reduced the PI as compared with the control. The mean length of PI of the treated cows was  $84.0 \pm 7.2$  days and that of the control was  $125.4 \pm 5.6$  days (Fig. 1).

### ***Number of services per conception (NS):***

As in Fig. 2. the number of services per conception for cows administered with  $\text{PGF}_{2\alpha}$  between the 1<sup>st</sup> and the 3<sup>rd</sup> week postpartum

was significantly different ( $P < 0.01$ ) from that of the control ( $1.1 \pm 0.0$  ;  $1.6 \pm 0.2$ , respectively)

***Days open (DO):***

As shown in Figure (3) postpartum cows injected with  $\text{PGF}_{2\alpha}$  between the 1<sup>st</sup> and the 3<sup>rd</sup> week postpartum showed a significantly ( $p < 0.01$ ) shorter DO compared to the control. The mean length of DO of the treated cows was  $85.7 \pm 7.9$  and that of the control was  $138 \pm 8.01$  days (Fig.3).

***Calving interval (CI):***

The results showed that treatment with  $\text{PGF}_{2\alpha}$  significantly ( $p < 0.01$ ) reduced the CI compared to the control. The mean CI of the treated postpartum cows was  $359.9 \pm 7.3$  days and that of the control was  $412.6 \pm 7.7$  days (Fig.4).

## **Discussion**

Injection of  $\text{PGF}_{2\alpha}$  during the first, second, third or the fourth week postpartum reduced the time taken for UI (Young et al., 1984; Kindahl et al., 1982). This reduction in the time taken for UI is due to the ecboic effect of  $\text{PGF}_{2\alpha}$ , which increases uterine muscle tone and accelerates UI (Lindell & Kindahl, 1983). The results of the current investigation showed that injection of  $\text{PGF}_{2\alpha}$  between the 1<sup>st</sup> and 3<sup>rd</sup> week postpartum

has no effect on UI. This finding disagrees with the above mentioned findings. This difference is probably due to breed difference or the treatment regime.

Sequential treatment with  $\text{PGF}_{2\alpha}$  during the third, fifth or the eighth week postpartum stimulates early cyclicity in dairy cows (Zemjanis, 1980; Risco et al., 1995). In the current investigation, when dairy cows were administered with  $\text{PGF}_{2\alpha}$  between the 1<sup>st</sup> and the 3<sup>rd</sup> week postpartum they recuperated their ovarian activity earlier, thus they had a reduced PI. This finding strongly supports the findings of Zemjanis (1980) and that of Risco et al. (1995). The findings of this study contrast the findings of Knight (cited by Schofield et al., 1999) who reported the failure of a single injection of  $\text{PGF}_{2\alpha}$  at day 14 -28 postpartum to induce the first oestrus.

The conception rate was improved in cows treated with  $\text{PGF}_{2\alpha}$  postpartum (Michel et al., 1999; Schofield et al., 1999). Also Young et al. (1984) reported that injection of  $\text{PGF}_{2\alpha}$  during the second or fourth week postpartum reduced the NS. The results of this study showed that injection of  $\text{PGF}_{2\alpha}$  during the 1<sup>st</sup> 3 weeks postpartum reduced the NS and this matches with the previous studies. This could be due to the ecboic effect of  $\text{PGF}_{2\alpha}$  that enhanced uterine involution.

The DO were reduced by injection of  $\text{PGF}_{2\alpha}$  during the postpartum period (Youngquist, 1988; Schofield et al., 1999).. According to the results of the present study it was found that injection of  $\text{PGF}_{2\alpha}$  during the

first 3 weeks postpartum shortened the DO. This finding agrees with that of Youngquist, (1988) and Schofield et al., (1999). Consequently the CI of the treated cows was reduced.

In conclusion, treatment with PGF<sub>2α</sub> during the first 3 weeks postpartum improves the reproductive efficiency of cross-bred dairy cows. Thus a calf per cow per year can be produced.

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**Title: Management of postpartum reproductive efficiency of dairy  
cows with PGF<sub>2α</sub>**

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**Running head: Management of postpartum interval**

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## تحسين الكفاءة التناسلية لأبقار اللبن بواسطة حقن هرمون البروستاغلاندين ( $PGF_{2\alpha}$ )

### عقب الولادة

عادل سالم الشيخ القراري وفيصل عمر احمد الزبير  
قسم التناسل والتوليد كلية الطب البيطري جامعة الخرطوم

### الخلاصة

صممت هذه الدراسة لمعرفة الأثر الذي يحدثه حقن هرمون البروستاغلاندين  $F_{2\alpha}$  في فترة النفاس على زمن ارتداد الرحم عقب الولادة (UI)، طول فترة النفاس (PI)، عدد التلقيحات اللازمة لإحداث الحمل (NS)، طول الفترة المفتوحة (DO)، وطول الفترة بين ولادتين (CI) في أبقار اللبن الهجين.

استخدمت عشرون بقرة هجين حلوب والدة حديثاً لمعرفة الأثر الذي يحدثه  $PGF_{2\alpha}$  في المعالم سالفة الذكر. وزعت هذه البقرات إلى مجموعتين: المجموعة الأولى (عدد= 15 بقرة) حقنت ب  $500 \mu g$  من  $PGF_{2\alpha}$  بالعضل ما بين الأسبوع الأول والثالث عقب الولادة والمجموعة الثانية (عدد=5 بقرة) لم تحقن واتخذت كمجموعة تحكم.

أثبتت هذه الدراسة أن حقن  $PGF_{2\alpha}$  في الفترة ما بين الأسبوع الأول والثالث عقب الولادة له تأثير معنوي واضح ( $p < 0.01$ ) في تقصير طول فترة النفاس ( $PI = 84.0 \pm 7.2$  يوم)، و تقليل عدد التلقيحات اللازمة للإخصاب ( $NS = 1.1 \pm 0.0$  تلقيحه)، تقليل طول الفترة المفتوحة DO ( $85.7 \pm 7.9$  يوم) وتقليل الفترة بين ولادتين CI ( $359.9 \pm 7.3$  يوم) مقارنة بمجموعة التحكم.

ولكن حقن  $PGF_{2\alpha}$  ليس له أثر معنوي ( $p>0.05$ ) في تقليل الزمن الذي يستغرقه ارتداد الرحم

عقب الولادة.

خلصت هذه الدراسة إلى أن حقن هرمون الـ  $PGF_{2\alpha}$  في الفترة ما بين الأسبوع الأول والثالث

عقب الولادة يحسن الكفاءة التناسلية لأبقار اللبن ويمكن لكل بقرة حقنت بهذا الهرمون في هذه الفترة

أن تنتج عجلًا كل عام.

كلمات مرجعية: أبقار اللبن، النفاس، البروستاقلاندين  $F_{2\alpha}$ ، الكفاءة التناسلية.