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Single fixed-time artificial insemination in gilts and weaned sows using pLH at estrus onset administered through vulvar submucosal route

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This study evaluated the use of a single fixed-time artificial insemination (FTAI) in gilts and weaned sows using 2.5 mg of porcine luteinizing hormone (pLH) administered through vulvar submucosal route, at the onset of estrus. In experiment 1 (Exp.1), 318 pubertal gilts were assigned to two groups: control-G—no hormonal application and artificial inseminations (AIs) at 12, 36, and 60 hours after the onset of estrus if they were still in standing estrus; and FTAI-G—use of pLH at the onset of estrus and a single FTAI 12 hours later. In experiment 2 (Exp. 2), 309 weaned sows were assigned to three groups: Control-S—no hormone application and AIs at 0, 24, and 48 hours after the onset of estrus if they were still in standing estrus; FTAI-NH—no hormone application and a single FTAI at 24 hours after the onset of estrus, and FTAI-pLH—use of pLH at the onset of estrus and a single FTAI 24 hours later. Transabdominal real time B-mode ultrasonography was performed to determine whether the insemination had been performed within 24 hours before ovulation, considered as the optimal interval. In Exp. 1, ultrasound evaluation (12-hour intervals) was carried out to determine the interval between the onset of estrus and ovulation. In both experiments, 2×10^9 sperm cells in 80 mL were used to perform cervical and postcervical deposition of semen in gilts and sows, respectively. Compared with control-G, FTAI-G gilts had shorter ($P < 0.05$) duration of estrus (57.7 vs. 61.2 hours) and interval between the onset of estrus and ovulation (36.3 vs. 42.3 hours). The adjusted farrowing rate (AFR) was lower ($P < 0.05$) in FTAI-G (86.0%) compared with control-G (93.5%), but total piglets born (TPB) did not differ between these groups (12.3 vs. 12.5 piglets). Within the FTAI-G group, the AFR was lower ($P < 0.05$) in the presence (50.0%) than in the absence (94.9%) of semen backflow during AI. Also in the FTAI-G group, the insemination outside the optimal interval reduced ($P < 0.05$) the TPB (10.5 vs. 12.9 piglets) in comparison with gilts inseminated within the optimal interval. In Exp. 2, there were no differences in the AFR (Control-S: 94.1%; FTAI-NH: 86.1%; FTAI-pLH: 88.0%) and TPB (Control-S: 12.8; FTAI-NH: 12.7, and FTAI-pLH: 12.0 piglets) among treatments. The presence of semen backflow reduced ($P < 0.05$) the TPB in FTAI-pLH and FTAI-NH sows. In the FTAI-pLH, a single insemination performed too late relative to ovulation reduced the AFR ($P < 0.05$) compared with sows inseminated within the optimal interval. In conclusion, 2.5-mg pLH applied at the vulvar submucosa at the onset of estrus advances the ovulation in gilts, but a single FTAI performed 12 hours later reduces the farrowing rate. A single FTAI performed at 24 hours after the onset of estrus in weaned sows does not affect their reproductive performance, regardless of pLH application.

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1. Introduction

Hormones are commonly used in a combined way to induce follicular growth and ovulation in protocols for fixed-time artificial insemination (FTAI) in weaned sows [1–3]. The eCG is the most common hormone used to synchronize follicular development after weaning [4]. However, peforelin has recently being indicated for this proposal in weaned sows [5]. The ovulation can be synchronized using exogenous gonadotropin acting at pituitary (triptorelin, buserelin, gonadorelin, and goserelin) or at the ovary (LH and hCG) [4]. Alternatives to simplify the protocols for synchronization of ovulation and reduce the use of hormones have been suggested. Thus, a single hormone for FTAI has been used for weaned sows considering that they have, at least to a certain extent, the follicle development and the estrus synchronized after weaning [6–10]. The use of triptorelin acetate applied at 96 hours after weaning and followed by a single insemination 22–24 hours later, has resulted in satisfactory reproductive performance under experimental [10] and field conditions [11], regardless of the estrus detection. In protocols considering the estrus detection, the reproductive performance of weaned sows has not been compromised by the use of a single FTAI 24 hours after pLH application, in comparison with multiple inseminations [9,12].

In gilts, a previous synchronization of the estrus cycle is usually necessary before inducing ovulation in FTAI protocols. A combination of progesterone analog (altrenogest), eCG, and an ovulation inductor has been used in FTAI protocols proposed for gilts [13–15]. Reproductive performance of gilts submitted to double FTAI in a protocol using the combination of altrenogest, eCG, and pLH, was similar to that of gilts receiving multiple inseminations [14]. Currently, it has been suggested that the synchronization of ovulation in gilts can be obtained by the use of altrenogest for at least 14 days, followed by the use of a single application of buserelin at 104–120 hours [6] or triptorelin 120 hours [16] after withdraw of altrenogest. Likewise, promising results of reproductive performance have been reported with a single FTAI in gilts after the use of only an ovulation inductor at onset of estrus [17]. However, for a practical use, the protocol proposed by Ulguim et al. [17] should be modified by reducing the interval between heat detections and establishing fixed-time AIs in a schedule more adaptable to the work routine of farms.

Protocols for FTAI considering the onset of estrus as the moment for a single pLH application have been proposed for weaned sows [12] and also for gilts [17]. The use of a single hormone without previous treatment with altrenogest and eCG in gilts would represent a promising opportunity to intensify the use of FTAI protocols in this category.

Generally, 5-mg pLH by the intramuscular route is the recommended dose to induce ovulation in swine females, although the use of 2.5 mg by the intramuscular route has been proposed in some studies [18,19]. Recently, Ulguim et al. [17] reported the effectiveness of 2.5-mg pLH, applied by the vulvar submucosal route at the onset of estrus, for the advancement of ovulation in pubertal gilts. Dose reduction by the vulvar submucosal route was described for prostaglandin analogs in swine [20,21]. The better response to hormonal application through the vulvar submucosal route might be attributed to the counter-current transfer of hormones in the periovarian vascular complex, allowing part of the hormone to arrive quickly to the site of action without systemic metabolization [22]. Considering the reduction of hormonal dose and the ease of application, the vulvar submucosal route could be a good option for FTAI protocols in gilts and weaned sows.

Costs can be reduced and labor optimized by using fewer doses or hormones, hence making the use of FTAI protocols feasible in the routine of the farms. The good fertility results (≥90% farrowing rate and ≥12.4 total piglets born) observed in gilts [17] or in weaned sows [9], even when ovulation was not advanced by hormonal application, opened up the possibility of investigating the effect of a single FTAI without any hormonal treatment. This study evaluated the reproductive performance of gilts and weaned sows submitted to a single FTAI after the application of a reduced pLH dose at the onset of estrus, by the vulvar submucosal route, in comparison with the use of multiple inseminations. In weaned sows, the reproductive performance after a single FTAI without a previous pLH application was also investigated.

2. Material and methods

Two experiments were carried out with gilts and weaned sows in a commercial farm located at southern Brazil, in the Santa Catarina State. The protocols were reviewed and approved (project number 22979) by the Institutional Animal Care and Use Committee (COMPESQ-FAVET-UFRGS).

2.1. Housing and feeding

The farm had an inventory of 9000 females distributed in a gilt development unit (GDU) and breed-to-wean unit (BWU). The first experiment was carried out in the GDU, where the gilts were housed in pens until the first expression of estrus and then moved to individual crates with a slatted floor in the breeding building. The pregnant gilts remained in the GDU up to 50 days of pregnancy and then were moved to BWU. The second experiment was carried out in the BWU, where the weaned sows were housed in individual crates with slatted floor. In both experiments, pregnant gilts and sows were housed in collective pens of 12 animals, from 45 to 60 days of pregnancy until 5 days before farrowing expected date, when they were moved to farrowing rooms.

Starting 2 weeks before insemination for gilts and during the interval-to-insemination for sows, females were fed 3 kg/day of a standard corn-soybean diet (3200-kcal EM/kg, 14% crude protein and 0.7% digestible lysine). From insemination until 86 days of gestation, the sows were fed 2.4 kg/day. From 87 days of gestation until the transfer to the farrowing rooms, they received 2.6–2.8 kg/day. *Ad libitum* access to water was provided throughout the experimental period.