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Studies on Serum Steroid Hormone Levels in the Puerperal Sow

Y. C. Chung • C. K. Kim • K. S. Lee* • C. S. Park* and K. S. Lee**
College of Agriculture, Chung Ang University • *College of Agriculture, Chungnam National University • **Livestock Experiment Sation, ORD

돼지에 있어서 分娩前後의 血淸 Steroid Hormone 水準에 關한 硏究

鄭英彩 • 金昌根 • 李揆丞* • 朴昌植* • 李根常**
中央大學校 農科大學 • *忠南大學校 農科大學 • **畜産試驗場

Summary

The purpose of this study was to measure the serum content of progesterone, estradiol-17β and cortisol. Blood samples collected from day 20 prepartum to day 20 postpartum in 8 sows. Progesterone and estradiol-17β were assayed by radioimmunoassay methods and cortisol was determined by competitive protein-binding methods.

Progesterone levels began to decline on day -4, reached 1.9 ng/ml by day +2 and remained quite constant thereafter. Progesterone levels remained fairly constant(18.4 to 20.0 ng/ml) from 20 to 6 days before parturition.

Estrdiol-17β increased from 205 pg/ml at day 6 prepartum to 425 pg/ml at the time of parturition. Cortisol reached a peak level of 86.5 ng/ml at day 0.

Ⅰ. Introduction

There is a paucity of information on serum levels of various reproductive steroids during the puerperal period in the sow. Shearer et al. (1972) have reported a limited amount of information on the levels of progesterone and unconjugated oestradiol-17β during the early and the later part of gestation, while Molokwu & Wagner (1973) and Ash et al. (1973) have described changes in plasma concentration of corticoids, progesterone and unconjugated oestrone and oestradiol-17β over the periods from 8 days before to 8 days after parturition and from 7 to 12 days before parturition to birth respectively. Robertson & King (1974) have described the changes in the plasma levels of progesterone, of unconjugated oestrone and oestradiol-17β, and of oestrone sulphate in the sow at time of implantation, during gestation and at parturition.

The purpose of the present study was to concurrently analyze serum progesterone, estradiol-17β and cortisol during during the periparturient period (20 days prepartum to 20 days postpartum) in the sow in order to determine the sequence or relationship of changes in these steroids during this period.

Ⅱ. Materials and Methods

Animals used in this study consisted of 8 sows [Duroc ♂×(Large White ♂×Landrace ♀) F_1 ♀ Matings]. The sows were maintained under normal conditions of husbandary throughout the experimental period. Every other day blood samples

were collected beginning 20days prior to expected farrowing date (based on 114 day gestation length) and continuing through day 20 postfarrowing.

For blood withdrawal the animals were restrained by a snout rope when in farrowing crates, or in a hog squeeze at other times. Blood samples were obtained by inserting a 21-gauge, hypodermic needle attached to 10cc syringe through surface veins in the ear. Blood samples were allowed to clot at 4°C and serum was obtained by centrifugation. The serum was then stored at −20°C.

The concentration of progesterone and estradiol-17β in serum was determined by radioimmunoassay. The principles and basic techniques for developing an RIA have been described (Berson & Yalow, 1964), and these techniques and procedures were followed with minor modification. The technical procedures used, i.e., buffers, incubation times, counting techniques etc. have been reported (Hallford et al., 1975).

Cortisols were determined by a competitive protein binding assay similar to that described by Murphy (1967) and Smith et al. (1972).

Ⅲ. Results

The mean serum progesterone levels are showns in table 1 and figure 1. The progesterone level began to decline on day 6 prepartum. This decline was very rapid from day 4 prepartum(19.4ng/ml) to day 0 parturition (2.6ng/ml). The serum level remained fairly constant at about 0.9ng/ml from day 2 showed similar patterns of change.

Table 1. Serum steroid hormone levels in sows during the periparturient period(Mean±S.E.)

No. of days to farrowing	Progesterone (ng/ml)	Estradiol -17β (pg/ml)	Cortisol (ng/ml)
−20	20.0±2.1	48.0± 6.1	47.0± 5.5
−6	18.4±1.6	205.0±29.5	36.5± 4.7
−4	19.4±2.4	328.5±28.5	34.0± 5.1
−2	8.8±1.0	344.9±25.7	48.8± 6.0
0	2.6±0.8	425.0±35.0	86.5±10.5
+2	0.9±0.3	59.5± 7.8	44.0± 6.6
+4	1.0±0.3	56.7± 5.7	31.5± 6.9
+6	0.8±0.2	28.1± 4.2	34.0± 8.0
+20	0.5±0.1	12.5± 3.4	32.5± 3.5

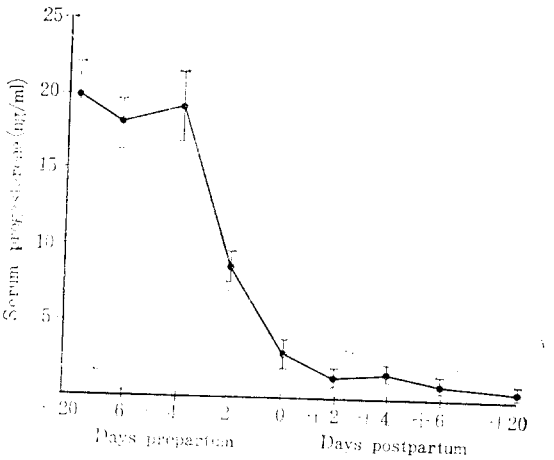

Fig.1. Serum progesterone levels in sows during the puerperal period. Vertical bars represent standard error of the mean.

The mean estradiol-17β level(table 1 and figure 2) started to rise on day 6 prepartum. The level peaked at 425pg/ml on day 0 and then decreased as rapidly as it had risen, returning to prefarrowing levels by day +2.

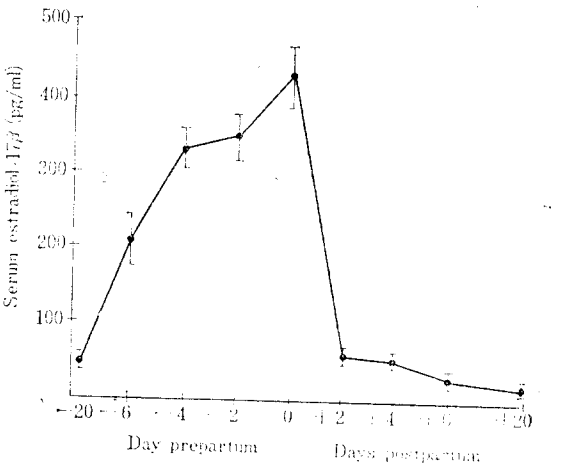

Fig. 2. Serum estradiol-17β levels in sows during the puerperal period. Vertical bars represent standard error of the mean.

Mean prepartum cortisol levels(table 1 and figure 3) remained consistently between 34.0 and 48.8ng/ml. At around 48hr. before parturition, mean cortisol levels began to rise and peaked at

a concentration of 86.5ng/ml on day 0 and returned to prepartum levels by 48hr. following parturition.

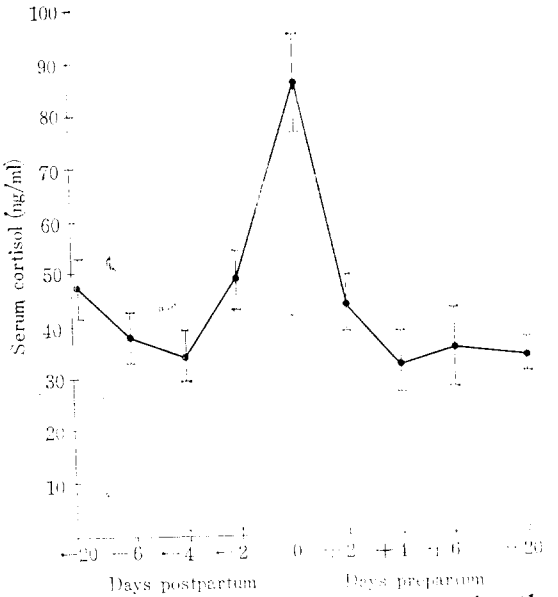

Fig. 3. Serum portisol levels in sows during the puerperal period. Vertical bars represent standard error of the mean.

Ⅳ. Discussion

The pattern of changes in progesterone levels observed in this study is in general agreement with the patterns noted in the sow by Short (1960), Molokwu and Wagner(1973), Ash et al. (1973), Robertson and King(1974) and First and Bosc(1979). Many studies have indicated that the corpus lutea(CL) remain the main physiological source of progesterone all through pregnancy, and that the ovary is indis pensable during gestation in the sow (Kimura and Cornwell, 1938; Short, 1956; Rombauts et al., 1965; Masuda et al., 1967; Molokwu and Wagner, 1973; First and Bosc, 1979). The abrupt postpartum decline of progesterone observed in this study coincides with the rapid degeneration of the CL of pregnancy. Palmer et al. (1965) reported that by day 1 after farrowing the luteal cells were already showing degenerative changes and that immediately after farrowing the luteal cells were much smaller than just prior to parturition. Thus it appears that the changes observed in serum progesterone in the present study would be consistent with the view that the CL are major source of progesterone in the pregnant.

No previous study has been done on serum levels of estradiol-17β in the puerperal sow, but the pattern of changes observed in this study is similar to that found in the plasma of puerperal sows (Molokwu and Wagner, 1973). The changes in serum estradiol-17β also correlate with those found by Robertson and King(1974) in the plasma of sows.

Previous studies have demonstrated that estrogens are produced by the placenta in the sow (Bowerman et al., 1964; Rombauts, 1964). Fèvre et al.(1968) further showed that urinary estrogen content in the pregnant sow not affected by ovariectomy or hypophysectomy. Fèvre et al. (1972), using adrenalectomised sows, demonstrated that estrogen synthesis in the pregnant sow was in dependent of the maternal adrenal. Fèvre (1970) reported convincing evidence of fetal involvement in this estrogen production by showing that administration of labeled C-19 steroids into the fetal compartment gave a greater conversion to estrone than when infused into the uterine artery of the dam. Since feto-placental unit appe ars to be responsible for estrogen production this accounts for the abrupt decline when this source is removed at parturition.

A rise in serum cortisol levels was observed at parturition in the sow and was similar to the report of Smith et al. (1972) in the cow. Adams and Wagner (1970) and Molokwu and Wagner (1973) also observed a rise in corticoids but their results 2 to 4 days prepartum. In the present study the cortisol rise began to 2 days prepartum which was similar to the report of Molokwu and Wagner (1973).

Thus, before parturition occurs, the serum estradiol-17β and cortisol levels rise well above the gestationlevels, and the progesterone levels show a substantial decline. Nellor (1963), Minar and Schilling(1970) and Coggins et al.(1977) were

able to delay parturition in the sow by oral administration of progestagens or by parenteral administration of progesterone. This evidence would provide support for the "progesterone block" theory of initiation of parturition (Csapo, 1956) for the sow. But a high proportion of stillbirth occurred when parturition was prevented by continuec administration of progestogens (First and Staigmiller 1973; Coggins et al., 1977; Nellor et al, 1975; Curtis et al., 1969), by induced corpora lutea (Coggins et al., 1977; Martin et al., 1977, Boscet al. 1974) or by inhibition of luteolysis(Nara and First, 1977). First and Bosc(1979) indicates that the sequence of events leading to parturition start with pituitary stimulation of cortisol production by the adrenal glands followed by cortisol causing stimulation of the production or release of prostaglandin $F_2\alpha$, probably by the uterus.

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