



Ovulatory pattern and serum progesterone levels during oestrous cycle in Jamunapari goats

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ABSTRACT

Present study was aimed to investigate the ovarian activity in terms of ovulatory pattern (time and rate) and progesterone levels in Jamunapari. Adult cyclic goats (15) were randomly assigned to 3 treatment groups (5 in each) and laparotomized at 24, 30 and 36 h after the onset of natural oestrus to record various observations in relation to ovulatory pattern. At 24 h, group 1 (5) goats had fully developed follicles visible on ovarian surface. At 30 h (group 2), 2 of 5 goats had signs of recent rupture of ovarian follicles (corpus hemorrhagicum) and remaining follicles were in advance stage of rupture. At 36 h, group 3 (5) goats had distinct developing corpora lutea indicative of follicle rupture. The number of ova shed per doe (ovulation rate) for the ovulating doe averaged 1.45 ± 0.20 (range 1–2). Right ovary was more functional than left ovary in terms of ovulatory points. Study revealed that ovulation in this breed occurred 30–36 h following natural oestrus i.e. towards the later part of the oestrus, considering the oestrus duration of 39 h in the breed. Based on these findings it is recommended that first mating should be allowed 10–12 h after onset of oestrus to achieve better conception rate. Levels of circulating progesterone hormone were measured in 9 adult cyclic Jamunapari goats during the period of peak oestrus activity (June - July). Progesterone levels ranged from 0.58 ± 0.12 ng/ml to 8.35 ± 2.60 ng/ml during the length of oestrous cycle. Progesterone level remained at basic level on the day of oestrus and thereafter increased gradually after ovulation. It reached to a peak level on day 14 of the cycle i.e. commencement of a new follicular wave. Information on the ovulatory pattern will permit mating at appropriate time for optimizing fertility and hormonal intervention to enhance fecundity. Study of progesterone profile will be further helpful for effective oestrus detection as well to know the reproductive status of this important breed of tropical region.

Key words: ELISA, Jamunapari goat, Oestrous cycle, Ovulation time, Progesterone

Progesterone levels are used in the determination of the onset of puberty in cattle (Diaz *et al.* 1986, Mondal and Prakash 2003), pigs (Shille *et al.* 1979), goat (Gaafur *et al.* 2005, Zarkawi and Masari 2002) and sheep (Oyedipe *et al.* 1986) and verification of the accuracy of oestrus detection (Sawyer *et al.* 1986). A knowledge of the levels of progesterone can be of benefit for diagnostic and therapeutic purposes in cases of endocrine dysfunction involving normal sexual activity of the female. Jamunapari goat breed of Indian subcontinent has been extensively used as improver breed for milk production in indigenous breeds of South east Asia and Indian subcontinent including Nepal and Bangladesh (Roy and Pant 2001). Jamunapari is a non-seasonal breeder characterized by peak oestrous activity in certain periods of the year (Goel *et al.* 2003). Ovulation rate vary with age (up to 6–7 years) and among seasonal breeders is highest in the first half of the breeding season. Thus it is indicative of

fecundity of a breed (Greyling and Van Nickerk 1990). Assessment of progesterone levels during different physiological stages in animals is considered one of the important parameters (Kadzere *et al.* 1996, Engeland *et al.* 1997, Kornalijnslijper *et al.* 1997, Al-Merestani *et al.* 1999, Decastro *et al.* 1999, Zarkawi and Soukouti 2001, Naqvi *et al.* 2002). Progesterone at appropriate level is essential for expression of oestrus, preparing the uterus for implantation and maintenance of pregnancy. The levels of progesterone hormone during the oestrous cycle and pregnancy have been determined in several species (Scaramuzzi 1976, Adeyemo and Health 1980, Voh *et al.* 1987); fewer reports are available for the goat (Mori and Kano 1984, Akusu *et al.* 1989). Therefore present study was aimed to investigate ovulation pattern and progesterone (P_4) concentrations during different phases of oestrous cycle in Jamunapari goats.

MATERIALS AND METHODS

Animals and management: Observations on ovulation pattern were carried out on 15 adult, normal cycling,

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randomly selected goats (age, 2 to 4 years; body weight, 35–55 kg) from the flock of Jamunapari goats. To study progesterone profile, 12 adult, normal cycling Jamunapari goats were randomly selected (age, 2 to 3.5 years; weight, 32–52 kg) from the same flock. All goats (27) under experiment were maintained under semi-intensive system of management. Both experiments were conducted during the period of optimum breeding behavior (June through Sept). All does used in the experiments had no previous records of reproductive disorders and exhibited regular inter-oestrus interval before experiment.

Ovulation pattern (time and rate): Adult cycling (parous and non-parous), 2–4 year- old, Jamunapari goats (5 in each group) were laparotomized at 24, 30, and 36 h post-onset of natural oestrus during the period of peak breeding (July–Sept). After laparotomy ovaries were visualized for the presence/ sign of ovulation i.e. fully mature follicles, corpus hemorrhagicum or developing corpus luteum protruding from the ovarian surface. Standard surgical procedure was adopted to visualize and monitor ovarian changes. To make it more precise, these goats were checked at every 6 h interval for onset of oestrus by a vasectomized buck prior to adopting surgical procedure.

Blood sampling and progesterone assay: Blood samples (132: 11 from each goat) @ 10ml/goat at each occasion were taken daily at 10 AM from 12 adult naturally cycling Jamunapari does at 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, and 20th of oestrous cycle from the jugular vein during June–July. Following centrifugation at 3000 rpm for 20 min, serum was harvested and stored at –20°C until assayed. Subsequently 3 of 12 goats did not repeat next oestrous cycle, therefore excluded from the experiment. Finally 99 samples from 9 goats were included in the study. Progesterone was analyzed by using commercial available ELISA kits. The absorbance was measured by spectrophotometrically at 450 nm by ELISA.

Statistical analysis: Data related to ovulation and progesterone levels during different days of the oestrous cycle were analyzed by analysis of variance (ANOVA) at 95% confidence level (Snedecor and Cochran 1989).

RESULTS AND DISCUSSION

Ovulation pattern (time and rate): There was no sign of follicular rupture in goats (5) at 24 h after the onset of natural oestrus, however fully mature follicles tending to ovulate within few hours were visible on ovarian surface of all the goats laparotomized under group 1 (Table 1). As the time advanced i.e. at 30 h, 2 of 5 goats had signs of recent follicular rupture (corpus hemorrhagicum) and remaining (3) were in advance stage of rupture (group 2). At 36 h, all goats (5) had distinct developing corpora lutea indicating ovulation (group 3). The number of ova shed per doe (ovulation) for does ovulating averaged 1.45 ± 0.20 (range, 1–2). Right ovary was more functional than left ovary ($P < 0.05$) in terms of ovulatory

Table 1. Ovulation pattern in Jamunapari goats

Parameters	Laparotomy post-onset of oestrus(h)		
	Group 1 (24 h)	Group 2 (30 h)	Group 3 (36 h)
Fully mature follicles	5	3	-
Recently ovulated follicles (corpus hemorrhagicum)	-	2	-
Early corpus luteum	-	-	05
No. of does observed	5	5	5
Ovulation rate $\pm$ SEM	1.45 ± 0.20		
Range of ovulation	1 - 2		

points. Study revealed that ovulation in this breed occurred during 30–36 h following natural oestrus i.e. towards later part of oestrus, as average duration of oestrus in this breed is 39 h (Goel *et al.* 2003). Considering the relatively longer duration of oestrous period and ovulation trend, initial mating in this breed should be carried out 10–12 h after the onset of oestrus. Second mating/insemination is also needed for further improvement in conception rate.

Progesterone levels during oestrous cycle: The levels of progesterone hormone ranged from 0.58 ± 0.12 ng/ml to 8.35 ± 2.60 ng/ml during the different phases of oestrous cycle. The average progesterone levels differed significantly between the days of the oestrous cycle. Progesterone level was lowest (0.58 ± 0.12 ng/ml) on the day of oestrus indicating no luteal activity. It increased gradually after ovulation and reached to a peak value of 8.35 ± 2.60 ng/ml on day 14 of the cycle indicating fully developed luteal tissue (corpus luteum) returning again to basal level on the day of next oestrus (0.40 ± 0.15 ng/ml).

Several physiological, biochemical and biophysical mechanisms operate during ovulatory process in mammals. Variations in the time of occurrence of ovulation in caprines are well documented in literature (Shelton 1978, Riera 1982, Greyling and Van Niekerk 1990). The time of occurrence of ovulation investigated in Jamunapari goats is in agreement with the reports of Salama (1972), Greyling and Van Niekerk (1990), Jainwen (1992) in exotic and Prasad *et al.* (1980), Rao and Bhattacharyya (1980), Chakraborty *et al.* (1993), Goel *et al.* (1992) and Goel and Agrawal (2003) in Indian goat breeds. Most goat breeds ovulate 24 to 36 h after the onset of oestrus, except the Nubian goat, which ovulates later due to relatively longer oestrous cycle (Jainudeen *et al.* 2000). Retrospective studies clearly indicated variation in ovulation rate at different hours after the onset of oestrus in goats. Studying ovulation sequence at different periods after the onset of natural oestrus, shown that Jamunapari is relatively prolific to many goat breeds native to India: 1.25 in Kutchi (Shukla *et al.* 1971), 1.40 in Barbari (Prasad *et al.* 1980), 1.20 in non-descript (Goel *et al.* 1992) and 1.33 in Jakhana (Goel and Agrawal 2003). Study revealed the scope of further improvement in litter size by breeding in relation to ova shed

and applying reproductive biotools in this important goat breed of India.

Meager information on the endocrinology of the oestrous cycle of Jamunapari is available in the literature. The pattern of serum progesterone in this study is in general agreement with those reported for exotic breeds (Damascus, Zarkawi and Soukoti 2001; Red Sokoto in Nigeria, Pathiraja *et al.* 1991; Dairy × Boer in Germany, Bauernfeind and Holtz 1991). Though in this study there were differences in the minimum and maximum values in progesterone levels among does studied, the general pattern for progesterone was similar for all does. This might be attributed to individual variations within the Jamunapari breed. Similar trends in progesterone levels were also reported by earlier workers in goats (Kumar and Neeru 2005, Sarath *et al.* 2005, Medan *et al.* 2003, Zarkawi 1997, Zarkawi and Soukoti 2001). Bera *et al.* (2002) and Khan and Ludri (2004) also reported a similar trend and highest values of plasma progesterone on day 14 of the cycle and concluded that progesterone levels in different phases of the oestrous cycle can be used as a tool for efficient oestrus detection to know the reproductive status of Black Bengal does. On the basis of progesterone levels during different days of oestrous cycle it is evident that Jamunapari goat can be superovulated between 12–14 days of oestrous cycle for achieving better ovulatory response/embryo recovery and increasing multiple births by advocating low dose gonadotrophin therapy (eCG).

From the present study it was possible to characterize the ovulation pattern and determine normal progesterone pattern during the different phases of the oestrous cycle in Jamunapari goats. These findings are relevant and useful in assessing the fecundity and oestrous cycle of Jamunapari goats as a basic parameter of reproduction.

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