Reproductive Performance of Late Pregnant Gilts Treated with Baypamun® before Farrowing

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Abstract

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The aim of this study was to investigate whether the production results of pregnant gilts, grown under commercial farm conditions and moved from the sow keeping unit to the prefarrowing unit, could be increased by non-specific immunization with Baypamun® (Bayer, Leverkusen, Germany; BPM), an immune response modifier (IRM). We used three groups of pregnant gilts that obtained different treatments. Non-treated group A served as control; two experimental groups were treated on Day 6, 4 and 2 (group B), or on Day 5, 3 and 1 (group C), respectively, before their transfer from the sow keeping unit to the prefarrowing unit. The experimental gilts received i.m. 2 ml of IRM BPM, i.e. inactivated *Parapoxovis* virus ($1 \times 10^{6.75}$ $TCID_{50}$). Throughout the trial, the numbers of liveborn and stillborn piglets and the duration of farrowing were recorded. Variance analysis with the type of treatment as independent variable showed a significant difference between control (group A) and experimental group B in the number of liveborn piglets ($P < 0.0001$) as well as between group A and group B ($P < 0.0001$) or group C ($P < 0.0001$) in the number of stillborn piglets, respectively. No differences in duration of farrowing between groups were recorded.

Reproduction, stress, immunomodulation, Baypamun®, swine

Mass swine production includes several production stages of which the penultimate stage consists of keeping and housing pregnant sows and gilts in pre-farrowing boxes**.** Each of the production stages requires housing of animals in separate, adequate premises. Thus, upon termination of each production stage the animals are moved from one to another unit. Both the possibility and development of stress in animals are thus increased. Frequent housing changes are critical particularly for pregnant animals that must adjust to the man-made environment. Due to numerous adverse effects the animals can hardly cope with these challenges (Pavičić et al. 2004).

Stress situations may cause changes in homeostatic balance in pregnant animals resulting in compromised production results (Santoro 1996). Exposure of pigs to changed microclimate or social stresses may alter their reproductive functions. For example, each rise in body temperature of 1 - 2 °C causes fertilization disorders and early embryonic death. An increase of intrauterine temperature of 3 °C results in autolysis of embryos. Stress affecting the animals during the first several weeks after insemination strongly affects the reproductive performance of primiparous gilts (increased incidence of abortions or reduced numbers of piglets per litter). The risk is not significant in mid-gestation period, whilst between days 102 and 110 of gestation, heat stress may be the cause of 45% deaths in piglets during parturition (Ivoš et al. 1981). Changes in housing may induce stress reaction in pigs (Barnett et al. 1984; Cronin et al. 1991). Stress hormones may affect the activity of

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reproductive hormones (Hansen and Curtis 1981) and may also prolong the duration of parturition and increase the number of stillborn piglets.

Numerous agents that modify immune response increase the physiological body resistance by reducing the effects of corticosteroids during stress (Blecha and Charley 1990). One of such substances, Baypamun® (Bayer, Leverkusen, Germany; BPM) has a good efficacy in stimulation of the immune response and control of stress in pigs (Mayr and Brunner 1980; Steinmasl and Wolf 1990; Pavičić et al. 2003).

The aim of this study was to develop an adequate method to reduce stress caused by technology requirements on reproductive performance of gilts, which in turn would improve the reproduction results in intensive swine breeding.

Materials and Methods

The study was performed using pregnant gilts of Swedish Landrace, aged 8 to 9 months. The animals were included in the general production cycle and technological process on the farm together with other animals. The criteria for selection of gilts for insemination comprised their age, minimal body weight of 85 kg, minimal backfat thickness of 20 mm and breed-related phenotype characteristics such as number of teats and their quality. Between the age of 110 and 190 days (according to the breeding technology applied on the farm), all gilts were intramuscularly vaccinated against swine erysipelas, leptospirosis, atrophic rhinitis, Aujezsky disease, parvovirosis, piglet influenza and piglet respiratory and reproductive syndrome (PRRS). The animals were also vaccinated against neonatal colibacillosis and clostridial enterotoxaemia on Day 90 of gestation.

Three groups of 50 selected pregnant gilts each were moved from the sow keeping unit to prefarrowing units where they were housed in groups of 10 into pens. Approximately 5 days (Day 108 of pregnancy) before expected farrowing (between days 112 and 116 of pregnancy) they were moved from prefarrowing unit to farrowing pens. Non-treated group A of pregnant gilts served as control. Treated gilts were intramuscularly injected with 2 ml of BPM solution (containing $1 \times 10^{6,75}$ $TCID_{50}$ of inactivated strain D 1701 of *Parapoxovis* virus) before their transfer to prefarrowing pens.

Based on the treatment they were assigned to two experimental groups which received BPM at either Days 6, 4 and 2 (group B treated at days of pregnancy: 102, 104, 106) or 5, 3, and 1 (group C treated ont Days of pregnancy: 103, 105, 107), respectively. The preparation was administered before feeding the animals (08.30 - 09.00 h).

Two stages of transfer of late pregnant gilts including regrouping and separation may be considered as stressful events accompanying intensive swine production.

The number of live-born and stillborn piglets and duration of parturition (interval between the delivery of the first piglet and completed expulsion of the placenta) were recorded.

The statistical analysis was performed by ANOVA using the STATISTICA 7.1 program (StatSoft 2005).

Results

Table 1. Reproductive indicators in the first-litter gilts treated with BPM at different intervals before their transfer to the pre-farrowing unit on Day 108 of pregnancy (5 days before expected farrowing)

Group of gilts*	Treatment**	Mean ± SD values for		
		No. of live piglets	No. of stillborn piglets	Minutes of duration of parturition
A	None***	9.50 ± 1.18	1.58 ± 0.81	343.60 ± 65.08
B	BPM (at Day 102, 104, 106)	10.60 ± 1,63[a]	0.44 ± 0.58[b]	332.40 ± 49.14
C	BPM (at Day 103, 105, 107)	10.16 ± 1.18	0.66 ± 0.72[b]	348.60 ± 53.22

* Groups comprised 50 gilts each.

** 2 ml of BPM (containing $1 \times 10^{6,75}$ $TCID_{50}$ of inactivated D1701 strain of *Parapoxvirus ovis*) was given i.m. on either Days 102, 104, 106 (group B) or 103, 105, 107 (group C) before the gilts were moved to the prefarrowing unit.

*** 2 ml of saline was given as a placebo (group A).

[a] Significantly ($P < 0.001$) higher No. of live-born piglets than in control gilts.

[b] Significantly ($P < 0.001$) lower No. of stillborn piglets than in control gilts.

Table 1 presents the mean arithmetic values and standard deviations of observed values in separate groups of gilts.

Analysis of variance with the type of treatment as independent variable shows the significant difference in dependent variables of live-born and stillborn piglets (Table 2). Scheffe's test revealed the difference between control (group A) and experimental group B in dependent variable of live piglets ($P < 0.0001$), between controls and experimental group B ($P < 0.0001$) or experimental group C ($P < 0.0001$), respectively, in dependent variable of stillborn piglets.

Table 2. Analysis of variance by the final significance test (F test) with regard to the mean of a variable, e.g. the type of treatment

Indicator	F	df1	df2	Significance*
Live-born piglets	8.431	2	147	0.000
Stillborn piglets	36.464	2	147	0.000
Duration of parturition	1.088	2	147	0.339

*Determining a single variable (e.g. the type of treatment) that discriminates between parameters in the F test.

Discriminant analysis implies significant function (Wilk's Lambda 0.474; chi-square = 109.01; df = 6, $P < 0.0001$). Coefficient of canonical correlation is 0.715. The number of stillborn piglets was the most significant result for all three groups (Table 3). Furthermore, the number of live-born piglets contributes most to the significant discrimination between groups. Duration of farrowing has no influence on the structure of discrimination function.

Table 3. Discriminant function (df) analysis for observed variables with regard to the groups of gilts studied

Group of gilts*	Treatment**	df		
		Live piglets	Stillborn piglets	Duration of parturition
A + B + C	Total gilts* studied	-0.858	1.037	0.109
A	Saline	1.383	-0.064	-
B	BPM (at Day 102, 104, 106)	-1.008	-0.179	-
C	BPM (at Day 103, 105, 107)	-0.375	-0.375	-

* Groups comprised 50 gilts each.

** All the groups of gilts were i.m. injected with either 2 ml of saline (group A) or BPM (containing $1 \times 10^{6,75}$ $TCID_{50}$ of inactivated D1701 strain of *Parapoxvirus ovis*) (group B and group C).

Control group (A) of gilts is on the positive edge of discrimination function, characterized by a smaller number of liveborn and a larger number of stillborn piglets (Table 3). The experimental group B is highly projected at the negative edge of discrimination function characterized by the large number of live-born and small number of stillborn piglets. The experimental group C is closer to zero point.

Discussion

Abundant literature describes the influence of stress factors on the reproductive performance in domestic animals which may occur at different stages of the reproductive cycle, and requires thorough consideration before evaluation of involved variables.

Changes in the reproduction of swine induced by the stress act in accordance with the biological maintenance law, since the animals confronting the stress must survive in order to secure their offspring. Pregnancy represents an additional effect and requirement to the pregnant animal under stressful conditions (Santoro 1996).

Studies performed in 1983 on mice under stress showed that the use of immunomodulators caused reduced secretion of corticosteroids. Baypamun®, an inducer of paraimmunity, has been prepared from the inactivated *Parapoxovis* virus isolated from sheep affected with pustular dermatitis (Büttner et al. 1987; Strube et al. 1989). The efficacy of Baypamun® in the reduction of stress effect and stimulation of immune response in pigs was investigated in numerous studies (Steinmasl and Wolf 1990; Valpotić et al. 1992; Kyriakis et al. 1996; Pavičić et al. 2003).

The use of Baypamun® in pregnant gilts may reduce the losses caused by gastrointestinal syndrome in newborn piglets. Furthermore, studies performed so far provided evidence that administration of Baypamun® to pregnant gilts significantly increases the level of total proteins and immunoglobulins in the blood serum and colostrum of gilts and in the serum of their offspring (Valpotić et al. 1992; Pavičić et al. 2004). Effects of Baypamun® on the reproductive performance of gilts subjected to transport were also studied. It was concluded that paraimmunization of gilts on three occasions during the transport improved their reproductive performance with respect to the number of live-born piglets and the average body weight of piglets at birth (Kyriakis et al. 1996). The stimulation of non-specific immunity of piglets may be helpful in preventing the appearance of post-weaning diarrhoea and wasting pig syndrome (Kyriakis et al. 1998).

The reproductive performance of gilts transported for long distances from three breeding farms to six commercial farms was tested after the use of the immunomodulator Baypamun N. The results indicated that no adverse reactions or adverse effects were noticed related to the treatment with Baypamun N. The treatment improved the reproductive performance of gilts (the proportion of gilts farrowed/total gilts examined, the total number of piglets born, the number of piglets born alive, the body weight of piglets at birth). Furthermore, treatment with Baypamun N reduced the cost of medication per gilt (Saratsis et al. 1999). Since these authors studied the effect of Baypamun N (in form of lyophylisate) on the reproductive performance of gilts following a long distance transport, their results are only in part comparable to ours. The results of our study confirm the beneficial effect of Baypamun® in improving the reproductive performance of gilts by reduction of stress effect. According to measured functions and predictions, we conclude that the optimal timing of Baypamun treatment was used in the first experimental group of gilts.

However, further research is needed in order to cover earlier phases of pregnancy with the treatment of pregnant gilts with either preparation tested (i.e. BPM) or other IRMs. Also, it may be relevant to test and extend our model (Pavičić et al. 2003; 2004) in other technological situations when pregnant sows are regrouped and/or transported from breeding to commercial farms.

Plodnost prasniček ošetřených před porodem v pokročilém stupni březosti Baypamunem®

Cílem studie bylo zjistit, zdali by produkce březích prasniček, odchovaných v podmínkách komerční farmy a přestěhovaných z chovu prasnic na porodnu, mohla být zvýšena nespecifickou imunizací Baypamunem® - (Bayer, Leverkusen, Německo; BPM), imuno-

modulátor (IRM). Použili jsme 3 skupiny březích prasniček, které byly různým způsobem ošetřeny. Neošetřená skupina A sloužila jako kontrola, dvě pokusné skupiny byly ošetřeny následovně: skupina B 6.,4. a 2. den; skupina C 5., 3. a 1. den před přesunem z chovu prasnic na porodnu. Pokusným prasničkám bylo aplikováno 2 ml IRM BPM i.m., inaktivovaného ovčího *Parapoxviru* ($1 \times 10^{6,75}$ $TCID_{50}$). Během pokusu byly zjišťovány počty narozených selat (živých a mrtvých) a byla zaznamenávána délka porodu. Při pokusu byly zjištěny signifikantní rozdíly mezi kontrolní (skupina A) a pokusnou skupinou B v počtech živě narozených selat ($P < 0,0001$) a stejně tak signifikantní rozdíly v počtech mrtvě narozených mezi skupinami A a B ($P < 0,0001$) a skupinou C ($P < 0,0001$). Mezi skupinami nebyly zaznamenány žádné rozdíly v délce porodu.

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