POST-CERVICAL INSEMINATION OF SOWS WITH LOW SPERM CONCENTRATION DOSE IN THE COMMERCIAL PIG FARM

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Abstract

The advantages of the insemination through the cervix into the uterus using a lower number of spermatozoa were investigated. Two hundred Danube White breed sows housed on a commercial pig farm were used in the study. The sows were randomly assigned to one of the following two equal treatment groups: group 1 – post-cervical insemination (PCI) with 1.5 x 10⁹ spermatozoa in 50 ml with a SOFT QUICK catheter, and group 2 – cervical insemination (CI) with 3.0 x 10⁹ spermatozoa in 100 ml with a spiral type catheter. The animals were inseminated twice after the onset of standing reflex. Pregnancy was diagnosed at 28 to 30 d after the insemination by ultrasonography. Prior to data analysis, the sows were categorised into two weaning-to-oestrus intervals (WEI) of ≤6 d or >6 d. The highest farrowing rate – 100% was obtained after cervical insemination with 3.0 x 10⁹ spermatozoa in sows cycling within 6 d after weaning. In both methods, there was a tendency for low farrowing in sows in the >6 d WEI category in comparison with the animals at ≤6 d WEI. Similarly, the mean litter size with the standard device (CI) were 10.35 and 11.67 and with the PCI device 10.23 and 10.35. The average number of piglets born alive per litter was greater (P<0.5) for sows inseminated by the CI method of at >6 d category. The results show that SOFT QUICK could be used in sows in a successful way as an intrauterine method in commercial farms. The main effect of the number of spermatozoa per dose and the weaning-to-oestrus interval did not significantly influence the overall birth weight of the litter and the average birth weight of the piglets.

Key words: sows, semen, post-cervical insemination, farrowing rate, litter size.

Artificial insemination (AI) is the main method for the intensification of pig production. One of the purposes of new reproduction technologies is a reduction in the number of spermatozoa needed for the insemination of sows within oestrus without decreasing the farrowing rate and litter size.

Two main strategies are used for the achievement of this goal – a reduction in the number of insemination procedures by fixed-time artificial insemination, and a reduction in the number of spermatozoa in the insemination dose by the deposition of semen directly into the uterus (1, 5, 6, 9, 14).

The current practice of the artificial insemination of sows is to use an insemination dose with a volume of 80-100 ml and 2.5 to 4 billion of spermatozoa. The number of spermatozoa reaching the oviducts decreases considerably during their “transportation” through the uterine horns. Only about 100,000 spermatozoa reach the utero-tubal junction in the isthmus of the oviduct (7, 8, 10), where the cells accumulate without a reduction in the fertilising ability (8).

The studies by Belstra et al. (1), Levis et al. (9) and Watson and Behan (14) have shown that, under practical conditions, intra-cervical insemination with 1.0 or 1.5 billion spermatozoa per 30 or 50 ml dose does not decrease fertility and litter size when the semen is deposited into the uterine body.

The aim of this study was to determine the effect of a low sperm dose application of post-cervical insemination (PCI), and cervical insemination (CI) on reproductive parameters in sows in a commercial pig farm.

Material and Methods

Animals. Two hundred Danube White breed sows housed at a commercial pig farm were used in the study. The body weight of the sows ranged from 250 to 280 kg. The lactation period was 25 d. The sows were weaned into individual gestation stalls.

Treatment of the semen. The semen was collected no more than twice a week from Duroc boars (DanBreedINT) housed at the same farm using the gloved hand method. The obtained ejaculates were individually assessed for volume, the number of sperm cells, and the
percentage of motile spermatozoa. The volume (without gel fraction) was determined by using a graduated glass vessel with a precision of 0.01 ml. The number of sperm cells was determined using a Thoma counting chamber. The percentage of motile spermatozoa (0 to 100%) was subjectively evaluated under a light microscope at a magnification of 100×. The spermatozoa were diluted in a BTS extender and packaged in 100 ml plastic bottles. After collection, the diluted semen was stored in a cooler unit at 17°C for 24 to 48 h. The bottles of semen were placed in the semen cooler 20 to 30 min after the dilution of the semen.

**Oestrus detection and artificial insemination.** Oestrus detection of the weaned sows was performed twice a day (09.30 to 10.30 and 15.00 to 16.00) starting on day 3 after weaning. Eight to 10 weaned sows were placed in a pen and checked for oestrus with a mature boar. Animals that showed a standing reflex were used for the experiments. The sows were randomly assigned to one of the following two equal treatment groups: group 1 – post-cervical insemination (PCI) with 1.5 x 10⁹ spermatozoa in 50 ml with a SOFT QUICK® catheter, and group 2 – cervical insemination (CI) with 3.0 x 10⁹ spermatozoa in 100 ml with a Spiral type catheter. Intrauterine body inseminations were performed by inserting a SOFT QUICK® catheter into the cervix in the traditional way, and then pushing an inner cannula (length 72 cm, and external diameter 3.5 mm) carefully through the rings of the cervix into the body of the uterus. Cervical inseminations were performed in the traditional manner by inserting a Spiral type catheter through the vagina into the cervix. The animals were inseminated twice, at 8 h and 24 h after the onset of standing reflex. The pregnancy was diagnosed at 28 to 30 d after insemination by ultrasonography (PREG-TONE®, Renco Corporation, USA). All the pregnant animals were allowed to carry the litters to term. The data were recorded for the weaning-to-oestrus interval (WEI), the farrowing rate, the total number of piglets born per litter, the number of piglets born alive per litter, the total birth weight of the litter, and the average birth weight of the piglets.

**Statistical analysis.** Prior to data analysis, the sows were categorised into two WEI of ≤6 d or >6 d. The data were statistically processed by one-way analysis of variance (ANOVA). All calculations were made using the statistical package inerSTAT-a v1.3.

**Results and Discussion**

The artificial insemination of sows in a commercial practice requires an insemination dose at a level from 2 to 4 billion spermatozoa to achieve high fertility and a high number of piglets per litter. Various models of catheters are used to deposit the semen into the posterior region of the cervix. From a practical point of view, pork producers have an economical advantage if inseminations can be provided into the caudal part of the uterine body with a low sperm concentration dose without decreasing the fertility. Several different types of catheters have been designed to introduction the semen by passing through the cervix into the uterus.

At the beginning of post-cervical insemination, some studies (2, 11, 14) demonstrated that acceptable results can be achieved when decreasing the semen dose to one third or less; time and practice (experience) show that, in order to obtain acceptable results in terms of farrowing rate and litter size at a commercial level, the semen dose must be prepared at a minimum of one half (45–50 ml and 1.5 x 10⁹ spermatozoa) or no less than one third (30 ml and 1.0 x 10⁹ spermatozoa) of spermatozoa concentration, respectively.

We investigated the post-cervical insemination with low numbers of spermatozoa of multiparous sows under commercial conditions. Table 1 indicates the reproductive parameters according to the number of spermatozoa per dose, and the weaning-to-oestrus interval. The highest farrowing rate (100%) was obtained after the cervical insemination with 3.0 x 10⁹ spermatozoa of sows in oestrus cycle within 6 d after weaning. A lower percentage of farrowing was found after PCI with 1.5 x 10⁹ spermatozoa per dose. These results are similar to the studies of Dial et al. (4) and Wilson et al. (16). In comparative experiments with transcervical insemination with doses containing 1.0 x 10⁹ and 1.5 x 10⁹ spermatozoa per dose, Dallanora et al. (3) and Watson and Behand (14) obtained similar results. Rozeboom et al. (13) achieved a significantly lower farrowing rate after post-cervical insemination with a dose of 0.5 x 10⁹ spermatozoa. In both methods there was a tendency for low farrowing in the sows of the >6 d weaning-to-oestrus interval category in comparison with the animals at ≤6 d WEI. Wilson and Dewey (16) reported that sows with a weaning-to-conceptus interval of 2 to 4 d had the highest litter sizes, while litter size decreased progressively for sows with a weaning-to-conceptus interval of 5 to 7 d. Sows with a weaning-to-conceptus interval of 7 to 10 d had the smallest litters. Levis et al. (9) also established the tendency for a decrease in the reproductive performance of the sows due to an increase in the weaning-to-conceptus interval.

Regarding the total number of piglets born per litter, the results were similar, but the difference between CI at ≤6 d WEI, and PCI at ≤6 d WEI- (P<0.5) was significant. The average number of piglets born alive per litter was greater (P<0.5) for sows inseminated by the CI method in the >6 d category. These results do not coincide with Wilson and Dewey (16), who reported that sows with a WEI of 2 to 4 d had the highest litter sizes, while litter size decreased progressively for sows with a WEI interval of 5 to 7 d. Sows with a WEI interval of 7 to 10 d had the smallest litters. The same dependency was found by Dallanora et al. (3) and Watson and Behand (14) but Roberts and Billkei (12) and Rozeboom et al. (13) established that reducing the spermatozoa per dose decreases the litter sizes.
This work has demonstrated that the farrowing sows is a simple and effective method. Watson and Behand (14) conclude that the post-cervical status, nutrition, the experience of the AI technicians etc. results – the season, the farm management, the health farrowing rate and litter size in comparison with the spermatozoa per dose resulted in a similar or better results.

1 Fecundity index is farrowing rate multiply by average number of total piglets born per litter times 100

2 Fecundity index

The main effect of the number of spermatozoa per dose, and the weaning-to-oestrus interval did not significantly influence the total birth weight of the litter and the average birth weight of the piglets. The average birth weight of the piglets was less for sows with a WEI of less than 6 d and inseminated by the CI method (1.62 kg) compared with sows inseminated by the PCI method (WEI >6 d, 1.64 kg). The average birth weight of piglets was less for sows with a WEI greater than 6 d and inseminated by the CI method (1.56 kg), compared with sows inseminated by PCI (WEI >6 d, 1.59 kg). A negative relationship between the litter size and the weight of the piglets at birth does exist.

These data and the results, which were obtained from other authors (6, 9, 14), have demonstrated that post-cervical insemination with 1.0 x 10⁹ to 5.0 x 10⁹ spermatozoa per dose resulted in a similar or better farrowing rate and litter size in comparison with the classical cervical method. Many factors influence the results – the season, the farm management, the health status, nutrition, the experience of the AI technicians etc. Watson and Behand (14) conclude that the post-cervical insemination with a low sperm concentration per dose of sows is a simple and effective method.

This work has demonstrated that the farrowing rate is not significantly reduced when sows are artificially inseminated by PCI (1.5 billion sperm cells per dose) compared with CI (3.0 billion sperm cells per dose). The results show that SOFT QUICK® could be used in sows successfully as an intrauterine method in commercial farms.

Table 1

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Cervical insemination</th>
<th>Post-cervical insemination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100 ml</td>
<td>50 ml</td>
</tr>
<tr>
<td></td>
<td>3.0 x 10⁹ sperm per dose</td>
<td>1.5 x 10⁹ sperm per dose</td>
</tr>
<tr>
<td>Number of sows</td>
<td>49 ± 6 d</td>
<td>67 ± 6 d</td>
</tr>
<tr>
<td>Weaning-to-oestrus interval, days (average)</td>
<td>11.16 ± 3.56</td>
<td>4.31 ± 0.66</td>
</tr>
<tr>
<td>¹Farrowing rate, %</td>
<td>100³ abc</td>
<td>92.50³ b</td>
</tr>
<tr>
<td>Average number of total piglets born per litter</td>
<td>10.35 ± 2.84</td>
<td>10.23 ± 2.79</td>
</tr>
<tr>
<td>Average number of alive piglets born per litter</td>
<td>11.33 ± 2.40⁴ b</td>
<td>10.05 ± 2.77⁴ b</td>
</tr>
<tr>
<td>²Fecundity index</td>
<td>1.035 ± 1.029</td>
<td>946 ± 846</td>
</tr>
<tr>
<td>Average total birth weight of litter, kg</td>
<td>15.98 ± 4.04</td>
<td>16.32 ± 4.03</td>
</tr>
<tr>
<td>Average birth weight of piglet, kg</td>
<td>1.62 ± 0.21</td>
<td>1.64 ± 0.22</td>
</tr>
</tbody>
</table>

ABC Different superscripts within row indicate a statistical differences between means (P<0.5)
1 Farrowing rate is the number of sows that farrowed divided by the number of sows breed
2 Fecundity index is farrowing rate multiply by average number of total piglets born per litter times 100


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References


