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OCCURRENCE AND PRACTICAL SOLVENT POSSIBILITY OF GILTS PREINSEMINATION ANESTRUS

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Review paper

Abstract: Gilts reproductive efficiency is one of the primary factors of successful piglets' production. This performance, among other things, is expresses by the number of pregnant gilts, with desirable genetic traits, body weight and age, sexual maturity status, and general good health, provided for the replacement of sows in primary herd. This goal is very difficult to achieve in practical conditions. The main reason is occurrence of prolonged preinsemination anoestrus (oestrus was not detected even after 8 months of age). This paper review the occurrence of prolonged preinsemination anoestrus, based on the results of our and study of other authors. All studies consistently show that, in most of these gilts, pubertal cyclic ovarian activity were established, that silent oestrus occurred in only 4% of the cyclic gilts, and that this problem can be solved by applying appropriate technologies for oestrus detection, and by treatment with adequate hormonal preparations.

Key words: prolonged anoestrus, oestrus detection, boar contact, hormonal treatment, gilt

Introduction

The quality of pregnant gilts, which are used for the annual sows' replacement, is very important and directly affects the herd reproductive efficiency. It is believed that today's intensive European breeds of gilts, reached puberty (first oestrus occurrence) at about 200 days of age and of about 100 to 110 kg body weight *(Evans et al., 2001)*. Modern technology requires that gilts must be fertile inseminated at the second or third pubertal oestrus, when they was 220 to 240 days of age, with a body weight 130 to 145 kg and with the minimum 18mm back fat thickness *(Close, 1997; Stančić et al., 2003)*. In fact, scientific research and practical experiences clearly demonstrate that insemination gilts with inadequate

age and body weight, inadequate reproductive status, and poor health, has resulted in significantly reduction of piglets production per sow during its total reproductive exploitation period *(Foxcroft, 2001; Gagrčin et al., 2002; Gagrčin et al., 2005)*. As the annual sows replacement ranges between 30 and 50% *(Kovčin et al., 1997; Tummaruk et al., 2000; Gagrčin et al., 2009)*, it is important to ensure that the number of sows, culled from the reproductive herd, can be replace by pregnant gilts with mentioned characteristics at the moment of fertile insemination.

However, this goal is, in practice, quite difficult to achieve. Namely, on the one hand, age and weight of gilts, at the first pubertal oestrus occurrence, varies in very wide ranges, as the result of strong influence of paragenetic factors, such as nutrition, the season, contact with sexually mature boars, accommodation conditions, stress, treatment by exogenous hormones and health *(Eliassson et al., 1991; Evans et al., 2001; Stancic et al., 2003; Peltoniemi et al., 2005)*. On the other hand, about 60% of gilts are culled from the herd before the first insemination or in the period from insemination to farrowing *(Tummaruk et al., 2000)*. Prolonged prepubertal anoestrus (oestrus was not detection in gilts older than 8 months) is the most common reason for culling gilts from the reproductive herd *(Ehnval et al., 1981)*. Determination of blood progesterone concentration *(Dalin, 1987)*, transcutaneous ultra-sonography *(Kauffold et al., 2004)*, and gilts sacrifice for morphological examination of their reproductive organs *(Dalin et al., 1997)* is the methods for successful diagnosis and prevention of prolonged preinsemination anoestrus.

The aim of this paper is to review the results, about the phenomenon of prolonged preinsemination anoestrus in the replacement gilts and contemporary features of its solution.

Prolonged preinsemination anoestrus occurrence

Although the gilts age at the puberty occurrence is genetically determined, the phenotypic value of these characteristic shows a very large variability. Namely, the investigations that are performed by *Eliassson et al. (1991)*, at a large number of Swedish gilts population, show that only about 15% of gilts achieved puberty with average 209 days of age, while the remaining number of gilts achieve puberty within interval 60 days before or later. This is a consequence of the interaction of genetic basis *(Cotton, 2001; King, 2002)* and numerous paragenetic factors *(Gordon, 1997; Evans et al., 2001; Stančić et al., 2003; Peltoniemi et al., 2005)*. The main paragenetic factors that influence the gilts age at the first pubertal oestrus occurrence, is nutrition *(Robinson, 1990; Kovčin et al., 1997; Tummaurk et al., 2001; Thacker, 2002)*, the annual season *(Stančić et al., 1990; Cotton, 2001)*, contact with sexually mature boars *(Hemsworth, 1987; Stančić et al., 1987; Dyck, 1988; Stančić et al., 1996; Levis, 2000)*, transportation and relocation *(Hughes,*

1982; Stančić et al., 1989), the number of gilts in the rearing group *(Cronin et al., 1983)* and the treatment by exogenous hormonal preparations *(Ziecik et al., 1996; Stančić et al., 2003)*.

Numerous studies show that significant number of gilts does not establish the first pubertal oestrus in normal (technologically desirable) range, between 6 and 7 months of age. It is believed that the appearance of puberty was delayed, if gilts not establish the first pubertal oestrus within 8 months of age *(Dalin, 1987)*. Prolonged preinsemination anoestrus was reason for culling 34% gilts older than 8 months of age *(Ehnvall et al., 1981)*. In one of our research, at the Vojvodina farm units, it was found that 29,3% of gilts have been culled because of the prolonged preinsemination anoestrus *(Stančić et al., 2008)*, and that 45% of gilts were fertile inseminated when they are older than 8 months of age *(Gagrčin et al., 2009)*. However, the post mortem examination of reproductive organs of such gilts, it was found that 50 to 70% of gilts, have functional ovarian structures (preovulatory follicles, corpora hemorrhagic, corpora lutea and corpora albicantia), which indicate that they have established cyclic pubertal ovarian activity *(Einarsson et al., 1974; Stančić et al., 1998; Stančić et al., 2005; Stančić et al., 2009)*. Moreover, 20 to 40% of the cyclic gilts were established two or three ovarian (oestrual) cycles before post mortem examination *(Stančić et al., 2007)*. In addition, at the reproductive organs of 50 to 70% of examined gilts was not found pathomorphological changes that could have result with prolonged anoestrus *(Gagrčin et al., 1998; Henionen et al., 1998; Stančić et al., 2007)*. On the other hand, a number of investigations consistently demonstrate that silent oestrus (ovulation without external signs of oestrus), occurs at a relatively small number (only 4,4%) of pubertal (cyclic) gilts *(Andersson et al., 1982)*.

According to above mentioned findings, the question is: (1) why, in farm conditions, external signs of oestrus are not detected in gilts with established cyclic ovarian activity and (2) whether the prolonged preinsemination anoestrus problem can be solved using modern biotechnological methods, such as adequate technology of oestrus detection and treatment by hormonal preparations?

Preinsemination anoestrus solvent possibilities

Considering these facts, in regard to occurrence of prolonged preinsemination anoestrus in gilts, at the farm conditions, the basic assumption in the practical solution of this problem is that most of these gilts have established cyclical ovarian activity. In fact, they have established at least one (first) pubertal oestrus cycle. Considering these, in order to increase the number of gilts in which external signs of oestrus (i.e. standing oestrus) will be detected, it is logical to perform the two basic treatments of contemporary biotechnology: (1) adequate

oestrus detection technologies on the farm and (2) treatment of these gilts with adequate hormonal preparations.

Oestrus detection technology

It has been shown that the high degree of standing oestrus can be detected only after twice detection during 24 hours, in 10 to 12h intervals, with full sexually mature boar contact *(See, 2000; Thodberg et al., 2007)*. However, on our farms, in many cases, oestrus detection are performed only once during the 24 hours, often only by the perception of external signs of oestrus, without full boar contact. In one of our investigation *(Stančić et al., 2008)*, during the first 7 days after the beginning of contact with boars, oestrus was detected in 63% of gilts, in which oestrus was detected 2 times per day, with 12h intervals, at in 53,3 % of gilts in which oestrus was detected once daily, repeated after 30 minutes and in 40% of gilts in which oestrus was detected only one in 24h, without full boar contact, as usual in our farms practice. Significantly higher farrowing rate (80%) was found if insemination was performed after twice daily oestrus detection, with full boar contact, compared to insemination performed after only once daily oestrus detection, without full boar contact (68%) *(Stančić et al., 2007)*.

Significantly higher level of gilts oestrus detection, after at least twice daily detection, with the full boar contact, is related to the following findings: (1) first pubertal oestrus cycles are often of irregular duration *(Willemse et al., 1966)*, (2) the period of standing reflex manifestation is, on average, shorter in gilts (1 to 2 days) and longer in sows (1 to 3 days) *(Kemp et al., 1996)*, (3) the average first pubertal oestrus duration is approximately 34,5h, compared with 52,6h in third pubertal oestrus *(Almeida et al., 2000)*, (4) silent oestrus (ovulation without external oestrus signs manifestations), occurs in only 4% oestrual gilts *(Andersson et al., 1982)*, (5) during the oestrus period, the intensity of standing reflex manifestation is not continuous within 24h, but there is a pause (i.e. refractive phase) between two consecutive standing reflex manifestation, which lasts 30 to 45 minutes *(See, 2000; Thodberg et al., 2007)*, (6) perception only visible signs of oestrus, by man, without boar presence, oestrus can be detected in only about 50% of oestrual gilts *(Signoret, 1971)* while, using direct contact with sexually mature boars, oestrus can be detected in 95 to 100% oestrual gilt *(Hemsworth et al., 1986)*, (7) gilts, which reached sexual maturity earlier (the younger ones), exhibit signs of oestrus intensively, and oestrus signs duration is longer, compared with gilts that reached puberty later (the oldest ones) *(Eliasson, 1991)*, and (8) most of the gilts manifest oestrus in the early morning and late evening hours *(Clark et al., 1986)*.

Hormonal treatment

The highest level of synchronized oestrus and ovulation occurrence, in the spontaneous sexually mature (asynchronously cyclical) gilts, can be achieved only by applying methods for prolongation of luteal phase, using treatment by progestagene preparations. Very high oestrus reaction (78 to 100% within 3 to 6 days after treatment), was achieved after treatment of gilts with 15 to 20mg Regumate (Altrenogest, synthetic analogue of progesterone) during 15 to 18 days *(Stančić et al., 1998; Estiene et al., 2001; Horsley et al., 2005; Stančić et al., 2007; Kaeoket, 2008*). In one of our research *(Stančić et al., 2009)*, within the first 7 days after treatment by Regumate, oestrus was estimated in 80% of gilts with prolonged preinsemination anoestrus (8 to 9 months of age) and in 53,3% of gilts 6 to 7 months of age. These results indicate that a significantly greater number of older gilts had established at least one spontaneous oestrus cycle, before starting of treatment. Namely, good synchronization of oestrus, using methods of prolongation luteal phase, can be achieved only in sexually mature, spontaneously cyclic gilts *(Stančić et al., 2000; Coffey et al., 2002)*.

Preparations of gonadotropins, luteolitics ($PGF_{2\alpha}$) or their combination, are not effective for the induction of synchronized oestrus in sexually mature (cyclic) gilts *(Stančić et al., 1998; Coffey et al., 2002; Stančić et al., 2003; Gordon, 2005)*. Namely, the single injection of PMSG, can induce ovulation and corpora lutea formation (i.e. accessory c. lutea), in any phase of spontaneous oestrus cycles of pigs. However, induction of accessory c. lutea at the beginning of dioestrus (5 to 6 days after spontaneous ovulation, early luteal phase), lead to their premature regression, and these animals continue their spontaneous oestrus cycle and, consequently, fails to occurrence high synchronized oestrus *(Webel, 1982)*. Therefore, the successful oestrus synchronization after a single PMSG injection, in sexually mature (cyclic) gilts, is very variable *(Estilll, 2000; Coffey et al., 2002)*. On the other hand, treatment with luteolitic preparations ($PGF_{2\alpha}$, or synthetic analogues) also does not give good results for oestrus synchronization in sexually mature (cyclic) gilts. This is due to the fact that pig corpus luteum reacts to luteolitics only in a very short period of the cycle, between 12 and 18 day (late luteal phase) *(Guthrie et al., 1976)*. Therefore, it is a high probability that, in the group of treated gilts, there are a large number of animals outside the reactive period of cycle. Such animals will not respond by luteolitic effect (i.e. corpora lutea regression) and, consequently, treatment result with poor oestrus synchronization *(Almond, 1997; Coffey et al., 2002; Stančić et al., 2007)*. For these reasons, prolongation of luteal phase (by progestagene treatment) is the only effective method for oestrus synchronization in sexually mature (cyclic) gilts.

Conclusion

Prolonged preinsemination anoestrus is the reason for culling of about 30% of replacement gilts, older than 8 months of age. However, post mortem morphological examination of their sexual organs, demonstrated that 50 to 70% of these gilts had established cyclic ovarian activity, and their reproductive organs have no patho-morphological changes that could result in prolonged anoestrus. These findings indicated that failure to detect oestrus on farm units, in greater number of gilts older than 8 months of age, was not a consequence of silent oestrus or not established pubertal cyclic ovarian activity, but inadequate oestrus detection technology. Practical solution of this problem is oestrus detecting twice a day, with full sexually mature boar contact, as well as treatment with progestagene hormonal preparation. Determination of blood progesterone concentration, transcutaneous ultrasonography and gilts sacrificed for morphological examination of their reproductive organs are the methods for successful diagnosis and prevention of prolonged preinsemination anoestrus.

Pojava i mogućnost praktičnog rešavanja preinseminacione anestrije nazimica

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Rezime

Reproduktivna efikasnost nazimica je jedan od primarnih faktora uspešne proizvodnje prasadi. Ova efikasnost se, između ostalog, izražava brojem suprasnih nazimica, poželjnih genetskih osobina, telesne mase i starosti, statusa polne zrelosti, kao i dobrog opšteg zdravstvenog stanja, obezbeđenih za remont krmača u osnovnom zapatu. Ovaj cilj je dosta teško postići u praktičnim uslovima. Osnovni razlog je pojava prolongirane preinseminacione anestrije (estrus nije otkriven ni posle 8 meseci starosti). U ovom radu je prikazana pojava prolongirane preinseminacione anestrije na osnovu naših i rezultata drugih autora. Sva istraživanja konzistentno pokazuju da je, kod većine ovih nazimica, uspostavljena pubertetska ciklična ovarijalna aktivnost, da se tihi estrus javlja kod, svega, 4% cikličnih nazimica, te da je ovaj problem moguće rešiti primenom adekvatne tehnologije otkrivanja estrusa, kao i tretmanom adekvatnim hormonskim preparatima.

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