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SOWS FERTILITY AFTER INTRACERVICAL OR POSTCERVICAL INSEMINATION WITH REDUCED SPERMATOZOA NUMBER IN AI DOSE*

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SUMMARY: The aim of this study was to determine whether the application of intrauterine (postcervical) AI, with twice reduced volume (50 ml) and the number of sperm (2x10 ^{9}) doses can increase the sows fertility, compared to the classical intracervical insemination (dose volume 100 ml with 4x10^{9} spermatozoa). After classical intracervical insemination, farrowing rate was significantly lower (67.5%) only after classical intracervical AI, with reduced spermatozoa number per AI dose (P<0.01). *Using new intrauterine (postcervikalne) AI technology, the farrowing rate were not significantly different (P> 0.05), depending on the number of spermatozoa number in AI dose (83.3% and 79.2%). The results show that the use of intrauterine insemination, with doses twice reduced in volume and sperm count, can significantly increase the reproductive efficiency of the AI boars.*

Key words: *Intracervical, postcervical, AI, fertility, sow.*

INTRODUCTION

In the classical technology of artificial insemination, used diluted liquid semen doses, volume 100 ml, with 3 to 5x10^{9} progressively motile sperm (Almin et al., 2006; Stančić et al., 2009). From a single ejaculate, it can be obtained on average 21 insemination doses, or about 2100 doses per boar per year (Singleton, 2001). Insemination dose is usually preserved 1 to 2 days at 17°C, before using for insemination (Johnson et al., 2000). However, in the intesive pig production these number of AI doses is not enough for effective reproductive exploitation of genetically superior boars. The formation of double insemination doses number per ejaculate, with reduced dose volume (50 ml) and sperm number (2x10^{9}), could be the solution of this problem. On this way, a sufficient number of insemination doses per one ejaculate, can be obtained from one boar. Such reduced dose is possible to

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use with intrauterine insemination technology, while the achieved level of sows fertility is similar to that obtained using classical intracervical insemination (doses of 100 ml volume, with $4x10^9$ spermatozoa) (Vansickle, 2002; Roseboom et al., 2004; Mesalira et al., 2005, Serret et al., 2005; Stančić et al., 2006; Stančić et al., 2007; Stančić et al., 2008; Stančić et al., 2010).

The aim of this study was to determine whether intrauterine insemination with doses of twice reduced volume and sperm count, increase the sows fertility compared with classical intracervical insemination.

MATERIALS AND METHODS

Classical, intracervical insemination and intrauterine (postcervical) insemination was performed with dose volume of 50 ml, contained $4x10^9$ or $2x10^9$ progressively motile sperm. Insemination was performed during the one year. The total of 480 sows, second to the fifth farrowing parity, (60 per each group) was inseminated by each insemination procedure and dose sperm number (60x4x2 = 480). Insemination where performed in the estrus detected at day 5 after weaning. Lactation lasted 28 days. The first insemination was carried out 12h, and second 36h after standing estrus detection. For conventional insemination were used sterile disposable catheters (Foamtip safe blue®), and for intrauterine insemination were used sterile disposable catheters Foamtip "Verona"® (Minitübe, Germany). Semen were diluted with BTS1, for short-term storage of liquid diluted boar semen (Minitübe, Germany). Value for farrowing rate and litter size were recorded. For the statistical analysis, "Statistica 9" software were used.

RESULTS

Using classical (intracervical) insemination, by both $4x10^9$ or $2x10^9$ progressively motile sperm per AI dose, achieved farrowing rate was significant ($P<0.01$) different (81.7% and 67.5%). However, farrowing rate was not significant ($P>0.05$) different (83.3% and 79.2%) after intrauterine insemination with $4x10^9$ or $2x10^9$ progressively motile sperm per AI dose (Table 1).

Table 1. Effect of insemination method and sperm number i dose on farrowing rate

Method of insemination	Spermatozoa number per AI dose	
	$4x10^9$	$2x10^9$
Classic intracervical	$81.7\%^{AX}$ (98/120)	$67.5\%^{BX}$ (81/120)
New Intrauterine	$83.3\%^{AX}$ (100/120)	$79.2\%^{AY}$ (95/120)

Different capital letters ($P<0.01$); ^{AB} Within the rows;
^{XY} Within the columns. In parenthesis: (No. farrowed/No. inseminated).

The average number of live born piglets per litter, after classical intracervical insemination, was not significant different ($P>0.05$) after AI with $4x10^9$ (10.08) or with $2x10^9$ spermatozoa per dose (10.14).

After intrauterine insemination, the average number of live born piglets did not differ depending on the dose sperm number (10.48 and 10.58), but these values were significantly (P <0.01) higher than those obtained after intracervical insemination (Table 2).

Table 2. Average litter size at farrowing

Method of insemination	Litter size (n)	Spermatozoa number per AI dose	
		$4x10^9$	$2x10^9$
Classic intracervical	Live	$10,08^{Ax}$	10.14^{Ax}
	Dead	0.46	0.54
	Total	10.54	11.68
New Intrauterine	Live	10.48^{Ay}	10.58^{Ay}
	Dead	0.46	0.48
	Total *o*	10.94	11.06

Different capital letters (P<0.01); The smal letters (P<0.05).
^{AB} Within the rows; ^{xy} Within the columns.

DISCUSSION

Our results clearly show that the intrauterine insemination, with double reduced dose volume (50 ml) and sperm number ($2x10^9$), result with statistically significant (P<0.01) higher farrowing rate (79.2%), compared to the intracevical insemination (67.5%). The average number of live born piglets per litter was significantly (P<0.01) higher after intrauterine insemination with reduced dose sperm number (10.48 and 10.58), compared to the intracervical insemination (10.08 and 10.14) by insemination with $4x10^9$ or $2x10^9$ spermatozoa in AI dose.

Using intrauterine (postcervikalne) insemination with different doses of volume (100, 85, 50, 30 and 20ml) and different sperm numbers (4, 3, 1.5 and $1x10^9$), result with 78 and 96% farrowing rate and 9 to 12 live born piglets per litter (Vansickle, 2002; Roseboom et al., 2004; Mesalira et al., 2005, Serret et al., 2005; Stančić et al., 2006; Stančić et al., 2007; Stančić et al., 2008; Stančić et al., 2010). By the sperm deposition in the cranial parts of the female reproductive tract (the body of the uterus, uterine horns, uterotubal junction or fallopian tubes), the volume of insemination dose and sperm number per dose can be radically reduced, with the same or higher fertility of inseminated sows, compared with the classical intracervical insemination (Mezalira et al., 2005; Stančić et al., 2007). Numerous studies show that the optimal value of the sows fertility has been achieved when insemination is performed approximately 24 hours before ovulation, with doses contained $2x10^9$ spermatozoa. Increasing the sperm number per dose does not affect sows fertility, while reducing the number of sperm under the $2x10^9$ leads to a decrease in sows fertility parameters (Knox, 2004; Stančić et al., 2007; Stančić et al., 2010).

The formation of twice more doses number from the same ejaculate, requires twice reduction of the sperm number of in a dose, and twice level of ejaculate dilution proportion. However, using a twice smaller dose volume (50 ml) and sperm cells number ($2x10^9$), it is not necessary to double the degree of ejaculate dilution. Adding large amounts of artificial extender in native semen, leads to a reduction in sperm progressive motility and agglutination (Harrison et al., 1978). This is due to reduction in amount of native protein and natural antioxidants, and other natural ingredients of seminal plasma, which are essential for the normal function integrity

and of sperm cell membrane (Kommisurd et al., 2002; Boe-Hansen et al., 2005). In addition, the sperm plasma has a significant impact on the process of sperm transport in the female reproductive tract (Rath et al., 1989) and is a significant factor in the regulation time of ovulation (Weitz et al., 1990b). On the other hand, it was found that the semen of a large number of boar does not tolerate the increasing degree of dilution. Namely, the results of numerous studies indicate that semen in only 20 to 30% of boars retained ≥ 65% progressive motility during 72h of storage, on +17°C, in dilution rate 1:4 (Weitz, 1990; Stančić et al. 2003).

Practical contribution to the results of our research consists in the fact that twice a smaller dose volume and sperm count can be used in the application of postcervikalne (intrauterine) insemination technology, without significant decrease in sows ferility. Thus it is possible to significant increase the reproductive exploitation of genetically superior boars in the modern pig production.

CONCLUSION

Based on these results, it can be concluded:

1. Farrowing rate was significantly lower using classical (intracervical), compared with intrauterine (postcervical) insemination of sows.
2. Using postcervical insemination AI doses with twice rerduced volume and sperm count, it is possible to
   significant increase the boars reproductive exploitation.

REFERENCES

ALMIN, K., PELTONIEMI, O.A.T., KOSKINEN, E., ANDERSSON, M.: Porcine Field Fertility with Two Different Insemination Doses and the Effect of Sperm Morphology. Reprod. Dom. Anim., 41(3)210-213, 2006.

BOE-HANSEN, B., G. - ERSBØLL, K.A. - GREVE, T. - CHRISTENSEN, P.: Increasing storage time of extended boar semen reduces sperm DNA integrity. Theriogenology, 63:2006-2019, 2005.

JOHNSON, L.A., WEITZE, K.F., FISER, P., MAXWELL, W.M.C.: Storage of boar semen. Anim. Reprod. Sci., 62:143-172, 2000.

KNOX, V.R.: Practicalities and pitfalls of semen evaluation. Advences in Pork Production, 15:315-322, 2004.

KOMMISRUD, E. - PAULENZ, H. - SEHESTED, E. - GREVLE, S.I.: Influence of boar and semen parameters on motility and acrosome integrity in liquid boar semen stored for five days. Acta Veterinaria Scandinavica, 43:49-55, 2002.

MEZALIRA, A., DALLANORA, D., BERNARDI, L.M., WENTZ, I., BORTOLOZZO, F.P.: Influence of Sperm Cell Dose and Post-insemination Backflow on Reproductive Performance of Intrauterine Inseminated Sows. Reprod. Dom. Anim., 40:1-5, 2005.

ROSEBOOM, J.K., REICKS, L.D., WILSON, E.M.: The reproductive performance and factors affecting on-farm application of low-dose intrauterine deposition of semen in sows. J. Anim. Sci., 82:2164-2168, 2004.

SERRET, C.G., ALVARENGA, M.V.F., CÓRIA, A.L.P., DIAS, C.P., CORCINI, C.D., CORRÊA, M.N., DESCHAMPS, J.C., BIANCHI, I., LUCIA, T. jr.: Intrauterine artificial insemination of swine with different sperm concentrations, parities, and methods for prediction of ovulation. Anim. Reprod., 2(4)250-256, 2005.

SINGELTON, W.L.: State of the art in artificial insemination in the Uniteted States. Theriogenelogy, 56:1305-1310 , 2001.

STANČIĆ, B., BOŽIĆ, A., RADOVIĆ, I., GRAFENAU, P., SEN., PIVKO, J., HRENEK, P., STANČIĆ, I.: Veštačko osemenjavanje svinja dozama sa smanjenim brojem spermatozoida (pregled). Savremena poljoprivreda, 56(1-2)1-11, 2007.
STANČIĆ, B., GAGRČIN, M., RADOVIĆ, I., STANČIĆ, I.: Sows fertility after transcervical intrauterine insemination (the summarize of ours results). International Symposium Anim. Prod., May, 29 – 30, Temisoara (Romania). Lucrari stiintifice Zootehnie si Biotehnologii, 41(2)624-628, 2008.
STANČIĆ, B., GAGRČIN, M., RADOVIĆ, I.: Effect of season, breed and age of boar on sperm quolity. 2. Extended sperm. Biotechnology in Animal Husbandry, 19(3-4)25-29, 2003.
STANČIĆ, B., RADOVIĆ, I., BOŽIĆ, A., GAGRČIN, M., ANDERSON, R.: Sow fertility after conventional AI with insemination doses of various volumes and spermatozoa number. Contemporary Agriculture, 58(1-2)62-66, 2009.
STANČIĆ, B., RADOVIĆ, I., STANČIĆ, I., DRAGIN, S., BOŽIĆ, A., GVOZDIĆ, D.: Fertility of sows after intracervical or intrauterine insemination with different spermatozoa number in reduced volumen doses. Acta veterinaria (Beograd), 60(2-3)257-262, 2010.
STANČIĆ, B., RADOVIĆ, I., STANČIĆ, I., GAGRČIN, M., BOŽIĆ, A., KRAGIĆ, S., GRAFENAU, P. JR., CHRENEK, P., PIVKO, J.: Fertilitet krmača posle intracervikalne i intrauterine inseminacije dozama redukovanog volumena. Biotechnology in Animal Husbandry, 22(special issue)273-281, 2006.
VANSICKLE, J.: New Insemination Tool Still Unproven. National Hog Farmer, 7:1-3, 2002.
WEITZE, F.K.: The use of long-term extender in pig AI: A view of the international situation. Pig News and Information, 11:23-26, 1990.

FERTILITET KRMAČA POSLE INTRACERVIKALNOG ILI POSTCERVIKALNOG VO U TOPLOJ I HLADNOJ SEZONI GODINE

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Izvod

Smanjen fertilitet nerastova i krmača, tokom toplijeg perioda godine, značajno smanjuje reproduktivnu efikasnost u intenzivnoj proizvodnji svinja. Cilj rada je bio da se ustanovi da li je primenom nove tehnologije intrauterine (postcervikalne) inseminacije, dozama duplo redukovanog volumena (50ml) i broja spermatozoida ($2x10^9$), u odnosu na klasičnu intracervikalnu inseminacije ($4x10^9$), moguće postići sličan fertilitet krmača. Posle klasične intracerviklalne inseminacije, dozama sa redukovanim brojem spermatozoida ($2x10^9$), vrednost prašenja je bila znatno niža (67,6%), u odnosu na intrauteriono osemenjavanje, kako primenom doza sa $4x10^9$ spermatozoida (83.3%), tako i primenom doza sa $2x10^9$ spermatozoida (79.2%). Primenom nove tehnologije intrauterine (postcervikalne) inseminacije, postignute vrednosti prašenja nisu bile statistički značajno različite, u zavisnosti od broja spermatozoida u dozi . Dobijeni rezultati pokazuju da je primenom intrauterine inseminacije, dozama duplo redukovanog volumena i broja spermatozoida, moguće značajno povećati stepen reproduktivnog iskorištavanja nerastova, bez smanjenja fertiliteta osemenjenih krmača.

Ključne reči: Intracervikalno, postcervikalno, VO, fertilitet, krmača.

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