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REPRODUCTIVE ACTIVITY OF GILTS WITH PROLONGED PREINSEMINATION ANOESTRUS AFTER HORMONAL TREATMENT

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Due to the prolonged preinsemination anoestrus (the sings of oestrus were not found even after eight months of age) 25 to 40% of gilts are culled on the farms in Vojvodina. The question is if those gilts did not reach puberty at all or if it was the result of an inadequate technology in oestrus detection. Concerning this issue, a morphological examination of the genital organs of 175 gilts, in which oestrus was not detected during the first 8 to 9 months of age, was carried out. The average age of these gilts was, at sacrifice, 267 days (242 to 278 days). In further reseach, the treatment of delayed puberty gilts and control gilts was carried out with hormone preparations from the progestin group (Regumate, Altrenogest) or placental gonadotropin (PMSG – "Folligon"). Based on examination of the gilts' genital organs, in which oestrus was not detected even after 8 months of age, it was established that 38.9% of those gilts did not reach sexual maturity at all, i.e. did not have cyclic ovarian activity. With the other 61.1% of the examined gilts, the puberty ovarian cyclicity was established, as their ovaries had the functional structures (preovulatary follicles, corpora hemorrhagica, corpora lutea and corpora albicantia). Thus, one oestrus cycle was reached by 57.9% while two oestrous cycles were reached by 42.1% out of the total number of sexually mature gilts. A high degree of oestrous reaction (80%), a high farrowing rate (87.5%) and a satisfactory average number of live-born piglets per litter were established in the delayed puberty gilts treated with the Regumate preparation. The obtained results distinctly show that a great number of gilts reached the puberty cyclic ovarian activity while the absence of oestrus detection was the result of inadequate technology in oestrus detection on farms.

Key words: delayed puberty, hormone treatment, fertility, gilt

INTRODUCTION

Modern technology of intensive pig breeding requires the gilts of the European breeds to reach puberty (the first oestrus occurrence) until the age of 200 to 210 days and with the weight of about 100 to 110 kg (Evans and O'Doherty, 2001). However, the research carried out by Eliasson *et al.* (1991) on a large number of Swedish gilts, showed that only about 15% of gilts reached puberty at 209 days of age while the others did so in the interval of 60 days before or after that period. That is the result of the fact that the age of gilts, when reaching sexual maturity, is greatly affected by the interaction of a number of paragenetic factors such as: nutrition, season, contact with a sexually mature boar, housing, stressful factors, treatment with exogenous hormones and health condition (Dalin and Einarsson, 1986; Stančić *et al.*, 2003). In the case of not manifesting signs of the first oestrus after full 8 months of age the gilt is considered to have a delayed puberty (Evans and O'Doherty, 2001). The most common reason for culling the gilts from breeding is a delayed prepubertal (preinsemination) anoestrus which significantly decreases the efficiency of pig production (Ehnval *et al.*, 1981). On large pig farms in Vojvodina, between 25 and 40% of gilts were culled due to the fact that the manifastation of oestrus was not detected even after 8 months of age.

However, some researches showed that a silent oestrus (ovulation without the manifestation of external estrus signs) was present in only 4 to 5% of sexually mature gilts' (Andersson *et al.*, 1982). In addition, by the examination of the gilts genital organs, in which the oestrus was not detected even after 8 months of age, a cyclic ovarian activity was established (Einarsson *et al.*, 1974; Stančić *et al.*, 1999), whereas the pathomorphological changes, which could have anoestrus as a consequence, were not found (Einarsson *et al.*, 1974; Gagrčin *et al.*, 1998).

Concerning these facts, the aim of this paper is to provide the answers to the following questions: (1) Did a great number of gilts, over 8 months of age, really fail to reach the pubertal ovarian activity or the manifestation of external signs of oestrus was not registered due to the bad tecnology of oestrus detection on farms? (2) Was it possible to achieve a satisfactory degree of oestrus reaction and fertility in those gilts by means of hormone treatment?

MATERIAL AND METHODS

The research was carried out on a large farm in Vojvodina with a capacity of about 5,500 sows. Within one year 29.3% of gilts in which the oestrus was not detected until 270 days of age were excluded, whereas 46.9% of gilts were inseminated in the first oestrus, detected when they were over 245 days of age.

In the first part of the research a morphlogical examination of the genital organs of 175 gilts in which oestrus was not detected during the first 8 to 9 months of age was carried out. The average age of those gilts, at sacrifice, was 267 days (242 to 278 days). The detection of oestrus on a farm is carried out once a day in the presence of a boar teaser, by observing the external oestrus signs (manifestation of standing reflexes at pressure in the lumbosacral region, edema and hyperaemia of the vulva), and it commences when the gilts are about 210 days of age and lasts the next 60 days.

Based on the morphological findings on the ovaries, all sacrificed gilts were divided into two basic categories: (1) prepubertal i.e. sexually immature and (2) pubertal i.e. sexually mature. The gilts on whose ovaries, apart from the tiny follicles (<4 mm in diameter), other ovarian structures were not found, were regarded as pre-pubertal. In the category of sexually mature gilts were those on whose ovaries the functional ovarian strtuctures were detected such as: preovulatory follicles (8 to 11 mm in diameter), fresh ovulatory spots (corpora hemorrhagica) or yellow bodies (corpora lutea). In the category of sexually mature gilts with one oestrus cycle there were gilts on whose ovaries there were: (a) preovulatory follicles, (b) yellow bodies or (c) fresh ovulations. In the category of gilts with two oestrus cycles there were gilts on whose ovaries one of the following combinations was present: (a) preovulatory follicles + corpora albicantia (regressed yellow bodies from the previous cycle), (b) corpora hemorrhagica + corpora albicantia or (c) corpora lutea + corpora albicantia.

In the other part of the research, the treatment of delayed puberty and control gilts with progestin hormone preparations (Regumate, Altrenogest) or the placental gonadotropine (PMSG – "Folligon") was carried out. The average age of the delayed puberty gilts was 262 days while that of the control gilts was 223 days. The total number of the treated gilts was 120 out of which 30 gilts were treated with Regumate and PMSG respectively in the group of delayed puberty gilts and in the group of control gilts.

The treatment with Regumate preparation was carried out by adding 5 mL (20 mg Altrenogest) to the feed ration per gilt a day, by means of an original automatic dosemeter, in the period of 18 days. The treatment with PMSG was carried out by a single i/m injection 1000 IU of the preparation Folligon per gilt. The day after completion of the treatment, the detection of oestrus was commenced within 24 hours by full contact with a sexually mature boar.

Artificial insemination was performed in two phases (immediately after the detection of oestrus and about 24 hours later) with the sperm of a proven fertility. The insemination dose was 100 mL in volume and contained about $3x10^9$ of the progressively motile spermatozoa.

The number of the farrowed gilts, as well as the number of piglets in a litter, was recorded from the insemination in the first oestrus after the treatment.

Statistical analyses were performed in the programme: Statistika 8. The significance of differences was established by t-test.

RESULTS AND DISCUSSION

Based on the present functional ovarian structures established by a morphological examination of the reproductive organs of 175 sacrificied gilts with a prolonged pre-insemination anoestrus, it was found that 38.9% of gilts did not have a pubertal ovarian activity. Namely, on the ovaries of those gilts, a part from the tiny antral follicles, the functional ovarian structures were not present. On the ovaries of the remaining 61.1% of gilts the functional ovarian structures were present which indicates that those gilts reached puberty. Out of the total number of sexually mature gilts, one oestrus cycle was established in 57.9% and two oestrus cycles in 42.1% of gilts (Figure 1).

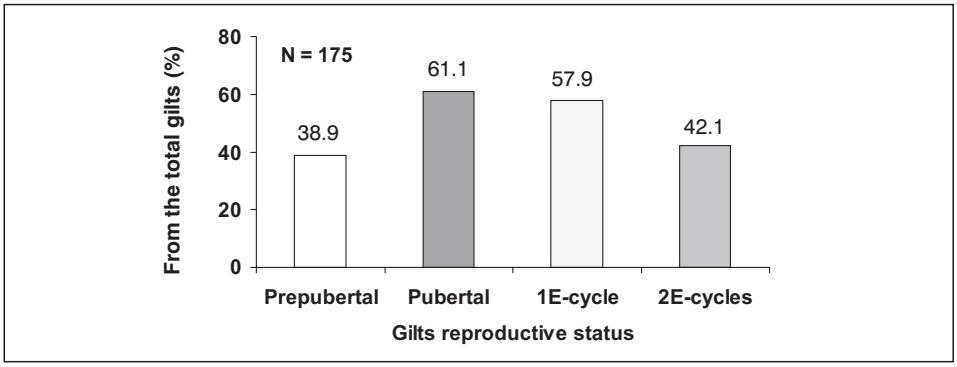

Figure 1. Reproductive status of sacrificied gilts

Within the first 30 days after the treatment with progestin preparation Regumate, oestrus was detected in 80% of the delayed puberty gilts, as well as in the control gilts. It is significant, however, to emphasize that oestrus, in all delayed puberty gilts, was detected within the first 7 days after the treatment whereas, during this period, only 53.3% of the control gilts manifested oestrus. The differences are statistically significant ($P<0.05$) (Table 1).

Table 1. Estrus reaction in gilts after treatment (%)

		Delayed puberty gilts (n = 60)		Control gilts (n = 60)	
		Regumate (n=30)	PMSG (n=30)	Regumate (n=30)	PMSG (n=30)
Interval: end of treatment – estrus (days)	1 – 7	80.0^a	46.7^b	53.3^b	56.7^b
	8 – 30	0.0^a	33.3^b	26.7^b	30.0^b
	1 – 30	80.0^a	80.0^a	80.0^a	86.7^a
Aneostrous gilts* (n)		20.0^a	20.0^a	20.0^a	13.3^b

* – Estrus not detected within 30 days after treatment.
$^{a, b}$ – The values with different superscripts, in the same rows, are statistically significant ($P<0.05$).

After treatment with placental gonadotropin (PMSG – Folligon) the oestrus was detected in 80% of the delayed puberty gilts and in 86% of the control gilts.

Thus, within the first 7 days after the treatment oestrus was manifested by 46.7% of the delayed puberty gilts and 56.7% of the control gilts (Table 1). Within 30 days after the treatment with Regumate oestrus was detected in 20% of the delayed puberty gilts and control gilts. During the same period, oestrus was not detected in 20% of the delayed puberty gilts and in 13.3% of the control gilts treated with PMSG (Table 1).

The farrowing rate after the insemination performed in the first oestrus after treatment with Regumate was 87.5% in the delayed puberty gilts and 79.2% in control gilts. This rate was 75% in the delayed puberty gilts and 73.1% in control gilts treated with PMSG (Table 2). The obtained values are not statistically significant (P>0.05). Taking into account the total number of the treated gilts, the farrowing rate of the delayed puberty gilts was somewhat higher (70%) after the treatment with Regumate in relation to the treatment with PMSG (60%). The farrowing rate of the control gilts was the same (63.3%) in both hormone treatments (Table 2).

Table 2. Farrowing rate and average litter size in treated gilts

		Delayed puberty gilts (n = 60)		Control gilts (n = 60)	
		Regumate (n=30)	PMSG (n=30)	Regumate (n=30)	PMSG (n=30)
Farrowing rate (%)	from inseminated	87.5	75.0	79.2	73.1
	from treated	70.0	60.0	63.3	63.3
Average litter size (n±SD)	alive	8.71±0.33	8.83±0.24	8.73±0.23	9.00±0.23
	dead	0.57±0.09	0.78±0.17	0.63±0.16	0.53±0.14
	total	9.28±0.36	9.61±0.28	9.36±0.30	9.53±0.25

The obtained values are not statistically significant (P>0.05).

The average number of live-born piglets per litter was between 9.0 and 8.71, and the total number of born piglets was between 9.61 and 9.28. The obtained values are not statistically significant (P>0.05). Similar values were obtained in the experimental and control gilts, without regards on different hormone treatment (Table 2).

In our research, based on the examination of gilts genital organs in which oestrus was not detected even after 8 months of age, it was established that 38.9% of those gilts did not reach sexual maturity at all i.e. did not have cyclic ovarian activity. In the remaining 61.1% of the examined gilts, the pubertal ovarian cyclicity was established as there were functional structures present on their ovaries. Thus, 57.9% had one oestrus cycle and 42.1% had two oestrus cycles out of the total number of sexually mature gilts.

It is believed that the occurrence of puberty is delayed if the gilt does not reach the first pubertal oestrus even with full 8 months of age (Dalin, 1987). The prolonged anoestrus is the reason for culling of 34% of gilts older than 8 months (Ehnvall *et al.*, 1981). However by examination of the reproductive organs of such gilts after sacrificing, it was established that in 70% of gilts there were functional structures on the ovaries which indicated that they had cyclic pubertal ovarian activity (Einarsson *et al.*, 1974; Dalin *et al.*, 1997).

In this paper, treatment of the delayed puberty gilts with the preparation of the synthetic progestin (Regumate) resulted in a high degree of oestrous reaction within the first 7 days after treatment (80%), with a high farrowig rate (87.5%), as well as in a normal average number of live-born piglets per litter (8.71). Similar values regarding the farrowing rate (79.2%) and the average number of the live-born piglets per litter (8.73) were also obtained after the progestin treatment of the control gilts. A significantly weaker oestruous reaction of the control gilts, within the first 7 days after treatment (53.3%) may indicate that there were more sexually mature gilts in the group of delayed puberty gilts. Namely, a high degree of the synchronized occurrence of oestrus, by the method of luteal phase prolongation (treatment with progestin preparations), is possible to achieve only in gilts which, on the onset of treatment, were sexually mature i.e. which had cyclic ovarian activity (Webel and Day, 1982; Ashworth *et al.*, 1992; Estienne *et al.*, 2001; Soede *et al.*, 2007). Our results regarding the degree of oestrus synchronization, as well as the fertility parameter of the gilts treated with Regumate, were very similar to the results obtained by other authors (Stančić *et al.*, 1998; Marić *et al.*, 2003; Horsley *et al.*, 2005; Kaeoket, 2008).

Within the first 7 days after the treatment with PMSG, oestrus was detected in a significantly smaller number of delayed puberty gilts (46.7%) and in control gilts (56.7%), in comparison to the gilts treated with Regumate preparation. This finding also supports the fact that in both groups of gilts there were about 50% of sexually mature ones. In other words, the PMSG injection brings about the ovulation and the formation of yellow bodies in any phase of the oestrus cycle of pigs. However, if the treatment is carried out during the first 5 to 6 days of the dioestrus of the spontenaous oestrus cycle, the premature regression of the induced (so called accessory) yellow bodies is caused, and the animal continues its spontaneous oestrus cycle (Webel and Day, 1982). Therefore there is a chance that about 50 to 70% of the sexually mature gilts, treated with a single injection of PMSG, do not manifest signs of oestrus within the first 7 days after treatment (Knox, 1999). In relation to this, the success of the synchronazation of oestrus is rather variable in gilts for which it is not known in which phase of the spontanious oestrus cycle they are at the time of PMSG injection (Nebesni *et al.*, 1997; Stančić *et al.*, 1998; Coffey *et al.*, 2002).

Taking into consideration the obtained results in this paper, as well as the results of other authors, it can be concluded that oestrus was not detected in over 60% of the examined gilts because they were not sexually mature (cyclic), or because of the occurence of the silent oestrus, but due to the inadequate (imprecise) technology of the oestrus detection on farms. That is to say, that the oestrus detection in gilts should be carried out at least twice a day in the interval of 10 to 12 hours by direct contact of boar teasers and gilts. It would be advisable that oestrus detection should be repeated after 25 to 40 minutes in one cycle (Spronk *et al.*, 1997; Stančić *et al.*, 2003). In the prevention and diagnosis of the anoestrus in gilts the determination of progesterone level in the blood (Chyn *et al.*, 2002) and the transcutaneous ultrasonography (Kauffold *et al.*, 2005), as well as a morphological examination of the genital organs of the sacrificed gilts (Stančić *et al.*, 2007) can be successfully applied.

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REPRODUKTIVNA AKTIVNOST NAZIMICA SA PROLONGIRANOM PREINSEMINACIONOM ANESTRIJOM POSLE HORMONSKOG TRETMANA

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SADRŽAJ

Zbog dugotrajne preinseminacione anestrije (znaci estrusa nisu otkriveni ni posle 8 meseci starosti), na vojvođanskim farmama se izlučuje 25 do 40% nazimica. Postavljeno je pitanje: da li ove nazimice zaista nisu postigle pubertet, ili je to posledica neadekvatne tehnologije otkrivanja estrusa. S tim u vezi, izvršen je morfološki pregled polnih organa 175 nazimica, kod kojih estrus nije bio otkriven tokom prvih 8 do 9 meseci starosti. Prosečna starost ovih nazimica je, kod žrtvovanja, iznosila 267 dana (242 do 278 dana). U drugom delu istraživanja, izvršen je tretman dugotrajno anestričnih i kontrolnih nazimica, hormonskim preparatima iz grupe progestina (Regumate®, Altrenogest) ili placentalnih gonadortopina (PMSG – Folligon). Na osnovu pregleda polnih organa nazimica, kod kojih estrus nije bio otkriven ni posle 8 meseci starosti, ustanovljeno je da 38,9% ovih nazimica zaista nije postiglo polnu zrelost, odnosno uspostavilo cikličnu ovarijalnu aktivnost. Kod preostalih 61,1% ispitanih nazimica, utvrđena je uspostavljena pubertetska ovarijalna cikličnost, jer su, na njihovim jajnicima, bile prisutne funkcionalne strukture (predovulatorni folikuli, *corpora hemorrhagica*, *corpora lutea* i *corpora albicantia*). Pri tome je jedan estrusni ciklus uspostavilo 57,9%, a dva estrusna ciklusa 42,1%, od ukupnog broja polno zrelih nazimica. Ustanovljen je visok stepen estrusnog reagovanja (80%), visoka vrednost prašenja

(87,5%) i zadovoljavajući prosečan broj živorođene prasadi po leglu (8,71), kod dugotrajno anestričnih nazimica, tretiranih preparatom Regumate. Dobijeni rezultati jasno ukazuju da je znatan broj nazimica postigao pubertetsku cikličnu ovarijalnu aktivnost, ali da je izostanak otkrivanja estrusa posledica neadekvatne tehnologije otkrivanja estrusa na farmi.