



“BOAR EFFECT“ INFLUENCE ON GILTS ESTRUAL REACTION

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ABSTRACT

Induction of synchronised estrus in prepubertal gilts by the sexually mature boar contact is a phenomenon known as “boar effect”. This effect is used for more efficient estrus detection in sexually mature (cyclic) gilts. The best results of application of “boar effect” are achieved if the stimulation is performed by direct contact between gilts and a sexually mature boar, at least two times a day every 12 hours. This paper presents the results of foreign and domestic authors on the “boar effect” application in terms of successful induction of synchronized estrus in prepubertal gilts and estrus detection in sexually mature gilts.

Key words: “boar effect”, estrus, induction, gilt

INTRODUCTION

The quality of breeding gilts is a factor that significantly influence the number of weaned piglets production per sow per year. Namely, scientific research, as well as practical experience, clearly demonstrate that insemination of gilts of inadequate age and body weight, inadequate reproductive status, as well as bad health status, result in considerably lower number of weaned piglets per breeding gilt, during their overall reproductive period (Foxcroft, 2002). Modern technology requires to fertile insemination of gilts in the second or

third puberty estrus, in the age of 220 to 240 days, with body weight between 130 and 145 kg, and backfat thickness at least 1.8 mm (**Close and Cole, 2000**).

In production conditions, it is very difficult to provide a sufficient number of fertile inseminated gilts of the above mentioned performance. The most important reasons for this are the factors which influence high variability in gilts age and body weight at pubertal and fertile estrus. This is a consequence of the interaction of genetic basis (**Cotton, 2001; King, 2002**) and numerous paragenetic factors, the most relevant of which are: nutrition, season of the year, contact with sexually mature boar, housing conditions, stressors, exogenous hormone treatment and health status (**Cronin et al., 1983; Levis, 2000; Evans and O'Doherty, 2001; Gordon, 2005; Peltoniemi et al., 2005; Kovčín et al., 2006**).

If the first pubertal estrus is not achieved by 8 months of age, the gilts are frequently defined as having delayed puberty or prolonged pre-insemination anoestrus (**Dalin, 1987**). In the farm conditions, the manifestation of external signs of estrus is not detected in 30-40% of gilts older than 8 months, and it is most frequently the reason for their culling from further reproduction (**Dalin, 1987; Ehnvall et al. 1981; Tummaruk et al., 2000; Gagrčin et al., 2009; Stančić et al., 2010**). This results in significant decrease of production efficiency from both an economic and zootechnical aspect. However, certain researches indicate that silent heat (ovulation without external signs of estrus manifestation) occurs in only 4 to 5% of sexually mature gilts (**Andersson et al., 1982**). Furthermore, by post mortem gilts sexual organs examination, in which estrus was not detected even after reaching the 8 months of age, cyclic ovarian activity was determined in around 60% of examined animals (**Einarsson et al., 1974; Stančić et al., 2007; Stančić et al., 2008; Stančić et al., 2010; Stančić et al., 2011**), while no pathomorphological changes, that could result in anestrus, were determined in their reproductive organs (**Einarsson et al., 1974; Gagrčin et al., 1999; Stančić et al., 2007; Stančić et al., 2010; Stančić, 2010; Stančić et al., 2011**). The stated facts point out the possibility that absence of estrus detection in culled cyclic gilts is most likely result of inadequate estrus detection technology (performed at farm once in every 24 hours), than real physiological anestrus.

Accordingly, the aim of this paper is to present, on the basis of previous research results, the significance of stimulation of gilts by the full boar contact, for induction first pubertal estrus or successful estrus detection in sexually mature gilts.

PHYSIOLOGICAL MECHANISM OF BOAR EFFECT

The influence of boar contact on induction of gilts pubertal estrus was first described by **Signoret (1971)**. Later on, numerous studies have confirmed that exposure of prepubertal gilts to the full contact with a sexually mature boar, significantly decreases and synchronises their age at first pubertal estrus manifestation (**Hemsworth, 1987; Dyck, 1988; Stančić et al., 1996; Levis, 2000**). This phenomenon is known as “boar effect”.

The boar olfactory, visual, tactile and auditory stimuli is the primary factors for “boar effect” manifestation (**Kirkwood et al., 1981**). Olfactory stimulus originates from a boar saliva substance (pheromone), which is secreted by the salivary glands (**Booth, 1983**). Pheromone stimulates activation of neurohormonal mechanisms on the hypothalamus-hypophysis-ovary axis, which leads to pubertal ovulation. However, for complete and efficient activation of these mechanisms, in addition to olfactory stimuli, it is also necessary to include tactile, visual and auditory stimuli coming from the boar. Therefore, full (direct) contact between a boar and gilts gives the best effect of stimulating faster sexual maturation (**Booth, 1984**). These stimuli are considered to cause stress in gilts, which results in sudden secretion of the hormone cortisol from the adrenal gland cortex. Cortisol enhances the sensibility of hypothalamus on stimulatory action of pheromone, regarding secretion of Gn-RH from hypothalamus and LH from adenohypophysis (**Pearce and Hughes, 1987; Li, 1987**). This creates the basic conditions for activation of ovaries in terms of follicular growth, maturation and ovulation. It is of great importance for stimulation to use fully mature boar, with high sexual libido and abundant salivation. Only such boar can efficiently induce manifestation of the described phenomenon. Younger boars, of the same age as the gilts they stimulate, are not capable of causing such effect, probably since they still have not sufficiently developed or do not sufficiently exhibit their sexual behaviour characteristics (**Patterson and Lindsay, 1980; Cole et al., 1982**).

ESTRUS REACTION IN GILTS

Prepubertal gilts

Reaching sexual maturity (puberty) is defined by the moment when a gilt, for the first time, establishes cyclic ovarian activity and manifests external signs of estrus. Due to the fact that the age of gilts at the first pubertal estrus manifestation is rather variable, for practical

production it is important that as many gilts as possible manifest the first pubertal estrus at the approximately same age. Therefore, various biotechnological methods are applied for induction of synchronised pubertal estrus in gilts of the desired age. The most efficient of these methods is the stimulation by contact with a sexually mature boar (**Tummaruk et al., 2000; Van Wettere et al., 2006; Stančić et al., 2010; Stančić, 2010**).

The number (%) of sexually immature (prepubertal) gilts which will manifest the signs of the first pubertal estrus, as well as the interval from the beginning of the boar stimulation, depends on: (a) the age of gilts at the moment when the stimulation begins, (b) the boar age and the sexual libido intensity, (c) the type of contact with the boar and (d) duration and frequency of the daily stimulation of gilts by the boar contact (**Levis, 1997; Foxcroft, 2002; Patterson et al., 2002; Van Wettere et al., 2006**).

The age of gilts at the beginning of the boar stimulation, highly influences the duration of the interval from the beginning of stimulation to reaching sexual maturity (the first ovulation with manifestation of external estrus signs), as well as the number (%) of gilts which will exhibit estrus after stimulation. Namely, gilts younger than 140 days have fewer estrus reactions, while the interval from the beginning of stimulation to the exhibition of estrus is considerably longer, compared with older gilts. Thus, it proved that within 10 to 20 days after stimulation, there is estrus reaction in over 80% of gilts older than 170 to 180 days at the beginning of stimulation (**Stančić, 1988; Levis, 1997**). The results of our research show that within the first 10 days after the beginning of stimulation with the full boar contact, estrus manifestations was detected in 67%, 78% and 88% of gilts, which are 160, 180 or 200 days of age at the beginning of stimulation, respectively (**Stančić and Šahinović, 1991; Stančić and Krstić, 1996; Stančić et al., 2007**).

Boar age and intensity of sexual libido. Presence of a sufficient amount of pheromone in boar saliva, is one of the crucial factors for successful stimulation of first ovulation and estrus onset in prepubertal gilts. Pheromones are synthesised in submaxillary salivary glands, which are not sufficiently developed and functional in boars younger than 6 months. Such boars also do not have sufficiently developed other components of sexual libido, important for stimulating gilts cyclical ovarian activity and estrus behaviour manifestation. Accordingly, for successful stimulation of gilts it is necessary to use fully sexually mature boars, usually not younger than 11 to 12 months, which have abundant salivation and definite signs of sexual behaviour (libido) (**Levis, 1997**). Our research showed that stimulation of gilts by boars of the same age (160 to 240 days) gives much worse results regarding the level of exhibiting estrus reaction and duration of the interval from the beginning of stimulation to the onset of estrus,

compared with the results acquired by using fully sexually mature boars with definite sexual libido (Stančić and Šahinović, 1991; Stančić and Krstić, 1996).

A form of boar contact also has significant influence on the level of estrus reaction in gilts. Namely, stimulation of gilts can be performed by: (a) full (direct) contact of gilts and a boar, when all the stimuli (olfactory, tactile, visual and auditory) are included in the stimulation, (b) by fence-line contact, when tactile stimulus is excluded, and (c) by so-called indirect contact, when a boar is placed in another box, in which tactile and visual stimuli are excluded, while auditory and especially olfactory stimuli are considerably weakened. Thus, **Patterson et al. (2002)** demonstrated that the best boar effect is achieved if gilts are stimulated by being placed in the boar's box, making a direct contact with it. Somewhat weaker reaction is achieved if a boar is placed in the box with gilts, while the weakest reaction occurs if boars are constantly kept in a box with gilts. It is also important to point out that the level of direct interaction of gilts with a boar significantly declines by increasing the number of gilts in a group, i.e. by decreasing the box surface available per gilt. This, certainly, decrease the efficiency of stimulation, i.e. decrease the number of estrual gilts and increase the interval from the beginning of stimulation to the onset of estrus (Stančić and Šahinović, 1991; Levis, 1997; Stančić et al., 2006).

Duration and frequency of daily stimulation of gilts by boar contact, significantly influences the number of estrual gilts, as well the interval from the beginning of stimulation to the onset of estrus. It is thus possible to enhance estrual reaction of prepubertal gilts if they are exposed to the direct contact with a boar once a day for around 15 minutes, compared with gilts which are not stimulated by such contact. However, the maximal effect is achieved if stimulation is performed 2 or 3 times a day for around 20 minutes (Stančić and Šahinović, 1991; Levis, 1997; Foxcroft, 2002; Stančić et al., 2006).

Sexually mature gilts

According to research of numerous authors, between 30 to 60% of gilts selected for reproduction are culled from further reproduction, because manifestation of external estrus signs was not detected even after gilts reached the 8 month of age. However, according to results obtained by post mortem examination of their reproductive organs, it was demonstrated that these gilts have established cyclic ovarian activity, without pathomorphological changes, that could result in anestrus (Einarsson et al., 1974; Andersson et al., 1982; Stančić et al., 2007; Stančić et al., 2008; Stančić et al., 2010;

Stančić et al., 2011). Because, the absence of estrus detection in culled cyclic gilts is most likely result of inadequate estrus detection technology (performed at farm once in every 24 hours), than real physiological anoestrus. This conclusion is based on the following facts: (1) prepubertal (physiological) anoestrus due to non-cyclic ovarian activity, (2) there were no pathomorphological structures on the reproductive organs which could have anoestrus as a consequence, (3) silent estrus occurs in a very small number of sexually mature (cyclic) gilts (4 to 5%) and (4) examination of gilts for signs of estrus only once daily is reported to detect less than 50% of estrus (**Signoret, 1971; Anderson et al., 1982; Hemsworth et al., 1996; Stančić et al., 2008; Stančić et al., 2010; Stančić et al., 2011**).

It has been clearly demonstrated that a high proportion of estrus manifestation can be determined only if estrus detection is performed twice daily (every 12 hours), with full sexually mature boar contact. This conclusion is based on the following facts: (1) the first pubertal estrous cycles have, most frequently, irregular duration, while the external signs of estrus (especially the standing reflex) are less prominently exhibited (**Willemse and Boender, 1966**), (2) duration of the period of exhibiting the standing reflex is, on average, shorter in gilts (1 to 2 days) and longer in sows (1 to 3 days) (**Kemp and Soede, 1996; Stančić, 2006; Stančić et al., 2008**), (3) the average duration of gilts first pubertal estrus is averagely 34.5h, while in the third estrus it is 52.6h (**Almeida et al., 2000**), (4) silent estrus (ovulation without manifestation of external estrus signs) occurs in a very small number of pubertal gilts (**Andersson et al., 1982**), (5) during estrus period, standing reflex is not exhibited continually and with the same intensity, but there is a pause between two successive manifestations of standing reflex, lasting 30 to 45 minutes (**See, 2000; Thodberg et al., 2007**), (6) observation of only visible estrus signs by a man, estrus is detected in only around 50% of estrual gilts or sows (**Signoret, 1971**), while by application of direct contact with sexually mature boar, estrus is detected in 95 to 100% of estrual gilts or sows (**Hemsworth et al., 1986**), (7) gilts which reached sexual maturity earlier (at younger age), exhibit signs of estrus more intensively, while the duration of these signs is longer, compared with gilts which reached the puberty later (**Eliasson, 1991**), (8) the greatest number of gilts manifest estrus in early morning and late evening hours (**Clark et al., 1986**).

In one of our researches (**Stančić et al., 2008; Stančić, 2010**) it was demonstrated that, within the first 7 days after the beginning of estrus detection, performed twice daily (every 12 hours), with a full sexually mature boar contact, estrus was manifested in 40% of pubertal gilts (180 to 210 days old), while this value was 20% when estrus detection was performed once daily, without direct boar contact, as it is usually done on farms in our

country. With the same treatment, in gilts with prolonged preinsemination anestrus (older than 240 days), within the first 7 days after the beginning of stimulation with a boar, estrus was detected in 63% of gilts stimulated twice daily and in 40% of gilts stimulated once daily, with no direct boar contact.

CONCLUSION

Based on the presented results of domestic and foreign authors, about boar effect on the induction of estrus in prepubertal gilts and estrus detection efficiency in sexually mature (cyclic) gilts, it can be concluded:

1. Stimulation of prepubertal gilts with a full sexually mature boar contact, significantly decreases the age of gilts at the first pubertal estrus occurrence.
2. Interval from the beginning of gilts stimulation to the estrus occurrence is significantly shorter, compared with gilts which are not stimulated by boar contact.
3. The stimulation efficiency depends on the age of gilts at the beginning of stimulation, age and intensity of sexual libido of a boar, manner and frequency of stimulation.
4. The maximal proportion of estrual reaction in sexually mature (cyclic) gilts can be achieved by estrus detection, with a full sexually mature boar contact at least twice daily, every 12 hours.

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