AGE AT PUBERTY IN FEMALE DWARF GOAT KIDS AND ESTROUS CYCLE LENGTH ON THE BASIS OF HORMONES

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ABSTRACT

A lot of five healthy female dwarf goat kids was reared at NIAB farm. Blood sampling was started at the age of 75 days. Progesterone and oestradiol profiles were monitored during prepuberal period and estrous cycle by using Radio-immunoassay (RIA) technique. During prepuberal period progesterone remained at the basal levels of 0.1-0.5 ng/ml. A small rise upto 2 pg/ml was noticed in oestradiol at the transition from prepuberal to puberal period. Hormonal levels begin to rise at the age of 4-5 months (120-160 days). Oestradiol started to increase to peak levels indicating estrous phase. After this period, progesterone values started to rise and attained the peak levels of 4-9 ng/ml during the 15 days. In the next 4 to 5 days, it started to fall and reached to basal levels. On the day of oestrous, peak values of oestradiol, ranged from 10-16 pg/ml were observed. The overall pattern of release of these hormones was similar in all the animals of the lot and the mean age at puberty in the dwarf goat was found to be 137±31 days with a mean estrous cycle length of 20±1 days.

Keywords: Progesterone, oestradiol, goat, estrous cycle, puberty

INTRODUCTION

Goat is one of the major livestock of the subcontinent (India, Pakistan and Bangladesh) and is reared for the production of meat, milk and skin. Among all breeds of goat, dwarf goat is preferred, because it is a non seasonal breeder, has 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 mechanism. The reproductive activity is controlled through endocrine secretions, receptors at target organs and feedback mechanisms (Tanaka *et al.*, 1992). These processes are initiated with the onset of puberty in the goat kids. The attainment of timely puberty is essential for optimum reproductive performance in farm animals (Lopez-Diaz *et al.*, 1988). Therefore, the physiological and endocrinological events involved in the onset of puberty and estrous cycle are of primary importance. The present study was planed to find out the endocrinological patterns and profiles of reproductive hormones (progesterone and oestradiol) at the onset of puberty and during estrous cycle and to determine the temporal relationship of these hormones.

MATERIALS AND METHODS

A lot of five healthy female dwarf goat kids was selected from NIAB farm, Faisalabad. One animal did not complete the study fue to causality. Blood sampling was initiated when the kids were 75 days-old except one that was 110 days-old. Blood sampling was carried out twice a week upto the age of 90 days and daily for 150 days. Serum was separated by centrifugation at 2000 rpm and stored at –20°C until analyzed. Hormones were estimated by Solid-phase RIA method using kits supplied by IAEA and SIGMA.

RESULTS

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

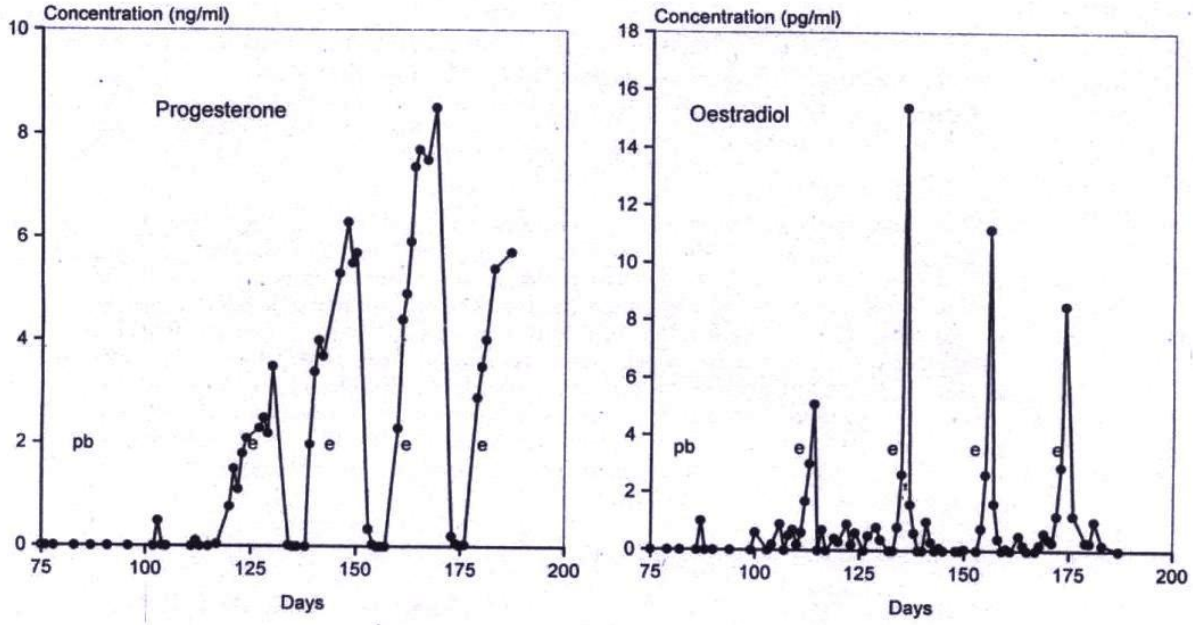

Fig.1. Serum profile of progesterone and oestradiol at prepuberal (pb) and puberal (e) phases in kid # I.

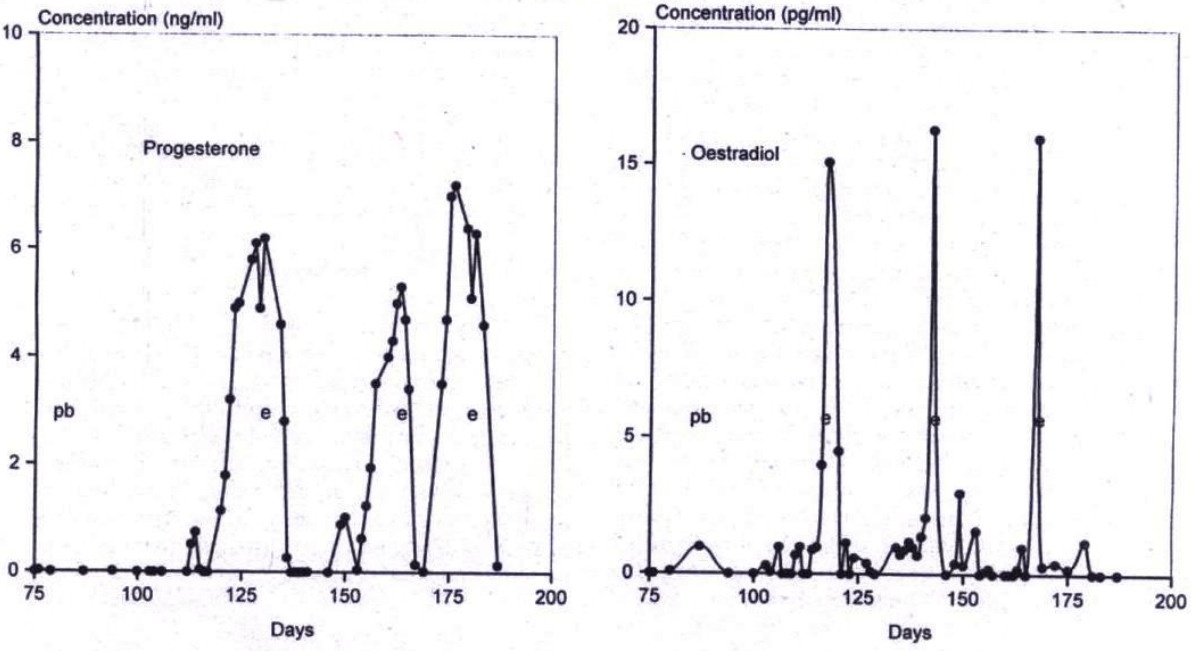

Fig.2. Serum profile of progesterone and oestradiol at prepuberal (pb) and puberal (e) phases in kid # II.

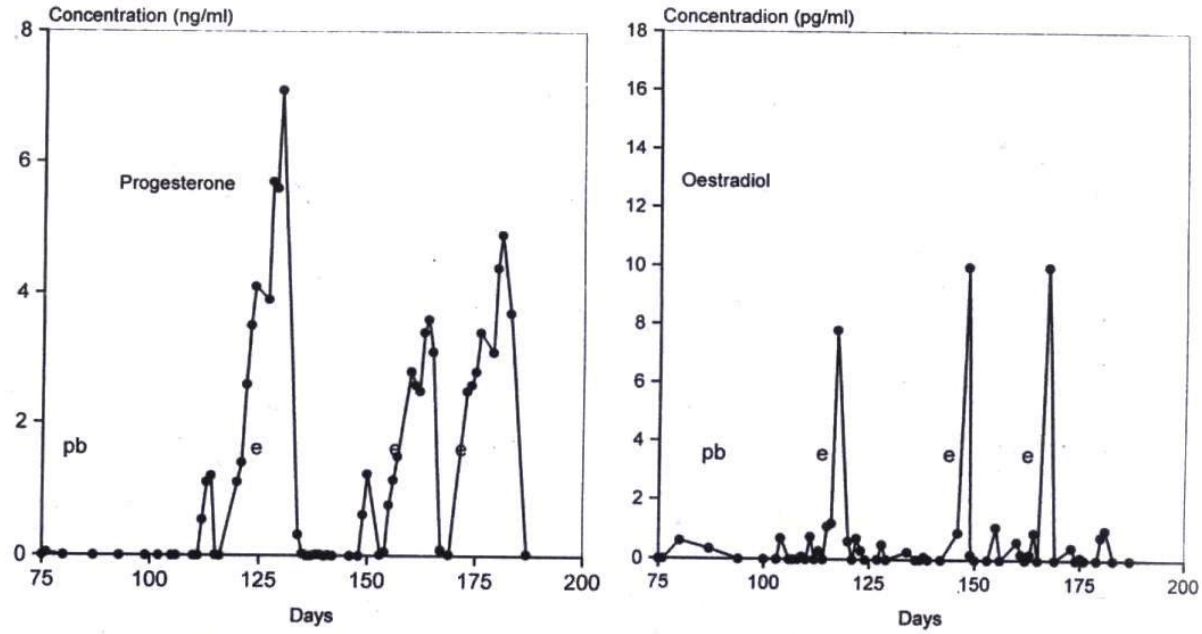

Fig. 3.Serum profile of progesterone and oestradiol at prepuberal (pb) and puberal (e) phases in kid # III.

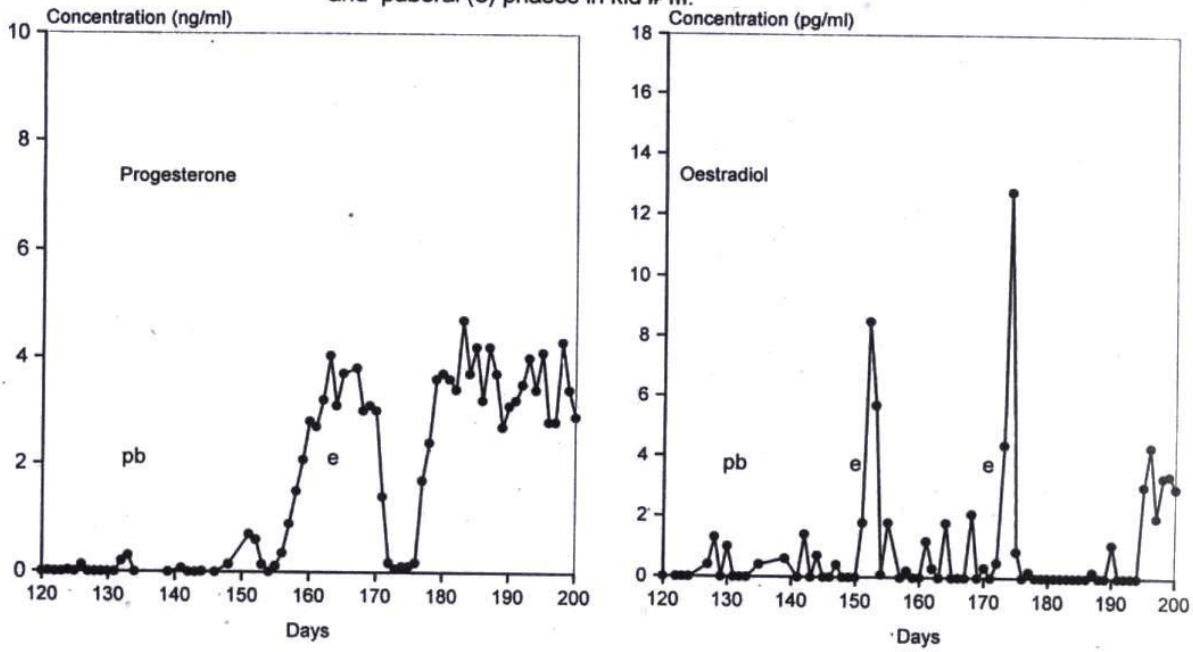

Fig. 4. Serum profile of progesterone and oestradiol at prepuberal (pb) and puberal (e) phases in kid # IV.

Fig. 1 shows the hormonal patterns of kid number 1, in which first estrous started at the age of 115 days. Four consecutive estrous cycles were observed in this kid. The length of each cycle was 20±1 days. A rise in oestradiol level reaching 15.4 pg/ml was noticed. This was taken as the day 0 of the estrous cycle and it was also the estrous phase of the cycle. During this period (2-3 days) progesterone remained at basal levels. This phase was actually the culmination of the estrous cycle. After this period, oestradiol values declined to lower levels and progesterone started to rise and reached up to the maximum level of 8.5 ng/ml in the next 10-11 days. Progesterone maintained its maximum levels for 4-5 days and then in the next 4-5 days, it declined gradually to the basal lower values.

Puberty started at the age of 120 days in kids number 2 and 3 (Fig. 2 and 3). Both these kids showed three estrous cycles during the study period. After first cycle, a silent period of about 15 days was noticed, during which irregular hormonal fluctuations were observed. The pattern of release of these hormones and the length of cycle in these kids were same as were in kid number 1. The maximum progesterone level was 7.1 ng/ml and 7.2 ng/ml and the peaks of oestradiol were 16.3 and 10.0 pg/ml, in animal number 2 and 3, respectively.

In kid number 4 (Fig. 4), first estrous started at the age of 150 days. This kid showed only one estrous cycle, while during the next cycle, the animal conceived and showed gestation by maintaining the progesterone period. During gestation period oestradiol again started rising after 25 days and reached to its peak levels before parturition.

DISCUSSION

The hormonal patterns and profiles of progesterone and oestradiol were followed in dwarf goat kids from the age of 75 days till the assumption of puberty. There were non-significant hormonal fluctuations except a few days (10-15 days) before the onset of puberty. Both 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. According to these authors, the progesterone increase is the result of the ovulation of immature follicles and subsequent short lived corpora lutea, and increase is needed to synchronize follicular development and the preovulatory gonadotrophin surge before puberty. This agrees with the statement of Ojeda *et al.* (1980) that these initial rises in progesterone may sensitize the ovaries for LH in some postpartum cows. According to the observation of Al-Hozab and Basiouni (1999) in Hebsi and Zomari goats, plasma progesterone concentration was below 0.5 ng/ml during the prepuberal period and reached to more than 2 ng/ml at first estrus.

Similarly, a significant increase in oestradiol 17-ß levels, 8 days before puberty, comparable to normal preovulatory peak in post puberal heifers had been reported by Glencross (1984). The experiment with Hue sheep ewe lambs and Corriedale ewe lamb showed that Hue sheep ewe lambs reached puberty at 180 days, which was earlier than Corriedale ewe lambs. The concentration of oestradiol-17ß in blood plasma was higher in Hue sheep lambs compared to Corriedale female lambs from 120-180 days of age (prepuberal period of these lambs) and results suggested that there was a close relationship between high levels of oestradiol 17-ß and early puberty, similarly the number of follicles (Yue *et al.*, 1996). In actual practice, the pitutary LH release system in ewe lambs is sensitive to the stimulatory effects of oestradiol, long before puberty (Meikle *et al.*, 1998).

Peters and Ball (1987) found that follicle growth starts soon after birth, as does production of LH and FSH. These findings support the idea of Ramirez and McCann (1963) that at puberty ovaries and hypothalmo-pituitary axis are fully mature for the sufficient stimulation and secretions of relevant hormones.

Age at puberty

The length of prepuberal age may be affected by various factors such as inherent characters of different breeds, body weight at birth, nutrition and photo-period etc. 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 Niekerk (1990) reported the puberty age in female Boar goat kids as 5.0-6.5 months and found significantly earlier in kids weaned in breeding season (April) than those in non-breeding season (December). Hebsi and Zomri goats reached puberty at 366±1.7 and 374±2 days of age respectively, which differed significantly. Weights at puberty were similar as 21.8±0.8 and 21.5±0.9 kg for Hebsi and Zomri goats, respectively. The results show that the attainment of proper weight is more critical than age in determining time of sexual maturity in both Hebsi and Zomri goats (A-Hozab and Basiouni, 1999).

Estrous cycle

In this investigation, progesterone levels observed were low during estrous (day 0) and showed a gradual increase and maximum peak in di-estrous within 10

days and dropped during pro-estrous to the basal levels within 4-5 days before the commencement of met-estrous. Estrous cycle in the goat is well studied and hormonal profile of 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 concentration found in earlier 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 variation in other hormones we have described.

Glencross and Pope (1981) found that oestradiol-17ß levels low in plasma of Taurine cattle for most of the estrous 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). Llewelyn *et al.* (1987) reported that progesterone concentration started to increase gradually 4 days after estrous, as the corpus luteum became functional. It reached to maximum level at 11-15 days after estrous and than declined to basal levels before the next estrous and ovulation.

Estrous occurs 1-5 days after the regression of corpus luteum which is brought about by the action of prostaglandins ($PGF_2\alpha$) secreted by the uterus (Knickerbocker *et al.*, 1988). The hormonal interactions that control the onset and progress of luteolysis are complex. They involve endocrine and paracrine signals that link the corpus luteum, uterus and posterior pituitary gland. Cattle, sheep and goat depend upon $PGF_2\alpha$, secreted from the uterus, to induce luteolysis. Three hormones, progesterone, oestradiol and oxytocin interact to regulate uterine secretion of $PGF_2\alpha$. Oxytocin is an acute stimulus for uterine $PGF_2\alpha$ secretion. Progesterone and oestradiol interact to regulate uterine secretary responsiveness to oxytocin (Silvia, 1999).

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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