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SOW FERTILITY AFTER THE INTRACERVICAL AI IN COOL AND WARM SEASONS USING CONVENTIONAL DOSES IN COMBINATION WITH SYNTHETIC SEMINAL PLASMA (PREDIL MR-A®)*

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SUMMARY: A significant reduction in the boar sperm quality during the warmer season of the year is a well-known phenomenon which directly contributes to a considerable decrease in the fertility of sows artificially inseminated (AI) during the period. The purpose of this study is to determine whether the conventional intracervical AI combined with the synthetic seminal plasma Predil MR-A® can increase the fertility of sows inseminated in warm seasons. The obtained results show that the insemination with *Predil MR-A®* significantly increases the farrowing *rate (82%)* in the warm periods of the year in comparison with the control sows (72%). Although an increasing trend in the average number of live born piglets per litter was recorded *in the* sows inseminated *with* Predil-MR*A®, this* increase was not statistically significant ($p < 0.05$) *both* within or between the observed seasons (*ranging from* 14.65 to 15.41 piglets per litter). *The obtained* results *can increase the total efficiency of* boar *reproductive exploitation as well as the fertility of inseminated sows.*

***Key words*:** *artificial insemination, season, seminal plasma, Predil MR-A®, fertility, sow.*

Original scientific paper / *Originalni naučni rad*

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INTRODUCTION

Sperm transport from the site of deposition (cervix, natural mating or conventional artificial insemination) through the uterine horns up to the utero-tubal junction, which serve as a sperm reservoir (Hunter, 1981), is believed to be a passive process in which intrinsic sperm cell motility plays no part (Langendijk et al., 2005). However, this passive transport is quite fast due to the fact that the sufficient population of spermatozoa is established in the caudal isthmus of the oviducts within 30 minutes following natural mating, and they are able to fertilize a high proportion of the oocytes (Hunter, 1990). Adequate antiperistaltic uterine contractions are the main factor for passive sperm transport (Scott, 2000). It has been shown that estrogens oxytocin and prostaglandin $F_{2\alpha}$, which contain the natural seminal plasma, play an important role in the stimulation of the myometrial contraction (Roseboom et al. 2000). The inadequate sperm transport within the uterus results in decreasing the sow fertility (Langendijk et al., 2005).

The reproductive performance of artificially inseminated sows is often lower, in farm practice, than that achievable with natural breeding (Spronk et al., 1997; Stančić, 2000). It is often the result of inadequate myometrial stimulation due to a small dose volume, a high dilution rate of native ejaculate, an inadequate stimulation of the sow by the boar presence and the absence of mechanical stimulation of the cervix (Langendijk et al., 2003; Beham and Watson, 2005; Kemp et al., 2005; Mezalira et al., 2005; Stančić et al., 2006; Stančić et al., 2013). Furthermore, abnormal myometrial contractions can be one of the factors for the summer sow infertility (Almond and Bilkie, 2005; Stančić et al., 2011). In order to stimulate myometrial contractions and thus enhance the sperm transport through the uterine horns, oxytocin, estrogens, prostaglandins and the synthetic seminal plasma Predil MR-A® can be added to the AI dose (Levis, 2002; Castaneda Morreno, 2002; Dimitrov, 2012; Stančić et al., 2013). It has been shown that a two-phase insemination in combination with the synthetic seminal plasma Predil MR-A® increases sow fertility parameters (the farrowing rate and litter size) (Martin Rillo et al., 1996; Lyczynski, et al., 2000; Garcia Ruvalcaba et al., 2008; Garcia Ruvalcaba et al., 2009).

The purpose of this study is to investigate the effects of a two-phase insemination in combination with the synthetic seminal plasma Predil MR-A® on the sows fertility in the cool and warm season of the year.

MATERIAL AND METHODS

The study was conducted on a commercial pig farm during the cool and warm seasons of 2012/2013. The sows in the experiment were F1-generation Yorkshire x Danish Landrace. The total of 200 sows (100 in the cool and 100 in the warm season) were included in the experiment. In each season, 50 sows were intracervically inseminated with conventional doses (4×10^9 spermatozoa in 100mL dose volume) + 30 mL of the synthetic seminal plasma (Predil MR-A®, Kubus S.A, Madrid, Spain), whereas the experimental group and another 50 sows were inseminated without the Predil MR-A® addition – the control group.

Predil MR-A® is a replacement of natural seminal plasma which gives the female genital tract salts, buffer and antibiotics that improve reproductive results. The synthetic

seminal plasma serves as the spermatozoa transportation medium, and contains organic and inorganic components which stimulate the sperm transport. It also enhances the insemination process of gilts and sows decreasing the backflow and improving the fertilization due to an increment of spermatozoa concentration. The use of synthetic seminal plasma before insemination introduces substances and components which are important for the viability of spermatozoa and ovum fertilization, improving fertility and litter size in gilts and sows. It stimulates uterine contractions and gives dilatation effect in the cervix (According to Kubus S.A, Madrid, Spain).

The semen was collected twice per week from high fertile boars. Each ejaculate was diluted with BTS1 for the short-term storage of the liquid diluted by boar semen extender (Minitüb, Germany) and packaged in 100 mL plastic bottles. The diluted sperm was stored in a termo-box at 17°C until used within 24 hours after collection. The estrus detection was performed twice a day (in the morning and evening with a 12-hour interval), starting on the second day after the sow weaning. Only the sows in estrus within the first 7 days after weaning were used in the experiment. The gilts were not used in the experiment. Conventional intracervical artificial insemination was performed about 3h to 4h after estrus detection, and the sows were reinseminated about 24h later. Sterile disposable catheters (Foamtip safeblue®, Minitüb, Germany), were used for AI. A two-phase insemination was performed in the experimental sows: 30 mL Predil-MRA® followed by conventional semen doses. The farrowing rate (calculated as a percentage of inseminated females that farrowed) and the litter size at farrowing (live born, stillborn and total born piglets per litter) were observed.

The data were processed by the *Statistica 10* software.

RESULTS AND DISCUSSION

The insemination with Predil-MRA did not have significant effects ($p>0.05$) on the sow farrowing rate in the cool season. However, in the warm season, the farrowing rate increased significantly ($p<0.05$) after the insemination combined with Predil-MRA (82%) in comparison with the control sows (72%). The farrowing rate after Predil-MRA insemination in the warm season was lower (82%), but not significantly ($p>0.05$) in comparison with the farrowing rate obtained after the inseminations performed in the cool season both in the sows inseminated with Predil-MRA and in the control sows (Table 1).

Table 1. Farrowing rate and litter size in sows treated during the cool and warm season (aver. ± SD)

		Cool season		Warm season	
		Predil-MRA	Control	Predil-MRA	Control
Sows inseminated (n)		50	50	50	50
Farrowing rate (%)		88%^{ax} (44/50)	84%^{ax} (42/50)	82%^{ax} (41/50)	72%^{by} (36/50)
Average litter size at farrowing (n)	Live born	15.18±3.18^{ax}	14.79± 3.32^{ax}	15.41± 1.75^{ax}	14.65± 2.80^{ax}
	Stillborn	1.09±1.72^{ax}	0.98±1.77^{ax}	1.31±1.30^{ax}	1.65±1.30^{ay}
	Total	16.27±2.93^{ax}	15.76^{ax} ±2.23	16.71^{ax} ±1.82	16.30^{ax}± 3.13

Values with different superscripts within the rows, differ ($p<0.05$);

[a,b] Comparison within the same season, [x,y] Comparison between the cool and warm season.

The number of live born piglets after the insemination with MRA in both seasons (15.18 in the cool and 15.41 in the warm season) was slightly higher than in the control sows (14.79 in the cool and 14.65 in the warm season), but these differences were not statistically significant ($p>0.05$). The number of stillborn piglets was significantly ($p<0.05$) higher in the control sows in the warm season (1.65) in comparison with the Predil-MRA (1.09) or conventionally inseminated sows (0.98) in the cool season (Table 1).

Seasons of the year greatly affect the variation of native semen quality parameters. The elevated ambient temperature during summer months is the main factor of reducing the boar semen quality. This result in decreasing the boar reproduction exploatation on the one hand, and the sow fertility rate in the warmer season on the other (Corcuera et al., 2002; Stančić et al., 2003; Okere, 2003; Suriyasomboon et al., 2004; Stančić et al., 2013). The results obtained in this study clearly show that the fertility of sows in the warm period of the year may significantly increase if conventional insemination is combined with synthetic seminal plasma (Predil-MRA®). Namely, the farrowing rate within the warm season was significantly higher in the sows inseminated with Predil-MRA® addition (82%) in comparison with the control (untreated) sows (72%). Reduced sperm number, progressive motility and morphologically normal sperm, increased number of abnormal and dead sperm in the ejaculate, as well as the reduction in the concentration of some natural bioactive substances in seminal plasma after semen dilution are the factors which decrease sow fertility in the warm season of the year (Roseboom et al., 2000; Ramirez Ovalle, 2002; Rekiel and Sujka, 2007; Stančić et al., 2011; Stančić et al., 2012; Stančić et al., 2013). The results of other authors (Martin Rillo et al., 1996, Lyczynski, et al., 2000, Garcia Ruvalcaba et al.,2008, Garcia Ruvalcaba et al., 2009; Dimitrov, 2012) also show positive effects of the application of synthetic seminal plasma (Predil-MRA®) on the sow fertility after intracervical or postcervical insemination.

CONCLUSION

The two-phase conventional intracervical insemination in combination with synthetic seminal plasma (Predil MR-A®) significantly increases the farrowing rate in the sows within the warm season of the year.

The usage of synthetic seminal plasma Predil MR-A® can be recommended as a method of improving the fertilization capacity of boar sperm in the warmer period of the year. This would increase the overall boar reproductive exploitation efficiency and, consequently the total sow fertility.

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FERTILITET KRMAČA POSLE INTRACERVIKALNOG OSEMENJAVANJA U TOPLOJ I HLADNOJ SEZONI UPOTREBOM KONVENCIONALNIH DOZA KOMBINOVANIH SA SINTETIČKOM SEMENOM PLAZMOM (PREDIL MR-A®)

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Izvod

Značajno redukovan kvalitet sperme nerastova, tokom toplije godišnje sezone, dobro je poznat fenomen. On ima direktan uticaj na značjno smanjenje fertiliteta krmača, osemenjenih u ovom periodu godine. Cilj ovog rada je bio da se ustanovi da li konvencionalno veštačko osemenjavanje, kombinovano sa sintetičkom spermalnom plazmom (Predil MR-A®), može povećati parametre fertiliteta krmača /% prašenja i veličina legla), osemenjenih u toplom periodu godine. Pokazalo se da je vrednost prašenja bila statistički značajno ($p<0.05$) veća kod krmača osemenjenih kombinacijom sa Predil MR-A® (82%), od one kod kontrolnih krmača (72%). Iako je ustanovljena tendencija povećanja prosečnog broja živo rođene prasadi u leglima krmača osemenjenih kombinacijom sa Predil MR-A®, ovo povećanje nije bilo statistički značajno ($p>0.05$) ni unutar ni između ispitivanih godišnjih sezona (kretalo se između 14.65 i 15.41 prasadi po leglu). Ovi rezultati pružaju mogućnost povećanja ukupne efikasnosti reproduktivne efikasnosti nerastova, kao i povećanja fertiliteta osemenjenih krmača.

Ključne reči: veštačko osemenjavanje, sezona, spermalna plazma, Predil MR-A®, fertilitet, krmača.

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