

## AGE AT PUBERTY IN FEMALE DWARF GOAT ON THE BASIS OF HORMONES

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**Abstract:** A lot of five healthy female Dwarf goat kids were reared at NIAB farm. Blood sampling was started at the age of 75 days. Progesterone, Oestradiol, LH and FSH values were monitored using Radioimmunoassay (RIA) during prepuberal period and oestrous cycle. During prepuberal period, progesterone remained at basal levels of 0.1-0.5 ng/ml. A small rise up to 2 pg/ml was noticed in Oestradiol at the transition from prepuberal to puberal period. Similarly, LH and FSH values were risen up to 2.9 ng/ml and 2.2 ng/ml respectively. Hormonal levels begin to rise at the age of 4-5 months (120-160 days). FSH and Oestradiol started to increase followed by the LH peak. A decrease in the LH peak level after 24 hours followed by FSH and Oestradiol level was noticed. After oestrous phase progesterone level started to rise up to 4-9 ng/ml during the next 15 days. In the next 5 days these levels started to fall to basal values. On the day of oestrous peak values of Oestradiol, LH and FSH ranged from 10-16 pg/ml, 13-23 and 13-22 ng/ml respectively. The overall pattern of release of all these hormones was found similar in all these four animals. So in this lot, the mean age of puberty was found to be  $137 \pm 31$  days with a mean cycle length of  $20 \pm 1$ .

**Key words:** Progesterone, oestradiol, LH, FSH, goat, oestrous cycle, puberty.

## INTRODUCTION

Goat is one of the animals domesticated by man a long time ago about 9000-7000 B.C. (Fpstein, 1971; Kamo, 1973) yet the knowledge about its reproductive processes and its physiology is not well understood. Goat is domesticated for the production of meat, milk and skin and it can be easily handled by man. It is the major livestock of the subcontinent (India, Pakistan and Bangladesh). Among all other breeds of goat Dwarf goat is preferred over the others, because it is a non-seasonal breeder. It has a high prolificacy and usually gives birth to twins and triplets, kidding thrice in two years (Srivastava *et al.*, 1968; Khan *et al.*, 1982). These characteristics of Dwarf goat are in contrast to the other breeds and accordingly may exhibit different hormonal mechanisms. The reproductive activity is a physiological process controlled by hypothalamus-pituitary-gonadal interactions through endocrine secretions, receptors at target and feedback mechanism (Tanaka *et al.*, 1992). These processes are initiated with the onset of puberty in the goat kids. Therefore, it is necessary to consider the physiological and endocrinological events involved in the onset of puberty and during



oestrous cycle. The aim of present work is to study the endocrinological pattern and profile of reproductive hormones (progesterone, oestradiol, LH and FSH) at the onset of puberty and during oestrous cycle and to determine the temporal interrelationship of these hormones. This study gives us the mean age at puberty of Dwarf goat kids.

## MATERIALS AND METHODS

A lot of five healthy female Dwarf goat kids (# 451, 456, 457 and 504) were selected from NIAB farm, Faisalabad. One animal did not complete the study due to some casualty. Blood sampling was initiated when the kids were 75 days old, except one kid (504) that was 110 days old. The blood sampling from the jugular vein was conducted with disposable syringes into plain glass tubes twice a week up to the age of 90 days and daily for 150 days. Serum was separated by centrifugation at 2000 revolutions/min and stored in capped tubes at  $-20^{\circ}\text{C}$  till hormonal analysis.

Steroid hormones were estimated by single antibody RIA method using kits supplied by IAEA. Whereas protein hormones (LH and FSH) were analyzed by a double antibody competitive binding RIA method with a slight modification in the Kanai and Ishikawa (1988) method. Iodination of LH and FSH was performed by Chloramine-T method at room temperature under fumehood. The activity of iodine used was 0.5 mCi.

## RESULTS

### *Prepuberal period of the Dwarf goat kids*

During prepuberal phase, progesterone, oestradiol, LH and FSH remained at basal levels. However, a few days before the onset of puberty, some fluctuations were observed. Progesterone remained at basal (0.1-0.6 ng/ml) level during this period except small irregular fluctuations near puberty. Oestradiol showed tiny pulses, sometimes up to 2.0 pg/ml followed by small rises in LH and FSH levels. After these fluctuations, the animals showed signs of puberty by significant changes in hormone levels indicating first oestrous or the onset of puberal period.

### *Onset of puberty in Dwarf goat kids*

Fig.1 shows the hormonal patterns of kid # 451, in which first oestrous started at the age of 115 days. Four consecutive oestrous cycles were observed in this kid. The length of each cycle was  $20 \pm 1$  days. First of all a rise in oestradiol level (15.4 pg/ml) was noticed followed by a peak of LH (22.7 ng/ml). This was taken as the day-0 of the oestrous cycle and it was also the oestrous phase of the cycle. Simultaneously a rise in FSH levels (20.0 ng/ml) was obtained. LH peak declined after 24 hours followed by oestradiol and FSH. During this period of 2 or 3 days progesterone remained at basal levels. This phase was

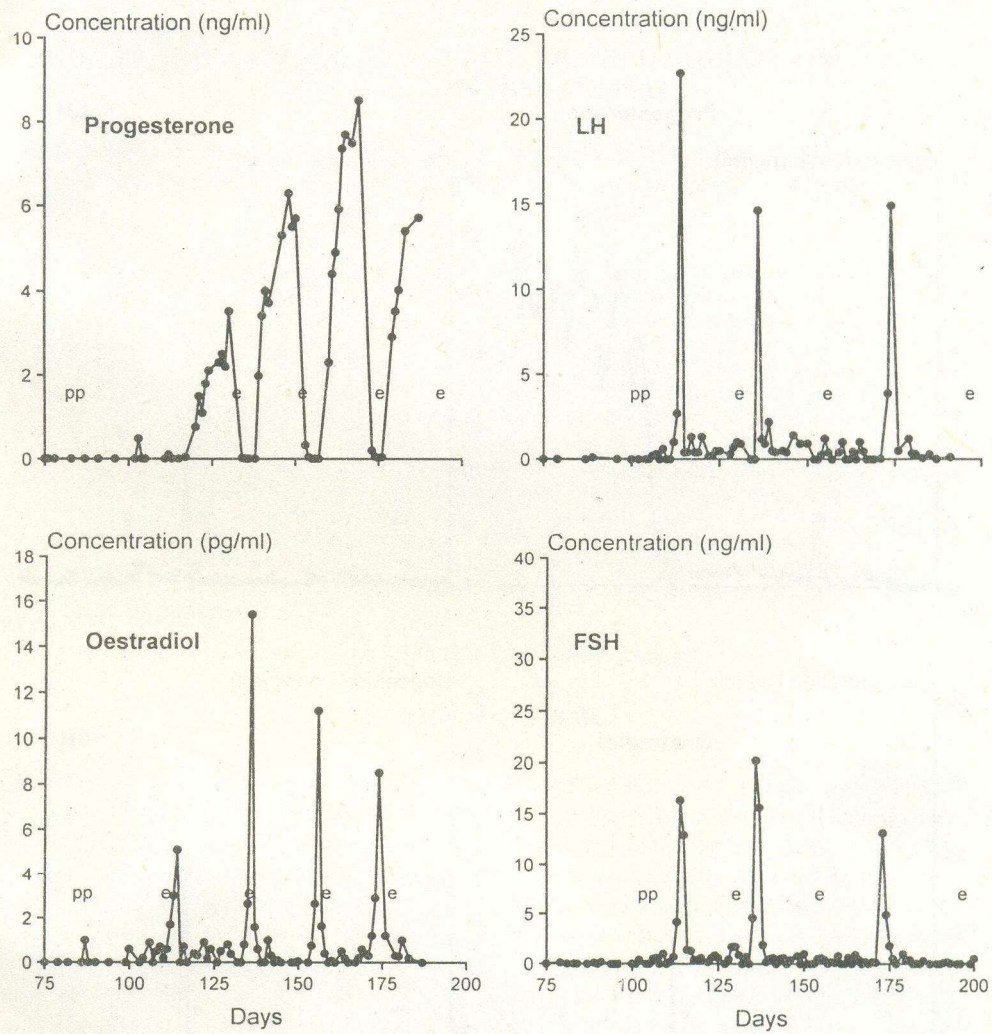


Fig. 1: Serum profile of progesterone, oestradiol, LH and FSH at prepuberal (pp) and puberal (e) phases in kid No. 451.



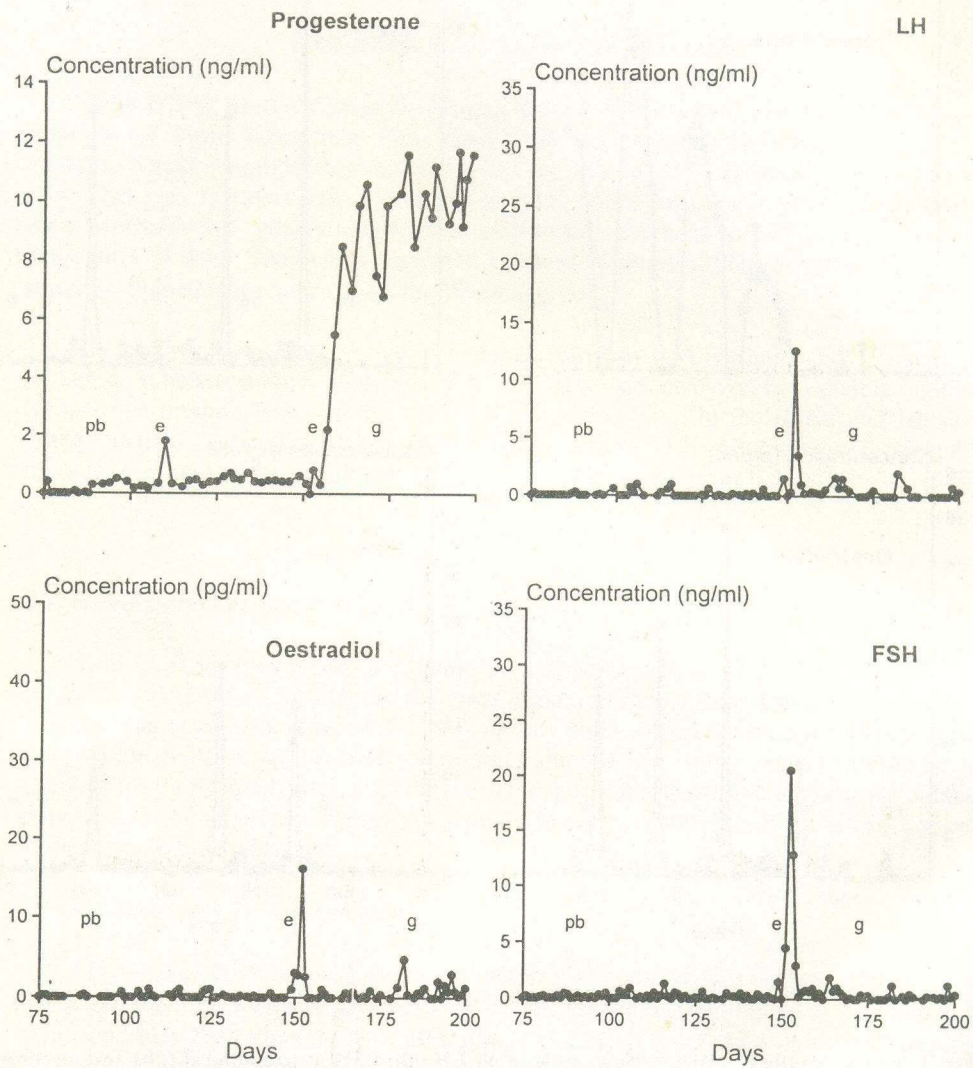


Fig. 2: Serum profile of progesterone, oestradiol, LH and FSH at prepubertal (pb) and pubertal (e) phases in kid No. 456.

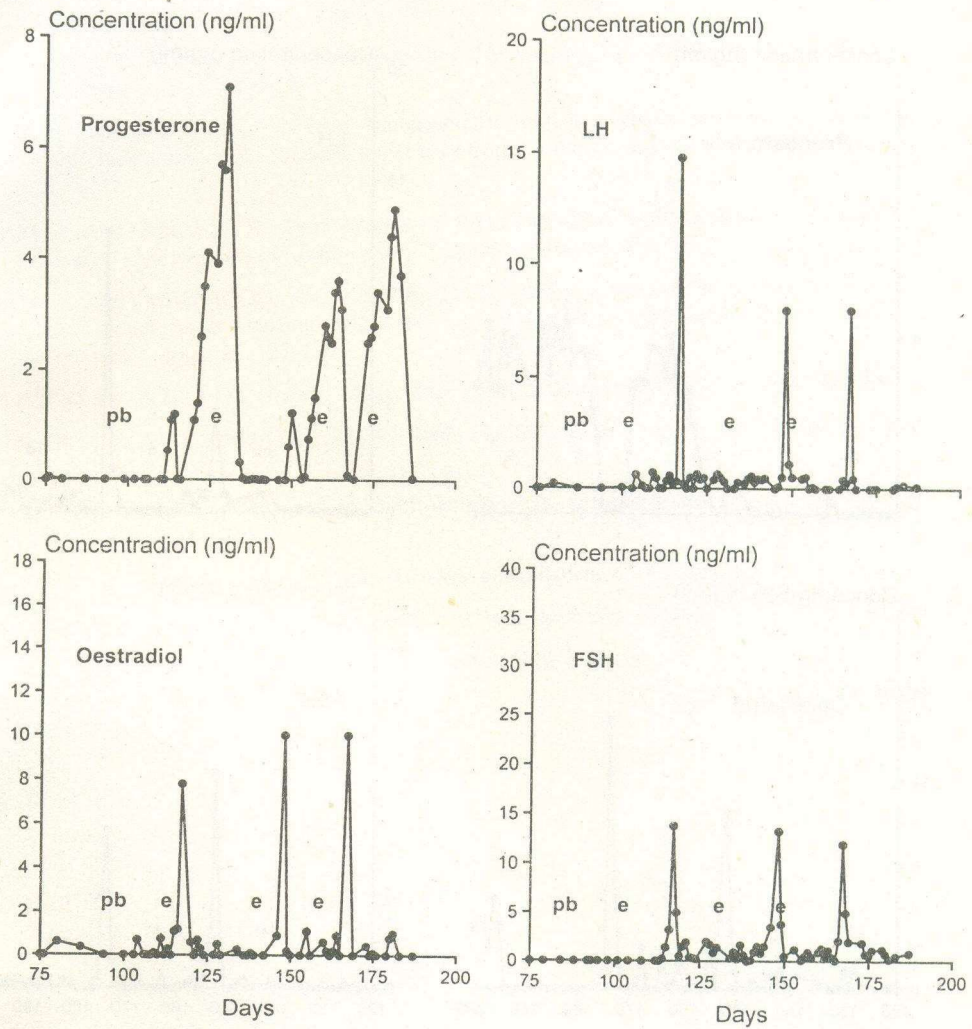


Fig. 3. Serum profile of progesterone, oestradiol, LH and FSH at prepuberal (pb) and puberal (e) phases in kid No. 457.

Fig. 3: Serum profile of progesterone, oestradiol, LH and FSH at prepuberal (pb) and puberal (e) phases in kid No. 457.



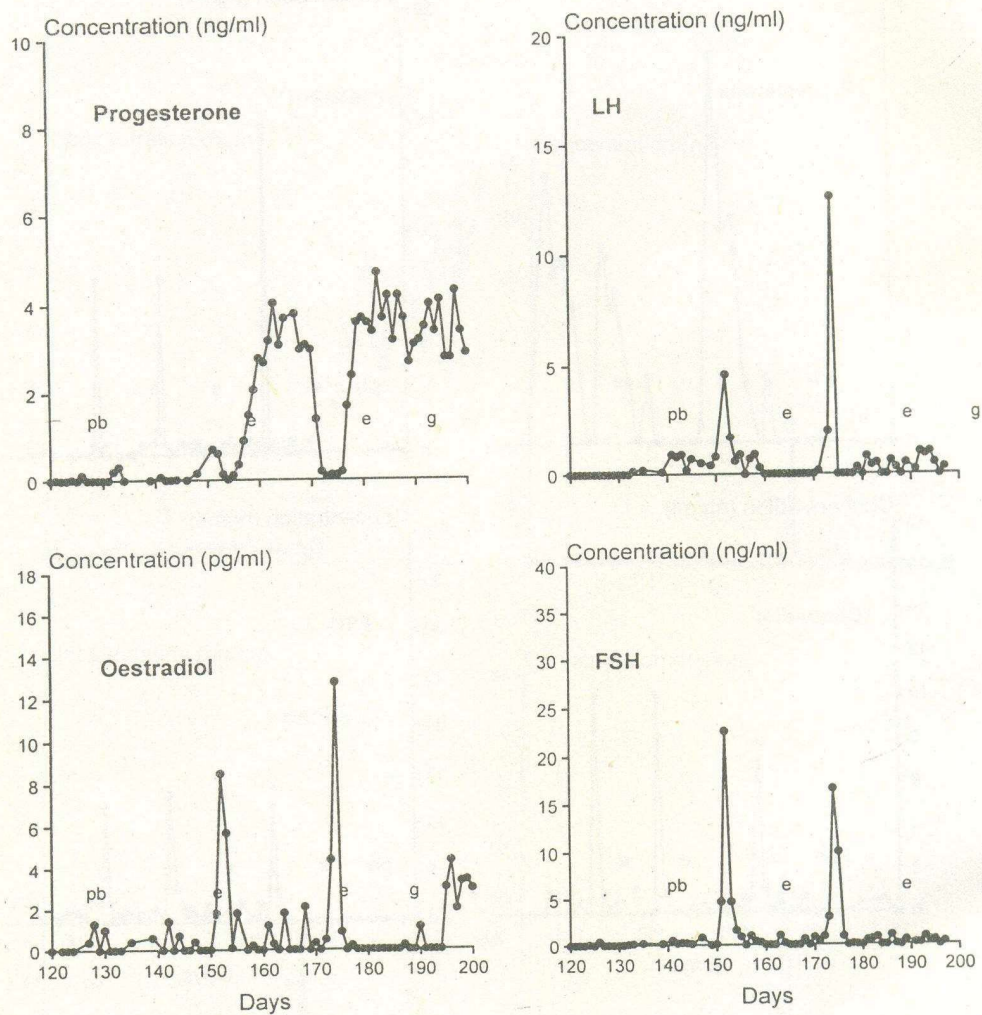


Fig. 4: Serum profile of progesterone, oestradiol, LH and FSH at prepuberal (pb), oestrous cycle (e) and gestation period (g) in goat No. 504.

actually the culmination of oestrous cycle. After this phase progesterone started rising and its value reached up to maximum level (8.5 ng/ml) in the next 10-11 days. Progesterone maintained its maximum level for 4-5 days and then in the next 4 or 5 days, it declined gradually to the basal level.

Puberty started at the age of 120 days in kids # 456 and 457 (Figs.2 & 3). Both these kids showed three oestrous cycles during the study period. After first cycle, a silent period of 15 days was noticed, during which irregular hormonal fluctuations were observed. The pattern of release of hormones and the length of cycle in these kids were same as were in kid # 451. The maximum progesterone level was 7.2 ng/ml and 7.1 ng/ml, the peak of oestradiol, LH and FSH were 16.3 pg/ml, 17.4 ng/ml and 30.0 ng/ml in animal No. 456 and 10.0 pg/ml, 14.9 ng/ml, 13.8 ng/ml in animal No. 457 respectively.

In kid # 504, first oestrous started at the age of 110 days. This kid showed only one oestrous cycle, while during the next cycle, the goat conceived and showed gestation by maintaining the progesterone concentration in the range of 3-5 ng/ml during this period. LH and FSH remained at basal levels during this period while Oestradiol started rising after 25 days of gestation.

## DISCUSSION

The hormonal patterns and profiles of progesterone, oestradiol, LH and FSH were followed in kids from the age of 75 days till the assumption of puberty. There were no significant hormonal fluctuations except a few days (10-15) before the onset of puberty. All the four hormones showed tiny irregular peaks a few days before puberty. These findings are similar to that of Gonzalez-Padilla *et al.* (1975) and Kinder *et al.* (1987) in heifers and ewes that progesterone concentration is low during most of the prepuberal period with two rises before puberty. This agrees with the statement of Ojeda *et al.* (1980) that these initial rises in progesterone may sensitize the ovaries for LH as in some postpartum cows. Similarly, a significant increase in oestradiol 17- $\beta$  levels, 8 days before puberty comparable to normal preovulatory peak in post puberal heifers has been reported by Glencross (1984).

Peters and Ball (1987) found that follicle growth starts soon after birth, as does the production of LH and FSH. These findings support the idea of Ramirez and McCann (1963) that at puberty ovaries and hypothalamo-pituitary axis are fully mature for the sufficient stimulation and secretions of relevant hormones. The length of prepuberal age may be affected by various factors such as inherent character of different breeds, body weight at birth, photoperiod etc.

### *Age at puberty*

During present investigations, the age at puberty in female Dwarf goat was found to



vary between 3-6 months with an average of 4-5 months. Greyling and Nickerk (1990a) reported the puberty age in female Boar goat kids at 5.0-6.5 months and found significantly earlier in kids weaned in breeding season (April) than those in non-breeding season (December).

#### *Oestrous cycle*

In this investigation LH and FSH concentration was found low during most of the oestrous cycle and started to increase 1-2 days prior to Oestrous (Rawlings and Cook, 1993). The maximum LH peak that occurred on the day of oestrous was preceded by a gradual rise in the concentration of oestradiol 2-3 days before oestrous (Thomus *et al.*, 1989). Progesterone levels observed were low during oestrous (day-0) and showed a gradual increase and maximum peak in dioestrous within 10 days and dropped during prooestrous to the basal levels within 4-5 days before the commencement of metoestrous. Oestrous cycle in the goat is well studied and hormonal profile of LH, FSH, Oestradiol and Progesterone observed during this study were similar to those reported by other workers (Kanai, 1987; Kanai and Ishikawa, 1988; Ryan *et al.*, 1991). However, the high variability of the concentrations found in different reports and in the present studies, the presence of some irregular peaks or occasional drops do not appear to be easily explained in relation to variations in other hormones we have described.

Glencross and Pope (1981) found that oestradiol-17 $\beta$  levels were low in plasma of Taurine cattle for most of the oestrous cycle and rose as the concentration of progesterone began to fall and attained maximum levels after 3-4 days. Probably the drop in progesterone concentration following luteal regression allows the preovulatory follicle to increase its secretion of oestradiol (Karsch *et al.*, 1978). Ilwelyn *et al.* (1987) reported that progesterone concentration started to increase gradually 4 days after oestrous, as the corpus luteum became functional. It reached to maximum level at 11-15 days after oestrous and then declined to basal levels before the next oestrous and ovulation.

Oestrous cycle occurs 1-5 days after the regression of corpus luteum which is brought about by the action of prostaglandins (PGF2 $\alpha$ ) (Knickerbocker *et al.*, 1988) secreted by the uterus. The duration of each cycle observed in the range of 18-22 days with an average of 20 days is similar to those reported in different breeds of goat (Ali *et al.*, 1973; Ali *et al.*, 1991).

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