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Hormonal profile in relation to early pregnancy diagnosis and litter size in crossbred sows

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ABSTRACT

Twelve crossbred sows (½ Large White Yorkshire x ½ Indigenous) were used to diagnose pregnancy and assess their litter size at the earliest through ELISA assayed hormonal profile. The mean concentration of estrone sulfate was 60.17 ± 0.48 ng / ml of serum on the day of service in the sows. It rose to 100.00 ± 0.52 ng / ml on 14th day after service and remained almost same on the 16th day also. Thereafter, it increased to 300.08 ± 0.71 on 18th, 400.08 ± 0.52 on 20th, 702.92 ± 0.07 on 22nd, 1200.08 ± 0.58 on 24th and 1900.08 ± 0.54 ng / ml serum on 26th day of pregnancy. The correlation between serum estrone sulfate concentration and litter size was significantly positive ($P < 0.05$) on 22nd (0.632) and 24th (0.594) days of pregnancy. The mean concentration of the progesterone on the day of service was 9.72 ± 0.75 ng / ml serum. It rose significantly ($P < 0.01$) to 25.67 ± 0.44 ng / ml serum on 14th day of pregnancy. Thereafter, upto 26 days of pregnancy the hormonal profile did not vary significantly. The levels of serum estrone sulfate and progesterone concentrations were directly related to pregnancy and litter size.

Key words : Estrogen-progesterone, ELISA, pregnancy, litter size, crossbred sows

Identification of unproductive non pregnant sows soon after mating enables minimizing time lost due to infertility, as these animals can be rebred appropriately, treated or permanently culled to save economic losses. The early confirmation of reproductive status of the animal can guide veterinarian and owner to take vital decisions related to the sale, insurance, treatment and economic vitality of the livestock. Serum concentrations of unconjugated estrogens such as estradiol are predictably high during late pregnancy, but they are not consistently high during early pregnancy and are not secreted into the maternal circulation in sufficient quantities to be used as an early, accurate test for pregnancy diagnosis (Robertson and King, 1974). Commencing at approximately 12 days in pig the conceptus develops the capacity to synthesize estrogen (Perry *et al.*, 1976). Hence, the present study was undertaken with an objective to diagnose pregnancy and assess litter size through ELISA assayed hormonal profile.

MATERIALS AND METHODS

Twelve crossbred sows (½ Yorkshire X ½ Indigenous) were used in the study. The schedule of collection of blood samples was on the day of service, 14th day post service and thereafter every alternate day till 26th day. The blood samples were drawn from the ear vein aseptically, serum separated and stored in sterilized serum vials at -20 °C till assayed. Serum samples were assayed, employing commercially available ELISA kits (Lilac Medicare, Italy), for estimation of estrogen and progesterone concentrations. Serum concentration of the hormones was used to indicate the early pregnancy and litter size after Stoner *et al.* (1986).

The data were analysed statistically after Snedecor and Cochran (1968). Linear regression was calculated to determine the accuracy of pregnancy diagnosis and litter size employing serum hormonal profile. Equation, i.e. $Y = a + bx$ was applied, where, 'Y' represented the dependent variable, 'a' an intercept, 'b' as regression co-efficient constant and 'x' an independent variable.

RESULTS AND DISCUSSION

The mean concentration of estrone sulfate was 60.17 ± 0.48 ng / ml of serum on the day of service in the sows. It rose to 100.00± 0.52 on 14th day after service and remained almost same on the 16th day also. Thereafter, it increased to 300.08± 0.71 on 18th, 400.08±0.52 on 20th, 702.92±0.07 on 22nd, 1200.08±0.58 on 24th and 1900.08±0.54 ng / ml on 26th day of

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pregnancy. The rise in serum estrone sulfate concentrations was significantly high ($P < 0.01$) between the day of service to 14th day of pregnancy (39.83 ng / ml serum), and between 16th to 18th (200.08 ng/ml serum), 18th to 20th (100.00 ng/ml serum), 20th to 22nd (302.83 ng / ml serum), 22nd to 24th (497.16 ng/ml serum) and 24th to 26th (699.91 ng/ml serum) days of pregnancies. However, there was no significant difference in the serum estrone sulfate concentrations during 14th to 16th days of pregnancy.

Serum concentrations of unconjugated estrogens such as estradiol are predictably high during late pregnancy, but they are not consistently high during early pregnancy and are not secreted into the maternal circulation in sufficient quantities to be used as an early, accurate test for pregnancy diagnosis (Robertson and King, 1974). Commencing at approximately 12 days in pig the conceptus develops the capacity to synthesize estrogen (Perry *et al.*, 1976).The endometrium of the sow and mature gilt contains estradiol dehydrogenase and estrogen sulfotransferase, which metabolise the unconjugated estrogens produced by the conceptus to the sulfate - conjugated by - products (Dwyer and Robertson, 1980). Hattersley *et al.* (1980) reported that the serum concentrations of estrone sulfate are high for a week or more, and peak for 1 to 2 days, usually between 22 to 30 days after breeding. As in the present study he observed that in some animals, the increase in serum concentrations of the hormone may be as early as 16 to 17 days, and in others it is no seen until 20 to 22 days. Breed appears to have no effect on estrone sulfate concentrations. Kensinger *et al.* (1986) in accordance to the present study found that estrone sulfate initially appears in the maternal circulation at approximately 16 to 20 days and rises linearly and peaks between 22 and 28 days, before decreasing to its lowest concentration at 35 to 45 days. A second increase in this hormone occurs concomitantly with increase in other estrogens commencing at 70 to 80 days and continuing until farrowing. The overall accuracy of the estrone sulfate test in the evaluation of pregnancy diagnosis was found to range from 82 to 100 % (Stone *et al.*, 1986).

The correlation between serum estrone sulfate concentration and litter size in the present study was significantly positive ($P< 0.05$) on 22nd (0.632) and 24th (0.594) days of pregnancy. Stoner *et al.* (1986) investigated the applicability of estrone sulfate in the estimation of litter size, and in the identification of sows and gilts that have abnormally small litters. As analysed in the present study they also positively correlated litter size with maternal serum estrone sulfate concentrations. Correlation of 0.4 to 0.95 was reported between estrone sulfate and number of pigs present at the time when samples were taken or at the time of farrowing.

The mean concentration of the progesterone on the day of service was 9.72±0.75 ng / ml serum. It rose to 25.67±0.44 and 26.67±0.44 ng / ml serum on 14th and 16th days of pregnancy, respectively. Thereafter, it declined to 24.90±0.33, 21.75±0.40 and 19.92±0.47 ng / ml serum on 18th, 20th and 22nd day of gestation, respectively. Then the hormone slightly increased to 21.80±0.40 ng / ml serum on 24th day of gestation and again dipped slightly to 20.67±0.44 ng/ml serum on 26th day. The rise in serum progesterone concentration was significantly high ($P < 0.01$) from the day of service to 14th day of pregnancy (15.83 ng/ml serum). Thereafter, upto 26 days of pregnancy the hormonal concentration did not vary much. The comparative ELISA analysed serum estrone sulfate and progesterone profile during different days of pregnancy in crossbred sows is depicted in Fig.1.

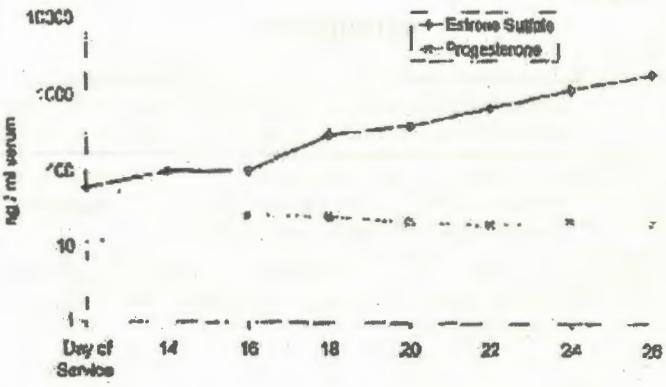

Fig.1 ELISA analysed serum estrone sulfate and progesteron profile during different days of pregnancy in crossbred sows

Ellendorff *et al.* (1976) determined the serum concentrations of progesterone to be high in pregnant sows and gilts during the expected time of return to estrus and low in bred sows and gilts that failed to conceive, the results were in accordance with the present study. Progesterone concentrations in serum obtained from 15 to 25 days after breeding were evaluated for accuracy in pregnancy diagnosis. The amount of circulating progesterone in nonpregnant sows and gilts became distinctly different from those of pregnant females at 17 days after breeding. Moeljono *et al.* (1977) found that if conception occurs, blastocyst induced maintenance of corpora lutea causes serum progesterone concentrations to

be continually high throughout pregnancy. Concentrations of 4, 5, 7, 7.5, and 9 ng of progesterone / ml of serum have been suggested to discern pregnancy status, however 5 ng / ml serum appears to be the most commonly used concentration (Williamson *et al.*, 1980). Kawata *et al.* (1982) as observed in the present study suggested the optimal time to obtain blood samples for subsequent progesterone determinations to be from 17 to 20 days if non conceiving sows and gilts are to be detected before the time they return to estrus. While it has not been determined how day of blood sampling influences the accuracy of the progesterone pregnancy test, overall accuracy of more than 88 % was found to be when samples were taken between 17 and 24 days.

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