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SHORT COMMUNICATION

PERIPHERAL PLASMA FSH CONCENTRATION IN RELATION TO EXPRESSION OF ESTRUS IN SAHIWAL CATTLE (BOS INDICUS)

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Abstract : An experiment was conducted to investigate the changes in peripheral plasma FSH concentrations in relation to expression of estrus in Sahiwal cows. Out of total five estrus, three were accompanied by overt signs whereas rest two were silent estrus. In cows with overt estrus, plasma FSH concentrations during periestrus, early luteal, midluteal and late luteal phase were 1.65 ± 0.34, 1.67 ± 0.21, 1.58 ± 0.18 and 1.69 ± 0.31 ng/ml, respectively and the corresponding values in cows with silent estrus being 0.68 ± 0.39, 0.50 ± 0.12, 0.75 ± 0.13 and 0.46 ± 0.12 ng/ml, respectively. The overall plasma FSH levels in cows that exhibited overt estrus was 1.63 ± 0.82 ng/ml as against 0.64 ± 0.55 ng/ml in silent estrus. It was concluded that FSH levels were higher ($P<0.01$) in cows that exhibited overt estrus compared to silent estrus.

Key words : FSH expression of estrus overt estrus silent estrus cattle

INTRODUCTION

Understanding of the endocrine factors that regulate estrus is essential for development of reproductive strategies to improve the detection of estrus behaviour (3). Poor expression of estrus is one of the major factors impeding efficient utilization of tropical Sahiwal cattle. Estrus is observed by behavioural symptoms which, is practically not possible in situations where herd size is large and animals are stallfed. Estrus detection is also very difficult due to lack of expert personal, variation of duration of estrus and reluctance of some teaser bulls to mate. Pituitary FSH is essential for development and maintenance of ovarian follicles in single and multiple ovulating species (39). FSH in plasma in cycling cow and heifer has also been implicated in expression of estrus and ovulation (2, 9). Progesterone as a marker for monitoring of functional status of corpus luteum and diagnostic tool for identifying ovarian condition such as estrus confirmation, silent estrus, lack of cyclicity have been

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reported (7, 11, 18, 27, 28, 29, 30). There is no information available on peripheral plasma FSH concentrations in relation to expression of behavioural estrus symptoms in Sahiwal cows. The present study was, therefore, undertaken to measure peripheral plasma FSH concentrations during estrous cycle and to relate them to occurance of overt or silent estrus in Sahiwal cows.

METHODS

Experimental animals and blood sampling

Three non-pregnant, non-lactating Sahiwal cattle (5–6 year old and having body weight between 550–600 kg) were selected from National Dairy Research Institute animal herd and maintained under standard feeding and management schedule as practised in the herd. Daily blood samples (20 ml) were collected through jugular venipuncture for consecutive 32 days during winter months of January and February. Blood samples were centrifuged at 3000 rpm for 30 min and plasma was harvested and stored in deep freeze at –20°C for analysis of progesterone. Estrus was detected by parading a vasectomized bull twice daily, palpation of reproductive organs per rectum and/or visual signs and confirmed by plasma progesterone concentrations.

Hormonal assay

Plasma FSH was estimated by double antibody RIA developed in our laboratory (33). The sensitivity of the assay was 0.4 ng/ml. The intra- and inter-assay coefficients of variation were <10% (n = 6). The crossreaction of FSH antiserum with other hormones were LH, 7%; prolactin, 0.20%; GH, 0.48% and TSH, 3.6%. Progesterone was estimate by a simple, direct radio-immunoassay developed in our laboratory (20). The sensitivity of the assay was 8 pg/tube. The intra- and inter-assay coefficients of variation were 13.4 and 16.9 percent, respectively (n = 6). The progesterone antiserum (anti-progesterone-11 alpha-hemisuccinate-BSA) crossreacted 4 pregnane-3, 20 diene, 11 alpha-hydroxyprogesterone and corticosterone to the extent of 100, 110 and 0.2 percent, respectively. The crossreactivity of the antiserum with cortisone, hydrocortisone was less than 0.01 percent and with β-estradiol, estriol and testosterone was less than 0.001 percent.

Statistical analysis

For statistical analysis the estrous cycle was divided into four phases namely late luteal (day-4 to day-2, day 0 = day of estrus), periestrus phase (day-1 to day 1), early luteal phase (day 2 to day 5) and mid luteal phase (day 6 to day 14). The changes in peripheral plasma FSH and progesterone concentrations during different phases of cycle in cows exhibited both overt and silent estrus were analysed by Analysis of Variance (38).

RESULTS AND DISCUSSION

Out of total 5 estrus, three were accompanied by overt sign whereas rest two were silent estrus. The plasma FSH concentrations in cows that exhibited overt estrus behaviour and those showed silent estrus during different days of cycle are depicted in Figs. 1 and 2. Among different days of estrous cycle, the mean (± S.E.M.)

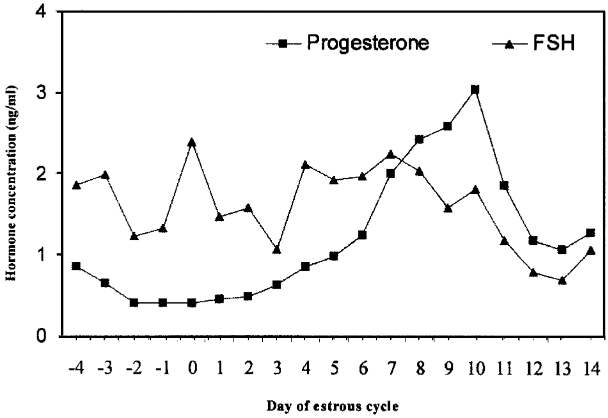

Fig. 1 : Peripheral plasma FSH and progesterone concentration in relation to overt estrus in Sahiwal cows.

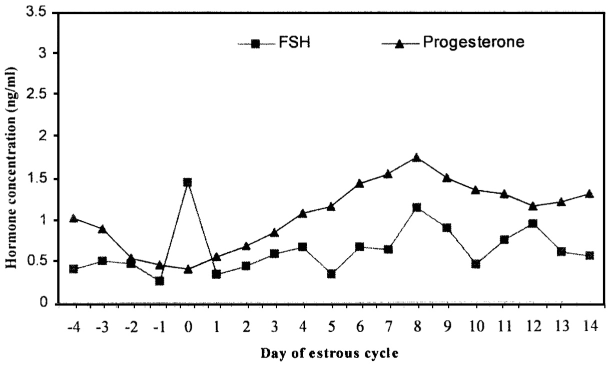

Fig. 2 : Peripheral plasma FSH and progesterone concentrations in relation to silent estrus in Sahiwal cows.

plasma FSH concentrations ranged from 0.70 ± 0.13 to 2.39 ± 0.94 ng/ml and from 0.25 ± 0.08 to 1.45 ± 1.18 ng/ml in cows that exhibited overt and silent estrus, respectively. Plasma FSH concentrations increased from 1.86 ± 0.54 ng/ml on day-4 to reach a peak concentration of 2.40 ± 0.94 ng/ml on day 0 (day of estrus) and decreased thereafter to 1.06 ± 0.20 ng/ml on day 3 in cows that exhibited overt estrus (Fig. 1). Plasma FSH concentrations increased from 1.58 ± 0.18 ng/ml during midluteal phase to 1.69 ± 0.31 ng/ml during late luteal phase and then declined to 1.65 ± 0.34 ng/ml during periestrus phase following which increased to 1.67 ± 0.21 ng/ml during early luteal phase (Fig. 3).

A similar trend was observed in cows that exhibited silent estrus in which plasma FSH concentrations increased from 0.41 ± 0.20 ng/ml on day-4 to reach a maximum concentration of 1.46 ± 1.18 ng/ml on day 0 and then decreased to 0.34 ± 0.16 ng/ml on day 5 (Fig. 2). Plasma FSH concentrations increased from 0.50 ± 0.12 ng/ml during early luteal phase to 0.75 ± 0.13 ng/ml during mid luteal phase and then declined to 0.46 ± 0.12 ng/ml during late luteal phase following which increased to 0.68 ± 0.39 ng/ml during periestrus phase (Fig. 4). The overall plasma FSH levels in cows that exhibited overt estrus was 1.63 ± 0.82 ng/ml as against 0.64 ± 0.55 ng/ml in silent estrus.

In cows that exhibited overt and silent estrus, mean (± S.E.M.) plasma progesterone concentrations declined from 0.85 ± 0.06 and 1.03 ± 0.02 ng/ml on day-4 to reach a lowest level of 0.40 ± 0.02 and 0.40 ± 0.03 ng/ml on the day of estrus and increased thereafter to reach maximum concentration of 3.03 ± 0.91 and 1.75 ± 0.35 ng/ml on day 10 and 8, respectively (Figs. 1 and 2). Plasma progesterone concentration which were lowest during periestrus phase, increased through late luteal phase to a maximum concentration during midluteal phase in cows that showed overt and silent estrus, respectively (Figs. 3 and 4). These results are in agreement with earlier reports in cows (16, 37) and buffaloes (1, 4, 32) in terms of minimum level on the day of estrus with gradual rise to the higher levels during

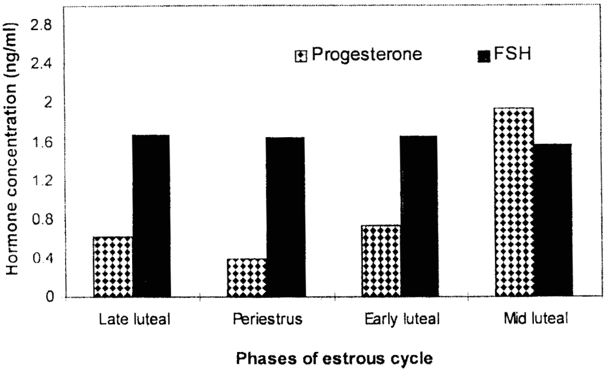

Fig. 3: Peripheral plasma FSH and progesterone concentrations in relation to overt estrus in Sahiwal cows.

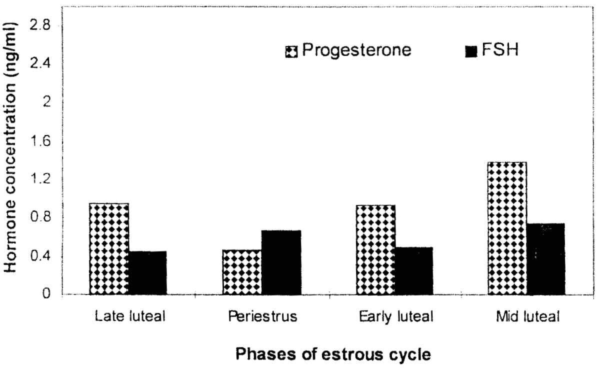

Fig. 4: Peripheral plasma FSH and progesterone concentrations in relation to silent estrus in Sahiwal cows.

luteal phase and then declining to basal level at subsequent estrus. In the present study plasma progesterone concentrations were found to be very low during periestrus phase which is necessary prerequisite for the expression of estrus because progesterone is inhibitory to estrus behaviour (8, 10, 12). Once progesterone concentrations increased to a threshold level, estrus is inhibited even when estrus inducing concentrations of estradiol exist (8, 10, 35, 40).

The pattern of plasma FSH levels during estrous cycle are in agreement with earlier reports in rats and humans (14), monkeys (6), ewes (23), cows (2, 5, 21), buffaloes (17, 25, 26, 36) in terms of peak level on the day of estrus compared to other days of estrous cycle. Akbar et al. (2) reported that serum FSH levels on the day of estrus to be higher than follicular or luteal phase levels in cattle. Plasma FSH concentrations increased 9 fold on the day of estrus compared to other days of estrous cycle in cattle (5). Kaneko et al. (21) reported that the concentrations of plasma FSH were relatively high during late luteal phase and then declined gradually to low levels during the follicular phase in cattle. Peak levels of FSH was detected on the day of estrus in Murrah buffaloes which declined gradually within next 3–6 days and fluctuated before rising again to the peak levels at next estrus (17). A sudden rise in LH levels was seen on the day of estrus in cattle but the levels of both FSH and LH attained high values on this day (31). Following estrus decline in FSH is slow whereas that of LH is sharp. Increasing levels of estradiol during follicular phase exert a positive feedback on the hypohalamo-hypophyseal axis resulting in release of peak levels of gonadotropins during estrus. The increased secretion of FSH and LH may be due to increased release of GnRH from thalamus or to increased sensitivity of FSH and LH secretring cells within adenohypophysis to GnRH (31).

The growth and development of follicles has been shown to be bimodal in cattle (15, 34) and buffalo (24). The first and second waves occur at days 1 and 11, respectively in cattle and at days 0.20 and 9.20, respectively in buffaloes. In each wave a dominant follicle emerges along with a cohort of subordinate follicles. Kaneko et al. (22) reported that plasma levels of FSH were high prior to emergence of each follicular wave and low during the growing phase of a dominant follicle. Our study suggests that plasma FSH concentrations were maximum on the day of estrus in cows that exhibited overt and silent estrus. Following a decreased thereafter, FSH concentration rose again and reach high concentrations on days 7 and 8 in cows that exhibited overt and silent estrus, respectively prior to emergence of the second wave. An inverse relationship has been observed between peripheral plasma inhibin and FSH concentration during estrus cycle in cattle (39) and buffaloes (25). The low concentrations of inhibin during mid luteal phase, an increase through the late luteal and periestrus phases and a decrease thereafter may play an important role in regulation of FSH secretion in cattle (26) and buffalo (25).

In conclusion the results of this study indicate that plasma FSH levels were higher (P<0.01) in cows that exhibited overt estrus compared to silent estrus and might be responsible for expression of estrus.

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