

Effect of insulin administration on peripheral concentration of luteinizing hormone in goat

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ABSTRACT

Effect of exogenous administration of insulin on peripheral concentration of luteinizing hormone was studied in 16 non-descript adult cyclic goats by collecting the blood samples at every 2 hours interval starting from onset of estrus upto 24 hours using standard diagnostic kit. There was no significant difference in average concentration of LH, its peak, onset of estrus to LH peak interval and duration of LH surge between insulin treated and control groups. The results indicate that exogenous administration of insulin has no effect on peripheral concentration of LH.

Key words : Insulin, luteinizing hormone, goat

A critical component for success of superovulation and embryo transfer programme is ovulatory response of donors. Understanding the precise mechanism controlling ovarian follicular growth and development is still inadequate. Gonadotrophins though play an important role in ovarian follicular growth and development, the role of autocrine and paracrine regulators influencing follicular growth and development has recently been explored. Growth factors and metabolic hormones i.e. somatotrophin, insulin and insulin like growth factors have received considerable attention in regulation of ovarian functions (Gong *et al.*, 1997). The growth factors alongwith gonadotrophins modulate survival, proliferation and differentiation of follicular cells ensuring growth of small antral follicles by enhancing granulosa cell mitosis (Monniaux *et al.*, 1997). Application of insulin to modulate reproduction in livestock is a fairly recent development. Administration of insulin in cattle increases intrafollicular and peripheral IGF-I level (Simpson *et al.*, 1994). Receptors of insulin have been demonstrated in ovary, oviduct, uterus and embryo (Daliri *et al.*, 1999). *In vitro* study revealed insulin and IGF-1 as an important mediators of follicular development, steroidogenesis, oocyte maturation and subsequent embryonic development (Totey *et al.*, 1996). Increase in size of follicle and ovulation rate have been reported in animals treated with insulin (Gong *et al.*, 1993). But it is

unclear whether the increase in ovulation rate after administration of insulin is due to increased secretion of LH from anterior pituitary or without altering it. The present investigation was therefore, designed to study the effect of exogenous administration of insulin on peripheral concentration of luteinizing hormone in goat.

MATERIALS AND METHODS

The study was conducted on 16 non-descript adult cyclic female goats maintained at experimental animal shed of Animal Reproduction and Physiology & Climatology Division, Indian Veterinary Research Institute, Izatnagar, U.P. All the goats were maintained under uniform standard of feeding and managemental conditions. They were randomly divided into two equal groups (n = 8) i.e. group A (control) and group B (insulin treated). Animals of group B were treated with long acting purified bovine insulin (Insulin Zinc suspension, lente Knoll Pharmaceutical Ltd., Astali India) @ 0.2 IU/kg body weight/day subcutaneously for three consecutive days starting from day 7 of estrous cycle. The dose of 0.2 IU/kg body wt./day was chosen for the present study as per the Simpson *et al.* (1994). Animals of control group were not treated with insulin instead normal saline was injected as placebo. All the does were subjected to detection of estrus thrice-daily using teaser buck. Blood sample from all the goats were collected from jugular vein in a sterilized vial at every two-hour interval upto 24 hours starting from the onset of estrus. Serum was separated and stored at -20°C until analysis. Profile of luteinizing hormone was studied using ELISA with the help of standard diagnostic kit (Omega Diagnostic Ltd., Scotland, U.K.).

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RESULTS AND DISCUSSION

Results pertaining to LH profile in goat are presented in Table 1.

Table 1. LH profile at estrus in normal cyclic (control) and insulin treated goat

Parameters	Group A (Control)	Group B (Insulin treated)
Average concentration of LH mIU/ml	54.4±5.60	60.70±5.72
LH peak (mIU/ml)	87.50±6.5	93.60±7.00
Onset of estrus to LH peak (hrs)	10.80±0.71	10.40±0.66
Duration of LH surge (hrs)	1.60±0.43	8.0±0.56

Average concentration of LH and its peak value at estrus was 54.4±5.6 and 87.5±6.5 mIU/ml in control and 60.70±5.72, 93.60±7.00 mIU/ml in insulin treated groups, respectively. The onset of estrus to LH peak and duration of LH surge was 10.8±0.71, 7.6±0.43 hours, in control and 10.40±0.66, 8.0±0.56 hours in insulin treated goats, respectively. The sharp increase in peripheral concentration and preovulatory surge of LH at estrus has been indicative of positive feed back of estradiol-17 β produced by the

preovulatory follicles (Leyva-ocariz, 1995) that is responsible for rupture of follicles and ovulation. Similar trend in LH profile during estrus has also been reported by most of the author (Chemineau *et al.*, 1982; Bono *et al.*, 1983 and Leyva-ocariz *et al.*, 1995). A wide variation in LH concentration (2.6 - 11.40 ng/ml) has been reported during the estrous cycle in goat (Chemineau *et al.*, 1982; Bono *et al.*, 1983; Leyva-ocariz *et al.*, 1995). Basal LH concentration in Alpine goat was reported as low as 0.5 - 3.0 ng/ml during the entire cycle and maximum level 40.7 ng/ml at estrus. Onset of estrus to LH peak and duration of LH surge observed in present study are in agreement with Mori and Kano (1984).

Average concentration of LH, its peak, onset of estrus to LH peak and duration of LH surge did not differ significantly between insulin treated and control goats indicating no effect of insulin on peripheral concentration of LH. Most of the authors have reported no increase in LH profile during estrous following administration of insulin in ewes and beef heifers (Harrison and Randel, 1986; Beam and Holcomb, 1992). Similarly in gilts, increase in ovulation rate was observed following administration of insulin without increase in peripheral LH concentration (Cox *et al.*, 1987).

An increase in ovulation rate in insulin-injected ewes had been observed without significant change in gonadotrophin concentration (Downing *et al.*, 1995). They opined that insulin, because of its role in cell growth and metabolism, is involved in mediating ovulation response by insulin mediated glucose uptake and decreased follicular

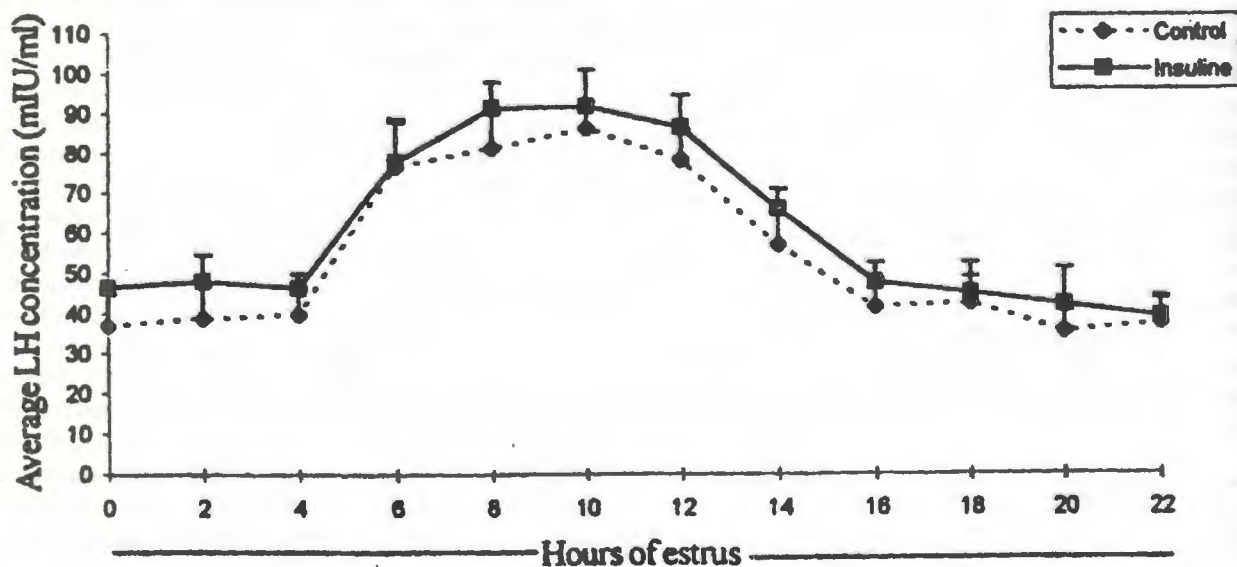


Fig. 1. LH profile at estrus in normal cyclic (control) and insulin treated goat

atresia. Moreover, insulin and glucose infusion inhibited the secretion of estradiol in ewes (Downing *et al.*, 1993). This suppressive effect of insulin was suggested to allow the selection of more than one ovulatory follicles leading to multiple ovulation (Downing *et al.*, 1995). It may be concluded that administration of insulin couldn't affect LH profile in normal cyclic goat.

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REFERENCES

- Adashi, E.V., Hsueh, A.J.W. and Yen, S.S.C. (1981). Insulin enhancement of luteinizing hormone and follicle stimulating hormone release by cultured pituitary cells. *Endocrinology*, **108**: 1441-1449.
- Beams, S.W. and Holcombe, D.W. (1992). Effect of insulin administration during follicular growth on serum glucose and hormone profiles in ewe lambs. *Canadian J. Anim. Sci.*, **72**: 421-426.
- Bono, G., Carioli, F., Tamanini, C. and Abrate, L. (1983). Progesterone, estrogen, LH, FSH and PRL concentration in plasma during the estrous cycle in goat. *Reprod. Nutr. Dev.*, **23**: 217-222.
- Chemineau, P., Gauthier, D., Poirier, J.C. and Saumande, J. (1982). Plasma levels of LH, FSH, Prolactin, Estradiol-17 β and progesterone during natural and induced estrous in dairy goat. *Theriogenology*, **17**: 313-323.
- Cox, N.M., Stuart, M.J., Althen, T.G., Bennett, W.A. and Miller, H.W. (1987). Enhancement of ovulation rate in gils by increasing dietary energy and administering insulin during follicular growth. *J. Anim. Sci.*, **64**: 507-516.
- Daliri, M., Appa Rao, K.B.C., Kaur, G., Gar, S., Patil, S. and Totey, S.M. (1999). Expression of growth factor ligand and receptor genes in preimplantation stage water buffalo (*Bubalus bubalis*) embryos and oviduct epithelial cells. *J. Reprod. Fertil.*, **177**: 61-70.
- Downing, J.A., Scaramuzzi, R.J. and Joss, J. (1993). Direct effect of insulin on ovarian steroid secretion in ewes with an autotransplanted ovary. *Proc. Aus. Soc. Reprod. Biol.*, **25**: 54 (Abstr.) (cited from Downing *et al.*, 1995, 46: 403-410).

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