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# EFFECT OF DIFFRENT DOSES OF PROSTAGLANDIN F2α ON ESTRUS SYNNCHRONIZATION, REPRODUCTIVE AND PRODUCTIVE PERFORMANCE IN BALADI GOATS

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**ABSTRACT:** The present study included 48 mature cyclic Baladi goats. The goats were randomly allocated in equal numbers to one of four experimental groups; group I, II and III received a single dose of 10, 17.5 and 25 mg of prostaglandin F2α through intramuscular injection, meanwhile group IV, served as a control. Goats showed signs of estrus were treated between 6-13 days of the cycle. The proportion of goats exhibiting estrus were higher (p 0.001) in goats treated with 17.5 and 25 mg PG F2α than injected with 10 mg and control groups. The injection of 25 mg PG F2α resulted in the greatest proportion of goats exhibiting estrus (91.6%) within 5 days after treatment as compared to the 17.5, 10 PGF2 and control(75,25,and 8.3%, respectively). No significant difference was found in the proportion of estrus exhibition between goats treated with 17.5 and 25mg PGF2α. No obvious variation was also observed in the duration of heat among the four treated groups. Conception rate tended to be higher in does treated with 17.5 and 25 mg PG F2α compared to the control or those injected with 10 mg PG F2α. No significant differences were found among the four treatments in number of services per conception and gestation period length. The productivity of does including litter size, number of kids born/doe and kidding rate per goats joined were higher in those treated with 17.5 or 25 mg PG F2α compared treated with 10 mg PG F2α and control.

## INTRODUCTION

Estrus synchronization is one of the most effective methods developed for increasing reproduction performance. Luteolytic dose of PGF2ά or one of its potent synthetic compounds cause regression of the bovine corpus luteum. In addition, the functional activity of the corpus

luteum is naturally terminated at the end of the oestruos cycle (Louis et al., 1973). Progesterone secreted by the corpus luteum stimulates the endometrium to synthesize and store the lytolytic agent (Wilson et al., 1972). The belief is that PGF2ά is realised from the uterus to cause regression of the corpus luteum (Goding, 1974). Increased levels of PGF2ά have been found is the uterine venous blood of sheep on day of - 15 of the cycle (Bland et al.,1971). Administration of PGF2ά to goats was followed by a decrease in serum progesterone and decrease in size of the corpus luteum and return to estrus at about 5 days (Jain and Madan, 1986).

More studies have indicated a simpler method of estrus synchronization when goats were given 62.5, 125 or 250 µg in which regression of the corpus luteum was induced with a fertile estrus within 3 days following treatment (Greyling and van Niekerk, 1986, Romano, 1989 and Whitley and Jackson, 2004). Fukui and Roberts (1981) studied the effect of giving a single dose of 8, 16 or 24 mg of analogous PGF2α to ewes between 6-12 days of the estrous cycle and found that the injection of 24 mg PGF2α results a higher proportion ewes exhibiting (92.9%) within five days after treatment as compared to the other two doses (16.7 and 66.7%). However, the injection between the stage of estrous cycle and the dose of PGF2α used to induce estrus synchronized and ovulation in goats has not been reported.

The present experiment was conducted to study, the effect of three different dosages of PGF2 α given intramuscularly to goats between day 6- 13 of the estrous cycle on estrus synchronization and reproductive performance.

## MATERIALS AND METHODS

Forty eight sexually mature female Baladi goats with average body weight of 24.60 ± 0.93 kg and of 3.26 ± 0.12 years old were used in the present investigation. Animals were belonged to the Station of Sheep Research, Animal Production Department, Faculty of Agriculture, Al-Azhar University, Nasr City, Cairo, Egypt. Animal were fed pleted concentration mixture containing 61 % TDN and 13 % digestible protein plus berseem (*Trifolium alexandrium*) in winter and berseem hay in summer. All does were allowed to drink fresh water twice daily. Goats were kept in semi-open pens and exposed to the external environmental conditions. Goats showed signs of estrus were treated between 6-13 days

of the cycle. Goats were randomly allocated in equal numbers to one of four groups. The first group was served as control meanwhile the 2 nd, 3 rd and 4 th groups were injected intramuscularly with a single dose of 10, 17.5 and 25 mg of Estrumate (a synthetic prostaglandin F2α, Coopers Animal Health Ltd. Berthhamsted Hill, respectively England).Injection with prostaglandin F2α was carried out during the luteal phase between 6-13 of the oestrous cycle. Heat detection and oestrus duration were recorded for 6 days after the injection of using sexually mature bucks, which were allowed to run with goats four times daily (30 minutes per each round). Immediately after heat detection goats were bred naturally. Fourteen days post-coitum does were checked for estrus twice daily and the process was repeated after 14 days. The duration of heat was measured from interval between the first mounting by the teaser buck to the onset of its refusal to mount. Conception rate, number of services per conception, gestation period length, number of kids born per doe conceived, and kidding rate were estimated.

Statistical analysis was carried out using the SAS program (SAS, Institute Inc., 1988). The GLM procedure of SAS was used to perform the one way analysis of variance between treatments. The frequencies were analyzed between each treatments group using Proc. Freq. (Chi-Square ($X^2$) test).

## RESULTS AND DISCUSSION

**Estrous synchronization:**

The estrus response of goats during the five days post administration of prostaglandin F2α is shown in Table (1). Proportion of does exhibiting estrus as results of PG F2α treatment differed among the doses of PG F2α and control. Number of does coming estrous after intramuscular for 17.5 and 25 mg of PG F2α (75 and 91.6 %, respectively) was significantly higher ($P < 0.001$) than for does injected with 10 mg PG F2α and control group (25 and 8.3%, respectively). The intramuscular injection of 25 mg PG F2α appeared to the most effect in synchronization of estrus. However, the effect was not significantly differed with that of 17.5 mg PG F2α.

These results are agreement with those reported of Fukui and Roberts, (1981), Jain and Madan, (1986), Greyling and Van Nikerk, (1986), Romano, (1998) and Khanum et al., (2006). The percentage of goats in estrus after treatment with 25 mg PG F2α in this study was

similar to that of previous studies using the same doses (Greyling and Van Niekerk, (1986) and Nuti et al (1992). Present results obtained after administration of 17.5 mg were similar to those of Winder and Sanchez (1991). Hackett and Roberson (1980) reported that estrus response of ewes treated at day 4 to 15 of the estrous cycle was higher after the treatment with 20 mg rather than 15 mg PG F2α. However, the estrus response in ewes regardless of the day of the estrous cycle would be largely dependent on the number of ewes cycling, or the number of ewes in luteal phase of the estrous cycle at the time of PGF2α treatment rather than on the does of PGF2α.

**Table (1): Number and percentage of does displayed estrus within 5 days after PGF2α treatments.**

| Treatment PGF2α) | No of goats | No. of does in estrus (days) 1 (%) | 2 (%) | 3 (%) | 4 (%) | 5 (%) | Total N (%) |
|---|---|---|---|---|---|---|---|
| Control | 12 | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 1 (8.3) | 1 (8.3)[b] |
| 10 mg | 12 | 0 (0) | 0 (0) | 1 (8.3) | 2 (16.7) | 0 (0) | 3 (25)[b] |
| 17.5 mg | 12 | 0 (0) | 2 (16.7) | 3 (25) | 3 (25) | 1 (8.3) | 9 (75)[a] |
| 25 mg | 12 | 1 (8.3) | 3 (25) | 3 (25) | 4 (33.3) | 0 (0) | 11 (91.7)[a] |

$\chi 2 = 43.78$ for the total period (1-5 days)
$\chi 2$ 0.05, 3= 21.0
$\chi 2$ 0.01, 3= 26.2

In the present study does exhibited signs estrus 2 days post treatment with 17.5 and 25 mg PG F2α and reached the highest percent after 3-4 days. This can explained on the basis that corpora lutea which showed rapid morphological regression was associated with a significant fall in progesterone level by rapid follicular growth and secretion of estradiol-17 ß (Dobson et al. (1975) and Mukasa-Mugerwa et al. **(1989).** Similar findings were reported by Cooper (1974) who proposed that the PGF2α causes luteolysis and onset of estrus within 3 days post- treatment. Acritopouluo et al., (1977) stated that the single injection of PGF2α in mid cycle resulted in fall in plasma progesterone concentration reached

to the lowest value by 24 hours post- treatment and high degree of synchrony in the return to estrus was observed 44 hours after injection. Furthermore, Dobson et al., (1975) reported that cows returned to esttous after 49 – 96 hours of injection with PGF2α.

In the present study, the low proportion of goats exhibited estrus after injection with 10 mg PGF2α than those observed with higher doses of PGF2α, so they suggested that the sensitivity of the corpus luteum to different doses of PGF2α is different in goats, even if they are at the same stage of the oestrous cycle. Berardinelli and Adair (1989) have showed that the ability of 10 mg PGF2α to induce luteal regression depends on the stage of oestrous cycle, and more effective in causing luteolysis when administrated during the early and late luteal phase.

It appears in the present study that 25 mg PGF2α administrated intramuscularly is effective for estrous and ovulation responses. Similar finding were reported by other workers (Greyling and van Niekerk, 1986 and Khanum et al. 2006).

**Duration of estrous:**

The data (Table, 2), show that duration of estrous in does injected PGF2α 25 mg was longer (33.25 ± 1.12 hours) than that in the control group (30.83 ± 1.08 hours) and other treated with 10 and 17.5 mg

Table (2): Effect of PGF2α on duration of heat, conception rate and number of services per conception.

| Trial | Doses of PGF2α | | | |
|---|---|---|---|---|
| | Control | 10 | 17.5 | 25 |
| No. of does | 12 | 12 | 12 | 12 |
| Duration of heat (hrs) x ± SE | 30.83 ± 1.08 | 31.50 ± 1.16 | 32.66 ± 1.23 | 33.25 ± 1.12 |
| Conception rate from 1st service (n-%) | 5 (41.7%) | 4 (33.3%) | 6 (50%) | 6 (50%) |
| Conception rate from 2nd services (n-%) | 2 (16.7%) | 3 (25%) | 3 (25%) | 4 (33.3%) |
| Conception rate from 3rd services (n-%) | 1 (8.3%) | 1 (8.3%) | 0 (0) | 0(0) |
| Total conception rate from 1st to3rd services (n-%) | 8 (66.7%) | 8 (66.7%) | 9 (75%) | 10 (83.3%) |
| No. of services / conception | 1.50 | 1.62 | 1.33 | 1.40 |

PGF2α (31.50± 1.16 and 32.66± 1.23 hours, respectively). However, no significant differences were observed among the four treatments. From

the results is due to the synchronization of estrous by injection of PGF2α analogues, which causes the degeneration of corpus luteum, and come into estrous within 4 days later. While, those which fail to respond should be in the responsive phase of a natural cycle. These results are in good agreement with the finding of Oyediji et al. (1990) who reported that the estrous duration of ewes did not differ significantly between ewes treated with PGF2α and untreated ewes. On the contrary, Hanafy (2001) showed that estrous duration length of does was significantly difference between goats treated with PGF2α and control goats. Deaver et al. (1986) showed that the duration of estrous in ewes treated with PGF2α on the $5^{th}$, $8^{th}$ or $11^{th}$ the post estrous was differed significantly between the three groups.

**Conception rate and number of services per conception:**

As shown in Table (2), the total conception rates from first, second and third services were greater in does treated with PGF2α 17.5 and 25 mg (75 and 83.33 %, respectively) rather than control and those treated with 10 mg PGF2α (66.67 %). However, no significant differences were observed between the four experimental groups. These results are in accordance with that of Acritopoulou *et al* (1978) who reported that conception rate did not differ significantly between ewes treated with PGF2α and untreated group. Romano (1998) observed that the conception rate of Nubian goats treated with 62.5 and 125 μg of PGF2α did not differ between two doses. Abd El-Bary(1990) showed that the conception rate in cows receiving one doses of PGF2α was 50%, 78.6%, 92.7% after$1^{st}$ ,$2^{nd}$ and $3^{rd}$ services, respectively. On the other hand, Beck et al (1987) found that the conception rate in synchronize ewes with single dose of 20mg PGF2α was lower than those treated with progestagen pessary (60mg) or the control group. Normal conception rate following synchronization with PGF2α and natural mating have been reported (Haresign and Acritopoulou, 1978). However, Greyling and Van Niekerk, 1986 observed that conception rate was much reduced in goats treated with PGF2α. These contradictory results may attribute to the effect of breeding season, bread and geographic location.

Insignificant differences were observed among the four groups in the number of services per conception (Table 2). These results are in good agreement with the findings of Hanafy, (2001) who found that insignificant difference goats treated with PGF2α and un-treated ones. Abd El Bary (1990) who reported non significant differences in number of services per conception between the cows or heifers treated with

PGF2α or progesterone and non- treated ones. It is clear from these data that injection of high doses of PGF2α (17.5 or 25 mg) may be advisable to obtain better results regarding induction of estrous, ovulation, conception and number of services per conception.

**Gestation period length:**

As shown in Table (3), there was no significant differences in gestation period length among the four treatments groups. The gestation period lengths were 149.24, 149.03, 149.03 and 148.69 days for control, 10, 17.5 and 25mg PGF2α. These results are in good agreement with finding of Hanafy (2001) who did not found significant differences in the gestation period length between does treated with PGF2α and non-treated ones. Henderson et al. (1984) and Beck et al. (1987) reported that the treatments with progestagen and single or double PGF2α injection, had no significant effect on gestation period length. Shelton et al.(1978) who suggested that gestation period length is probably affected by sex of foetus, parity and genetic factors.

Table (3): Gestation period length, number of goats kidding singles, number of goats kidding twins and kidding rate in goats injected with PGF2α.

| Trial | Doses of PGF2α | | | |
|---|---|---|---|---|
| | Control | 10 | 17.5 | 25 |
| No. of does | 12 | 12 | 12 | 12 |
| Gestation period (days) x | 149.24 | 149.03 | 149.14 | 148.69 |
| ± SE | ± 1.14 | ± 1.25 | ± 1.14 | ± 1.13 |
| No. of kids born | 11 | 10 | 12 | 13 |
| Kids born/goat conceived | 1.37 | 1.25 | 1.33 | 1.30 |
| Goats kidding singles (n-%) | 5 (62.5%) | 6 (75%) | 6 (66.7%) | 7 (70%) |
| Goats kidding twins (n-%) | 3 (37.5%) | 2 (25%) | 3 (33.3%) | 3 (30%) |
| Kidding rate (%) | 91.66 | 83.33 | 100 | 108.33 |

**Performance:**

Table (3) shows that the number of kids born per goats conceived was the greatest in the control group (1.37)and the least (1.25) in those injected with 10mg PGF2α. However, the differences in this respect were not significant. These differences may be due to differences in ovulation rate.

Kidding rate was greater in does synchronized with 25 mg PGF2α (108.33 %) than that in the other experimental groups (91.66, 83.33 and

100 % for control, 10 and 17.5 mg PGF2α, respectively). However, differences were not significant. The data in Table (3), also show that the high dose (25 mg PGF2α) increased kidding rate. Similar trend was reported by Hanafy (2001) who found that kidding rate in synchronized with 25 mg PGF2α was greater than untreated group. This is an indication that the synchronization of estrus with high dose of PGF2α leads to synchronized kidding rate. Hoppe and Slyter (1989) observed that lambing rate in synchronized ewes was affected by the treatment with PGF2α. Henderson et al. (1984) found that normal lambing rates following PGF2α and progestagen treatments. Hulet and Foote (1967) reported high positive relationship between number of corpora lutea (which was increased in ewes treated with PGF2α) and the number of lambs born. In addition, the longer estrus duration in ewes treated with PGF2α may be due to higher estrogenic level which may reflect higher LH level thus increasing ovulation rate in the PGF2α treated ewes.

From the results of this experiment it is concluded that, estrus synchronization and ovulation in goats depended on the dosage of prostaglandin F2α during the mid- luteal phase of the cycle. However, the cause for the variability in responsiveness to prostaglandin F2α among goats, seemed to be unclear and needs further investigations especially sperm transport the female genital tract, mucus properties and hypophyseal-gonadal hormones balance.

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# تاثير جرعات من البروستاجلاندين ف2 – الفا على تنظيم الشياع والاداء التناسلى والانتاجى فى الماعز البلدى

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## الملخص العربى

اشتملت هذه الدراسة على عدد 48 من الماعز البلدى. تم تقسيمهم عشوائيا الى اربع مجموعات متساوية المجموعة الاولى والثانية والثالثة تم حقنهم فى العضل بجرعات مختلفة من البروستاجلاندين ف2 – الفا، 10، 17.5 و25 ملليجرام على التوالى . اما المجموعة الرابعة اعتبرت مجموعة المقارنة. وكانت الماعز عند بداية التجربة فى اليوم 6- 13 من دورة الشبق. اوضحت النتائج ان نسبة الماعز التى أظهرت الشياع خلال خمسة أيام من المعاملة فى المجاميع التى تم حقنها بالجرعات 17.5 و25 ملليجرام بالبروستاجلاندين ف2 – الفا كانت أعلى معنويا مقارنة بالمجموعة المحقونة 10 ملليجرام بروستاجلاندين ف2 – الفا وكذلك مجموعة المقارنة.

اظهرت النتائج ان نسبة الشياع فى المجموعة التى تم حقنها 25 ملليجرام بروستاجلاندين ف2 – الفا كانت 91.6% وذلك خلال الخمسة ايام بعد المعاملة مباشرة، بينما كانت نسبة الشياع 75، 25 و 8.3% على التوالى فى المجموعات التى تم حقنها 17.5 و10 ملليجرام بروستاجلاندين ف2 – الفا والكونترول، وكان لا يوجد اختلاف معنوى بين كلا من المجموعة التى تم حقنها 25 و 17.5 ملليجرام بروستاجلاندين ف2 – الفا.

اوضحت النتائج زيادة معدل الحمل فى كلا من المجموعة المحقونة 25 و 17.5 ملليجرام البروستاجلاندين ف2 – الفا مقارنة بالمجموعة المحقونة ب 10 ملليجرام البروستاجلاندين ف2 – الفا والكونترول، وكان لا يوجد فروق معنوية على عدد التلقيحات اللازمة للحمل وايضا على طول مدة الحمل بين المجموعات الاربعة.

اوضحت النتنج زيادة فى عدد الحملان المولودة وكذلك معدل الجديان المولودة فى كلا من المجموعة المحقونة 25 و 17.5 ملليجرام بروستاجلاندين ف2 – الفا مقارنة بالمجموعة المحقونة 10 ملليجرام بروستاجلاندين ف2 – الفا و مجموعة المقارنة.