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Hormonal Changes of Serum Progesterone and Estradiol-17β on Flushing Feed before Estrus during Estrous Cycle in Sows of Landrace, Yorkshire and F_1 (Landrace × Yorkshire)

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ABSTRACT

This study was conducted to investigate the changes of hormone levels of serum progesterone (P4) and estradiol-17 β (E2) in sows of Landrace (L), Yorkshire (Y) and F_1 (L × Y) (respectively n=3) with excellent ability, and to provide a baseline data for improving reproductive performance. In this experiment, the sows at the age of 12 months or more were used. The sows were fed by two way methods, one is conventional methods and the other is 3 days-flushing feed before estrus. Each pig's blood was collected in 3, 6, 9, 12, 15 and 18 days after the estrus for the analyses of P4 and E2. Serum was separated by centrifugation for 15 min. with 3,000 rpm. Progesterone and estradiol-17β were measured by immunochemical assay (ELIZA test). In conventional feeding, serum progesterone levels were significantly (p<0.01) higher in F_1 than in L and Y. No significant differences in P4 concentrations were seen between the L and Y of sows. Serum E2 levels were similar the serum progesterone levels. In the case of flushing feed, the tendency of hormonal changes were similar to conventional methods. But almost of hormonal levels were a little higher than that of conventional methods. P4 level of L and Y in flushing feed were significantly different (p<0.01). Serum E2 level of Y in flushing feed was significantly different among the breeds (p<0.01). These results were similar to the tendency of hormonal changes in general sows and moreover, flushing feed is known to develop the swine production, these results proved the fact of the methods. And these results suggested that more studies about hormonal changes in sows according to seasonal and nutritional factors should be needed.

(Key words : sow, Landrace, Yorkshire, progesterone, estradiol-17β)

INTRODUCTION

Progesterone and estradiol-17β were well known to play an important role for the reproduction in swine (Shearer *et al*., 1972). Many researchers had been made an attempt to improve the productivity of litters in sow managements. One of the improving management technique is the flushing feed affected increasing the number of ovulation in sows (Anderson and Melampy, 1971). Improving the ovulation might be expected to increase farrowing and affected MSY in farms, even if number of litters were depend on reproductivity of sows. It was reported by Davis *et al*. (1987) that flushing increased more litter of pubertal gilts than the postpubertal gilts. This result could not prove flushing effect on litter size of gilts(Kim *et al*., 2003). However effect of flushing had been affected by various causes between the control diet and flushing diet, according to diet duration and differentiation of supported energy etc. Increasing diet (energy) may be affected to produce metabolic hormones and then influence follicular development. Sows are more sensitive to have diet during the estrus cycle and exposed to stress (Brouns and Edwards, 1996) since it has been shown that embryos mortality occurs before 10 days of pregnancy (Lambert *et al*., 1991) and direct after ovulation (Mburu *et al*., 1998). This means that effect of fasting on the plasma P4 level occurs later than 36h after the onset of food deprivation (Rozeboom *et al*., 1993; Razdan *et al*., 2001).

The purpose of this study was to investigate the hormonal profiles of progesterone and estradiol-17β due to a short term flushing of dietary energy during the estrous cycle of sows in Landrace, Yorkshire and F_1 (Landrace × Yorkshire).

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MATERIALS AND METHODS

1. Experimental Animals and Flushing Feed

9 sows of Landrace, Yorkshire and F1(L × Y) (respectively n=3) about 12 months of age were used in experiment and breeding by 2 kg of freeding formulated according to the KNRC and free water in National Institute of Animal Science. Increasing intake of energy diet was supported from 3 day before heat to just on heat day.

2. Collection of Blood Samples

Serial blood was sampled from all sows by puncture of the jugular vein into evacuated blood tubes. Blood samples were collected Day 3, 6, 9, 12, 15 and 18 after the heat to assess progesterone and estradiol-17β. Blood obtained from the Landrace, Yorkshire and F1 sows should be handles extremely carefully, and than transferred to the laboratory to separate the serums.

3. Serum Collection

After sufficient clotting, the blood samples were centrifuged at 3,000rpm for 15 minutes at room temperature. Aliquots of supernatant were portioned by 1 ml into labeled EP tubes. The portioned serums transferred at to −80℃ freezer until immunochemical assay(ELISA assay).

4. Hormonal Assays

1) Serum Progesterone and Estradiol-17β

Serum progesterone and estradiol-17β levels were determined by Pig ELISA kit by CUSABIO® (CSB-E12869p).

2) Statistical Analysis

All data were analyzed by ANOVA test. Repeated measurements, including serum concentrations of progesterone and estradiol-17β were analyzed by ANOVA (SAS program).

RESULTS

Mean hormonal levels of P4 and E2 on 3 breed of 3 sows were represented in Fig. 1 and 2 on control group and Fig. 3 and 4 on flushing feed group. P4 and E2 were showed significant differences among the breeds in both treatments (p<0.01). Especially both hormone levels of F_1 were showed much higher, about 5∼6 times, than hormone levels of other breeds. Only P4 levels of Yorkshire in control group was showed significant difference among collection days after heat (p<0.05) but other breed were not different, and also E2 of 3 breeds were not different. In flushing feed group, P4 levels of Landrace and Yorkshire were showed significant different among the collecting days after heat (p<0.01), but only E2 levels of Yorkshire was significant different (p<0.01) and the other breeds was not. Almost of P4 levels were showed highest at 12 day after heat in all breeds but E2 levels were not showed level change during estrus cycle in all breeds. It is also same tendency on flushing feed groups in all breeds.

DISCUSSION

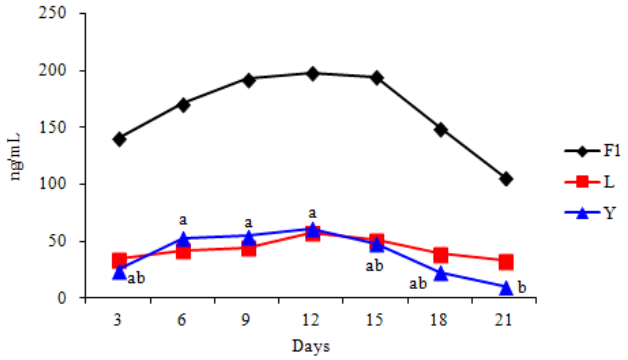

Fig. 1. Serum progesterone concentrations of sows in Landrace, Yorkshire and F_1 (L × Y) during estrous cycle with conventional feeding. [ab] Values in Yorkshire without acommon super script differ (p<0.05). Significant differences among breed are as in the following: F_1 vs Landrace, p<.000; F_1 vs Yorkshire, p<.000; Landrace vs Yorkshire, p=0.584.

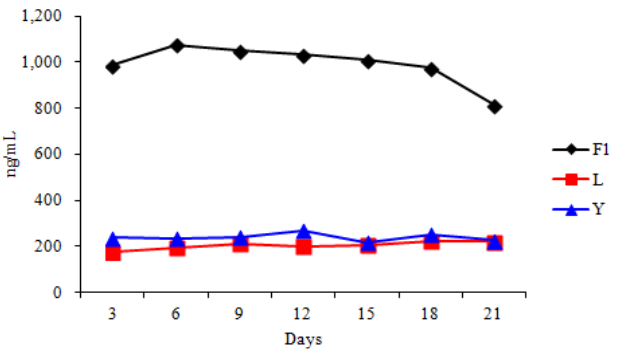

Fig. 2. Serum estradiol-17 β concentrations of sows in Landrace, Yorkshire and F_1 (L × Y) during estrous cycle with conventional feeding. Significant differences among breed are as in the following: F_1 vs Landrace, p<.000; F_1 vs Yorkshire, p<.000; Landrace vs Yorkshire, p<0.01.

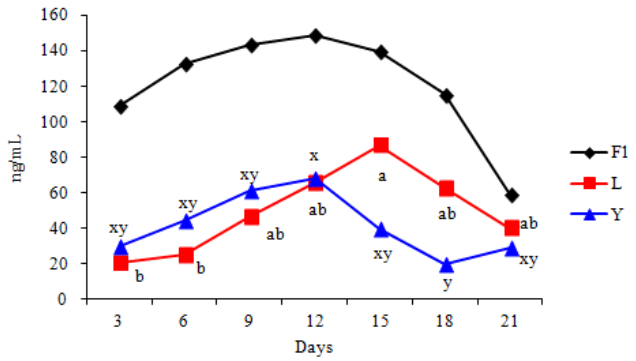

Fig. 3. Serum progesterone concentrations of sows in Landrace, Yorkshire and F_1 (L×Y) during estrous cycle with flushing feed. ^{ab} Values in Landrace without acommon super script differ (p<0.05). ^{xy} Values in Yorkshire without acommon super script differ (p<0.05). Significant differences among breed are as in the following: F_1 vs Landrace, p<.000; F_1 vs Yorkshire, p<.000; Landrace vs Yorkshire, p=0.314.

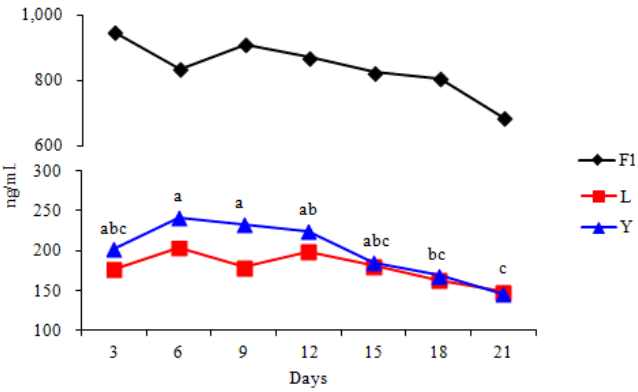

Fig. 4. Serum estradiol-17β concentrations of sows in Landrace, Yorkshire and F_1 (L × Y) during estrous cycle with flushing feed. $^{a\sim c}$ Values in Yorkshire without acommon super script differ (p<0.05). Significant differences among breed are as in the following: F_1 vs Landrace, p<.000; F_1 vs Yorkshire, p<.000; Landrace vs Yorkshire, p=0.084.

This study agreed the effects of flushing feed affect the hormonal changes in sows like with numerous reports that represented positive influence of increasing energy intake on ovulation, even though hormone levels increase a little during estrous cycles (Anderson and Melampy, 1971; Cole, 1982; Aherne and Kirkwood, 1985; Mwanza *et al*., 2000). But flushing feed was determined by Anderson and Melampy (1971) that optimal periods is 11 to 14 day during estrus cycle and the feeding level 60 to 8.0 additional Mcal ME/D. In this experiment we supported the additional diet 2 kg for flushing feed than about 2 kg in conventional diet on 3 day before heat. Generally the purpose of flushing feed is for the ovulation. We think that flushing feed before heat is optimal for improving ovulation because of the additional intake (energy) produce gonadotropins such as GnRH, FSH, LH etc through the metabolic pathway for steroids and then gonadotropins stimulate the follicle and succeed ovulation (Madej *et al*., 2009). This pathway might be taken 3~4 days to stimulation. Gonadotropin secretion is controlled by hypothalamus-hypopyseal axis (Knobil, 1980). LH secretion cascade was firstly regulated by secretion of GnRH from hypothalamus (Brinkly, 1981). Amstrong and Britt (1987) reported restriction of feed intake caused anestrus and decrease in LH secretion. According to this report, hypothalamus is stimulated pituitary gland by dietary energy level. We did not perform measurement of GnRH level, this report may be proven to secrete LH by flushing feed.

Henricks (1971) reported that progesterone levels began to increase rapidly within 2 days after estrus. We also found pattern like above report and all of P4 levels showed peak on 12 days after estrus. It is agreed with the assertion of Lambert *et al*. (1991), P4 peak on 12 days after estrus affects GnRH secretion and then it could not stimulate LH surges. It may prove that optimal flushing feed period is before estrus. In this measurement of P4, it showed in that manner of general sows but we could not find the patten of E2. Moreover, in case of F_1, the levels of P4 and E2 was showed tremendous differences than that of others.

Further investigation were required to obtain the phenomena of P4 and E2 levels during estrus cycle in F_1 (L × Y). And the other F_1 combined another strains also need to search the physiological relation about hormonal profiles.

It can be concluded that flushing feed before estrus increase the GnRH secretion related LH surge and succeed to ovulation but had various condition affected the reproductive physiological environments. In this manner, flushing should improve productivity of commercial pork production although the exact mechanism of this phenomenon has to be needed further.

REFERENCES

Amstrong JD and Britt JH. 1987. Nutritionally-induced anestrus in gilts : Metabolic and endocrine changes associated with cessation and resumption estrous cycles. J. Anim. Sci. 65: 508.

Anderson LL and Melampy RM. 1971. Factor affecting ovulation rate in the pig. In: D.J.A. Cole(Ed.), Pig Production. Butterwoths, London, pp.14-31.

Aherne FX and Kirkwood RN. 1985. Nutrition and sow prolificacy. J. Reprod. Fertil. Suppl. 33: 169.

Brinkley HJ. 1981. Endocrine signaling and female production. Biol. Reprod. 24: 22.

Cole DJA. 1982. Nutrition and reproduction. In: D.J.A. Cole and G.R. Foxcroft (Ed.), Control of Pig Reproduction. Butterwoths, London, pp.603-619.

Brouns F and Edwards SA. 1994. Social rank and feeding behaviour of group-housed sows fed competitively or *ad libitum*. Appl. Anim. Behav. Sci. 39: 225-235.

Henricks DM, Guthrie HD and Handlin DL. 1972. Plasma estrogen, progesterone and luteinizing hormone levels during the estrous cycle in pigs. Biology of Reproduction 6: 210-218.

Kim HK, Kim JS and Kim HZ. 2003. Effects of breeds on body weight, age, body conformation, backfat thickness and steroid hormone concentrations at first estrus and mating of gilts. Korean J. Vet. Serv. 26(2): 151-156.

Knobil E. 1980. Neuroendocrine control of the menstructual cycle of the Rhesus monkey. Recent Prog. Horm. Res. 36: 53.

Lambert E, Williams DH, Lynch PB, Hanarahan TJ, McGeady TA, Austi FH, Boland MP and Roche JF. 1991. The extent and timing of prenatal loss in gilts. Theriogenology 36: 655-665.

Madej A, Brandt Y and Einarsson S. 2009. Endocrine dynamics associated with follicle development in pigs: a review. Anim. Reprod., v.6,n.1, pp.135-143.

Mburu JN, Einarsson S, Dalin A-M and Rodriguez-Martinez H. 1995. Ovulation as determined by transrectal ultrasonography in multiparous sows: relationship with oestrous symptoms and hormonal profiles. J. Vet. Med. A 42: 285-292.

Mwanza AM, Englund P, Kindahl H, Lundeheim N and Einarsson S. 2000. Effects of post-ovulatory food deprivation on the hormonal profiles, activity of the oviduct and ova transport in sows. Anim. Reprod. Sci. 59: 185-199.

Razdan P, Mwanza AM, Kindahl H, Hulten F and Einarsson S. 2001. Impact of postovulatory food deprivation on the ova transport, hormonal profiles and metabolic change in sows. Acta. Vet. Scand. 42: 45-55.

Rozeboom DW, Pettigrew JE, Dial GD, Moser RL, Cornelius SG and Wheaton JE. 1993. Estrous cycle characteristics of postpubertal gilts approaching anestrus due to limited dietary energy intake. J. Anim. Sci. 71: 436-441.

Shearer IJ, Purvis K, Jenkin G and Haynes NB. 1972. Peripheral plasma progesterone and oestradiol-17β levels before and after puberty in gilts. J. Reprod. Fert. 30: 347-360.

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