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Research Article

Chronological relationships between oestrus onset, time of LH surge and ovulation time in does synchronized using fluorogestone with different doses of eCG

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Abstract

A controlled study was conducted to evaluate chronological relationship between oestrus onset, time of LH surge and ovulation time in does synchronized with Fluorogestone with different doses of pregnant mare serum gonadotropin (PMSG). For the purpose of the study, a total of 90 desert goats were used in this experiment. All does were treated with impregnated vaginal sponge containing 45 mg Chronogest. Upon sponge removal, animals were divided randomly into 3 groups (A, B, and C) and assigned to different PMSG doses (group A, 300 IU, group B, 500 IU and group C, 700 IU). There were no significant differences (P>0.05) between the treatment groups for the onset of oestrus or oestrous duration. Ovulation was occurred 54 hours post removal (HPR) in group A and 48 HPR in group B and C. LH surge reached 28 hours post removal, irrespective of the treatment. The chronological relationship between ovulation and oestrous onset was significantly longer in group A compared with group B and C. The time taken from LH surge to ovulation was significantly longer in group A (25.5 hours) compared with group B and C (19.7 and 19.8 hours, respectively). There was no significant difference in the time taken from LH surge to ovulation in group B and C. These results imply that the increasing doses of PMSG, following a 12 day treatment with intravaginal sponges significantly affect the ovulation time and chronological data in desert goats.

Keywords: Goats; PMSG; heat onset; ovulation time; LH surge

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Introduction

Estrus synchronization or the induction of oestrus is a valuable management tool for increasing the pregnancy rate in goats (Lymberopoulos et al., 2002). Wide variations are reported in time of oestrous onset in goats 28 hours after sponge removal in hair goats after short and long progesterone treatment (Karaca et al., 2010) and 30.7 hours after sponge removal in Nguni goats injected with 300IU pregnant mare serum gonadotropin (PMSG) (Lehloenya et al., 2005). Many studies investigated the effects of different doses of PMSG on the onset of the induced oestrous in goats, 28.3 hours after Controlled Internal Drug Releasing Device (CIDR) removal in the Desert goats injected with 700IU PMSG (Elmubark, 2010), 39.8 hours was reported after CIDR removal in the Desert goats injected with 300IU PMSG (Ali, 2004).

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In other reports, 24 hours after CIDR removal in Saanen goats receiving 100 IU PMSG (Oliveira et al., 2001) and 39.3 hours after sponges removal was reported in Boer goat synchronized with 500IU PMSG (Greyling and Van-Niekerk, 1991).

PMSG elicits response characteristics of both follicle stimulating hormone (FSH) and luteinizing hormone (LH) (Mit et al., 2004). A previous study noted that when intravaginal progesterone devices are used, it is necessary to use PMSG as a source of gonadotrophin at the end of the progesterone priming period (Noakes, 2001). The responses to different PMSG doses varies among various breeds (Karagiannidis et al., 2001). The increasing doses of PMSG increases the ovulation rate in non-lactating goats and advances the time of ovulation in lactating and non-lactating females (Ritar et al., 1984). PMSG may increase not only the number of follicles, but also the growth rate of the large follicles (Ritar et al., 1984). Previous studies (Zarkawi et al., 1999; Ustuner et al., 2007) reported that PMSG administration improved the efficiency of synchronization of oestrus and ovulation both during and outside the breeding season. However, the different PMSG doses following 12 days treatment period with intravaginal sponges in Awassi ewes during the transition period had a characteristic effect on the reproductive performance (Abuzer et al., 2011). The PMSG treatment induces a preovulatory LH peak in a greater number of goats (Robin et al., 1994). A routine synchronization treatment combining vaginal sponges inserted for 11 days, together with a prostaglandin and eCG injections 2 days before sponge removal, efficiently induces and synchronizes oestrus and ovulation during the breeding as well as the non-breeding seasons (Leboeuf et al., 2003).

The objective of this study was to investigate the impact of oestrus synchronization using chronogest with different doses of PMSG on the ovulation time and its correlation to preovulatory LH surge and oestrous onset to avail baseline data for insemination timing.

Materials and Methods

This study was conducted in Nyala, South Darfur state, which is located in the semi arid zone, between latitudes 12.03^{o} N. and longitudes 24.53^{o}E.

Experimental design

Ninety desert goats were divided into 3 groups (A, B, and C). Induction of oestrous in all groups was carried out using intravaginal sponge (Chronogest, Intervet, Boxmeer, Holland) impregnated with 40 mg fluorogestone for 12 days. At time of sponge removal, group A, B and C were injected with 300IU, 500 IU and 700 IU pregnant mare serum gonadotrophin (PMSG) respectively.

Oestrus detection

Observations for oestrous to detect the onset and duration was carried out every 4 hours after sponge removal using male with abdominal apron, introduced for a period of 10 minutes.

Blood sampling and hormonal analysis

Blood samples for LH assay was collected at 0, 24, 28, 30, and 32 hours post sponge removal. The LH determination in the serum samples of experimental goats were analyzed using LH radioimmunoassay kits IRMA – 211, supplied by Department of Isotope, China Institute of Atomic Energy, Beijing.

Ovulation detection

Ovulation time was detected by directly visualizing the ovaries after being exposed through a surgical incision at 46, 48, 50, 52 and 54 hours post sponge removal.

Statistical analysis

The results were expressed as means ± standard deviation. Data were analyzed by one ways Analysis of Variance (ANOVA) and Least Significant Difference (LSD). $P<0.05$ was considered to be statistically significant.

Results

Heat onset

As shown in Table 1, the mean time interval between sponges removal to oestrus onset for treatments with 300, 500 and 700IU PMSG was 28.9±2.4, 28.8±5.6 and 28.2±3.8 respectively, with no significant difference.

Heat duration

As shown in Table 1, no significant difference was detected in oestrous duration which was 36.±4.5, 42.0±3.1 and 42.0±3.9 hours in does synchronized using Chronogest with 300, 500 and 700 IU PMSG respectively.

Ovulation time

Table 2 shows percentage of does ovulated at 48, 50, 52 and 54 hours post sponge removal. As shown in the table, 50% of the does were found ovulated at 50-52 hours and all animal examined were found ovulated at 54 hours post sponge removal synchronized with Chronogest and 300 IU PMSG. All animals examined were found ovulated at 48 hours post removal in does synchronized using Chronogest with 500 and 700 IU PMSG. This result show that ovulation was detected at 54 hours post removal in does synchronized using Chronogest with 300 IU PMSG and 48 HPR in experimental desert goats synchronized using Chronogest with 500 and 700 IU PMSG.

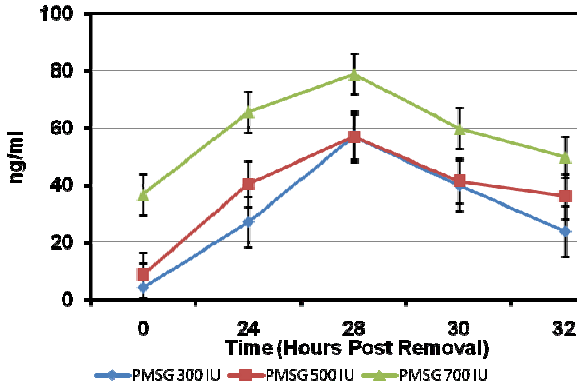

Fig. 1: LH pattern in does synchronized using Chronogest with 300, 500 and 700 IU PMSG

Table 1: Heat onset and duration in synchronized goats using Chronogest with different doses of PMSG

PMSG (IU)	No. of Animals	Heat onset (HPR)	Heat duration (h)
300	30	28.9±2.4	36.±4.5
500	30	28.8±5.6	42.0±3.1
700	30	28.2±3.8	42.0±3.9

HPR = hours post removal of sponges; Values are mean ± SD

Table 2: ovulation time in goats synchronized with Sponges and different doses of eCG

PMSG (IU)	Ovulation checked time (HPR)				
	46	48	50	52	54
300	0%(6)	33.3%(6)	50%(6)	50%(6)	100%(6)
500	0% (6)	100% (6)	100%(6)		
700	33.3%(6)	100%(6)	100%(6)		

HPR = hours post removal of chronogest

LH pattern in does synchronized using Chronogest with 300, 500 and 700 IU PMSG

Figure 1 shows the mean values for LH concentration at 0, 24, 28, 30 and 32 hours post removal when using Chronogest with 300,500 and 700 IU PMSG. As shown LH surge was reached 28 hours post removal of sponges irrespective of treatment.

Chronological relationships between oestrus onset, time of LH surge and ovulation time in synchronized does using Chronogest with different doses of PMSG

Chronological relationships between oestrus onset, time of LH surge and ovulation time in does synchronized using Chronogest with different doses of PMSG are shown in Table 3. The result shows that the mean time for oestrous onset was 0.2±3.6 hours before LH surge in goats synchronized using Chronogest with 300 IU PMSG and those received 500 IU PMSG showed oestrous onset 0.5±6.4 hours after LH surge while those received 700 IU PMSG showed oestrous onset 0.1±2.8 hours after LH surge. No significant difference was detected with regard to time from oestrous onset to LH surge for all treatments.

The data obtained in the present study (Table 3) indicated that ovulation occurred around 25.7±2.3 hours after the onset of oestrous in synchronized does using 300 IU PMSG and around 19.2 and 19.4 h after the onset of oestrus in synchronized does using 500 and 700 IU PMSG, respectively. The chronological relationships between ovulation and oestrous onset was significantly longer in does received 300 IU PMSG compared to those injected with 500 or 700 IU PMSG. There was no significant difference in the time taken from oestrous onset to ovulation time in does injected with 500 compared to 700 IU PMSG.

The time taken from LH surge to ovulation in synchronized does using Chronogest with 300, 500 and 700 IU PMSG was 25.5±2.3, 19.7±5.6 and 19.8±3.8 hours respectively (Table 3). The time taken from LH surge to ovulation was significantly longer in does received 300 IU PMSG compared to those injected with 500 or 700 IU PMSG. There was no significant difference in the time taken from LH surge to ovulation in does injected with 500 compared to 700 IU PMSG.

Discussion

The main objective of this study was to generate a base line data for goat breeding based on the first oestrous sign. It has been reported that PMSG might increase not only the number of follicles, but also the growth rate of the large follicles (Ritar et al., 1984). It has also been noted that estradiol is derived almost entirely from developing ovulatory follicles (Carson et al., 1981), and levels of circulating estradiol increase follicles size in a dependant manner (Dobson et al., 1997; Evans et al., 2000). Earlier studies clearly demonstrated that regardless of the season, a rise in estradiol concentration during the late follicular phase levels acts centrally upon the GnRH neurosecretory system to initiate a large and abrupt release of GnRH coincident with the onset of the preovulatory LH surge and ovulation (Moenter et al., 1990).

In the current study, we have shown that the oestrous onset after the use of progesterone sponges in combination with different doses 300, 500 and 700 IU of PMSG was 28.9±2.4, 28.8±5.6 and 28.2±3.8 hours respectively. The time of oestrus onset was in agreement with the findings reported by Lehloenya et al. (2005) in South African indigenous goats and Montlomelo et al. (2002) in goats using 300 IU PMSG and also agreed with those reported for Yankasa ewes using 750 IU PMSG (Oeydipe et al., 1989). In contrast, previous studies reported late onset in the Boer goats (Greyling and Van-Niekerk, 1991) and Awassi goats (Abuzer et al., 2011) using 500 IU PMSG. Another studies reported earlier onset (Iida et al., 2004) in ewes using 500 IU PMSG, or in ewes treated with progestagen and PMSG, compared to ewes treated with progesterone alone (Kridli and Al-Khetip, 2006).

Table 3: Chronological relationships between oestrus onset, time of LH surge and ovulation time in does synchronized using Chronogest with different doses of eCG

Treatment (eCG IU)	Time of oestrous onset (HPR)	Time of LH surge (HPR)	Time from oestrous onset to LH surge (h)	Time from oestrous onset to ovulation time (h)	Time from LH surge to ovulation time (h)
300	28.2 ± 2.3	28.4±2.1	0.2±3.6	25.7±2.3[a]	25.5±2.1[a]
500	28.8 ± 5.6	28.3±2.5	0.5±6.4	19.2±5.6[b]	19.7±2.5[b]
700	28.6 ± 3.8	28.2±2.7	0.1±2.8	19.4±3.8[b]	19.8±2.7[b]

Values are Mean ± SD; Values with different superscript within columns differ significantly (P<0.05); HPR = hours post removal of Chronogest.

No significant difference was detected in oestrous duration, which was 36.0±4.5, 42.0±3.1, and 42.0±3.9 hours in does synchronized using Chronogest with 300, 500 and 700 IU PMSG respectively. The duration of oestrus in this study was similar to those reported by Greyling and Vander Nest (2000) in Boer goats Lehloenya et al. (2005) in South African indigenous goats using 300 IU PMSG, Ahmed et al. (1998) in Nubian goats and Gungor et al. (2007) in fat-tailed ewes. In contrast, other studies reported shorter duration, Bitaraf et al. (2007) in Nadoshani goats synchronized using sponges without PMSG, Zeleke et al. (2005) and Abuzer et al. (2011) in ewes synchronized using 500 IU PMSG. Another study reported longer duration (49.9 H) in ewes synchronized with 750 IU PMSG (Oeydipe et al., 1989). The differences in oestrous duration between the present study and those of other (Abuzer et al., 2011; Oeydipe et al., 1989; Zeleke et al., 2005) could be ascribed to the differences in mating systems, breed, season, duration of treatment and overall managerial conditions.

The present study clearly demonstrated that increasing doses of PMSG advanced the time of ovulation in desert goats. Ovulation was detected at 54 hours post removal in does synchronized with Chronogest with 300 IU PMSG and 48 HPR in experimental desert goats synchronized using Chronogest with 500 and 700 IU PMSG. This clearly shows that the administration of PMSG was necessary to stimulate an earlier ovulatory response in the desert goat. A result which is in same line with the previous findings (Greyling and Van- Niekerk, 1990; Ritar et al., 1984; Robin et al., 1994). Moreover, the different doses of PMSG following a 12-day treatment with intravaginal sponges in Awassi ewes during the transition period had a uniform effect on the reproductive performance of the animals (Abuzer et al., 2011). Cameron et al. (1988) reported that most of the ovulations probably appeared between 36 and 60 h after sponge withdrawal in goats treated with PMSG.

The LH surge reached 28 hours post removal irrespective of the treatment, the result demonstrated that the LH pattern was not affected statistically. The time of LH surge reported in this study is in agreement with that of Leboeuf et al. (2003) who reported 28.7 hours post sponge removal in goats synchronized using Chronogest with 500 IU PMSG. Iida et al. (2004) reported 27.0 hours in ewes synchronised with 500 IU PMSG and Kohno et al. (2005) reported 30 hours in ewes. In contrast, LH surge was detected at later time (37.6 hours after sponge removal) in ewes (Quirke et al., 1981).

The finding that the administration of PMSG was necessary to stimulate ovulatory response in the desert goat reflected the time taken from oestrous onset to ovulation time and the time taken from LH surge to the time of ovulation.

The data obtained in the present study indicated that ovulation occurs around 25.7±2.3 hours after the onset of oestrous in does synchronized with 300 IU PMSG and around 19.2 and 19.4 h after the onset of oestrus in does synchronized using 500 and 700 IU PMSG respectively. The chronological relationships between ovulation and oestrous onset was significantly longer in does received 300 IU PMSG compared to those injected with 500 or 700 IU PMSG. There was no significant difference in time taken from oestrous onset to ovulation time in does injected with 500 compared to 700 IU PMSG. The time from onset of oestrous to ovulation in does injected with 500 and 700 IU PMSG in the present study is according with previous finding in goats (Mori and Kano, 1984; Asher et al., 1990). The time from onset of oestrous to ovulation in does 500 and 700 IU PMSG in this study is shorter than previously reported by Goel and Agrawal (2003), Cumming et al. (1973) and Henricks et al. (1970).

The time taken from LH surge to ovulation was significantly longer in does receiving 300 IU PMSG compared to those injected with 500 or 700 IU PMSG. There was no significant difference in the time taken from LH surge to ovulation in does injected with 500 compared to 700 IU PMSG. These results are in according with those reported for the Shiba goats (16-24 h) by Mori and Kano (1984). The time from LH surge to ovulation in does injected with 500 and 700IU PMSG in this study is shorter than previously reported ewes (24 h) by Cumming et al. (1973) and in Heifers (26 h) by Mori et al. (1982).

This is the first study that investigated the ovulation time in desert goats, and the chronological relationships between oestrous onset, LH surge and ovulation time. These results imply that the increasing doses of PMSG, following a 12 day treatment with intravaginal sponges

significantly affect the ovulation time and chronological data in desert goats.

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