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Journal of Agricultural and Veterinary Sciences
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Effect of Oestrous Synchronization using $PGF_{2\alpha}$ on Subsequent Fertility of Nubian Goats (*Capra hircus*)

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Article History: Recieved:
Accepted: 25.11.2014

Abstract

This study was conducted to monitor the oestrous response to prostaglandin ($PGF_{2\alpha}$) treatment and subsequent fertility on days 45, 60 and 90 post-partum (pp). A total number of 30 Nubian goats were equally divided into three groups (n = 10) and given double intramuscular injections of 125µ cloprostenol, 11 days apart.. Goats detected in oestrus were handmated twice on 1st and 2nd day of oestrus. The conception, fecundity and prolificacy rates were measured 40-60 days after mating using ultrasonography. The accuracy of ultrasonographic detection of pregnancy was 100% for both pregnant and non pregnant females and the results were confirmed at parturition. The results indicated that the conception rate was high on day 60 pp (30%) compared with day 45 (20%) and day 90 (20%) pp. Fecundity rate was 40% on day 60 pp, 30% on day 45 pp and 20% on day 90 pp. Prolificacy rate was 150% on day 45 pp, 133.3% on day 60 and 100% on day 90 pp. The differences in these parameters among the groups were not significant ($p > 0.05$). It could be concluded that fertility rates in Nubian goats synchronized by $PGF_{2\alpha}$ on days 45, 60 and 90 pp were low and there were no significant difference among the groups.

Keywords: Prostaglandin, oestrous synchronization, fertility rates.

Introduction

Oestrous synchronization plays a major role in multiple ovulations, laparoscopic ovum-pick up (LOPU) for oocyte or embryo collection and embryo transfer (ET) (Jainudeen *et al.*, 2000; Rahman *et al.*, 2008). It also allows for controlled parturition at appropriate times of the year to take advantage of forage availability, labour and rising price trends for marketing (Whitley and Jackson, 2004). Methods of oestrous synchronization have included techniques as simple as alteration of light patterns or manipulation of social inputs (i.e., the buck effect) and as complex as varying timed hormonal treatments combined with light alteration and the buck effect (Whitley and Jackson, 2004).Since the length of the inter-oestrus interval in most domesticated species is controlled by the duration of the life span of the CL, premature lysis, induced by the administration of $PGF_{2\alpha}$ or its analogues, can

be used to manipulate the normal pattern of cyclic activity (Noakes *et al.,* 2009).

In goats, the administration of two doses of $PGF_{2\alpha}$ at an interval of 10–12 days has been used to synchronize oestrus (Khanum *et al.*, 2006; Noakes *et al.*, 2009; Riaz *et al.*, 2012). These treatments can be used on cycling goats only, limiting its application during the extended periods with non-functional corpora lutea (Rubianes *et al.*, 2003). Kusina *et al.* (2000) found that double i/m injections of 125 µg of cloprostenol administered 10 days apart were as effective as the progestogen treatments. Also, Khanum *et al.* (2006)observed that estrumate is an efficient synchronizing agent for the Dwarf goats kept under different environmental-nutritive conditions.In Sudanese Desert ewes, Makakwi and Manahil (2007) found that the percentage of ewes showing oestrous response to treatment of double intramuscular injections of $PGF_{2\alpha}$ (80%) was significantlyhigher than those treated with FGA alone (44.4%) or with eCG (55.5%).Contreras-Solis *et al.* (2009)observed that the use of short-interval cloprostenol (3 doses: Days 3, 5 and 7 after ovulation) combined with male effect may be an adequate alternative for synchronizing oestrus and enable applying artificial insemination, in hair sheep, throughout the entire year.

In Sudanese Nubian goats,Ahmed *et al.* (1998)reported that the two injections of PGF2α were more efficient for inducing and synchronizing oestrus with higher pregnancy (77.8%), fecundity (88.8%) and prolificacy (160%) ratesthan the treatment by progesterone (70.4%, 60% and 150% respectively). Also, Riaz *et al.* (2012) recorded higher pregnancy (78%) and fecundity (1.6 ± 0.7) rates in Beetal and Dwarf goats were treated by double injections of PGF2α 10 days apart.

Ronquillo *et al.* (2008) reported that the administration of two doses of PGF2α (10 days apart) after 30 days pp were resulted in low oestrous response (35.7%) with lower pregnancy rates (28.5%) and prolificacy rates (1.3 ± 0.2) in suckling Pelibuey ewes. Fierro *et al.* (2011) noted that in ewes synchronized with $PGF_{2\alpha}$ given twice, 7 days apart, lower reproductive performance was associated with an environment dominated by lower progesterone concentrations that stimulated the pre-ovulatory follicle to grow faster and become larger; this was associated with lower rates of ovulation, conception, prolificacy, and fecundity.

Despite the sizable contribution of the Nubian goats to the national economy, little effort has been undertaken to improve their reproductive performance. The aims of this study were to investigate the effect of oestrous synchronization by $PGF_{2\alpha}$ on subsequent fertility and determine the most suitable time for optimal conception after parturition in Nubian goats.

Materials and Methods:

Area of study:

This study was carried out at the farm of Sudan University of Science and Technology (SUST) at Hilat Kuku - Khartoum North ((N 15° 37` 11.30", E 32º 33` 51.35").

Animals:

A total of 30 Nubian goats at the age of 5-8 years and body weight of 40-60 kgs were used.

Management:

Animals were fed on concentrates (44% sorghum, 36% wheat bran, 10% ground nut cake and 10% ground nut hulls) and alfalfa hay once a day. Water troughs (20 liters capacity) were filled with fresh water twice daily in the morning and afternoon. Mineral salt licks were made available during the whole period of the study. The goats were allowed to exercise and to graze for 4

hours twice a week in an adjacent field. The kids were allowed to suckle normally throughout the study period.

Animals were kept off food for 12 hours prior to scanning. The ventral abdomen was clipped and shaved carefully. Animals were layed on their backs (dorsal recumbency) and well restrained on a flat table, a pillow was used as cushion for their prominent spine and to relax the animal.

Oestrous synchronization, detection and insemination:

The female goats were equally allocated to three groups A, B and C. Each group was given double intramuscular injections of 125 µg (0.5 ml), Cloprostenol (Estrumate, Essex Animal Health Friesoythe, Germany) 11days apart (Khanum *et al.*, 2006; Noakes *et al*., 2009) after 45days (A), 60 days (B) and 90 days(C) pp respectively.

Detection of oestrus was monitored three times daily (morning, afternoon and evening) for a period of 30 minutes after the end of Cloprostenol treatment, by teaser(fertile Nubian bucks) and observation of the signs of overt oestrus (tail wagging, bleating, searching of the male, frequent urination, hyperemia, oedema and contraction of the vulva, vaginal mucus discharge). The goats detected in oestrus in each group were separated from the others and handmated twice at the 1st and 2nd day of oestrus, and dates of mating were recorded.

Fertility measurement:

Conception rates (pregnant does/inseminated does×100) were determined 40-60 days after mating using B-mode real-time ultrasonography (Pie Medical, Easote, Holland) with a 3.5/5 MHz trans-abdominal convex transducer (Abdelgahfar *et al.*,2011).

Sonographic pictures were documented by a video graphic printer (Sony Corporation 6-7-35, Kitashinagawa Shinagawa, Tokyo, Japan). Some other parameters were also investigated and calculated according to Fierro *et al.* (2011), these include:

- Prolificacy rate: (number of embryos/number of pregnant does) ×100.
- Fecundity rate: (number of embryos/total number of does) ×100.

Ultrasound scanning:

Area of scanning extends across the width of the abdomen, passing from one side of the udder across the front of the udder, to the other side 15 cm anterior to the udder. Sufficient amount of ultrasound gel (Aquasonic, Parker Laboratories, INC. Fairfield, New Jersey, USA) was applied to the area prior to scanning.The transducer was held in a sagittal plane and moved in a systemic w- shaped searching pattern from one side of the abdomen to the other (Figure 1). When pregnancy was confirmed then crosses and oblique sections of image were taken(Abdelgahfar *et al.*, 2007).

According to Abdelgahfar *et al.* (2007), measurement of Bi Parietal Diameter (BPD) by the scanning of the head in transverse axial plane was done to determine gestational age by the following equation: Gestational age (days) = 1.432 + BPD (cm)/ 0.055.

Statistical analysis:

Chi square test was used to determine the effect of different synchronization time on fertility measures according to Petrie and Watson (2006). The computer programmer statistical package for social science (SPSS) version 18 was used.

Figure 1: Ultrasound technique for pregnancy detection

Results

All animals were displayed signs of oestrus. The accuracy of ultrasound in measurements of conception, fecundity and prolificacy rates were 100% for both pregnant and non pregnant females, and these results were confirmed at parturition. Doe was considered pregnant when fluid filled (gestational sac) in the uterus and/ or foetal parts were recognized (Figures 2 and 3). The measurement of Bi-Parietal Diameter (BPD) was done as shown in Figure 4.The BPD was used to determine gestational age as in the following equation: Gestational age (days) = 1.432 + BPD (cm) ÷ 0.055.

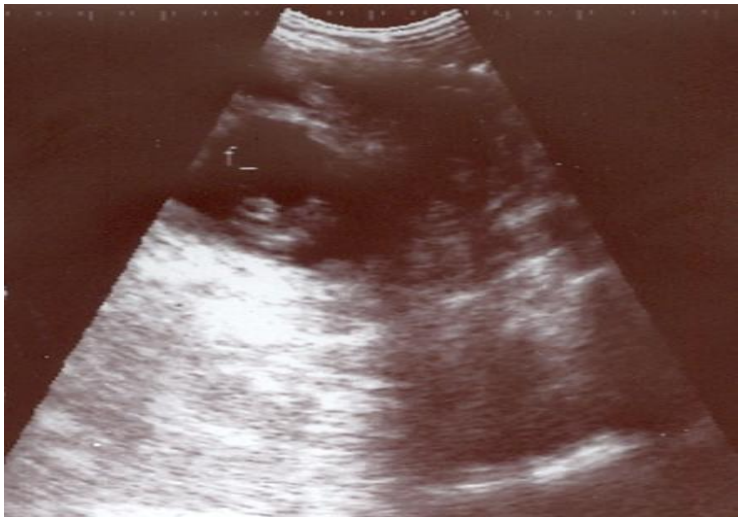

Figure 2: Gestational sac with foetus (f) at 41 days of gestation

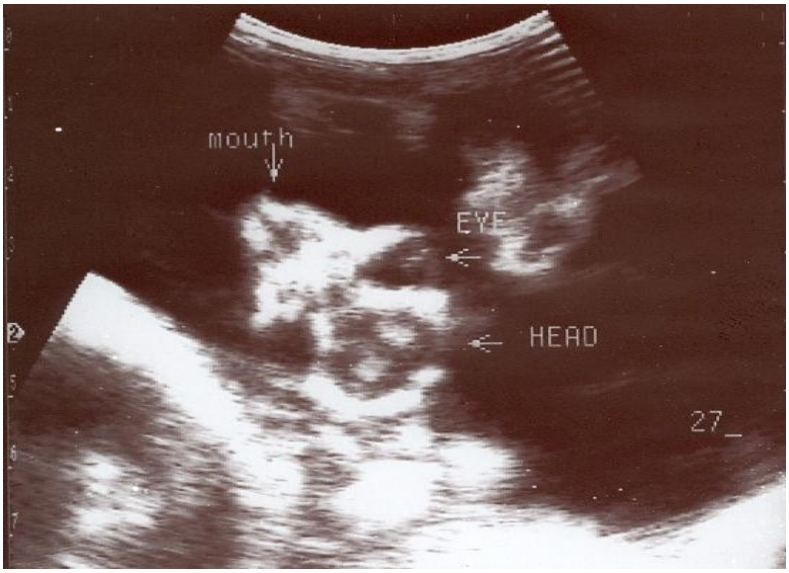

Figure 3: Foetal head with mouth and eye at 63 days of gestation (arrows)

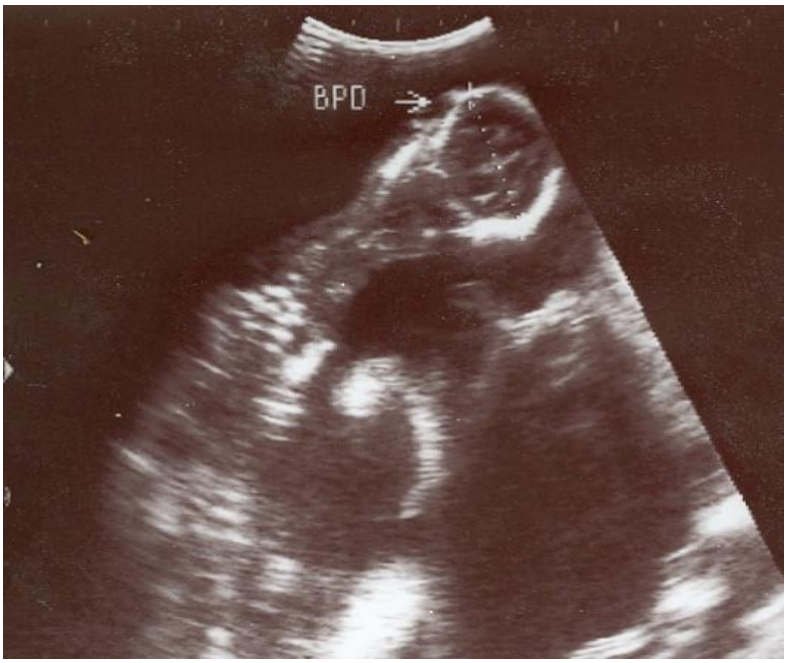

Figure 4: Measurement of BPD (2.99 cm) at 80 days of gestation (arrows)

Number of does returning to oestrus, conception, fecundity and prolificacy rates, evaluated by ultrasonography in goats synchronized with cloprostenol ($PGF_{2\alpha}$) after 45 (group A), 60 (group B) and 90 days pp (group C) are shown in Table 1. Conception rate was high in the group B (30 %) compared with groups A and C (20%),

but this increase was not significant ($p > 0.05$). Fecundity rate was high in the group B (40%), and then followed by the group A (30%) while group C came in last place (20%). Prolificacy rate was slowly high in the group A (150%) rather than the group B (133.3%) and C (100%) and this difference was not significant ($p > 0.05$).

Table 1: Fertility parameters evaluated by ultrasonographyafter synchronization with $PGF_{2\alpha}$during different pp

Parameters	45 days	60 days	90 days
No. of does inseminated	10	10	10
Oestrus response (%)	100%	100%	100%
Does returning to service	8 (80 %)	7 (70 %)	8 (80 %)
Conception rate (%)	2 (20 %)	3 (30 %)	2 (20 %)
Fecundity rate (%)	30	40	20
Prolificacy rate (%)	150	133.3	100
Significance	N.S	N.S	N.S

Discussion

There is little information available on the influence of oestrous synchronization on fertility of sheep and goats during postpartum period. In the present results, the conception and prolificacy rates in these does which were treated by two injections of $PGF_{2\alpha}$ 11 days apart after 60 days pp were similar to that reported by Ronquillo *et al.* (2008) in Pelibuey suckling ewes which were synchronized by the same hormone during 30 days pp. On the other hand, Ungerfeld and Sanchez-Davila (2012) reported that pregnancy rates of 29.7% and 47.1% in Corriedale ewes treated with 8-days-medroxyprogesterone plus eCG during 30 days and 45 days pp, respectively. However, the same authors found pregnancy rates of 59.6% and 85% in Merilin ewes treated by 12-days-medroxyprogesterone following introduction of the rams during 35 days and 90 days pp, respectively. These results disagree with those noted in the present study, when the conception rates were 20%, 30 % and 20% during 45, 60 and 90 days pp, respectively. These variable rates of pregnancy between two studies may attribute to the different methods of oestrous induction which were used in each of them.

In previous report (Ahmed *et al.*, 1998) in Nubian goats synchronized by double injections of $PGF_{2\alpha}$ 13 days apart, the conception, fecundity and prolificacy rates were 77.8%, 88.8% and 160% respectively. These findings were dissimilar compare with those demonstrated by the current results and this variation may be due to the difference between methods of pregnancy detection were used in two studies or because the present study was conducted during the pp period.

Although, many previous studies in sheep (Makakwi and Manahil, 2007) and goats(Kusina *et al.*, 2000; Riaz *et al.*, 2012) noted that overall fertility rates were higher when use$PGF_{2\alpha}$ for oestrous synchronization, but some authors like (Fierro *et al.*, 2011) found that conception, fecundity and

prolificacy rates measured by ultrasonography in ewes synchronized with $PGF_{2\alpha}$ were lower than those in spontaneous oestrus. The present findings were in accord with the last authors.

Conclusions and Recommendations:

- The accuracy of ultrasonography in measurements of conception, fecundity and prolificacy rates were 100%.
- Fertility rates of Nubian goats, in this study, were low with no significant differences among treatment groups at 45, 60 or 90 days postpartum.
- Further research to improve postpartum fertility Nubian goats could include: improved nutrition, suckling, management and other hormonal protocols for oestrous synchronization.

Acknowledgments

Great thanks to Scientific Research Council, Sudan University of Science and Technology (SUST), for providing financial support for this study.

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تأثير المعالجة بواسطة هرمون البروستاقلاندين علي حدوث الشبق والخصوبة الناجمة في الماعز النوبية

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المستخلص

أستخدمت في هذه الدراسة عدد 30 ماعز نوبية لقياس تأثير المعالجة بواسطة هرمون البروستاقلاندين علي حدوث الشبق ومعدلات الخصوبة الناجمة وذلك في أيام 45 و 60 و90 مابعد الولادة. قسمت الحيوانات الي ثلاثة مجموعات بالتساوي (10 ماعز لكل مجموعة) وعولجت كل الحيوانات بهرمون البروستاقلاندين بجرعة قدرها 125 مايكروغرام في العضل مع تكرار الجرعة بعد 11 يوماً من الجرعة الأولى. أجري الكشف عن الشبق عن طريق المراقبة وبمساعدة تيوس نوبية، بعد ذلك أستخدمت تيوس نوبية معلومة الخصوبة لتلقيح الإناث التي ظهرت عليها علامات الشبق في اليوم الأول والثاني من ظهورها. أجري قياس معدلات الحمل و الخصوبة والمواليد لكل مجموعة في الفترةمن 40 الي 60 يوماً بعد التلقيح عن طريق الموجات فوق الصوتية.وكانتدقةالتشخيص بالموجات فوق الصوتيةبنسبة 100٪في الإناثالحواملوغيرالحوامل، وأكدت هذه النتائجبعدالولادة. أظهرت نتائج هذه التجربة أن معدل الحمل في يوم 60 بعد الولادة (30%) أعلي مقارنة بيومي 45 و90 بعد الولادة (20%). وكان معدل الخصوبة 40% في يوم 60 و 30% في يوم 45 و20% في يوم 90 بعد الولادة. وكان معدل المواليد 150% في يوم 45 و 133.3% في يوم 60 و 100% في يوم 90 بعد الولادة. كما أن الاختلافات في تلك المعايير بين المجموعات كانت غير معنوية. اتضح من هذه الدراسة أنمعدلات الخصوبة في الماعز النوبية المعالجة بواسطة هرمون البروستاقلاندين في أيام 45 و 60 و 90 بعد الولادة متدنية مع عدم وجود أي أختلاف معنوي بين المجموعات.