

The influence of oxytocin added to diluted boar semen on the main reproduction parameters calculated for Duroc sows that were artificially inseminated

Ioana Pandur, Nicolae Păcală, Vasile Iezan

Banat's University of Agricultural Sciences and Veterinary Medicine, Timisoara, Romania.
Corresponding author: I. Pandur, tm81sgr@yahoo.com

Abstract. Oxytocin has been used to improve reproductive performances in swine, especially the farrowing rate and litter size. The objective of this study was to investigate whether the main reproduction parameters calculated for sows, improve when oxytocin (Oxytocin®) is added to the diluted semen. We aimed to test the efficiency of adding oxytocin in the diluted semen tubes upon the main reproduction parameters (fecundity rate, gestation rate, farrowing rate and litter size) for Duroc sows. Sows from one large production unit were artificially inseminated; semen was either enriched with oxytocin (group 1, n=318), either untreated (group 2, n=336). Fecundity rate, gestation rate, farrowing rate and litter size were recorded. After adding 0.4 mL Oxytocin to the diluted semen, right before artificial insemination of Duroc sows, the *fecundity rate* was 79.87 %, while the group inseminated with untreated semen had a fecundity rate of 74.40%, the difference being statistically uninsured. Regarding the *gestation rate*, for the experimental group, it was 74.84%, while the control group had 68.15%, this difference being also statistically uninsured ($p>0.05$). The *farrowing rate* calculated for the experimental group was 72.33%, while for the control group it was 65.77%, this difference being also statistically uninsured ($p>0.05$). *Litter size* was 11.75 piglets/sow for the experimental group, with 1.11 piglets/sow higher than for the control group (10.64 piglets/sow), this difference being very significant ($p<0.001$).

Key Words: sows, oxytocin, reproduction parameters, semen, Duroc.

Introduction. Oxytocin is released from the brain of the sow at the time of mating in response to boar stimulation. It is assumed that it enhances sperm transport to the oviduct (Levis 2000). Several investigators have showed that injecting oxytocin into semen before artificial insemination improves the farrowing rate and litter size, especially when low sperm concentration is used (Gibson et al 2004).

With artificial insemination, the reduction in the sperm cell reservoir may result from poor timing of semen deposition relative to time of ovulation or inadequate stimulation of the sow during and after insemination resulting in reduced myometrial contractions and a poorer sperm cell transport to the oviduct (Langendijk et al 2003).

Also, excess semen reflux (backflow) during insemination may reduce fertility, presumably by reducing the potential size of the sperm cell reservoir (Steverink et al 1998).

The boar ejaculate contains high levels of estrogens and improvements in sow fertility have been noted following insemination of semen doses containing supplemental estrogen (Kirkwood et al 1991). The estrogen stimulates myometrial contractions via an estrogen-induced local release of prostaglandin $F_{2\alpha}$ (PGF) (Willenburg et al 2004). Additionally, the presence of a boar during estrus stimulated the endogenous release of oxytocin and enhanced uterine contractions (Claus et al 1989).

Increase of oxytocin concentrations in peripheral blood plasma occurs in immediate response to boar presence and lasts for approximately 10 minutes (Langendijk 2001).

This effect can only be partially mimicked by a robot teaser boar which emits olfactory, acoustic and visual boar cues (Gerritsen 2005).

The scope of this experiment was to test the efficiency of adding oxytocin in the diluted semen tubes upon the main reproduction parameters (fecundity rate, gestation rate, farrowing rate and litter size) for Duroc sows.

Materials and Methods. The researches were carried out on 654 primiparous and multiparous Duroc sows raised in intensive system with controlled microclimate. The aim of this study was to investigate whether the main reproduction parameters calculated for sows improves when oxytocin (Oxytocin®; 10 IU/mL) was added to the diluted semen. The scope of this experiment was to test the efficiency of adding oxytocin in the diluted semen tubes over the main reproduction parameters (fecundity rate, gestation rate, farrowing rate and litter size) for Duroc sows.

Waiting for breeding sows accommodation was made with a capacity of 10 to 12 sows/pen. Sows in pig accommodation were made in common pens, with a capacity of 8 to 16 heads/pen.

Heat detection was done daily, using the back pressure test response during the boar exposure. Estrous sows have been mated during the morning period of the day when the heat check was made and repeated the next day, also in the morning.

Artificial insemination was made using 80 mL semen tubes, with 2.5 billion sperm cells/mL, processed 1 to 3 days before; the extender used was M III (long term extender, Minitube). The insemination technique was cervical insemination, using a foam type catheter.

Right before the artificial insemination, 0.4 mL of Oxytocin product (Pasteur, Filipești) were added to the diluted semen. 1 mL of solution contains 10 IU and excipients: sodium chloride, clorobutanol, glacial acetic acid and distilled water.

Synthetic oxytocin, compared to the natural oxytocin, doesn't contain vasopressin, but has the same effect over the uterus smooth muscle. This decreases the frequency of contractions myometrium, but their amplitude increases.

After 18 days from breeding, heat detection was made in order to detect the sows not in pig, by the back pressure test response during the boar exposure. At 28 days after artificial insemination the first gestation check was performed, thru ultrasound. The second ultrasound check was performed at 56 days after breeding; the ultrasound equipment used was Echoscanner T 100.

During the gestation period, sows and gilts which aborted or have been culled were removed from the herd. At 112 gestation days, the sows were moved to the farrowing barns.

The results obtained after determining the main reproduction parameters were keyed and statically analyzed. Analysis of variance has been used as data processing method. The significance of difference between the variance was determined by χ^2 test. Statistical processing was performed using the computer software SPSS for Windows.

Results and Discussion. The goal of this study was to determine the main reproductive parameters of artificially inseminated sows, after 0.4 mL of Oxytocin have been added to the diluted semen right before artificial insemination. Table 1 presents the main reproduction parameters (fecundity rate, gestation rate, farrowing rate and litter size) calculated for the Duroc sows, separated in two groups; the experimental group was inseminated with diluted semen enriched with 0.4 mL of oxytocin right before artificial insemination, while the control group was inseminated with untreated diluted semen.

Data presented in Table 1 reveals that, by adding 0.4 mL of Oxytocin in the diluted semen tubes, right before the artificial insemination of Duroc sows, the *fecundity rate* reached 79.87%, while the sows from the control group, inseminated with untreated semen, showed only 74.40%, the difference being statistical uninsured ($p>0.05$).

Table 1

The main reproduction parameters calculated for artificially inseminated Duroc sows

Specification	Sows artificially inseminated (n)	Sows in pig at 28 days		Sows in pig at 56 days		Farrowing rate		Litter size (n)
		n	% fecundity	n	% gestation	n	%	
Control group	336	250	74.40 ^a	229	68.15 ^a	221	65.77 ^a	10.64 ^a
Experimental group	318	254	79.87 ^a	238	74.84 ^a	230	72.33 ^a	11.75 ^d

χ^2 test: a – a: $p > 0.05$; a – b: $p < 0.05$; a – c: $p < 0.01$; a – d $p < 0.001$

For the experimental group the *gestation rate* was 74.84%, while for the control group it was 68.15%, this difference being also statistically uninsured ($p > 0.05$). The *farrowing rate* calculated for the experimental group was 72.33%, while for the control group it was 65.77%, this difference being also statistically uninsured ($p > 0.05$).

Litter size was 11.75 piglets/sow for the experimental group, with 1.11 piglets/sow higher than for the control group (10.64 piglets/sow), this difference being very significant ($p < 0.001$).

Figures 1 and 2 highlight the differences regarding the main reproduction parameters calculated for the control and the experimental group formed by Duroc sows.

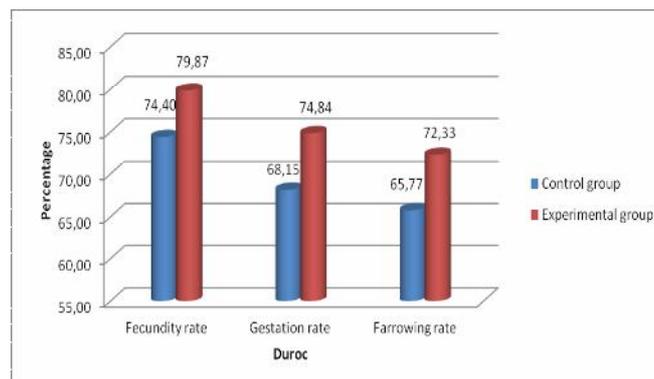


Figure 1. Graphic representation of the main reproduction parameters calculated for the artificially inseminated Duroc sows.

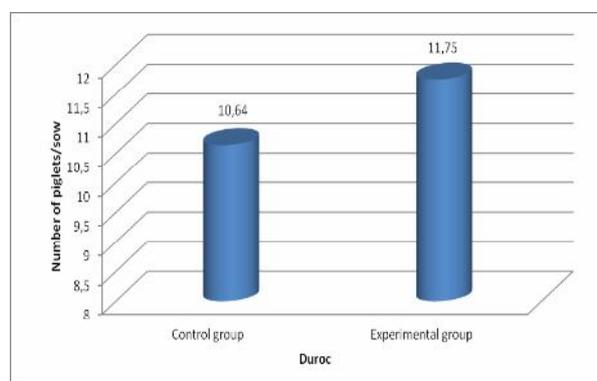


Figure 2. Graphic representation of the litter size for the artificially inseminated Duroc sows.

Conclusions. Most of the experiments performed by researchers conducted to the idea that sows fertility is improved when oxytocin is added to the diluted semen, right before

breeding, but the results obtained had varying degrees of success. Their variety comes from an unknown cause, but it is assumed that it derives from the management of the reproduction activity (Flowers & Esbenshade 1993). It can be also assumed that another cause of the results variance between field trials is semen backflow, which appears to the majority of the sows, which seems to intensify when oxytocin is present in uterus and to limit the amount of active hormone stimulation (Langendijk et al 2002).

Field trials in which oxytocin or prostaglandins are injected in sows during insemination or used in the insemination dose seem to indicate that these treatments may improve reproductive results in sub optimal conditions (Levis 2000), for example when inseminations are performed by inexperienced inseminators (Flowers 1995), when using old semen (Flowers 2002) or during summer infertility (Peña et al 1998).

Levis (2000) states that adding 4 IU (0.4 mL) or 5 IU (0.5 mL) of oxytocin to the diluted semen at ten minutes before insemination, the farrowing rate and litter size can be significantly improved, especially for multiparous sows. In this sense, he has studied the influence of 0.4 mL oxytocin added to the diluted semen, that showed a significant difference between the control group and the experimental group regarding farrowing rate, litter size and fecundity rate.

Our research showed that after adding 0.4 mL Oxytocin to diluted semen right before artificial insemination of Duroc sows, *fecundity rate* was 79.87%, while the group inseminated with untreated semen had a fecundity rate of 74.40%, the difference being statistically insignificant. Regarding the *gestation rate*, for the experimental group it was 74.84%, while for the control group it was 68.15%, this difference being also statistically insignificant ($p>0.05$). The *farrowing rate* calculated for the experimental group was 72.33%, while for the control group it was 65.77%, this difference being also statistically insignificant ($p>0.05$). The *litter size* was 11.75 piglets/sow for the experimental group, with 1.11 piglets/sow higher than for the control group (10.64 piglets/sow), this difference being very significant ($p<0.001$).

References

- Claus R., Moshammer T., Aumuller R., Weiler U., 1989 Replenishment of AI-doses with oestrogens in physiological amounts: effect on sow prolificacy in a field trial. Zentralbl Veterinarmed A. 36: 797-800.
- Flowers W. L., 1995 Characterization of the implementation and use of artificial insemination (A.I.) in N.C. swine industry. J Anim Sci 73(Suppl.1): 6.
- Flowers W. L., 2002 Increasing fertilization rate of boars: Influence of number and quality of spermatozoa inseminated. J Anim Sci Suppl. 80: 47-53.
- Flowers W. L., Esbenshade K. L., 1993 Optimizing management of natural and artificial mating in swine. Department of Animal Science. North Carolina State University, Raleigh. USA.
- Gerritsen R., Langendijk P., Soede N. M., Kemp B., 2005 Effects of (artificial) boar stimuli on uterine activity in estrous sows. Theriogenology 64(7): 1518-152.
- Gibson S., Tempelman R. J., Kirkwood R. N., 2004 Effect of oxytocin-supplemented semen on fertility of sows bred by intrauterine insemination. J Swine Health Prod 12: 182-185.
- Kirkwood R. N., Thacker P. A., 1991 The influence of adding estradiol to semen on reproductive performance of sows. Can J Anim Sci 71: 589-591.
- Langendijk P., 2001 PhD-thesis. Wageningen University. Holland.
- Langendijk P., Bouwman E. G., Kidson A., Kirkwood R. N., Soede N. M., Kemp B., 2002 Functions of myometrial activity in sperm transport through the genital tract and fertilization in sows. Reproduction 123: 683-690.
- Langendijk P., Bouwman E. G., Schams D., Soede N. M., Kemp B., 2003 Effects of different sexual stimuli on oxytocin release, uterine activity and receptive behavior in estrous sows. Theriogenology 59: 849-861.
- Levis D. G., 2000 The Effect of Oxytocin at the Time of Insemination on Reproductive Performance. A Review. Nebraska Swine Reports.

- Peña F. J., Dominguez J. C., Carbajo M., Anel L., Alegre B., 1998 Treatment of swine summer infertility syndrome by means of oxytocin under fields conditions. *Theriogenology* 49: 829-836.
- Steverink D. W. B., Soede N. M., Bouwman E. G., Kemp B., 1998 Semen backflow after insemination and its effect on fertilisation in sows. *Anim. Reprod. Sci.* 54: 109-119.
- Willenburg K. L., Knox R. V., Kirkwood R. N., 2004 Effect of estrogen formulation and its site of deposition on serum PGFM concentrations, uterine contractility, and time of ovulation in AI weaned sows. *Anim Reprod Sci* 80: 147-156.

Received: 20 June 2012. Accepted: 28 June 2012. Published online: 30 June 2012.

Authors:

Ioana Pandur, Banat's University of Agricultural Sciences and Veterinary Medicine, 300645 Timisoara, Calea Aradului 119, Romania, European Union, tm81sgr@yahoo.com

Nicolae Păcală, Banat's University of Agricultural Sciences and Veterinary Medicine, 300645 Timisoara, Calea Aradului 119, Romania, European Union.

Vasile Iezan, Banat's University of Agricultural Sciences and Veterinary Medicine, 300645 Timisoara, Calea Aradului 119, Romania, European Union.

This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

How to cite this article:

Pandur I., Păcală N., Iezan V., 2012. The influence of oxytocin added to diluted boar semen on the main reproduction parameters calculated for Duroc sows that were artificially inseminated. *Porc Res* 2(1): 11-15.