

Post-weaning Altrenogest treatment in primiparous sows; the effect of duration and dosage on follicular development and consequences for early pregnancy

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Many first litter sows suffer from a suboptimal reproductive performance in the second cycle, shown by an increased weaning-to-oestrus interval, a low farrowing rate and a small litter size (e.g. Thaker & Bilkei 2005). This so-called 'second litter syndrome' may be related to the suppressive effects of a negative energy balance on lactational follicle development, since several authors have shown that pre-follicular phase feeding levels (either during lactation or during the luteal phase of the oestrus cycle) affect the antral follicle pool and subsequent follicle development (Quesnel *et al.* 2000), oocyte development (Zak *et al.* 1997), ovulation rate (Hazeleger *et al.* 2005), embryo development (Algriany *et al.* 2004) and embryo mortality levels (Almeida *et al.* 2000). Postponing oestrus by administration of a progesterone analogue (altrenogest) from weaning onwards positively affects subsequent reproductive performance (e.g. Martinat-Botte *et al.* 1994, Patterson *et al.* 2008). Success of altrenogest treatment is probably related to the improvement of follicle development during treatment. Therefore, the objective of this study was to investigate follicle development at weaning and during and after different altrenogest treatments, and relate this to subsequent ovulation rate and early embryonic development.

For this study, 48 primiparous sows were weaned from their (9.4 ± 1.1) piglets at Day 21 ± 3 of lactation (= Day 0) and were randomly assigned to the following treatments: control (no altrenogest, $n = 11$), RU8-15 (15 mg of altrenogest, $n = 11$, Day -1 till Day 7), RU8-20 (20 mg of altrenogest, $n = 12$, Day -1 till Day 7) or RU15-15 (15 mg of altrenogest, $n = 12$, Day -1 till Day 14). From weaning onwards, trans-abdominal ultrasound was performed daily and the five largest follicles on one ovary were measured until ovulation occurred. Oestrus detection was performed twice daily and sows were inseminated 12 hours after first detected oestrus on 12 hours intervals during standing oestrus. Sows were slaughtered 5 days after ovulation to determine ovulation rate and to recover embryos. At slaughter a blood sample was collected from each sow to determine progesterone concentrations. Embryo morphology and quality was assessed after which embryos were treated to spread and count cell nuclei and number of accessory sperm cells, and to determine the number of cell cycles ($^2\log$ of the nuclei count) and homogeneity of the litter (expressed as the range in number of cell cycles for embryos with more than 90% of the litter average in cell cycles).

Follicle size at weaning was 2.6 ± 1.1 mm. Follicle size increased during treatment to reach a plateau of 4.6 ± 1.6 mm around Day 6, irrespective of treatment. This increase resulted in larger follicles at the onset of the follicular phase for treated animals (4.8 ± 1.8 , 4.8 ± 1.4 and 4.9 ± 0.9 mm for RU8-15, RU8-20 and RU15-15) compared with controls (2.9 ± 0.8 ; $P = 0.0002$). Follicles of treated animals remained significantly larger until the fourth day of the follicular phase. Pre-ovulatory follicle size tended to be larger for treated animals (7.9 ± 2.4 mm, 7.9 ± 0.7 mm and 8.6 ± 1.3 mm for RU8-15, RU8-20 and RU15-15, respectively) than for controls (6.9 ± 0.9 mm; $P = 0.07$).

The interval to onset of oestrus (from weaning for controls and from 24h after last treatment for treated animals) was shorter for treated animals (4.6 ± 1.4 , 4.7 ± 0.9 and 5.2 ± 1.6 days for RU8-15, RU8-20 and RU15-15) compared with controls (6.5 ± 1.4 days; $P = 0.0001$). Duration of oestrus was not affected by treatment, neither was ovulation rate (18.9 ± 4.0 vs. 21.2 ± 5.4 vs. 18.8 ± 4.0 vs. 19.5 ± 3.1 for RU8-15, RU8-20, RU15-15 and controls, respectively ($P > 0.1$)), luteal weight, or progesterone levels at slaughter. Average fertilization rate of the recovered embryos and oocytes was 90.6%, which was not affected by treatment. The majority of the recovered embryos consisted of compact morulas (26%) and blastocysts (53%). No treatment effect was found on embryo quality (visual appraisal), number of accessory sperm cells, number of cell cycles or homogeneity of the litter. Further, none of these parameters were related with follicle size at weaning, follicle size at the start of the follicular phase or pre-ovulatory follicle size. For treated animals, the increase in follicle size during treatment was significantly related with ovulation rate ($P = 0.05$); every mm increase in size during treatments resulted in an increase in ovulation rate of 1.1.

The fact that altrenogest treatment after weaning did not affect ovulation rate and embryonic development may be related with the low lactational burden of these sows (on average 9.4 piglets and a relative weight loss of 4%). However, even under these circumstances treated animals had larger follicles than controls at the onset and first four days of the follicular phase, tended to have larger pre-ovulatory follicles, and the follicle growth during treatments was positively related with subsequent ovulation rate. Further studies need to evaluate subsequent reproductive performance of different altrenogest treatments.

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