

REPRODUCTIVE EFFICIENCY AND PROGESTERONE PROFILE FROM PARTURITION TO PARTURITION IN DWARF GOAT

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ABSTRACT

A study was undertaken to look into the reproductive performance of female Dwarf goat. The serum progesterone profile was used to monitor various reproductive parameters including length of postpartum period, the resumption of cyclicity, gestation period, pre-partum period, parturition, litter size and kidding interval. Most of the animals conceived within 20-65 days of postpartum period. During gestation period, higher levels of progesterone were maintained with wide variations falling in the range of 3-13 ng/ml. Notable feature was the fluctuation of progesterone level in the higher limits (> 3 ng/ml) throughout the gestation. However, a few days before parturition a decline was noticed in all the animals. This decline started at 6 ± 0.4 days of prepartum and dropped to the lowest level of 0.1 ng/ml after the completion of parturition process. The length of gestation period was found to be 145.5 ± 1.1 days. A very short kidding interval (204 ± 19 days) and a big litter size was observed. All the parturitions were normal and a considerable weight gain (8.2 ± 0.3 kg) was recorded during pregnancy. The initial birth weight of kids was 2.1 ± 0.53 kg. All the animals of the lot conceived at first or second oestrous, indicating the high prolificacy of the breed.

Keywords: Progesterone, oestrous cycle, gestation, postpartum cyclicity, goat

INTRODUCTION

Despite domestication of goat since ancient times of 9000-7000 B.C. (Epstein, 1971; Kamo, 1973), its reproductive physiology remained far from sufficiently documented. The reproductive activity is controlled through endocrine secretions, receptors at target and feedback mechanism (Tanaka *et al.*, 1992). Progesterone hormone is the best indication to monitor various phases of reproduction. Its concentration in animal body reflects the stage of the reproductive cycle, pregnancy and ovarian disorders (Qureshi *et al.*, 2000). Plasma progesterone concentration depends on the rate of progesterone secretion by corpus luteum, which in turn, has been reported to be greatly influenced by a number of factors viz, breed, plans of feeding, season of the year (Peters and Lamming, 1984), genetic make up (Bullman and Lamming, 1979), stage of oestrous cycle (Vale *et al.*, 1990), pregnancy status of the animal (Fayed, 1990) and undefined factors (Noseir *et al.*, 1992). The present study was undertaken to find out the reproductive performance and progesterone profiles in female Dwarf goat from one parturition to the next parturition. The serum progesterone profile was used to monitor various reproductive parameters such as postpartum anoestrous, the resumption of postpartum cyclicity (oestrous cycle), gestation period, prepartum, parturition and kidding interval etc.

MATERIALS AND METHODS

A lot of eight postpartal goats, coded G1 to G8,

weighing between 8.25 and 20.0 kg, were selected from Nuclear Institute for Agriculture and Biology farm. The animals were reared under normal grazing conditions, within the premises of the farm. Different fodders such as various types of grasses, sorghum (*Sorghum vulgare*), lucerne (*Medicago sativa*), jantar (*Sesbania aculeata*), sarson (*Brassica napus*) and berseem (*Trifolium alexandrinum*), etc. were available at the farm in different seasons for free grazing. A male buck was introduced in the herd for heat detection. Body weight of animals was recorded weekly at a fixed time before the animals were allowed for grazing.

Blood sampling from the jugular vein was carried out on alternate day after one parturition to the completion of the next for 280 days. Serum was separated by centrifugation (MSE-Mistral 2L) at 2000 rpm for 15 minutes and frozen in plastic capped tubes at -20° C until analysis.

Progesterone was estimated by solid-phase Radioimmunoassay (RIA) method using 125 labeled hormone and following the protocol recommended on the kit (coat-A- count progesterone), obtained from the Diagnostic Products Corporation (DPC) and supplied by International Atomic Energy Agency (IAEA). The kit contained rabbit antibodies to progesterone coated on the walls of assay tubes. Progesterone standards contained, respectively, 0, 1.25, 2.5, 5, 10, 20 and 40 ng of synthetic progesterone per milliliter (ng/ml) in processed human serum.

Observations regarding prepartum period (period when progesterone started declining till parturition),

postpartum period (interval from parturition to first estrus/ovulation), length of oestrous cycle and gestation, and general observations related to Dwarf goats were recorded. Two of the animals (G7, G8) did not complete the experimental period due to some illness and abortion.

RESULTS

All animals exhibited the postpartum period of about 20-65 days, except one (G 2), which cycled after 15 days postpartum, showed a normal cycle of 21 days and conceived at the 2nd oestrous. Two of the animals (G7, G8) did not complete the experimental period due to some illness and abortion. They, however, showed the resumption of postpartum cyclicity after 20-25 days. The average length of postpartum period was found as 27.5 ± 5.6 days. In all animals during the postpartum anoestrous period, the progesterone concentrations remained at basal levels, fluctuating between $0.1-0.8 \text{ ng ml}^{-1}$ (Fig. 1) and exhibited increase in basal levels with the resumption of postpartum cyclicity. During oestrous cycle, the progesterone concentration tended to increase gradually 3-4 days after oestrous, reached maximum levels of $6.0-11.3 \text{ ng ml}^{-1}$ within 6-7 days during luteal phase (14 days) and then showed a rapid decline ($0.02-0.1 \text{ ng ml}^{-1}$) towards the end of the cycle. The average length of the cycle was found to be 20.5 ± 0.7 days (Table 1).

All animals conceived within 31 days of postpartum ovarian activity (Figure 1) with the exception of two animals (G4 and G5), which showed acyclic period after the resumption of postpartum cyclicity and progesterone levels were found at basal levels ($0.1-0.34 \text{ ng ml}^{-1}$). Both these animals conceived on 2nd oestrus cycle (at 105 and 120 days postpartum).

During gestation period, higher levels of progesterone were maintained with wide variations in the range of $3-13 \text{ ng ml}^{-1}$. The hormone levels started to decrease during the prepartum period of 6 days and dropped from higher levels to 0.1 ng ml^{-1} after the completion of parturition process. All the experimental animals showed similar patterns of hormonal changes during pregnancy except G5, which showed a maximum level of $5-11 \text{ ng ml}^{-1}$ upto 40 days of gestation and then dropped within 25 days to $3.8-6.2 \text{ ng ml}^{-1}$ and was

maintained for the rest of the gestation period of 80 days. Then a decreasing trend was observed towards the end of parturition process and dropped to 0.3 ng ml^{-1} on the day of parturition. The average gestation length was found to be 145.5 ± 1.1 days and prepartum period was 6 ± 0.4 days (Table 1). All the animals conceived on first or second oestrous showing the high prolificacy of this breed and a very short kidding interval of 204 ± 19 days was observed (Table 1). The litter size was in the range of 2:3:1 (Single: Twins: Triplets) and most of the kids were male (9:2).

All the parturitions were normal and a considerable weight gain was observed ($8.2 \pm 0.3 \text{ kg}$) during pregnancy. The weight loss of animals after parturition was found to be $4.53 \pm 0.65 \text{ kg}$. This weight loss was due to the birth weight of kids and other factors. The average initial birth weight of kids was $2.1 \pm 0.53 \text{ kg}$. The birth weight of singlet was higher than twins or triplets (Table 1).

DISCUSSION

Oestrous cycle is controlled by a complex of endocrine events involving the interaction of various hormones from the hypothalamus, pituitary, ovary and uterus. In the present study, the progesterone concentration reached maximum levels of $6.0-11.3 \text{ ng ml}^{-1}$ during luteal phase and showed a rapid decline up to $0.02-0.1 \text{ ng ml}^{-1}$ at follicular phase. Musaddin *et al.* (1996) reported that the mean progesterone concentration during the follicular phase of oestrous cycle was 0.19 ng ml^{-1} in Dorset Horn -Malin (DHM) and Long Tail (LT) while 0.26 ng ml^{-1} in Malin ewes. The mean progesterone concentrations during the luteal phase were 2.94 ng ml^{-1} in Malin, 2.54 ng ml^{-1} in DHM and 2.33 ng ml^{-1} in LT ewes.

The length of oestrus cycle observed in the range of 19-22 days with an average of 20.5 ± 0.7 days, is similar to that reported by others in different breeds of goat. Bhattacharya *et al.* (1981) reported the mean cycle length of 20.39 ± 0.39 days in Pashmina goats. Although this Dwarf breed is a continuous breeder, acyclic periods of variable length were observed between normal oestrous cycles (Fig. 1).

Table 1: Length of various reproductive parameters and general observations related to Dwarf goat.

Animal code	Postpartum period (days)	Oestrus cycle (days)	Gestation length (days)	Prepartum period (days)	Wt. gain in pregnancy (kg)	Wt. loss after parturition (kg)	Litter size/sex	Kidding interval (days)	Birth weight of kids (kg)
G1	20	-	144	7	7.6	3.5	2 (MM)	163	1.6, 1.5
G2	15	22	146	6	8.4	3.0	1 (M)	188	2.9
G3	30	-	150	6	9.4	3.7	2 (MM)	180	1.7, 1.7
G4	20	21	142	5	8.4	7.2	3 (FFM)	245	1.8, 2.4, 2.6
G5	65	20	146	7	7.4	2.9	1 (M)	280	2.5
G6	25	-	145	5	7.0	4.9	2 (MM)	170	1.6, 2.7
G7	20	19	-	-	9.1	-	Died	-	-
G8	25	-	-	-	8.1	6.5	Abortion	-	-
Mean±SE	27.5±5.6	20.5±0.7	145.4±1.1	6±0.4	8.2±0.3	4.53±0.65		204±19	2.1±0.53

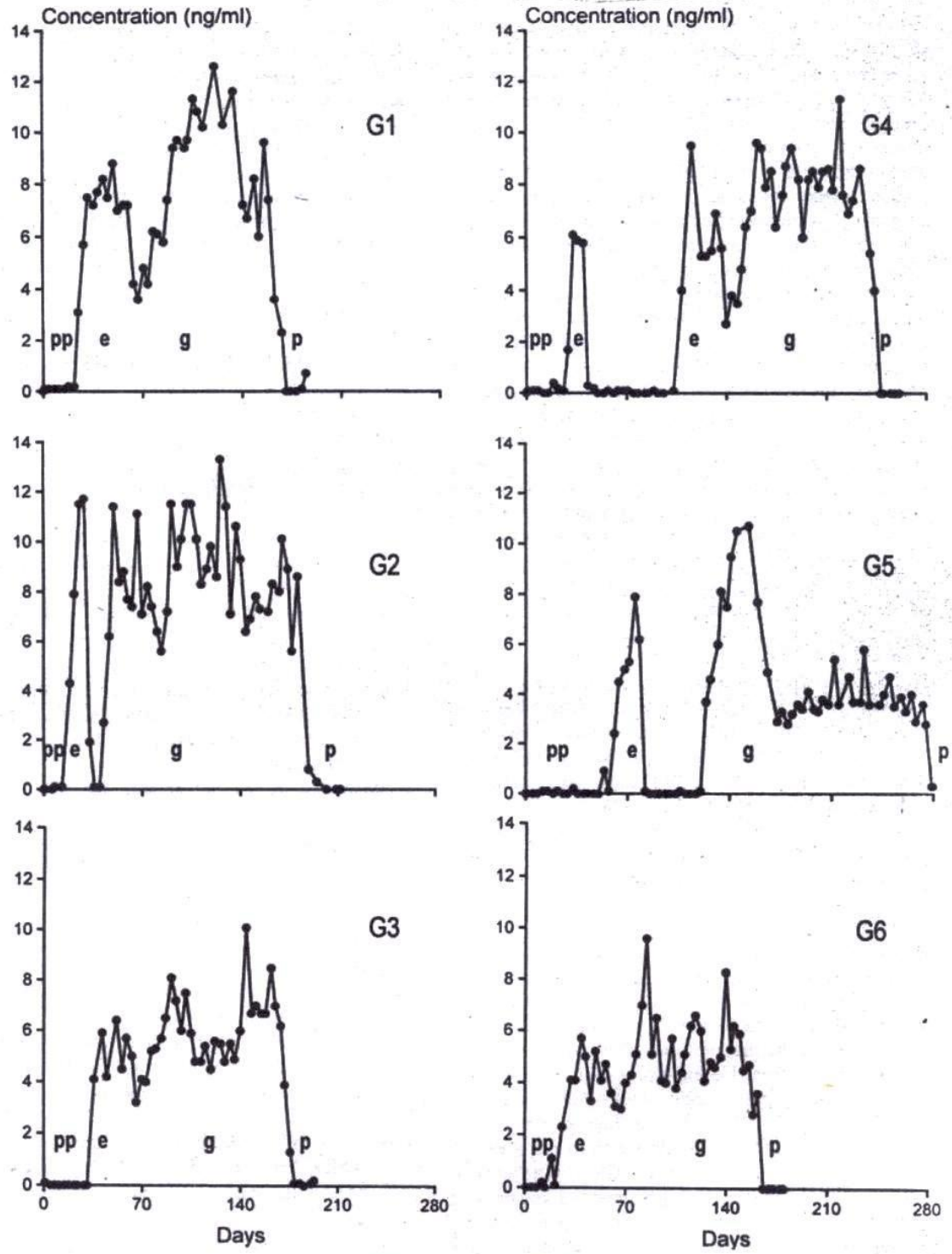


Fig. 1: Serum progesterone levels in adult goats, (G1-G6) at various reproductive phases; postpartum (pp); oestrus cycle (e); gestation period (g) and parturition (p)

During gestation period, higher levels of progesterone were maintained with wide variations. In cattle, the serum level of progesterone remains at the peak level throughout the gestation, contrary to the normal oestrous cycle where a declining trend is noted and the hormone level drops to the basal level, about 15-18 days after oestrous (Peters and Lamming, 1983). A functional corpus luteum in goats is necessary through out pregnancy; ovariectomy at any stage of pregnancy would result in abortion (Choe *et al.*, 1986), preceded by a drop in the maternal levels of progesterone.

In the present study, the overall pattern of the increase of progesterone during pregnancy and decline towards the prepartum and parturition resembled with Chilean Creole goats (Parraguez *et al.*, 1995). However, there were differences in the levels of hormones. Mizinga and Verma (1984) reported the progesterone levels in goat in the range of 8-10 ng ml⁻¹ during gestation. Agarwal *et al.* (1988) reported that progesterone levels were significantly higher from 8-12 weeks of gestation than the preceding and succeeding periods. The observed patterns in the present investigation during gestation period, i.e., an increase in serum progesterone concentration during pregnancy followed by a marked decline before parturition (prepartum period) were similar to those reported by other workers (Cameron and Batt, 1991; Manabe *et al.*, 1993).

Gestation period observed in these animals (142-150 days with an average of 145.5 ± 1.1 days) resembles with some other breeds of goat. Average gestation length of 143 days in Black Bengal goat, 146 days in Barbari and South African Dwarf goat and 145 days in local Brazilian goat have been reported (Peaker, 1978).

The period from kidding to the resumption of next cyclicity is known as postpartum anoestrous. In the present study, the progesterone profile was found at lower levels with small variations after parturition to the resumption of first postpartum ovarian activity. This period varied with breed and may be affected by various factors; the most important of which are nutritional levels and suckling. In the present investigation, large variations were found among the animals in the postpartum interval (15-65 days) to the first oestrous. This interval has been reported to vary from 1-3 months or even more, such as 34-61 days in Barbari goat in India (Sahni and Roy, 1976); 60 days in Black Bengal does in Bangladesh (Rehman *et al.*, 1977); 51-110 days with an average of 84 days in West African Dwarf goat in Ghana (Ochere and Nimo, 1978) and 68-172 days in Saanen and Toggenburg goats in Cuba (Carmenate, 1977). In Malaysia, lactating Katjang goats with singlet and twins had an average postpartum interval of 89 and 106 days, respectively; suggesting that lactation had a suppressing effect on ovarian activity (Banomathi and Mukherjee, 1981).

The resumption of ovarian cyclicity depends on the establishment of a pulsatile pattern of LH secretion (Peters and Lamming, 1983), which is not established for some period due to insufficient oestradiol levels (Peters *et al.*, 1981). The episodic release of LH by stimulating the development of a graffian follicle may initiate the events required for the first oestrous to occur. Since early postpartum resumption is important in goats which are non-seasonal breeder and as compared to most breeds, Dwarf goat has short postpartum interval, so this factor makes it an important breed with respect to reproductive aspects. Thus, it appears that the Dwarf goat is a continuous and prolific breeder.

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