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Feeding affects reproductive performance and reproductive endocrinology in the gilt and sow

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Introduction

The pig is considered to be a highly prolific species with a high ovulation rate and if mated at the right moment, the sow also holds a very high probability of pregnancy. It is generally accepted that little variation in live weight of the sow throughout the production cycle is associated with high fertility and improved longevity. This goal requires high energy intake during lactation, which may be achieved by ad libitum feeding with high energy high protein lactation diet without feed restriction, especially during the last part of lactation. In endocrinological terms, gonadotrophin secretion is affected by suckling and metabolic messengers, which transfer information regarding lactation and metabolic state of the dam. These messages are received by the hypothalamo-pituitary axis and eventually follicular development is either inhibited or encouraged, depending on the messages. Management practices such as intermittent suckling are developed to alleviate the sow to meet with the metabolic challenges imposed by lactation and expected fertility. After mating, social stress and restricted feeding may create a situation where embryonic survival and pregnancy is jeopardized. The risk of losing embryos/pregnancy may be highest when individual sows experience considerable food deprivation for longer than two days around implantation. Feeding a sow group more may provide the farmer with simple solution to problems with early pregnancy. Approaching term, compromising between high birth weigh of newborn piglets associated with abundant feeding and a feed restriction together with increase in fiber to improve intestinal function may be the strategy of choice.

Feeding during lactation and related new management strategies

Before mating, feeding has a major impact on ovulation rate and litter size in the pig. During lactation, feed restriction at any time results in prolonged weaning to oestrus interval and therefore reduced pregnancy rates and litter size [1]. Feed restriction is likely to inhibit luteinizing hormone (LH) secretion during that period, which even in short term affects ovarian function [1]. LH and FSH pulsatility is suppressed and follicular development is inhibited. Lactational anestrus is brought about through gonadotrophin secretion, too. Suckling stimulus inhibits gonadotrophin production and management techniques have been developed to break down the inhibition of gonadotrophin secretion induced by suckling. In intermittent suckling, suckling is interrupted for instance in a 6-hour suckling 6-hour isolation manner. Applying this technique, sows may be in oestrus and submitted to insemination already during lactation. Using intermittent suckling, the negative energy balance of the dam can be alleviated due to reduced milk consumption and sows may therefore be metabolically ready for another pregnancy. In another management technique along the same line, only the better half of the litter is weaned, while the smallest piglets are left suckling. This quite widely used technique is called split weaning.

Management techniques after weaning may also be used in order to allow sows to recover from the metabolic burden caused by lactation. In the skip-a-heat technique, the first oestrus after weaning is skipped and sows are given a metabolic holiday for the duration of one oestrous cycle. This management strategy has been frequently used with low parity sows, which are still growing up while lactating while trying to stay fertile. Skip-a-heat strategy may therefore be a good approach to encourage sows to gain condition prior to pregnancy. Economic modeling does not necessarily support skip-a-heat strategy, however accounting for the whole production life of the animal may change the outcome of the modeling exercise.

There is a general agreement on the effect of feeding on reproductive performance in the sow during lactation. It has been shown in a fairly great number of studies that the more the sows eat during lactation, the less condition they loose and lactational inhibition induced by suckling may be reversed sooner after weaning [2].

Feeding the sow during the embryonic period

After mating, feed restriction has been shown to support progesterone rise and embryonic survival in the gilt. Gilts fed ad libitum had slower rise in progesterone after mating and this slow rise could be compensated for by providing them with additional progesterone by means of gestagens provided per os. A corresponding negative effect on embryonic survival was also reversed by gestagen administration.

However, it should be emphasized that the positive effect of feed restriction after mating may only apply to the first four days after mating and, on the other hand, this effect has been shown to be true only for gilts. Beyond day 4 of pregnancy in gilts and from day 1 in sows, no such benefit of feed restriction has been demonstrated. In contrast, studies by our group [3] and others [4] have shown a benefit of abundant feeding during early pregnancy in terms of embryonic survival as well as maintenance of pregnancy.

The pig does not appear to have an active placenta to support CL function but gonadotrophins from the pituitary seem to have that a supportive role during early pregnancy [5]. Later on, prolactin may take over as the main luteotrophin [6]. Regarding feeding, it appears therefore that anything having a substantial effect on these gonadotrophins may also affect embryonic survival and pregnancy outcome. If feeding is restricted and availability of the feed is under constant competition amongst pen mates, low ranked and young sows may experience periods of undernutrition. If these periods last long enough, embryonic survival may be reduced due to inadequate gonadotrophin support to CL and, in extreme cases, maintenance of pregnancy may be jeopardized.

Regarding length of such a period of inadequate pituitary support to CL, it seems probable that the period should last longer than 48 hours. In studies where feed was deprived or stress was induced for 48 hours, no harmful effect on implantation of embryos was observed in experimental sows [7]. Similarly, a short term immunological manipulation of LH secretion did not have a marked effect on embryonic survival and pregnancy outcome [8]. However, a long term immunological suppression of LH secretion [9] and long term suppression of LH pulsatility [5] at around the time of implantation resulted in termination of pregnancy in all cases studied.

Feeding the sow during late pregnancy

Approaching term in the pig, different feeding strategies have been adopted by the industry. There is a clear pressure to feed the sow with high levels of energy since fetuses grow fastest during the very last weeks before term. Birth weights of newborn piglets can therefore be increased most efficiently by abundant feeding of the dam during the last two to three weeks of pregnancy and, on the other hand, birth weight is seen as one of the most important determinant of survival and growth. The heavier at birth, the better the chances of survival and fast growth are.

However, work carried out by Persson *et al*. [10] demonstrated a link between high feeding level during the last two weeks of pregnancy and post partum dysgalactia syndrome (PDDS). It was shown that a considerable restriction of feeding prior to parturition reduced the risk of PDDS by almost 50%. Our latest results support not only feed restriction before term but also keeping the feed stuff of the sow low in energy and high in fiber through parturition and into the first few days of lactation. By postponing the changeover to concentrated lactation diet beyond parturition, the intestinal function of the sow is clearly improved and water intake is encouraged on the crucial times of initiation of lactation (Oliviero *et al*, unpublished results).

Conclusion

Sows are fed ad libitum during lactation and flush fed after weaning before oestrus, which strategy is warranted by clear evidence showing how feed restriction causes detrimental effects on subsequent follicular growth. After mating, a fairly abundant feeding strategy appears justified, however gilts seem to benefit from a feed restriction applied for the first days of pregnancy. Approaching parturition, fetal growth is supported by a liberal feeding strategy but it may also introduce a risk of contracting PPDS after parturition. A diet high in fiber prior to and

during parturition appears to improve intestinal function and alleviate initiation of lactation.

References

1. Foxcroft GR, Aherne FX, Clowes EC, Miller H, Zak LJ: **Sow fertility: The role of suckling inhibition and metabolic status.** In *Animal Science Research and Development; Moving Toward a New Century* Edited by: *Ivan M. Centre for Food and Animal Research, Ottawa, Canada*; 1995:377-393.
2. Einarsson S, Rojkittikhun T: **Effects of nutrition on pregnant and lactating sows.** *J Reprod Fertil Suppl* 1993, **48:**229-239.
3. Virolainen JV, Tast A, Sorsa A, Love RJ, Peltoniemi OAT: **Changes in feeding level during early pregnancy affect fertility in gilts.** *Anim Reprod Sci* 2004, **80:**341-352.
4. Love RJ, Klupiec C, Thornton EJ, Evans G: **An interaction between feeding rate and season affects fertility of sows.** *Anim Reprod Sci* 1995, **39:**275-284.
5. Peltoniemi OAT, Easton BG, Love RJ, Klupiec C, Evans G: **Effect of chronic treatment with a GnRH agonist (Goserelin) on LH secretion and early pregnancy in gilts.** *Anim Reprod Sci* 1995, **40:**121-133.
6. Szafranska B, Tilton JE: **Prolactin as a luteotrophin during late pregnancy in pigs.** *J Reprod Fertil* 1993, **98:**643-648.
7. Radzan P: **Stress and early pregnancy in sows.** In *PhD thesis Swedish University of Agricultural Sciences, Uppsala, Sweden*; 2003.
8. Virolainen JV, Love RJ, Tast A, Peltoniemi OAT: **Effect of a gonadotrophin-releasing hormone antagonist on luteinising hormone secretion and early pregnancy in gilts.** *Reprod Fertil Devel* 2004, **15:**451-459.
9. Tast A, Love RJ, Clarke IJ, Evans G: **Effects of active and passive gonadotrophin-releasing hormone immunization and establishment of pregnancy in pigs.** *Reprod Fertil Devel* 2000, **12:**1-6.
10. Persson A, Pedersen AE, Goransson L, Kuhl W: **A long term study of the health status and performance of sows on different feed allowances during late pregnancy. I. Clinical observations, with special reference to agalactia post partum.** *Acta Vet Scand* 1989, **30:**9-17.