Original paper

ESTRUS INDUCTION IN SEXUALLY MATURE GILTS WITH DIFFERENT HORMONAL TREATMENTS

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Abstract

The aim of this study was to determine the effectiveness of the synchronized estrus induction in sexually mature gilts, after treatment with different hormonal treatments, given in the unknown phase of a spontaneous estrus cycle. Sexually mature gilts were used, with at least one spontaneous estrous cycle. A total of 90 gilts were treated with single i/m injection of 1,000 IU eCG (Folligon®), 40 gilts were treated with two separate i/m injection of 1 ml PGF2α (Dinolytic®), at an interval of 11 days, and 40 gilts were treated orally (within diet) with 20 mg of synthetic progestagen preparation Altrenogest (Regumate®), during 18 days. Estrus was detected twice daily, in the 10h to 12h intervals, by direct contact with the teaser boar. The best induction of synchronized estrus (in 90% of gilts), which appeared within the first 7 days (mean 5.3 days) after treatment, was found in gilts treated with progestagen preparations. In the three repetitions of treatment with eCG, within the first 7 days (mean 4.2 days) after the treatment, estrus was detected in 65%, 40% or 33% of the treated gilts. After treatment with luteolytic preparation $PGF_{2\alpha}$ (Dynolitic®), estrus was detected in 40% of gilts, on average 5.5 days after treatment. The obtained results clearly show that the successful induction of synchronized estrus in sexually mature gilts can be done only by the method for prolongation of the luteal phase of the spontaneous estrous cycles, using progestagen preparations.

Key words: *estrus, gilt, hormones, induction, treatment*

Introduction

In the intensive pig production, it is often necessary to induce synchronized estrus, for a number of sexually mature gilts (Gordon, 2005; Stančić, 2005). The goal is to get all the treated gilts at the beginning of the follicular phase (proestrus) of the induced estrous cycle, after cessation of treatment. In general, the induction of synchronized estrus in sexually mature gilts can be done by the control of spontaneous cycles luteal phase duration, using different hormone preparations (Stančić, 2002; Coffey et al., 2002; Cassar, 2009; Brüssow and Wähner, 2011). Luteal phase of the spontaneous estrous cycles can be either shortened by

using luteolytic preparations (native or synthetic $PGF_{2\alpha}$ preparations) or prolonged by using synthetic progestagen preparations, as well as by regression accessory corpora lutea (with a single $PGF_{2\alpha}$ injection), induced by a single injection of gonadotropin eCG (Stančić et al., 1998; Estill, 2000; Flowers, 2001; Marić et al., 2003; Estienne, 2003; Stančić et al., 2007; Bošnjak, 2007; Davis, 2008; Stančić, 2010; De Rensis et al., 2012; Stančić et al., 2013). However, the success of the degree of estrus synchronization depends on the phase of the spontaneous estrous cycle of the gilts at the treatment beginning, as well as on the applied hormonal preparations. In the practical conditions, most often, the phase of spontaneous estrous cycle in gilts at the start of hormonal treatment is unknown. This results in a highly variable success of synchronized estrus induction, depending on the applied hormone preparations (Stančić, 2005; Gordon, 2005; Stančić et al., 2013).

Therefore, the aim of this study was to determine the degree of synchronized estrous response in sexually mature gilts treated with various hormonal preparations (gonadotropins, prostaglandin $F_{2\alpha}$ and progestagens) in an unknown stage of spontaneous estrous cycle.

Materials and methods

Farm. Investigations were carried out on an intensive pig production farm in AP Vojvodina, Serbia. For the experiment we used gilts of 7 to 8 months of age, 125 to 140 kg body weight, in which at least one spontaneous estrous cycle was detected. Detection of estrus was performed twice daily at an interval from 10h to 12h, by full contact with the teaser boar. The experimental gilts were housed in group pens, with the possibility of individual nutrition. Gilts were treated in an unknown stage of spontaneous estrous cycle, using gonadotropin (eCG - equine chorionic gonadotropin), luteolytic ($PGF_{2\alpha}$) or synthetic progestagen (Altrenogest) hormonal preparations.

Gonadotropin treatment. A total of 90 gilts (30 gilts per group, for three treatment replications) was treated with gonadotropin preparation eCG (Folligon®, Intervet - Boxmer, Holland). The treatment was performed by a single i/m injection of 1,000IU eCG.

Luteolytic treatment. Prostaglandin $F_{2\alpha}$ preparation ($PGF_{2\alpha}$) Dynolitic® (Phizer) was used as a luteolytic hormone for gilts treatment. A total of 40 gilts was treated by two separate i/m injections of 1ml Dynolitic solution (containing 5mg Dinoprost), within an interval of 11 days.

Progestogen treatment. Preparation Regumate® (Roussel Uclaf, Bernburg, Germany) was used. The active substance of the preparation is Altrenogest, highly potent synthetic analogue of progesterone. Each gilt (n=40) received 5ml Regumate daily, containing 20mg Altrenogest, for 18 days. The preparation was applied by the original spray bottle, directly into the individual gilts morning part of daily meal, just before consumption, so each gilt consumed the entire daily dose of preparations.

Induced estrus detection was performed as described for the detection of spontaneous estrus, starting about 24h after the cessation of the hormonal treatments. Estrus which appeared within the first 7 days after treatment was considered to be induced by hormonal preparations (Gordon, 2005; Stančić, 2005).

Results and discussion

The experimental results are shown in Table 1. The degree of synchronized induced estrous reaction in gilts, within the first 7 days after treatment with gonadotropin preparation eCG, was highly variable among the three treatment groups (63%, 40% and 33%). The average interval from the end of treatment to the occurrence of induced estrus was 4.2 days (3 to 6 days). Total estrous response, in this group of gilts, was high (93%, 83% and 97%), but the average interval from the end of treatment to estrus, was much longer (lasting 24 to 27 days).

On average 5.5 days (4 to 7 days) after second luteolytic ($PGF_{2\alpha}$) injection, synchronized estrus was induced in only 40% of treated gilts. Total estrus reaction was high (90%), with an average interval of 11.2 days (8 to 15 days) from the second $PGF_{2\alpha}$ injection to estrus detection.

Progestagen treatment resulted in high proportion of synchronized estrus induction (90% of treated gilts). On average, induced estrus was detected 5.3 days (4 to 7 days) after cessation of treatment. In the remaining four gilts (10%) estrus was not detected within 30 days after cessation of treatment with progestagen.

Table 1. *Estrus reaction in sexually mature gilts after different hormonal treatments*

		Hormonal treatments		
		eCG	$PGF_{2\alpha}$	Progestagen
Gilts treated, n		30[1], 30[2], 30[3]	40	40
Average gilts age at the start of treatment, days		218 (205-234)	231 (212-240)	223 (210-238)
Gilts with detected estrus within 7 days after treatment*	n	19[1], 12[2], 10[3]	16	36
	%	63[1], 40[2], 33[3]	40.0	90.0
Average interval from the end of treatment to induced estrus, days		4.2 (3-6)	5.5 (4-7)	5.3 (4-7)
Total gilts with detected estrus	n	28[1], 25[2], 29[3]	36	36
	%	93[1], 83[2], 97[3]	90.0	90.0
Average interval from the end of treatment to estrus in the total gilts with detected estrus, days		24[1], 26[2], 25[3] (24-27)	11.2 (8-15)	5.3

* Estrus induced by hormonal treatment. [1, 2, 3] First, second and third treatments.
Minimal and maximal values in parenthesis.

The results of our study clearly show that there is a considerable variation in the degree of synchronized estrous response after treatment performed with various hormonal preparations, in the unknown phase of a spontaneous estrous cycle of gilts. Thus, within 7 days after treatment with placental gonadotropin eCG, in the three groups of gilts, estrus was detected in 63%, 40% or 33% of the treated gilts. In the same interval after treatment with luteolytic preparation $PGF_{2\alpha}$, estrus was detected in 40% treated gilts. Higher degree of synchronized estrous reaction was found after treatment with progestagen preparations. Namely, within 7 days after cessation of treatment, estrus was detected in 90% gilts. The interval from the end of treatment to the appearance of induced estrus was similar (average 4.2 to 5.5 days), regardless of the used hormonal preparations.

Synchronized ovulation can be induced by placental (eCG and hCG) or pituitary (FSH and LH) gonadotropic hormone preparations in sexually immature (prepubertal, acyclic) and sexually mature (pubertal, cyclic) gilts, as well as in weaned sows (Flowers, 2001; Stančić,

2005; Tummaruk et al., 2011; Brüssow and Wähner, 2011). Prepubertal gilts and weaned sows respond with very high proportion of synchronized estrus, within 4 to 6 days after a single injection of 500 to 1,500 IU eCG. This effect is achieved due to the fact that, at the moment of treatment, only follicles with non-functional corpora lutea (CL) are present at ovaries of both females category (Stančić et al., 1998; Coffey et al., 2002; Gordon, 2005; Stančić et al., 2007; Cassar, 2009). In 80 % to 100 % of sexually mature gilts, eCG injection given at any stage of spontaneous estrous cycle causes a synchronized ovulation and formation of functional accessory corpora lutea. However, the synchronized estrus, within 4 to 6 days after the eCG, occurs only in the gilts treated during the follicular phase or at the end of the luteal phase of spontaneous cycles. This is due to the inhibitory action of the induced (accessory) and spontaneous estrus cycles corpora lutea. Therefore, the degree of synchronization of estrus is highly variable in sexually mature gilts treated at an unknown stage of spontaneous estrous cycle, depending on the proportion of gilts in certain phases of spontaneous estrous cycle at the moment of eCG treatment (Ramapacek et al., 1992; Heavenly et al., 1997; Haff et al., 2002; Stančić, 2005; Bošnjak et al., 2007; Stančić et al., 2012; Stančić et al., 2013).

The injection of $PGF_{2\alpha}$, within the first 12 days of the luteal phase of the spontaneous estrous cycle does not cause regression of corpora lutea (CL). This is due to the fact that the pigs CL, unlike cows CL, are responsive to the luteolytic action of $PGF_{2\alpha}$ only within the last 4 days of the luteal phase, ie. after day 12 of diestrus (Guthrie and Polge, 1976; Guthrie, 1979; Puglisi et al., 1979; Stančić, 1979; Stančić and Vuković, 1995; Stančić et al., 1998; Stančić et al., 2007). Therefore, there is a high probability that a large number of gilts, at the moment of $PGF_{2\alpha}$ treatment, are not in the reactive phase of spontaneous estrus cycle (follicular and first 12 days of luteal phase). Such gilts will not react with CL regression, and with synchronized estrus manifestation. The result is low degree of estrus synchronization after $PGF_{2\alpha}$ treatment of gilts in the unknown stage of spontaneous estrous cycle (Stančić et al., 1995; Almond, 1997; Nebesni et al., 1997; Stančić et al., 1998; Stančić, 2010; De Rensis et al., 2012).

The highest level of synchronized estrus in sexually mature gilts can be achieved by peroral treatment with synthetic progestagen preparations (Davis et al., 1979; Almond, 1997; Stančić et al., 2005). Recently, the most commonly used preparation has been Altrenogest (Regumate®) for 16 to 18 days peroral treatment. After such treatment, synchronized estrus occurs 4 to 7 days after cessation of treatment in 80% to 100% of gilts (Estienne et al., 2001; Estienne and Harper, 2002; Marić et al., 2003; Gordon, 2005; Stančić, 2005; Stančić et al., 2007; Bošnjak et al., 2007; Stančić, 2010).

The results of the present study and the results of other authors clearly demonstrate that a high degree of estrus synchronization in sexually mature gilts can only be achieved by applying treatment with progestagen preparations. Treatment of these gilts with gonadotropin or luteolytic hormonal preparations is not effective and has no relevance to the practical application for estrus synchronization in sexually mature gilts.

Conclusion

Based on the obtained results, we can conclude the following:

1. The degree of synchronized estrous response in sexually mature gilts significantly varies depending on the applied hormonal preparations (gonadotropins, luteolytics or

progestagens) and the phase of the spontaneous estrous cycle in which the treatment is carried out.

2. Within the first 7 days after treatment, estrus was detected in 33% to 63% gilts treated with gonadotropin eCG (Folligon®), in 40% gilts treated with luteolytic $PGF_{2\alpha}$ (Dynolitic®), and in 90% gilts treated with progestagen preparation (Regumate®).
3. Synchronized estrus in high proportion of sexually mature gilts can only be achieved by progestagen treatment. Treatment with gonadotropin or luteolytic hormonal preparations is not effective and has no relevance to the practical application for estrus synchronization in sexually mature gilts.

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