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SOWS FERTILITY AFTER OXYTOCIN ADDITION IN SEMEN DOSE OR VULVAR INJECTION TO STIMULATE MYOMETRIAL ACTIVITY AROUND INSEMINATION

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SUMMARY: These study compares farrowing rate and litter size in sows after oxytocin addition in sperm or after vulvar injection immediately before AI. Within firs 7 days after weaning, the total of 150 sows were AI: (a) with sperm doses additioned by 10 IU oxytocine immediately before AI (n=50), (b) after 5 IU vulvar injection prior to AI (n=50), or (c) not treated, control, (n=50). Farrowing rate were significant higher (P<0.05) after vulvar oxytocin injection (88%) or oxytocin addition in AI dose (92%), compared with control sows (78%). These value were not significant differ (P>0.05) after vulvar oxytocin injection or oxytocin addition in AI dose. Treatment with oxytocin has no significant effect on litter size. These results indicate that oxytocin treatment can be useful method to improve sows fertility.

Key words: *oxytocin, addition, sperm, injection, fertility, sow.*

INTRODUCTION

Artificial insemination (AI) is the method used in intensive pig production all ower the world, to improve genetic development faster than natural mating. AI techniques can also lower the risk of spreading reproductive deseases, reduce the number of boars on the farm as well as reducing the number of workers needed during mating. However, in farm practice, the reproductive performance of artificial inseminated sows is often lower than that achievable with natural breeding (Stančić, 2000). It has been shown that semen quality, insemination techniques, optimal AI-timing relative to moment of ovulation as well as inadequate stimalation of sow during and immediately after insemination is the key factors that influence the sows fertility rate (Spronk et al., 1997). An adequate myometrial stimulation is most important in the intrauterine inseminatin technology with reduced volume and spermatozoa number doses (Roseboom et al., 2004; Stančić et al., 2010).

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A sufficient number of spermatozoa in the oviductal sperm cell reservoir ie. caudal istmus in the 24-hour period preceding ovulation (Hunter, 1981), is the ultimate factor for successful fertilization (Soede et al., 1995). Any factors that reduces this reservoir may compromise fertility. In the AI, such a reduction in the sperm cell reservoir may result from poor timing of semen deposition relative to time of ovulation (Kemp and Soede, 1996; Stančić and Šahinović, 2001), inadequate stimulation of the sow during and after insemination resulting in reduced myometrial contractions (Langendijk et al., 2002) and a poorer sperm cell transport to the oviduct (Langendijk et al., 2003; Stančić et al., 2006) as wel as by excess semen reflux (backflow) during insemination (Steverink et al., 1998). Inadequate sperm transport within the uterus and consequently reduction the optimal number of sperm population in the caudal istmus result in decreasing the sows fertility. To overcome this problem, several investigators have studied whether farrowing rate and litter size are enhanced by adding: (1) oxytocin to a dose of semen just before insemination, or (2) by injecting oxytocin into the muscle or vulva immediately prior to AI (Peña et al., 1998; Levis, 2000; Gibson et al., 2004; Peláez, et al., 2006).

The aim of the present study was to investigate the effects of oxytocin addition in to the semen dose or injection in to the vulva immediately prior to an intracervical insemination, on the sows farrowing rate and litter size under field conditions in Serbia.

MATERIALS AND METHODS

The study was conducted during September to November 2011, in an intensive piggery housing about 1,200 sows. Lactation length of herd was average 28 days. Average sows farrowing rate at the farm in 2010. were 76%, and average liveborn piglets per litter were 10.68. Estrus detection of weaned sows involved full boar contact once daily starting on day 2 after weaning. At detection of the first or repeat estrus, sows were inseminated with 4 × 109 sperm cells in 100 mL dose (BTS-extender, Minitübe). Insemination was repeated 24 hours later if sows still exhibited estrous behavior, using disposable Safe Blue® AI catheters, lubricated and single wraped in protective sheaths, sterilized (Minitübe, Germany). Third estrus inseminations were not allowed. Age of semen at insemination was 4-6 hours to 1 day.

At the time of AI (4-5 days after weaning), experimental sows (2 to 5 parity) were assigned to three groups: (1) AI doses supplemented with 10 $IUmL^{-1}$ oxyticin (10 IU/mL wather solution, Oxytokel, Kelan N.V. - Belgium), immediately before insemination (n=50), (2) sows injected with 5 $IUmL^{-1}$ oxytocin in the mucosa of the vulvar lips just prior insemination (n=50) or (3) insemination without semen supplementation or injection with oxytocin, control group (n=50). Data recorded were farrowing rate after first postlactational insemination and subsequent litter size (liveborn, stillborn and total born piglets).

Obtained date were analyzed by using software package Statistica 10 (StataSoft 2012). Data for litter size were testing by General linear model (GLM) and by LSD test. Farrowing rate was analyzed by test of proportion.

RESULTS AND DISCUSSION

Our results demonstrated that farrowing rate were significant higher (P<0.05) after vulvar oxytocin injection (88%) or oxytocin addition in AI dose (92%), compared with control sows (78%). These value were not significant differ (P>0.05) after vulvar oxytocin injection or oxytocin addition in AI dose. Treatment with oxytocin has no significant effect on litter size, compared with untreated sows (Table 1).

Table 1. Farrowing rate and litter size in treated and control sows

		Treatment groups		
		Oxytocin addition		Control
		5 IU injection in vulva	10 IU in semen dose	
No. of AI sows		50	50	50
Farrowing rate (%)		88[a] (44/50)	92[a] (46/50)	78[b] (39/50)
Av. litter size (n)	Liveborn	11.52[a] ±2.889	11.41[a] ±2.374	11.79[a] ±2.755
	Stillborn	0.84[a] ±1.140	0.93[a] ±1.296	0.77[a] ±0.777
	Total	12.36[a]±2.804	12.34[a]±2.699	12.56[a]±2.780

[a,b]Within a row, means without common superscripts differ (P<0.05).

Values in parenthesis: No. farrowed/No. inseminated.

Addition of 5 to 10 $IUmL^{-1}$ oxytocin has no effect boars sperm motility or morphology in the semen samples *in vitro* stored at + 18°C for 56 h (Çiftçi, 2005). Farrowing rate were higher (*P* = .02) if oxytocin was included in the semen for weaned sows bred only once (84.9%) than for repeat sows (63.7%), but litter size was not affected (Gibson et al., 2004). Authors conclude that inclusion of oxytocin in extended semen may benefit sow fertility when breeding management may otherwise result in a smaller sperm cell reservoir in the oviduct.

The farrowing rate was 5.7 percent greater for sows inseminated with oxytocin-treated semen (83%) compared to sows injected with oxytocin (77.3%) immediately before insemination. The litter size was 11.50 pigs for sows inseminated with oxytocin-treated semen and 10.97 pigs for sows injected with oxytocin at the time of insemination (Peña et al., 1998). Hormone (estrogens, oxytocin or prostaglandin F2α) addition to semen increased numbers of fetuses 25 to 30 days after AI (estrogen-7.2; oxytocin-8.4; PG F2α-8.7 and control-5.8). Therefore, in situations of lowered fertility, hormone addition could be a strategy to limit infertility in swine (Willenburg et al., 2003). According to results obtained by other authors, the conclusions from review paper of Levis (2000) are: (1) Adding 4 to 5 IU's of oxytocin to a dose of semen improves farrowing rate and litter size, (2) Use of oxytocin treated semen is more effective in multiparous sows than gilts, (3) During the summer months, oxytocin-treated semen significantly increased farrowing rate and litter size and (4) In most studies, the use of oxytocin at the time of insemination was profitable.

Inseminations performed too early or too late relative to ovulation decrease litter size and especially farrowing rate. This effect can be explained to a large extent by the increase in the percentage of non-fertilized eggs, resulting in partial fertilization or no fertilization at all. In general, insemination between 0 and 24 h before ovulation gives

good fertilization results (Kemp and Soede, 1997). Bath, becouse negative correlations between weaning-to-estrus interval (WEI) and duration of estrus and moment of ovulation after onset of estrus, the sows with short WEI must be inseminated earlier after estrus detection then sows with longer WEI to achieve the optimal farrowing rate and litter size (Vesseur et al., 1994; Weitze et al., 1994; Kemp and Soede, 1996; Stančić and Šahinović, 2001; Timotijević-Koprivica et al., 2001; Stančić and Gagrčin, 2002).

The establishment the optimal number of spermatozoa in the utero-tubal junction, caudal istmus and the site of fertilization (ampulo-istmic junction of the oviduct) is the key factor for successful ovulated ova fertilization (Hunter, 1981). Sperm cells have to be transported from the site of deposition (cervix) to the utero-tubal junction within 15 minutes to 2 hours after deposition in the cervix. These rapid transuterine transport spermatozoa to the utero-tubal junction and oviduct is extremely important for prevent spermatozoa to being phagocytized (killed) by leukocytes (Levis, 2000). This passive transport is mainly driven by uterine contractions (Scott, 2000) influenced by dramatically oxytocin concentration increases in the blood of sows, within 2 minutes of the onset of ejaculation by a mature boar (Levis, 2000). Additionally, the presence of a boar during estrus stimulated the estrus expression (Kemp et al., 2005) and endogenous release of oxytocin and enhanced uterine contractions (Langendijk et al., 2003). Further more, the boar ejaculate contains high levels of estrogens (Claus, 1990), which stimulates myometrial contractions (Willenburg et al., 2004) via an estrogen-induced local release of prostaglandin $F_{2\alpha}$ (Claus, 1990; Willenburg et al., 2004). The synchronization of viable spermatozoa presence in oviduct and the time of ovulation is of extremely importance for successful fertilization. Whole boar semen or seminal plasma has been demonstrated to advance the time of ovulation (Waberski et al., 2000). It is plausible that semen-induced cytokines in the uterine lymph undergo counter-current transfer to the ipsilateral ovary and accelerate the final maturation of pre-ovulatory follicles (Waberski et al., 2006).

According to mentioned facts, lower farrowing rate and litter size, after artificial insemination, my be caused by: (a) inadequate time of insemination related to time of ovulation, (b) lower amount of semen oxytocin and estrogen in insemination dose, due to increase dilution rate of ejaculate, (c) inadequate sow sexual stimulation, due to no full boar contact and act of coitus and (d) semen backflow (reflux) during insemination.

CONCLUSION

Oxytocin addition to semen (10 IU per dose) immediately before AI or vulvar injecting the sow (5 IU) prior to AI, significantly increase farrowing rate (92% and 88%) compared with untreated sows (78%). Subsequent litter sizes were not affected by treatment.

However, according to results of other authors, this method is controversial and the generalized recommendations for use should be made with caution, since the most profound effects occur in sub-fertile farms, groups of sows, seasonal infertility, and with sub-fertile boars. However, in many cases, farrowing rate and litter size are improved.

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FERTILITET KRMAČA POSLE DODAVANJA OKSITOCINA U DOZE SPERME ILI INJEKCIJE U VULVU ZA STIMULACIJU AKTIVNOSTI MIOMETRIUMA KOD INSEMINACIJE

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Izvod

U radu je izvršeno upoređivanje vrednosti prašenja i veličine legla u krmača, posle dodavanja oksitocina u spermu ili posle injekcije oksitocina u vulvu, neposredno pre veštačkog osemenjavanja (VO). Unutar prvih 7 dana posle zalučenja, osemenjeno je ukupno 150 krmača i to: (a) inseminacionim dozama u koje je dodato 10 IJ oksitocina (n=50), (b) posle injekcije 5 IJ oksitocina u vulvu, neposredno pre inseminacije (n=50) ili (c) bez navedenih tretmana, controlne krmače (n=50). Vrednost prašenja je bila signifikantno veća ($P<0.05$) kod tretiranih krmača (88% i 92%) u poređenju sa netretiranim, kontrolnim, krmačama (78%). Tretman nije imao značajnog uticaja ($P>0.05$) na veličinu legla kod prašenja. Dobijeni rezultati pokazuju da navedena metoda tretmana sa oksitocinom može povećati fertilitet osemenjenih krmača.

Ključne reči: oksitocin, dodavanje, sperma, injekcija, fertilitet, krmača.

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