EFFECT OF LONG-TERM AND SHORT-TERM PROGESTAGEN TREATMENTS ON THE INDUCTION OF ESTRUS AND LAMBING RATE IN ACYCLIC EWES

By

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ABSTRACT

A total of twenty nine Romanov crossbred ewes were divided into three groups. Ewes in group 1 (n = 10) and group 2 (n = 9) long-term treatment received intravaginal fluorogestone acetate (FGA, 30 mg) for 14 and 12 days, respectively, with or without 500 IU PMSG injected at sponge removal. Ewes in group 3 (n = 10) short-term treatment received flourogestone acetate for 6 days plus i.m. injection of 500 IU PMSG at sponge withdrawal. All ewes were intramuscularly injected with 125 μg $PGF_{2\alpha}$ at sponge withdrawal. Percentage of ewes in estrus was significantly ($P < 0.05$) higher in long-term plus PMSG and short-term treated ewes than with long-term without PMSG (90 and 80% vs. 44.4%, respectively). The time elapsed from sponge withdrawal to onset of estrus was significantly ($P < 0.05$) longer in long-term treated ewes without PMSG than in both long-term ewes plus PMSG and short term treatment (48 h vs. 29 and 26 h, respectively). Lambing rate was higher in short-term and long-term treated ewes plus PMSG than in long-term treated ewes without PMSG (100 and 66.7% vs. 50%, respectively). However, within treatments number of lambs born, incidence of twins and fecundity rates were higher in ewes administered 500 IU PMSG than those not injected with PMSG. We concluded that short-term progestagen (6 d) combined with PMSG can be used successfully to induce fertile estrus in late seasonal anestrus ewes.

INTRODUCTION

The control of estrus and ovulation in farm animals remains the basis and a prerequisite for the success of controlled breeding. Long-term (12 to 14 d) progestagen treatments are widely used in small ruminants to induce and synchronize estrus. As a result of

treatment a high percentage of animals show estrus, but fertility is lower than that of ewes showing natural estrus (Robinson *et al.*, 1970). Two explanations are offered for the reduction of fertility: impaired sperm transport and survival that reduces the number of ova fertilized (Allison and Robinson, 1970); an extension of the life span of the ovulatory follicle, as a consequence of low concentrations of progesterone (Vinoles *et al.*, 1999), that may be associated with a low viability of the ovulated oocyte.

Recently, it has been reported that short-term (5 to 6 d) treatment with different progestagen devices during the non-breeding season which shows higher progeserone levels at the time of device withdrawal, were as effective as long-term treatment to induce estrus, and the subsequent fertility was also high (Ungerfeld and Rubianes, 1999 and Vinoles *et al.*, 2001). These short term primings can be a good alternative to transitional primings (12-14 d), permitting more flexibility under field conditions A 5 day progestagen treatment was used in combination with PG to improve estrus synchronization with good results (Beck *et al.*, 1993), but the potential benefit of a short-term treatment alone has not yet been evaluated. The administration of PMSG when progestagen treatment was terminated could compensate for the deleterious effect of long-term treatment on follicular dynamics by promoting the recruitment of new follicles (Noel *et al.*, 1994) and could overcome the problem of lower fertility (Boland *et al.*, 1978). The aim of this study was to compare the effect of the length of a progestagen treatment (12 to 14 d vs. 6 d) on estrus synchronization and pregnancy rates using fluorogestone acetate (FGA) with or without PMSG at the end of FGA treatment.

MATERIALS AND METHODS

This study was carried out on 29 clinically normal mature Romanov crossbred ewes belonging to Mehallet Mousa Station, Animal Production Institute, Ministry of Agriculture from end of May 2003 till January 2004. The average age of the ewes was 3 years and the average weight was 50 kg. Ewes were fed concentrate mixture (0.5 kg), rice straw (0.6 kg) and berseem hay (3-4 kg). Besides, water and salt were freely available. The experiment was conducted during the late seasonal anestrus. The ewes were

assigned into three groups. In the first group (n = 10) each ewe received an intravaginal sponge containing 30 mg fluorogestone acetate (FGA; Chronogest, Intervet) for 14 days. Estrumate (125 μg Cloprostenol, Coopers Tierazneimittel GmBH, Germany) and pregnant mare serum gonadotropin (PMSG folligen, intervet) 500 IU were administered i.m. at removal of vaginal sponges. In the second group (n = 9) received sponges similar to group 1 but the sponges were left *in situe* for 12 days. At sponge withdrawal, all ewes received only 125 μg cloprostenol (estrumate) intramuscularly. In the third group (n = 10) received sponges for 6 days followed with i.m injection of both cloprostenol (125 μg) and PMSG (500 IU) at sponge removal. At the end of hormonal treatments all ewes were placed with sexually experienced adult Romanov crossbred rams (one ram: 10 ewes). Rams were fitted with marking harnesses and marked ewes were recognized twice daily for 72 h after sponge withdrawal for onset of estrus. At mating time, ewes were allowed to be mated naturally with two fertile rams for each group.

The number of marked ewes, the interval from device withdrawal to estrous onset and lambing rate for fluorogestone acetate duration (14 & 12 vs. 6 days) were recorded.

The obtained data were statistically analysed using (Chi-square test) General Linear Models Procedure Adapted by SPSS (1997) for Use's Guide.

RESULTS AND DISCUSSION

Results in Table (1) show that 6-day progestagen priming plus PMSG (short-term treatment) is as effective as longer traditional priming with PMSG (14 d) to induce estrus during late seasonal anestrus (80 vs. 90%, respectively). However, ewes received FGA for 12 days without PMSG showed lower ($P < 0.05$) percentage of heat exhibition (44.4%). These findings agree with previous works where similar percentages of marked ewes were obtained by administering either daily progesterone injections or using fluorogestone intravaginal sponges for short periods (Ungerfeld and Rubianes, 1999). Also, Rubianes *et al.* (1998) found that 5-day progesterone priming (CIDR) plus eCG was effective in inducing estrus (100%) in seasonally anoestrus goats with a high conception rate (60 to 70%). Present results extended these previous

observations to seasonal anoestrus ewes. Zeleke *et al.* (2005) found that no significant differences in terms of estrous response in Dorper ewes due to differences in the type of progestagen sponges (MAP vs. FGA) or time (24 h before, at or 24 h after sponge removal) and route (i.m. vs. subcutaneous) of PMSG administration. Motlomelo *et al.* (2002) reported that the three progestagen treatments (MAP, FGA or CIDR for 16 days plus 300 IU PMSG at sponge withdrawal) did not show significant differences in estrous response (93.1, 96.7 and 100%, respectively) in goats. The response obtained in the present trial was lower than 92.3 to 96.4% reported by Ungerfeld and Rubianes (1999), 100% reported by Ungerfeld and Rubianes (1999a) but it was higher than 79.3, 77.4 and 80.9% reported by Simonetti *et al.* (2000).

Table (1): Estrus response, interval to onset of estrus and lambing rates after a long-term (14 d & 12 d) and short-term (6 d) treatment with intravaginal FGA (30 mg).

Groups	No.	Marked ewes		Interval to onset of estrus (d)	Lambing rate	
		No.	%	Mean ± S.E.	No.	%
G_1 (14 d)	10	9	90.0^{b}	$29^{a} + 2.5$	6	66.7^{a}
G_2 (12 d)	9	4	44.4^{a}	$48^{b} + 2.0$	2	50.0^{a}
G_3 (6 d)	10	8	80.0^{b}	$26^{a} + 2.4$	8	100.0^{b}

a, b means within columns with different superscripts are significantly different ($P < 0.05$).

The interval from sponge withdrawal to onset of estrus was significantly ($P < 0.05$) shorter (26 h) in short-term treatment than in either long-term treatments (14d-29 h & 12 d- 48 h), Table (1). This finding was in contrast with the finding by Vinoles *et al.* (2001) but it was in agreement with that reported by Ungerfeld and Rubianes (1999), who found that the time elapsed from sponge removal to onset of estrus was significantly shorter in 6-day than in both 3-day or 12-day treated ewes. They added that 73% of 6-day treated ewes came into estrus between 24 and 48 h after sponge withdrawal. In our short-term treatment, 87.5% of ewes showed estrus at that time. The different intervals to estrus could reflect differences among treatments in the development stage and/or the growth rate of the follicle selected to ovulate. However, it was demonstrated that the

growth rate during the final maturation of an ovulatory follicle recruited by PMSG administration was not affected by the progesterone priming (Walton *et al.*, 1995). Souza *et al.* (1996) and Bartlewski *et al.* (1998) found that in seasonally anestrus ewes follicular waves emerge approximately every 5 days. During the estrus cycle of ewes, supraluteal progestagen concentrations decrease the growth of the dominant follicle of wave 1 (Rubianes *et al.*, 1996) and the supplementation with a progestagen accelerates the follicular wave turnover (Noel *et al.*, 1994). It may be that, after 6-d short-term treatment priming with high levels of progestagen, a young and growing follicle was challenged in most ewes by the mild dose of PMSG used.

Short-term treatment led to high lambing rate (100%) followed by long-term treatment (14 d) plus PMSG (66.7%) while it was (50%) in long-term treatment (12 d) without PMSG (Table, 1). The lower pregnancy rate observed after the long-term progestagen treatment is in agreement with a previous reported of Smith *et al.* (1991) who found that in two trails, a 9 and 21% decrease in pregnancy rate was observed in long-treated ewes compared with control ewes. Recently, it was found in cows that when follicle dominance was prolonged more than 9 d, with low progesterone concentrations, a reduction in follicle health occurred (Mihm *et al.*, 1999) and low fertility was observed. This was attributed to an impaired oocyte quality ovulated by an aged dominant follicle (Revah and Bulter, 1996). Therefore, low fertility (66.7 & 50%) observed in our long-term treatment with FGA plus or without PMSG is probably due to the decrease in the endogenous progesterone concentrations and/or a lower rate of progestagen absorption (McDonnell, 1985, Harmra *et al.*, 1986 and Vinoles *et al.*, 2001). In the short-term treatment, where progestagen levels were high due to the endogenous progesterone secretion and/or a higher rate of exogenous progestagen absorption, a normal follicular turnover was promoted and a newly formed follicle ovulated (Vinoles *et al.*, 2001). This could explain the higher pregnancy rate observed in this treatment. It is interesting to note that in the short-term treated ewes, the pregnancy rate was better than usually achieved after traditional synchronization protocols (Robinson *et al.*, 1970).

Table (2): Effect of different hormonal treatments on the pattern of lambing and fecundity rate in Romanov crossbred ewes.

Groups	No. of lambed ewes	Litter size		Pattern of lambing						Fecundity rate
				Singles		Twins		Triplet		
		No.	Average	No.	%	No.	%	No.	%	
G_1 (14 d)	6	10	1.67[a]	2	33.3	4	66.7[ab]	-	-	167
G_2 (12 d)	2	3	1.50[a]	1	50.0	1	50.0a	-	-	150
G_3 (6 d)	8	18	2.25[b]	-	-	6	75.0[b]	2	25.0	225

a, b means within columns with different superscripts are significantly different ($P < 0.05$).

The PMSG treatment improved twining rate in both long-term (14 days) plus PMSG and short-term treatment (Table 2). These findings were contrasted with finding of Greyling *et al.* (1997) , Vinoles *et al.* (2001) and Ungrefeld and Rubianes (2002), but in agreement with that reported by Zeleke *et al.* (2005) who found that pregnancy, lambing and fecundity rates were significantly higher in ewes given 300 IU PMSG 24 h prior to or at sponge withdrawal compared to those administered 24 h after sponge withdrawal. Administration of PMSG provoked the development of follicular cysts in some cases probably because endogenous progesterone levels were still high at the time of PMSG injection (Vinoles *et al.*, 2001). Therefore, the reduction in fertility observed in long-term treatment could be associated with the development of follicular cysts. In cattle, follicular cysts are commonly accompanied by behavioural estrus, but mostly no ovulations occur (Garverick, 1997 and Webb *et al.*, 1998). We concluded that the lower lambing rate observed after long-term progestagen treatment was related to a slow follicle turnover that promoted the ovulation of persistent dominant follicle, while short-term progestagen treatment resulted in a higher lambing rate probably due to the ovulation of newly recruited growing follicles. Also, PMSG-treatment leads to improve fertility and twining rates in long-term treatment (14 d) when compared with the long-term treatment without PMSG.

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الملخص العربى

تأثير المعاملة بالبروجستاجين لمدة طويلة ولمدة قصيرة على استحداث الشياع ومعدل الولادة فى النعاج الخاملة جنسيا

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استخدم فى هذه الدراسة ٢٩ نعجة من خليط الرومانوف وقسمت إلى ثلاث مجاميع: معاملة طويلة الأجل: تتلقى كل نعجة فى المجموعة الأولى (عددها ١٠ نعاج) ، والمجموعة الثانية (عددها ٩ نعاج) لبوس مهبلى (خلات الفلوروجستين ٣٠ مليجرام) لمدة ١٤ يوم ، ١٢ يوم على

التوالى مع أو بدون الحقن بـ ٥٠٠ وحدة دولية من مصل الفرس الحامل عند إزالة اللبوس المهبلى والمعاملة قصيرة الأجل (المجموعة الثالثة وعددها ١٠ نعاج) حيث تتلقى كل نعجة لبوس مهبلى (خلات الفلوروجستين ٣٠ مليجرام) لمدة ٦ أيام مع الحقن العضلى بـ ٥٠٠ وحدة دولية من مصل الفرس الحامل عند إزالة الاسفنجات المهبلية. وتم حقن كل نعاج التجربة عضليا بـ ١٢٥ ميكروجرام بروستاجلاندين عند إزالة الاسفنجات المهبلية. أظهرت النتائج أن النسبة المئوية لحدوث الشياع كانت مرتفعه معنويا فى النعاج المعاملة باللبوس المهبلى لمدة طويلة مع الحقن بالـ PMSG والنعاج المعاملة باللبوس المهبلى لمدة قصيرة بالمقارنة بالنعاج المعاملة باللبوس المهبلى لمدة طويلة بدون الحقن بمصل الفرس الحامل (٩٠ & ٨٠٪ مقابل ٤٤,٤٪ على الترتيب). الوقت المنصرم من وقت إزالة اللبوس المهبلى لبدء حدوث الشياع كان طويل معنويا فى النعاج المعاملة باللبوس المهبلى لمدة طويلة بدون مصل الفرس الحامل بالمقارنة بالنعاج المعاملة باللبوس المهبلى لمدة طويلة مع الحقن بمصل الفرس الحامل والنعاج المعاملة باللبوس المهبلى لفترة قصيرة (٤٨ ساعة مقابل ٢٩ & ٢٦ ساعة على الترتيب). النسبة المئوية للولادة كانت مرتفعه معنويا فى النعاج المعاملة بمصل الفرس الحامل واللبوس المهبلى لمدة قصيرة وطويلة بالمقارنة بتلك بدون مصل الفرس الحامل (١٠٠ & ٦٦,٧٪ مقابل ٥٠٪ على الترتيب) ومع ذلك فإن عدد الحملان المولودة وحدوث التوأم ومعدل الخصوبة كانت عالية فى النعاج المعاملة بـ ٥٠٠ وحدة دولية من مصل الفرس الحامل بالمقارنة بتلك الغير محقونة بالـ PMSG.

ونستنتج من ذلك ان المعاملة باللبوس البروجستاجين المهبلى المقترن باستخدام الـ PMSG يمكن استخدامها بنجاح لاستحداث الشياع المخصب فى النعاج أثناء الفترة الأخيرة من موسم الخمول الجنسى.