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Backing Up Postpartum Dairy Cows with $PGF_{2\alpha}$

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Abstract: The present study was designed to investigate the effects of administration of prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) during early postpartum on 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 randomly distributed into 2 groups. Group I (n=15) was intramuscularly injected with 500 µg of $PGF_{2\alpha}$ between the 1st and the 3rd week postpartum. Group II (n=5) was untreated control. The results showed that the time taken for UI was not affected ($p>0.05$) by injection of $PGF_{2\alpha}$. However, PI (84.0 ± 7.2 day) , NS (1.1 ± 0.0), DO (85.7 ± 7.9 day) and CI (359.9 ± 7.3 day) of the treated cows were less ($p<0.01$) than those of the control. It is concluded that the use of $PGF_{2\alpha}$ during early postpartum improves the reproductive efficiency of dairy cows. Thus a calf per cow per year can be produced.

Key words: Dairy cows, Postpartum, Prostaglandin $F_{2\alpha}$, Backing up

Introduction

Postpartum period is unnecessary long in crossbred dairy cows in the Sudan (Musa 2001 and 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 and Prandi *et al.*, 1999).

Prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) is widely used to manage postpartum reproductive efficiency through reduction of postpartum interval "backing up" (Kindahl *et al.,* 1982 and Young *et al.,* 1984; Youngquist, 1988; Risco *et al.*, 1995; Michel *et al.*,1999; Schofield *et al.,* 1999 and Elsheikh and Ahmed, 2004).

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 1st 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 1994 and 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 and Schofield *et al.,* 1999).

The aim of the current investigation was to study the effectiveness of $PGF_{2\alpha}$ treatment during the first 3 weeks postpartum to back up and mange the reproductive efficiency of postpartum 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. Twenty crossbred cows (Friesian × Kenana) were used for this experiment, they were multiparous and their ages were more than 4 years. Their body condition scores were estimated between 2.5 and 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 and were fed Alfalfa *ad libitum* and individually fed dairy concentrates (10 kg/cow). The concentrate consisted 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: Milk samples were collected 10 days apart following parturition. Ten milliliters from evening milk was collected 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.

Serum Progesterone Radio Immunoassay (P4 RIA): P 4 concentration in the serum was assayed according to

FAO/IAEA (1996) progesterone RIA protocol version 3.1. 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 and continued till complete uterine involution occurred. The uterus is considered involutedly when each of it's horns is equal to two fingers and its body is palpated in the pelvic cavity (Arthur *et al.*, 1998)

Detection of Postpartum Oestrus and Postpartum Interval (PI): The recrudescence of oestrus postpartum was determined by observation and P_4 RIA. Well-trained herdsmen observed the animals, for 20 minutes, thrice daily (7:00, 13:00 and 19:00). The cow was 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. Fortunately the herdsmen were able to detect oestrus in all cases. The recrudescence of oestrus postpartum was confirmed by P_4 RIA. The cow was considered in the luteal phase of the first postpartum oestrus when its milk P4 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): Cows 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 was 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 Procedure: This experiment was a one factorial design to study the effects of $PGF_{2\alpha}$ treatment during the first 3 weeks postpartum on UI; PI; NS; DO; and CI in cross-bred Sudanese dairy cows. Twenty cross-bred postpartum dairy cows were randomly distributed to two groups. Group I (15 cows) was intramuscularly injected with 500 µg $PGF_{2\alpha}$ (Estrumate, Coopers, England) between the 1st and 3rd week postpartum. Group II (5 cows) were used 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: Data were subjected to ANOVA followed by Fisher's protect least significant difference (PLST). Differences at probability of $P< 0.05$ were considered to be statistically significant.

Results and Discusion

Uterine Involution (UI): The results showed that injection of $PGF_{2\alpha}$ between the 1st week and the 3rd week postpartum has no effect on UI ($p>0.05$) compared to the control. The mean time taken for UI in treated cows was 24.1 ± 0.9 days while that of the control group was 26.4 ± 1.4 days.

Postpartum Interval (PI): The results also showed that injection of $PGF_{2\alpha}$ between the 1st and the 3rd 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 ± 7.2 days while that of the control group was 125.4 ± 5.6 days.

Number of services per conception (NS): The number of services per conception for cows administered with $PGF_{2\alpha}$ between the 1st and the 3rd week postpartum was significantly different ($P< 0.01$) from that of the control (1.1 ± 0.0; 1.6 ± 0.2, respectively)

Days open (DO): Parturient cows injected with $PGF_{2\alpha}$ between the 1st and the 3rd 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 ± 7.9 while that of the control group was 138 ± 8.01 days.

Calving interval (CI): The results showed that treatment with $PGF_{2\alpha}$ significantly ($p<0.01$) reduced the CI compared to the control. The mean CI of the treated postpartum cows was 359.9 ± 7.3 days while that of the control group was 412.6 ± 7.7 days.

For a diary farm to be economically feasible, all efforts should be directed towards shortening calving interval (CI): ideally, a calf per cow per year. To achieve this, various management systems are adopted depending on the nature of the breed in question and the climate conditions that prevail at a particular locality. $PGF_{2\alpha}$ is widely used for this purpose (Kindahl *et al*,. 1982; Young *et al.,* 1984; Youngquist 1988; Risco *et al.,* 1995; Michel *et al.,* 1999; Schofield *et al.,* 1999 and Elsheikh and Ahmed 2004).

The current investigation showed that injection of $PGF_{2\alpha}$ between the 1st and 3rd week postpartum had no effect on time of UI. However , Young *et al.* (1984), Kindahl *et al.* (1982), Lindell and Kindahl (1983) reported that injection of $PGF_{2\alpha}$ at the 1st ,2nd and 4th week postpartum had an ecoblic effect that reduced the time of UI. This difference could be attributed to variation among breeds, climatic conditions and/or the regime of the treatment adopted.

Sequential treatment with $PGF_{2\alpha}$ during the third, fifth or the eighth week postpartum stimulates early cyclicity in dairy cows (Risco *et al.*, 1995). In the current investigation, when dairy cows were administered with $PGF_{2\alpha}$ between the 1st and the 3rd week postpartum they recuperated their ovarian activity earlier, hence they had a reduced PI. This finding supports the finding of Risco *et al.* (1995), but contradicts that of Knight (cited by Schofield *et al.*, 1999) who reported a single injection of $PGF_{2\alpha}$ at day 14 -28 postpartum failed to induce the first oestrus.

In accordance with Young *et al.,* (1984) Injection of $PGF_{2\alpha}$ during the first 3weeks postpartum reduced the NS. This reduction will lead to improvement of conception rate (Michel *et al.,* 1999; Schofield *et al.,* (1999). The effectiveness of $PGF_{2\alpha}$ in improving the NS may be due to the fast recuperation of the ovarian cyclic activity, which allows for a better repair of endometrial mucosa under the effect of estrogen secreted by the ovaries (Arthur *et al.,* 1998).

Moreover, the present study showed that injection of $PGF_{2\alpha}$ during the first 3 weeks postpartum shortened the DO which supported the finding of Youngquist (1988) and Schofield *et al.,* (1999). The reduction in time lapse of the DO was a sequel of the reduced PI and NS and consequently shortened CI of the treated cows.

In conclusion, reproductive efficiency of cross-bred dairy cows was improved when $PGF_{2\alpha}$ was injected during the first 3 weeks postpartum.

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References

Arthur, G.H., D. E. Noakes, H. Pearson,T. J. Parkinson, 1998. Infertility in the cow. In: Vet Reproduction and Obstetrics (7th ed). W.B. Saunders, London Publishers, pp 345-388.

Edqvist, L.E., J. O. Lindell and H. Kindhal, 1980. Premature and normal term delivery in the cow. *Anim. Reprod. and A.I.* 2: 41-50.

Elhag, M. A., 2003. Factors influencing postpartum reproductive traits in cross-bred dairy cows in the Sudan. M.Sc. Thesis, Department of Reproduction and Obstetrics, Faculty of Veterinary Medicine, University of Khartoum.

Elsheikh, A.S. and F. O. Ahmed, 2 004. The effect of administration of $PGF_{2\alpha}$ during early postpartum on reproductive efficiency of cross- bred dairy cows in the Sudan. J. Anim. Vet. Advances. 3: 495- 499.

FAO/IAEA (1996). Progesterone radioimmunoassay protocol version 3.1.

Gong, J.G., W. J. Lee, P. C. Garnsworthy and R. Webb, 2002. Effect of dietary–induced increases in circulating insulin concentrations during the early postpartum period on reproductive function in dairy cows. Reproduction 123 : 419-227.

Guilbault, L.A., W. W. Thatcher, D. B. Foster and D. Caton,1984. Relationship of 15-keto 13, 14 dihydroprostaglandin F-2-α concentrations in peripheral plasma with local uterine production of F, series prostaglandins and changes in uterine blood flow during the early postpartum period of cattle. *Biol. Reprod.* 31: 870-878.

Guilbault, L. A., W. W. Thatcher and C. J. Wilcox,1987. Influence of physiological infusion of $PGF_{2\alpha}$ into postpartum cows with partially suppressed endogenous production of prostaglandins 2-interrelationships of hormonal ovarian and uterine responses. Theriogenology 27: 947-959.

Kindahl, H., L. E. Edqvist, K. Larsson and A. Malmquist, 1982. Influence of prostaglandin on ovarian function postpartum. In: Current Topics in Veterinary Medicine and Animal Science, Vol.20. Krag, H., Schallenberger, E. (eds). Martinus Nijhoff, Publishers, The Hague. pp. 173-196.

Lindell, J. O. and H. Kindahl, 1983). Exogenous prostaglandin $F_{2\alpha}$ promotes uterine involution in the cow. *Theriogenology* 24: 269-274.

Michel, G., H. Bostedt, B. Hoffmann,K. Failing and E. Rattenberger,1999. Effect of a 10 day postpartum administration of $PGF_{2\alpha}$ analog at different concentrations on the course of the puerperium and fertility in dairy cows. *Tierarztl prax Ausq G. Grosstiere*, 27: 16-24.

Musa, S. N., 2001. Hormonal manipulation of some infertility problems in cross-bred cows in Sudan. M.Sc. Thesis, Department of Reproduction and Obstetrics, Faculty of Veterinary Medicine, University of Khartoum.

Prandi, A., M. Motta, A. Tondolo and C. Rossi, 1994. Evaluation of the reproductive efficiency of Simmental and Fresian dairy cows farmed In Friuli (Italy) by the analysis of progesterone level. *Theriogenology* 42: 65-78.

Prandi, A., M. Messina, A. Tondolo and M. Motta, 1999. Correlation between reproductive efficiency, as determined by new mathematical indexes and the body condition score in dairy cows. *Theriogenology,* 52: 1251-1265.

Risco, C.A., R. L. De La Sota, G. Morns, J. D. Savio and W. W. Thatcher, 1995. Postpartum reproductive management of dairy cows in a large Florida dairy herd. Theriogenology 43: 1249-1258.

Salam, H., D. Vaillancourt and A. K. Goff, 1994. Control of in vitro $PGF_{2\alpha}$ and PGE synthesis by caruncular and allanto-chorionic tissues from cows that calved normally. Domestic Anim. Endocrinol. 11: 175-185.

Schofield, S.A., S. E. Kitwood and C. J. Phillips,1999. The effects of a postpartum injection of $PGF_{2\alpha}$ on return to oestrous and pregnancy rates in dairy cows. Vet. J., 157: 172-177.

Toribio, R. E. J. R. Molina, M. Forsberg, H. Kindahl and L. E. Edqvist, 1995. Effects of calf removal at parturition on postpartum ovarian activity in zebu cows in humid tropics. Acta. Vet. Second; 36: 343-352.

Wildman, E.E., G. M. Jones, P. E. Wagner, R. L. Boman, H. F. Trout and T. N. Lesch, 1982. A dairy cow body condition scoring system and its relationship to selected production characteristics. *J. Dairy Sci.* 65: 495-499.

Young, I. m., D. B. Anderson and R. W. Plenderleith, 1984. Increased conception rates in dairy cows after early postpartum administration of prostaglandin $F2\alpha$. *Veterinary Record,* 115: 429-431.

Youngquist, R.S., 1988. Anestrus and fertility in the cow. *In: Fertility and Infertility In Veterinary Practice (4th ed)*. Laing, J.A.; Brinley, M.J. and Wagner, W.C. (eds). Bailliere Tindal, East Sussex, England, Publishers. pp: 91-112.