Animal Reproduction Science 119 (2010) 258–264

Contents lists available at ScienceDirect

Animal Reproduction Science

journal homepage: www.elsevier.com/locate/anireprosci

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

J.J.J. van Leeuwen[a,*], S.I. Williams[b], B. Kemp[a], N.M. Soede[a]

[a] Adaptation Physiology Group, Department of Animal Sciences, Wageningen University, PO Box 338, 6700AH Wageningen, The Netherlands
[b] Facultad de Ciencias Veterinarias, Universidad Nacional de La Plata, PO Box 296, La Plata, Buenos Aires, Argentina

ARTICLE INFO

Article history:
Received 28 August 2009
Received in revised form 5 February 2010
Accepted 11 February 2010
Available online 18 February 2010

Keywords:
Follicle development
Sows
Altrenogest
Ovulation rate
Embryonic development

ABSTRACT

Our objective was to investigate follicle development in sows during and after different Altrenogest treatments post-weaning and relate this to subsequent ovulation rate and embryonic development. Primiparous UPB sows ($n = 47$) were randomly assigned to (weaning = Day 0): control (no Altrenogest, $n = 12$), RU8-15 (15 mg of Altrenogest, Day-1 till Day 7, $n = 12$), RU8-20 (20 mg of Altrenogest, Day-1 till Day 7, $n = 12$) or RU15-15 (15 mg of Altrenogest, Day-1 till Day 14, $n = 11$). From weaning onwards, trans-abdominal ultrasound was performed daily. Sows were slaughtered on Day 4 or 5 after ovulation.

Follicle size increased during Altrenogest treatment and reached a plateau around Day 6, regardless of dose (4.6 ± 1.5, 4.6 ± 1.6 and 4.6 ± 1.6 mm for RU8-15, RU8-20 and RU15-15, respectively). This increase resulted in larger follicles ($P = 0.0002$) at the onset of the follicular phase (i.e. time of weaning for control sows and 24 h after last administration of Altrenogest for treated sows); 4.8 ± 1.8, 4.8 ± 1.4, 4.9 ± 0.9 mm and 2.9 ± 0.8, for RU8-15, RU8-20, RU15-15 and controls, respectively. Pre-ovulatory follicle size tended ($P = 0.07$) to be larger for treated animals (7.9 ± 2.4, 7.9 ± 0.7, 8.6 ± 1.3 and 6.9 ± 0.9 mm for RU8-15, RU8-20, RU15-15 and controls, respectively). The interval follicular phase-oestrus was shorter ($P = 0.005$) for treated animals. Treatment did not affect ovulation rate or early embryonic development. However, for treated animals, the increase in follicle size during treatment was positively related with ovulation rate ($P = 0.05$). In conclusion, post-weaning treatment with Altrenogest of first litter sows influenced follicle size and shortened the follicular phase, but did not affect ovulation rate or early embryonic development.

1. Introduction

Many first litter sows suffer from a suboptimal reproductive performance in the second breeding cycle including an increased weaning-to-oestrus interval, a low farrowing rate and a smaller litter size (Morrow et al., 1989). These negative effects on reproduction are associated with the negative energy balance during first lactation (e.g. Thaker and Bilkei, 2005). Several authors have shown that feeding levels either during lactation or during the luteal phase of the oestrous cycle affect the antral follicle pool and subsequent follicle development (Quesnel et al., 2000), ovulation rate (Hazeleger et al., 2005) and also oocyte development (Zak et al., 1997b), contributing to embryo development (Algriany et al., 2004), leading to increased embryo mortality (Almeida et al., 2000).

Postponing mating of first litter sows to the second oestrus after weaning ('skip-a-heat') consistently improves

* Corresponding author at: Adaptation Physiology Group, Department of Animal Sciences, Wageningen University, Marijkeweg 40/building 531, PO Box 338, 6700AH, Wageningen, The Netherlands. Tel.: +31 317 483120; fax: +31 317 485006.
E-mail address: Jessika.vanLeeuwen@wur.nl (J.J.J. van Leeuwen).

0378-4320/$ – see front matter © 2010 Elsevier B.V. All rights reserved.
doi:10.1016/j.anireprosci.2010.02.008

subsequent reproductive performance (Morgan Morrow et al., 1990; Clowes et al., 1994). Also postponing oestrus for a shorter period, by administration of a progesterone analogue (Altrenogest) from weaning onwards, positively affects subsequent reproductive performance (Morgan Morrow et al., 1990; Koutsotheodoros et al., 1998; Martinat-Botté et al., 1994; Martinat-Botté, 1995; Patterson et al., 2008). It is unclear what the cause is of this improved performance after Altrenogest treatment, but it may be related to improved follicle development during this period. Until now follicle development during Altrenogest treatments in post-weaning sows has not been studied. It is our hypothesis that during Altrenogest treatment, follicle development (measured as an increase in size of the largest follicles) improves and as a consequence, ovulation rate and early embryonic development also improve. If true these effects may be dependent on the dose and duration of Altrenogest treatment. Testing this hypothesis will provide insight into post-weaning follicle dynamics and its consequences for reproductive processes in sows and is needed to develop optimal Altrenogest treatment schemes to improve second litter fertility.

Therefore the current experiment used first litter sows to study follicle growth during and after Altrenogest treatments differing in dosage and duration and relate this to subsequent ovulation rate and early embryonic development.

2. Materials and methods

2.1. Animals, housing and diets

A study was conducted during spring and summer from October 2007 to March 2008 in a commercial swine herd in Intendente Alvear, Argentina (35°14′0″S, 63°35′0″W) in accordance with the Argentine law for the protection of animal welfare (Ley penal 14346). Pregnant gilts ($n = 47$, UPB Genetic World) entered the maternity facilities on average 5–9 days before farrowing and were individually housed in farrowing crates. Post-partum cross-fostering was performed within 3 days after farrowing to adjust litter size to 9–11 piglets. During lactation sows received a corn and soybean based diet, formulated to contain 14.07 MJ digestible energy/kg with 17% crude protein and 1% lysine, to a maximum of 8 kg per day. At weaning, at Day 21 (18–24) of lactation, piglets were individually weighed and the sows moved to individual crates in another barn where they were fed twice a day (8 a.m. and 4 p.m.), to a maximum of 4 kg of the lactation ration.

Barns were equipped with individual drinking nipples providing ad libitum access to water for all sows.

Daily minimum and maximum environmental temperatures were registered throughout the experiment. Average temperature varied between max. 23.2 ± 5 °C and min. 11.7 ± 2 °C (October) and max. 31.2 ± 4 and 17.3 ± 4 °C (December) (range of maximum temperature; 14.2–38.1 °C). Whenever environmental temperature exceeded 25 °C spray coolers were activated in the gestation barn.

Sows were weighed and P2 back fat was measured using A-mode ultrasound (lean-meater®, Renco Corporation, Minneapolis, USA) (6.5 cm off the midline at the level of the last rib) at entering of the farrowing facilities. Sow weight before farrowing was corrected for the weight of the litter at birth, estimated placenta and amnion weight (216 g/piglet) and estimated fetal growth during the days between weighing of the sow and farrowing 60 g/fetus/day; based on Leenhouwers et al. (2002), van Rens and van der Lende (2002) and van Rens et al. (2005). Sow weight and P2 back fat were also assessed at weaning and at slaughter.

2.2. Treatments

The day before weaning (weaning = Day 0), sows were randomly assigned to one of four treatments: control (no Altrenogest treatment; $n = 12$), RU8-15 (15 mg Altrenogest, Day -1 till Day 7; $n = 12$), RU8-20 (20 mg Altrenogest, Day -1 till Day 7; $n = 12$) and RU15-15 (15 mgAltrenogest, Day -1 till Day 14; $n = 11$). These dosages were chosen because these represent the commercially used dosages for extension of the luteal phase in pigs (15 mg in North America and 20 mg in Europe and South America). Altrenogest (Regumate®, Intervet Productions S.A.), a progesterone analogue containing 4 mg of Altrenogest/ml was administered daily, as a top dressing, over a small portion of the morning feed to assure full ingestion of the entire dose, using a 5 mL syringe.

2.3. Oestrus detection and insemination

From weaning onwards, oestrus detection was performed at 8.30 a.m. and 4.30 p.m. by a trained farm technician using fenceline boar contact and a back pressure test. Sows were considered to be in oestrus when they exhibited a standing reflex in the presence of the boar. Onset and end of oestrus were recorded for each sow. Sows were inseminated on the first insemination session after first detected oestrus and inseminations were repeated twice daily to a maximum of 4 inseminations as long as the sows exhibited a good standing reflex. Inseminations consisted of an 80 ml dose of semen containing approximately 4.4×10^9 spermatozoa derived from the farm's Large White boars. Semen was diluted with a semen extender (BTS® extender, Mini Tüb, Germany) and stored for a maximum of 3 days after collection.

2.4. Follicle development

From weaning until day of ovulation, trans-abdominal ultrasonography (Piemedical Aquila, Maastricht, The Netherlands) was performed daily with a 5 MHz multiconvex transducer. One ovary was scanned each time since it was considered to be representative of the contra lateral one (N.M. Soede; unpublished results). Recorded images were subsequently reviewed using the cineloop application of the scanner. The diameters of the five largest follicles were measured and averaged. Ovulation was presumed to have occurred when previously present pre-ovulatory sized follicles (6–9 mm) had disappeared. This was confirmed by an additional scanning the next day. Since follicle