Management of Postpartum Interval of Nubian goats with $PGF_{2\alpha}$ and GnRH

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Abstract: In this study two experiments were designed to examine the effects of prostaglandin ($PGF_{2\alpha}$) and gonadotropin releasing hormone (GnRH) on the length of postpartum interval to first oestrous (PPI) and progesterone (P_4) profile of postpartum (p.p.) Nubian goats. In experiment I the PPI and P_4 profile of p.p. Nubian goats treated with $PGF_{2\alpha}$ were compared with untreated control. Seventeen p.p. Nubian goats (2 to3 years old) were divided into 4 groups. Groups I (n = 4) was intramuscularly injected (i.m) with 125 µg of $PGF_{2\alpha}$ on day 7 p.p., group II (n = 4) was injected on day 15 p.p., group III (n = 4) was injected on day 21 p.p. and group IV (n = 5) was not injected and served as controls. Milk samples for P_4 assay were collected after parturition every 3 days until P_4 concentration in the milk of the goats leaped beyond 1.5 ng/ml. Injection of $PGF_{2\alpha}$ on day 7 p.p. had no effect ($p>0.05$) on the PPI. However, $PGF_{2\alpha}$ injections on day 15 and day 21 p.p. significantly ($p<0.0I$, $P<0.00l$) reduced the PPI by 18 and 30 days, respectively. The P_4 level of goats treated with $PGF_{2\alpha}$ on day 7, 15, and 21 p.p. remained below 0.04 ng/ml until days 51, 43, 30 p.p. respectively, then increased to a level ≥1.0 ng/ml. The P_4 profile of the control goats remained below 0.04 ng/ml until day 61 p.p and started to increase to a level ≥1.0 ng/ml on day 67. Experiment II investigated the effects of GnRH injection during early p.p on the PPI and P_4 profile of the Nubian goats. Twenty p.p Nubian goats were distributed to 4 groups. Group I (n = 5) was i.m injected with 100 μg of GnRH on day 7 p.p, group II (n = 5) was injected on day 15 p.p and Group III (n = 5) was injected on day 21 p.p. Group IV (n = 5) was not injected and served as controls. GnRH injection on day 7, 15, and 21 p.p. significantly ($p<0.05$, $p<0.0I$, $P<0.00I$) reduced the PPI by 32.8, 40.8, 41.8 days, respectively. The P_4 levels of goats treated with GnRH on day 7, 15, and 21 p.p remained below 0.04 ng/ml until days 36, 28, 27 p.p, respectively, and then it increased to levels ≥1.0 ng/ml. The P_4 of the control group remained at a basal level of 0.04 ng/ml until day 68 p.p. and then increased to level ≥ 1.0 ng/ml. It is concluded that p.p Nubian goats treated with $PGF_{2\alpha}$ or GnRH during early p.p resume ovarian activity earlier than non treated control. Thus their PPI was reduced.
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Key words: Postpartum interval, Nubian goats, $PGF_{2\alpha}$, GnRH

1. Introduction

The kidding interval of the Sudan Nubian goats is relatively long. This is probably due the long PPI recorded for this breed (Ibrahim, 2000;S Yagoub, 2003; Elsheikh and Yagoub, 2006). The PPI may extend for as long as 112 days or even for 120 days. This long PPI is probably due to failure of resumption of ovarian activity postpartum, a phenomenon reported in dairy cows (Lamming and Darwash, 1998; Roche et al., 2000; Hommeida et al., 2005). It may also be due to a prolonged luteal phase following the first ovulation postpartum (Hommeida et al., 2005). Furthermore, a delayed uterine involution may contribute in prolongation of the PPI (Hommeida, et al,. 2005). The goat prolonged PPI, due to failure of resumption of ovarian activity, can be corrected with the use of GnRH (Elsheikh and Yagoub, 2006). $PGF_{2\alpha}$ is also used to mange the PPI in cows through its ecobolic and/or luteolytic effects (Risco et al., 1995: Schofield, et al., 1999; Elsheikh and Elzubeir, 2004; Elsheikh and Ahmed, 2005). No report on the use of $PGF_{2\alpha}$ for management of PPI in goats is available. The objectives of the current study were to investigate the effects of $PGF_{2\alpha}$ and GnRH on PPI and Progesterone (P_4) profile during the early postpartum period in the Sudan Nubian goats.

2. Materials and methods

2.1. Study area

The experiment was conducted in the main Centre for Goat Production Improvement (Kuku, Khartoum North, Sudan) between 2001- 2003. This area lies within the semi-arid zone at latitude 15:16 and longitude 32:32, 376 meters above sea level. The average rainfall per year is 167mm.

2.2. Experimental animals

Thirty- seven Nubian goats that gave birth were selected from the flock at the main centre for goat production improvement 12 goats were injected with

$PGF_{2\alpha}$, 15 goats were injected with GnRH and 10 goats (not treated) were employed as a control.

2.3. Husbandry

The animals were housed in an open side-shed. The roof was 3.0 meters in height and was constructed with corrugated, galvanized ion sheets. The floor was 1.0 meter above the ground made of concrete. The houses were well ventilated.

2.4. Health and feeding

The goats were injected against ecto-parasites with –1 ml/50 kg, Ivermectien (Ivomec ®, Merial, France). The animals were fed 250 g of concentrates made at the farm and composed of 33% groundnut cake, 33% sorghum (*Sorghum vulgare, Vr. Fetarita*), 33% wheat bran and 1% sodium chloride and were offered Alfa alfa ad libitum. Water troughs were filled with fresh water twice daily in the morning and afternoon. The animals were allowed to exercise and to graze once a week in an adjacent field previously cultivated by mesquites shrubs.

2.5. Oestrus detection technique

Oestrous behaviour was observed twice daily 8.00 a.m and 4.00 p.m. Mature active bucks were introduced to the goats after 2 weeks postpartum (p.p.). The female goat is considered in oestrus when it allows the buck to mount her. (Mackenzie, 1975). Oestrous occurrence is confirmed by progesterone radioimmunoassay. When the P_4 level in the milk is above 0.3 ng/ml the goat was considered in the luteal phase of the first p.p oestrus (Marvogenis, 1987).

2.6. Milk sampling and processing

Ten ml of whole milk were collected from p.p. goats, every 3 days, starting with day zero p.p., in milk sample vials. The whole milk was preserved by adding one sodium azide tablet (100 mg) per 10 ml. The preserved milk was centrifuged at 2500 g for 15 min at room temperature. The centrifuged milk was separated into fat layer and skim milk. The skim milk was drawn off as follow: the centrifuged milk was placed in refrigerator at 4°C for 15 minutes to harden the fat layer. A glass rod was used to pierce the fat layer. The entire skim milk sample was transferred to a storage vial by using Pasteur pipette. The skim milk samples were stored at –20°C and kept frozen until used.

2.7. Progesterone radioimmunoassay

The occurrence of 1st oestrus p.p was confirmed by P_4 RIA (FAO/IAEA protocol, 1996). The minimum detecting limit of this protocol is 0.02 ng/ml. Ovulation was assumed having occurred 4 days before the first time the milk progesterone values were > 0.3 ng/ml (Marvogenis, 1987).

2.8. Experimental design

2.8.1. Experiment I

This experiment was a simple factorial design to determine the effects of $PGF_{2\alpha}$ on the PPI and the P_4 profile of dairy Nubian goats. Seventeen dairy Nubian goats 2 – 3 years old were used. They were grouped into 4 groups. Group I (n=4), group (n=4) and group III (n=4) were i.m injected with 125 µg of $PGF_{2\alpha}$ (Estrumate, Coopers, England) (Elnaiem, 2003), on day 7, 15 and 21 p.p, respectively. Group IV (n=5) was used as an untreated control. Milk samples were collected every 3 days for P_4 assay. Oestrous detection was done as described in the materials and methods. The goat that did not show oestrous signs was considered in oestrus 4 days before the level of P_4 reaches 0.3 ng/ml or more (Mavrogenis, 1987).

2.8.2. Experiment II

This experiment was also a simple factorial design to determine the effects of GnRH on PPI and P_4 profile during early p.p. Twenty p.p Nubian dairy goats were employed. The goats were grouped into 4 groups. Group I (n=5), group II (n=5) and group III (n=5) were all injected i.m. with 100 µg of GnRH (Fertagyl, Intervet Boxmeer, Holand) on day 7, 15 and 21 postpartum, respectively (Elsheikh and Yagoub, 2006). Group IV (n=5) was kept as the untreated control. The milk samples were collected every 3 days for P_4 RIA. The oestrous detection method was done as described in above. The goat was considered in oestrous 4 days before the level of P_4 reached 0.3 ng/ml or more.

2.9. Statistical analysis

Data were subjected to one way ANOVA. Differences at a probability of $P < 0.05$ were considered statistically significant. The P_4 profiles were drawn using Cricket graph package.

3. Results

3.1. Experiment I

The result of one way ANOVA showed that injection of $PGF_{2\alpha}$ during the first week postpartum in Nubian goats has no effect ($P > 0.05$) on occurrence of first oestrus p.p and the PPI. However, injection of $PGF_{2\alpha}$ during the second or third week significantly ($P < 0.01$, $P < 0.001$, respectively) reduced the time taken for recrudescence of oestrus p.p compared to the control. Thus it reduced the PPI (Fig. 1). The mean PPI of goats treated with $PGF_{2\alpha}$ during the first week, second week, third week and the control groups were: 51± 0.71, 43 ± 0.98, 30 ± 0.65, and 61± 4.82 days, respectively.

The milk progesterone level during p.p period remained below 0.04 ng/ml in goats treated with $PGF_{2\alpha}$ during the first, second, third weeks and the control until day 50, 43, 30, 61 days, respectively. Then it increased to a level of ≥ 1.0 ng/ml (Fig. 2) after day 56, 49, 36 and 67 respectively.

3.2. Experiment II

One way ANOVA showed that injection of GnRH during the first, second and third week p.p in Nubian dairy goats reduced ($P < 0.05$, $P < 0.01$, <

0.001, respectively) the time sto the first oestrus p.p. as compared to the control. Thus it reduced PPI (Fig.3). The mean PPI of goats treat with GnRH during the first week, second week, third week and the control groups were: 36 ± 1.05, 28 ± 0.71, 27 ± 0.66 and 68.8 ± 4.83 days respectively. The P_4 levels remained below 0.04 ng/ml in goats treated with GnRH during the first week, second week, third week and the control until day 36, 28, 27 and 68 p.p., respectively. Then P_4 levels increased to ≥ 1.0 ng/ml on day 42, 34, 33 and 74 respectively (Fig. 4).

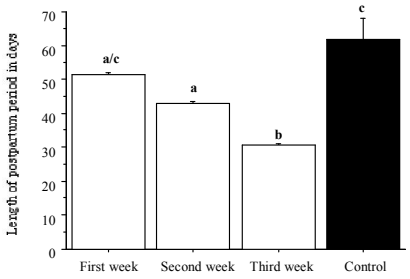


Fig.1. The effect of treatment with $PGF_{2\alpha}$ during the 1st, 2nd or 3rd week p.p on the PPI of Nubian goats. Means ± SE ($^{a, b}$ p<0.01, $^{b, c}$ p<0.001).

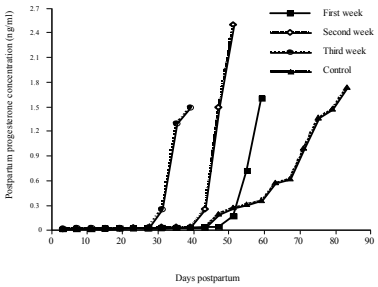
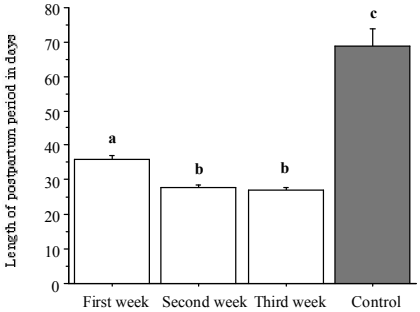


Fig. 2. Milk progesterone profiles of postpartum Nubian goats treatedwith $PGF_{2\alpha}$ during the 1st week (n=4), 2nd week (n=4), 3rdweek (n=4) and control (n=5).



(n=5) (n=5) (n=5) (n=5)

Fig.3.The effect of treatment with GnRH during the 1st, 2nd, or3nd week postpartum on PPI of Nubian goats. Means ± SE($^{a, b}$ p<0.05, $^{b, c}$ p<0.001).

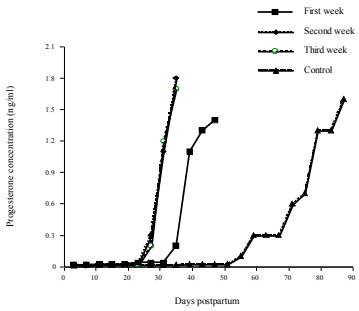


Fig. 4. Milk progesterone profiles of postpartum Nubian goats treated with GnRH during the 1st (n=5), 2nd week (n=5), 3rd week (n=5) and control (n=5).

4. Discussion

Prostaglandin $F_{2\alpha}$ has a direct ecbolic effect on bovine uterus, and increases the tone of uterine muscles, thus increases involution rate (Lindell et al., 1982). The complete involution of bovine uterus is accompanied by the recrudescence of oestrous and the first ovulation followed by a normal luteal phase (Young et al., 1984). Postpartum cows treated with $PGF_{2\alpha}$ between 20 and 24 days postpartum showed a reduced interval to first oestrus (Bernard and Stevenson, 1986). There is no literature on the effect of $PGF_{2\alpha}$ on the length of the p.p period in goats.

The results of the present study showed that treatment of Nubian dairy goats with $PGF_{2\alpha}$ during the second and the third week p.p reduces the time to the first oestrous postpartum and the length of p.p period. This result agrees with the finding of the above mentioned studies. However, some reports showed that $PGF_{2\alpha}$ treatment during p.p has no effect on occurrence of the first oestrous p.p in cows (Lindell et al., 1982; Young et al., 1984).

The results of the present study make support the use of $PGF_{2\alpha}$ during p.p. period in goats. The progesterone profile reported in the present study is an indicative for the recrudescence of p.p ovulation in treated Nubian goats.

The gonadotropin releasing hormone (GnRH) treatment during p.p period in dairy cows is reported to induce ovarian cyclic activity (Bernard and Stevenson, 1986). Furthermore injection of GnRH during second week p.p in dairy cows induced recrudescence of first oestrus p.p. (Thatcher et al., 1993; Risco et al., 1995). GnRH had indirect and/or direct action on the ovaries (Chenault et al., 1990; Hsuch and Jones, 1981).

A single dose of GnRH on days 10 – 15 postpartum in dairy Nubian goats reduced the length of p.p period (Yagoub, 2003). The results of this study showed that Nubian goats return their responsiveness to exogenous GnRH as early as the first week p.p. Nubian goats treated with GnRH during the first week or between the second and third week expressed a shorter

p.p. period. Furthermore, the increment in the progesterone profile indicates early ovarian activity. This finding agrees with that of Yagoub (2003). However, in this study GnRH was used during the first, and between the second and third week, while Yagoub used GnRH during the second week only. Contrary, some authors reported that administration of GnRH in the early postpartum period did not produce a clear improvement in reproductive efficiency in cows (Thatcher et al., 1993). This is in disagreement with the results of the present study. The difference between the two studies is probably due to a species difference.

Few workers reported the P_4 profile of p.p. goats (Khanum et al., 2008; Djurici et al., 2011); however, many authors determine P_4 profile during oestrus cycle and pregnancy in goats (Bauernfein and Holtz, 1990; Pathiraja et al., 1991). Progesterone concentration patterns are similar between breeds in these studies. The P_4 concentrations in the peripheral circulation did not exceed 0.2 ng/ml until the time of ovulation. These basal level on day (0) of the oestrous cycle in Nubian goats was reported as 0.59±0.31 ng/ml (El-Naiem, 2003). In this study the progesterone level during p.p period is very low compared to the normal oestrous profile. The P_4 profile in the p.p goats assumes a general and common trend starting with basal level then gradually increases to reach a level of ≥ 1.0 ng/ml.

It is concluded that $PGF_{2\alpha}$,and GnRH treatments during early p.p reduces the time to occurrence of the first oestrus p.p and the length of postpartum period in Nubian goats. Moreover, Nubian goats return their responsiveness to exogenous GnRH as early as the first week postpartum.

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