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FERTILITY RESPONSE OF NUBIAN GOATS AFTER OESTRUS SYNCHRONIZATION WITH PROGESTERONE, PGF2A AND ECG

(With One Table)

By

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استجابة خصوبة الماعز النوبي بعد تزامن الشبق بهرمونات البروجسترون والبروستجلاندين والحاثة المنسلية المشيمية الخيلية

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أجريت هذه الدراسة لمعرفة فاعلية المعاملات الهرمونية في تحفيز وتزامن الشبق وزيادة معدل المواليد في الماعز النوبي بالسودان. استعمل في هذه الدراسة عدد 60 رأس من الماعز وزعت لأربعة مجموعات (أ – د) بمعدل 15 رأس لكل مجموعة. المجموعة أ (المجموعة الضابطة) تركت من غير معاملة هرمونية ولقحت طبيعياً، أما المجموعات الأخرى (ب، ج، د) فقد تمت معاملتها بهرمونات البروجسترون (FGA sponges) والحاثة المنسلية المشيمية الخيلية (FGA+eCG) والبروستجلاندين (FGA+ PGF2α.) على التوالي. تم تلقيح المجموعات الثلاثة اصطناعياً باستعمال السائل المنوي الطازج والمخفف بعد 48 ساعة من انتهاء المعاملات الهرمونية. أوضحت النتائج أن كل المعاملات الهرمونية التي استخدمت قد أحدثت شبقاً متزامناً. كانت الاستجابة أعلى (80%) في المجموعة ب والمجموعة ج، بينما كانت الاستجابة أقل (65%) في المجموعة د. أعلى نسبة للحمل (45%) وأعلى نسبة للتوائم (35%) سجلت في المجموعة ج. لم تكن هناك فروقات معنوية في معدل الولادات وطول فترة الحمل نتيجة للمعاملات الهرمونية. من النتائج السابقة يمكن أن نخلص إلى أن استعمال الاسفنجات المهبلية المشبعة بهرمون البروجسترون مع الحقن بهرمون الحاثة المنسلية المشيمية الخيلية أو البروستجلاندين قد عملت على تحفيز وتزامن دورة الشبق في الماعز النوبي.

SUMMARY

The reproductive performance following oestrus synchronization and artificial insemination (AI) was evaluated during autumn and early winter in 60 Nubian goats in the Sudan to determine the best hormonal approach in inducing and synchronizing oestrus. The animals were divided into 4 groups (A–D). All goats, except the control group, were synchronized for 12 days with flourogestone acetate (FGA) sponges followed by an IM injection of equine chorionic gonadotropin (eCG) or cloprostenol (PGF2α) at progestagen withdrawal. Cervical artificial inseminations (AI) were performed at 48 h after FGA withdrawal using fresh diluted semen. Results obtained indicated that all hormonal treatments used were efficient to induce and synchronize oestrus in Nubian goats. However, the response in treatment B and treatment C (FGA and FGA/eCG) were higher (80%) than FGA/PGF2α treatment (65%). Animals treated with FGA/eCG recorded higher pregnancy rate (45%) and kidding rate (35%). The fertility as indicated by pregnancy and kidding rates was lower in animals treated with FGA/PGF2α and in the control group. In the present study, kidding rate, fecundity, twining rate and gestation length were not significantly affected by synchronization methods. Therefore, the use of progestagen sponges with or without eCG or PGF2 α was effective in induction and synchronization of oestrus in Nubian goats.

Keywords: *Oestrous synchronization, Nubian goats, FGA, eCG, PGF2 α.*

INTRODUCTION

Oestrus detection is time consuming and subject to human error. Therefore, synchronization of oestrus and ovulation in a group of females allows one to predict the time of oestrus with reasonable accuracy and minimizes the time and difficulty involved in detecting oestrus (Abu *et al*., 2008). Oestrous synchronization together with AI in goats is important in the improvement of reproductive efficiencies and management programmes. Successful techniques must not only establish tight synchrony, but also provide an acceptable level of fertility upon AI or natural mating (Wildeus, 2000; Lassala *et al.*, 2004; Chao *et al*., 2008). Methods of 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 (Whitely and Jackson, 2004). This can be achieved in farm animals when the luteal phase is shortened by premature luteolysis of functional

corpora lutea or the phase is extended by suppressing follicular growth (Abu *et al*., 2008).

A number of workers have administered progestagens in cyclic female goats with satisfactory results (Wildeus, 2000; Dogan *et al*., 2005; Abu *et al*., 2008). At the same time, prostaglandin F2α and its synthetic analogues have been found to be more efficiently used to synchronize oestrus in goats during natural breeding season and was found to be the more convenient and economical method (Muna *et al*., 1998; Wildeus, 2000; Faruk *et al*., 2004; Bitaraf *et al*., 2007). PGF2α application together with FGA increased oestrus response rates (Dogan *et al*., 2005). The use of Gonadotropins such as eCG in conjunction with intravaginal progestagen treatment, regardless of PGF2α administration was found to be efficient method for oestrus induction and synchronization in sheep and goats (Fonseca *et al*., 2005; Dogan and Nur, 2006; Mehmet and Mehmet, 2006).

Although oestrus synchronization in goats has been accomplished using several protocols with varying degrees of success, very scarce work has been conducted concerning the efficacy of oestrus synchronization in Sudanese goats. Therefore, the objective of the present study was to compare the efficiency of FGA sponges in combination with either eCG or cloprostenol in inducing and synchronizing oestrus cycle in Nubian goats in the Sudan and compare the fertility rates obtained following AI.

The objective of the present study was to compare the efficiency of different hormonal treatments in synchronizing oestrus in Nubian goats and compares the fertility rates obtained following AI at the induced oestrus.

MATERIALS and METHODS

Location:

This study was carried out at the National Artificial Insemination Centre, Khartoum North, Sudan. The area is located at a latitude of 15^0 36' N, a longitude of 32^0 33' E and an altitude of 380 m above sea level.

Experimental animals:

The experiment was performed on a total of 60 mature Nubian dairy does. The does were 2–5 years of age with an average body weight of 30 kg. The animals were kept on suspended pens and fed daily with a ration that contained wheat bran (43%), molasses (32%), ground nut

cake (20%), urea (3%) and salt (2%). Alfalfa hay was fed *ad libitum*. Water and mineral licks were always available. Before the beginning of the experiment, all does were checked for the absence of pregnancy by radioimmunoassay (RIA).

Treatments:

The animals were allocated to four groups each of 15 does. The four treatment groups consisted of the following:

Treatment A (control): Does received no treatment and were naturally mated at natural heat. All other groups received intravaginal progesterone-impregnated sponges (40 mg of flourogestone acetate, FGA, Sanofi, France) for 12 days.

Treatment B: Does were artificially inseminated 48 h after sponge removal.

Treatment C: Does were injected with 300 – 500 IU of PMSG (Intervet, UK) intramuscularly at time of sponge removal and artificially inseminated 48 h later.

Treatment D: Does were injected with PGF2α (cloprostenol, Coopers, France) at time of sponge removal and artificially inseminated 48 h later.

All does were monitored for oestrus behaviour after each treatment. The oestrus signs observed were: restlessness, constant wagging of the tail from side to side, vaginal mucous and mounting activities. Cervical artificial inseminations (AI) were performed using fresh extended (Tris extender) Saanen semen. A volume of 0.5 ml fresh extended semen containing 200 x 10^6 sperms was administered intracervically. Conception rates based on non-return were determined 21 – 60 days following insemination. Early pregnancy was confirmed by RIA for measuring progesterone (P4) in serum. Samples were collected in heparinized tubes at weakly intervals and centrifuged for 15 min. The plasma was stored at – 20 until assayed for progesterone. RIA kits were supplied by the International Atomic Energy Agency.

Statistical Analysis:

Numbers of does showing oestrus, pregnancy and kidding were analyzed using Chi-square ($\chi 2$) technique, and other data were analyzed by the analysis of variance using Statistical Package for Social Science.

RESULTS

The results in terms of oestrus response, pregnancy rate, kidding rate, fecundity (number of kids born/number of females kidded), twining rate and gestation length are set out in Table (1). The results revealed

that the degree of oestrus response due to hormonal treatments was not significantly different ($p > 0.05$); although oestrus response obtained from FGA/PGF2α (Treatment D) was the lowest (65%). Conception rate showed significant treatment effect. It was highest (40 and 45%) in FGA and FGA/PMSG groups, respectively (Treatments B and C) and least (30%) in FGA/PGF2α treatment and the control group (20%). Fertility measured by the kidding rate was not significantly different between groups, although it was better (35%) in treatment C and low (20%) in the control group. Twining rate, fecundity and gestation length were not significantly affected by synchronization methods.

Table 1: Fertility of Nubian goats after different oestrus synchronization treatments.

Parameter	Treatments			
	A	B	C	D
No. of animals No. of animals	15	15	15	15
Oestrus response (%)	100[a]	80[b]	80[b]	65[b]
Conception rate (%)	20[b]	40[a]	45[a]	30[b]
Kidding rate (%)	20[a]	30[a]	35[a]	25[a]
Fecundity	0.25±0.05[a]	0.65±0.5[a]	0.75±0.5[a]	0.45±0.5 [a]
Twining rate	0.16[a]	0.37[a]	0.41[a]	0.25[a]
Gestation length (days)	146.3±2.1[a]	152.3±1.9[a]	147±1.5[a]	149.0±2.1[a]

Values within different superscripts in the same raw differ significantly ($P<0.05$).
A = contrpl group.
B = FGA sponges.
C = FGA + PMSG.
D = FGA+ PGF2α.

DISCUSSION

The three synchronization methods employed in this study resulted in oestrus response in 65 – 80% of the treated goats. The responses in all hormonal protocols were as good as those of previous works (Muna *et al*., 1998; Chao *et al*., 2008; Abu *et al*., 2008). On the other hand, the oestrus response obtained in this study was lower than the 100% reported by Dogan *et al*. (2005). Oestrus response in the present study was not affected by synchronization methods; although

lower response (65%) was recorded on PGF2 α treatment. Although PGF2 α seems to be very effective for rapid lysis of corpora lutea and subsequent falling of progesterone (Whitley and Jackson, 2004; Bitaraf *et al*., 2007), not all stages of the oestrus cycle are similarly receptive to PGF2 α treatment (Wildeus, 2000). Some goats in the flock will be in early stages of the luteal phase at the time of synchronization (Karikari *et al*., 2009). In the present trial, the progesterone effect (Treatment B) on oestrus synchronization in Nubian goats agrees with the earlier reports of Lassala *et al*. (2004) in crossbred Alpine x Boer and Abu *et al*. (2008) in West African Dwarf goats. Oestrus response and fertility vary greatly when intravaginal sponges are applied, dependent on species, breed, co-treatment, management and mating system (Wildeus, 2000).

The overall post-treatment conception rate with fresh diluted semen found in this study was 38.3.0%. This finding is similar to the results of other works (Muna *et al*., 1998; Dogan and Nur 2006). The results are lower than that reported by Lassala *et al.* (2004); Dogan *et al*. (2005); Imasuen and Ikhimioya (2009) and Karikari *et al*. (2009). FGA treatments in this study with or without eCG yielded fertility rates (40 – 45%) that were higher ($P < 0.05$) than those in FGA/ PGF2 α treatment (30%) and the control group (20%) which indicated better response to hormonal treatments and AI compared to the control group which was hand mated. Hormonal treatments can stimulate follicular growth and affect the time of ovulation (Dogan *et al*., 2005). The use of FGA sponges in combination with eCG at withdrawal was successful for synchronization during the breeding season in sheep and goats (Fonseca *et al*., 2005; Dogan and Nur 2006; Mehmet and Mehmet, 2006). The use of eCG resulted in a more predictable occurrence of oestrus. One limitation of eCG after long-term use is the active production of anti eCG antibodies which decreases fertility in goats (Leboeuf *et al.*, 1998; Fonseca *et al*., 2005).

In the present study, AI in synchronized does was carried out at a fixed time following sponge withdrawal. The low conception rate recorded could be attributed to the inseminations being executed too late in some goats in the flock or in early stages of the luteal phase at the time of synchronization (Chao *et al*., 2008; Karikari *et al*., 2009). A decrease in fertility following progestin-based synchronization of oestrus in the absence of a corpus luteum has been observed (Lassala *et al*., 2004). It means that when applying artificial insemination in fixed time in induced oestrus in goats, interval to oestrus should be considered (Fonseca *et al*., 2005).

In the present study, kidding rate, fecundity, twining rate and gestation length were not significantly affected by synchronization methods. Similarly, reproductive performance of Sudanese Nubian goats (Muna *et al*., 1998) and Nadooshani goats (Bitaraf *et al*., 2007) was not significantly affected. The results in this study showed low kidding rate. High incidence of embryonic loss was also reported by Muna *et al*. (1998). It was suggested that the high loss of embryos after synchronization and insemination was caused by functional poor corpora lutea bringing low doses of progesterone (Chao *et al*., 2008). Although fecundity was not significantly different between hormonal treatments, it increased ($P < 0.05$) over that of the control and it was better in eCG groups, suggesting that treatment with eCG after the removal of the sponge influenced the fertility or fecundity rates (Mehmet and Mehmet, 2006). The gestation length (146 – 152 days) was not significantly different between groups and within the normal range (144 – 155 days) reported by Bitaraf *et al*. (2007). Twining rate in the present study was not significantly different between treatment groups. The results showed better reproductive performance with treatments B and C.

In conclusion, it can be said that progesterone treatments (FGA) intravaginal sponges and their combinations with either eCG or PGF2α in Nubian goats are efficient in synchronizing oestrus. FGA with or without eCG seems to be more convenient.

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