Original paper

LITTERS HEALTH STATUS AND GROWTH PARAMETERS IN THE SOWS FEEDING DIETS SUPPLEMENTED WITH PROBIOTIC Actisaf Sc 47® WITHIN PREGNANCY OR LACTATION

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Abstract

The aim of this study was to investigate the effect of supplementing standard diets for pregnant and lactating sows with live yeast culture (*Saccharomyces cerevisiae*) on their health status, as well as the health status and growth parameters of their litters during lactation. A total of 120 sows were divided into three groups: the first group was fed diets supplemented with probiotics during pregnancy (G+P, n=40), the second group was fed these diets during lactation (L+P, n=40), and the third group was the control group which was not fed diets supplemented with probiotics (C, n = 40). During the lactation period, a significantly ($p<0.01$) smaller proportion of probiotic treated sows (G+P=7.5%, L+P=12.5%) manifested clinical signs of the uterus and/or the udder disease in comparison with the control sows (22.5%). The incidence of infectious diarrhea in the nursing piglets was significantly ($p<0.05$) lower in the treated sows (12.5%) compared to the control sows (27.5 %). The average number of weaned piglets per litter (p/l) and average litter weight at weaning (lw) (G+P=11.6 p/l and 103.6 kg lw, L+P=11.1 p/l and 102.8 kg lw, C=10 p/l and 79 kg lw) were significantly higher ($p<0.01$ or $p<0.05$) in sows treated with probiotic compared to the control sows. These results clearly show that the use of probiotic significantly improves the health status of sows and nursing piglets, as well as the piglets growth parameters.

Key words: *diets, performance, piglets, probiotic, sows*

Introduction

Under the intensive production conditions, sows are exposed to numerous chronically stressogenic conditions (Hyun et al., 1998) which reduce their natural immunity (Kick et al., 2011; Potočnjak et al., 2012) and increase susceptibility to various infectious agents

(Sutherland, 2006). In addition, the long-term application of conventional antimicrobial preparations in the prevention and treatment of infectious diseases significantly increase infectious agent resistance to these antimicrobial preparations (Cromwell, 2002; Pugh, 2002; Gagrčin et al., 2003; Le Coz, 2012). Reduced natural immunity and increased resistance of microorganisms to antimicrobial agents result in the increase of numerous infectious diseases, and consequently in the reduced reproductive performance of sows (Hogg and Lewis, 1997; Floss and Tubbs, 1999; Gagrčin, 2003; Sutherland, 2006; Yeskim, 2007; Stančić et al., 2010). Recently, the problem of lower sow reproductive performance, as a result of reduced natural immunity and increased infective agents resistance to conventional antimicrobial preparation, has been frequently solved by using probiotic preparations (natural immunomodulators) (Blecha, 2001; Pavičić et al., 2003; Zvekić, 2006; Gallois and Oswald, 2008; Pragathi et al., 2011; Zvekić et al., 2012; Apić and Zvekić, 2013). Yeast culture was one of the most active natural immunomodulators added to food in order to prevent infectious diseases of the udder and the uterus, as well as to increase the reproductive performance of sows and their litters (Bonneau and Laarveld, 1999; Davis et al., 2004; Gallois et al., 2009; Pragathi et al., 2011). However, the results of previous studies on the effectiveness of replacing conventional antimicrobial agents with probiotics for the prevention and treatment of infectious diseases, as well as their impact on the reproductive performance of sows, are not entirely consistent (Gallois et al., 2009; Plante et al., 2011; Zvekić et al., 2012; Ferroni et al., 2012; Faldyna et al., 2012; Apić et al., 2013). According to the studies of Gagrčin et al. (2002), (2003), Stančić et al. (2010) and (2012), in more than 50% of Serbian pig farms, there is a problem of udder and uterus infectious diseases (MMA - syndrome), resulting in significantly reduced reproductive performance of sows.

Therefore, the aim of this study was to investigate the effect of adding probiotic Actisaf Sc 47® in gestating or lactating diets on the performance of sows and their litters.

Material and methods

Experimental sows. The experiment was carried out on a commercial pig farm, with about 1,200 sows in the reproductive herd, located in the AP Vojvodina, Serbia. A total of 120 experimental sows (between the first and the sixth parity) were divided into three separate groups, immediately after artificial insemination. The sows in each experimental group were equalized according to body condition, parity and health. The pregnant sows were housed in group pens (10 sows per group) and equalized by age, body condition, parity, health and the stage of pregnancy. Between 7 and 10 days before the scheduled date of farrowing, the sows were moved into the farrowing building with individual pens, where they stayed with their litters during lactation. The average lactation duration was 33 days.

Feeding sows. Standard feed diets for gestating and lactating sows were used as complete basic diets (produced by Veterinary Institute, Subotica, Serbia). These diets were supplemented with the probiotic preparation "Actisaf Sc 47", which contains live culture of *Saccharomyces cerevisiae 47* (produced by Lesaffre Group, France), in the amount of 600 g per ton of the basic feed diet for gestating or lactation sows. During the first half of gestation, all sows received 3.2 kg of complete basic diets per day, and during the second half of gestation, 3.5 kg per day. During lactation, sows were fed ad libitum with complete basic diets

for lactating sow, twice a daily (morning and afternoon). Water was available ad libitum for pregnant and lactating sows.

Experimental groups of sows. The first group (n=40 sows) was fed diets supplemented with probiotic within gestation (G+P group), the second group (n=40 sows) was fed diets supplemented with probiotic only within lactation (L+P group), and the third control group (n=40 sows) was fed only basal diets without probiotics (C group).

Estrus detection and artificial insemination. The detection of estrus was performed twice per day by direct contact with the sexually mature teaser boar, starting from the first day after weaning. The double artificial insemination (AI) was performed in estrus detected sows within first 7 days after weaning.

Data recorded: (a) liter size at farrowing, (b) litter weight at farrowing, (c) infectious diarrhea and preweaning piglets mortality and (d) litter size and litter weight at weaning. The measurement of litter weight was done immediately after farrowing and weaning and was performed with digital scales. Sows rectal temperature was measured first three days after farrowing. Elevated rectal temperature (>39.3^{o}C) and manifestation of specific clinical signs, were assumed as postpartum metritis, mastitis, hypogalactia or agalactya. The diagnosis of piglets diarrhea was established on the basis of specific clinical symptoms.

Statistical analysis. The evaluation of phenotypic parameters of the research results was done by the "Statistic 12" software package according to the average, minimum and maximum values and standard deviation of the experimental results.

T-test was used to test the difference between the arithmetic means of the results.

Results and discussion

The average live born piglets per litter were 12.22 in the G+P sows, 11.53 in the L+P sows, and 11.42 piglets in the control sows. These values were significantly ($p<0.05$) higher in the G+P sows in comparison with the control and L+P group of sows, but average number of live born piglets per litter in L+P and C control group of sows was not significantly different ($p>0.05$) (Table 1).

The average weight of a live born piglet in the litter. in both treatment groups (G+P = 16.4 kg. L+P = 16.1 kg) was significantly higher ($p<0.01$) than in the control group (13.5 kg). The significantly higher average number of weaned piglets per litter was estimated in G+P sows (11.65 piglets. $p<0.01$). and in L+P sows (11.15 piglets. $p<0.05$) than in the control group of sows (10.0 piglets). Infectious diarrhea was clinically manifested in 12.5% litters of probiotic treated sows (G+P and L+P groups). and in the significantly higher ($p<0.05$) proportion of litters (27.5%) of untreated (control-C) sows. Within the first three days after farrowing averaged piglets mortality per litter was 0.43 piglets in the G+P sows and 0.65 piglets in the L + P sows. and this difference was not statistically significant ($p>0.05$). The average number of dead piglets per litter. within the first three days after birth in the control group of sows was 0.97 piglets. and was significantly higher ($p<0.05$) only compared with treatment groups G+P sows. Preweaning piglet mortality was approximately 10% lower in the probiotic-treated sows (G+P = 4.9%. L+P = 3.4%) compared to the control sows (C = 14.2%). The average weaned litter weight was significantly higher ($p<0.01$) in both treatment groups (G+P = 103.6 kg. L+P = 102.8 kg) in comparison with the control group of sows (79.1 kg) (Table 1).

Table 1. *Litter parameters from farrowing to weaning ($\bar{x} \pm SD$)*

Parameters		Period of treatment with probiotic "Actisaf Sc 47"		Control group, without probiotic (C)
		Gestation (G+P)	Lactation (L+P)	
Number of litters		40	40	40
Total piglets born (n)		520	505	515
Aver. live born piglets per litter (n)		$12.23^{a}\pm1.66$ (9-16)	$11.53^{b}\pm1.50$ (9-14)	$11.42^{b}\pm1.88$ (8-16)
Aver. weight of live born piglets per litter (kg)		$16.43^{A}\pm2.17$ (12-21)	$16.07^{A}\pm2.26$ (13-21)	$13.47^{B}\pm2.74$ (7-21)
Litters with infectious diarrhea	n	5 ± 0.33^{a}	5 ± 0.33^{a}	11 ± 0.45^{b}
	%	12.5	12.5	27.5
Piglets mortality within first 3 days after farrowing	Total (n)	17	26	39
	A/L	$0.43^{a}\pm0.87$	$0.65^{ab}\pm0.80$	$0.97^{b}\pm1.23$
Total preweaning piglets mortality (%)		4.9	3.4	14.2
Aver. weaned piglets per litter (n)		$11.65^{A}\pm2.09$ (7-16)	$11.15^{a}\pm1.76$ (7-14)	$10.0^{Bb}\pm2.50$ (4-16)
Aver. litter weight at weaning (kg)		$103.6^{A}\pm15.66$ (51-128)	$102.8^{A}\pm13.53$ (63-103)	$79.1^{B}\pm16.9$ (34-102)

Minimal and maximal values in parenthesis. A/L – Average per litter
Values with different superscripts significantly differ: ^{ABC} ($p<0.01$); ^{abc} ($p<0.05$); Not significant: ^{NS} ($p>0.05$)

The studies carried out on large farms in Serbia show that the average farrowing number per sow was 3.5 with the average 2.1 annual farrowing index (Radović et al.. 2006; Stančić et al.. 2010). The average farrowing rate is 78.9%. and the average number of live born piglets per litter was 10.9. Total sows culling rate was 38.4% per year. About 42% of total culled sows were culled due to the health problems. Diseases of the uterus and/or udder were the reasons for culling 30.4% of the total sows culled due to the health problems (Radović et al.. 2006; Stančić et al.. 2010; Maletić. 2012; Stančić et al.. 2012). The authors also found permanent decreasing in the efficacy of treating sow uterus and/or udder diseases. as well as newborn piglet infectious diarrhea by using conventional antimicrobial preparations. primarily due to resistance of infectious agents on increasing number of antimicrobial preparations. Similar problems related to increasing microbial resistance to conventional antimicrobial preparations have been shown by other authors (Wray and Gnanou. 2000; McEwen and Fedorka-Cray. 2002; Ozawa et al.. 2012). Therefore. the aim of this study was to solve this problem by using natural probiotic preparations.

In recent years. natural probiotics have been used as substitutes for traditional antimicrobial preparations in animal production (Spring, 2004; Roseboom et al., 2005; Gallois and Oswald, 2008; Giang. 2010; Bass et al., 2012). The results obtained by experimental studies in the present paper clearly show that feeding the sows during pregnancy or lactation period by standard complete diets supplemented with probiotics (live culture of *Saccharomyces cerevisiae*) significantly improve their health status and health status of their piglets.

preweaning piglet mortality within lactation. and increase the average number of weaned piglets per litter and the average litter weight at weaning. Similar results after application of probiotic preparation. were obtained by other authors. Namely. although not clearly consistent (Jacela et al.. 2010). most researches show that the use of probiotic preparations. containing live yeast culture. in the diets of pregnant and lactating sows. can significantly reduce sow puerperal uterus and/or mammary gland diseases. newborn piglet infectious diarrhea. and increase the preweaning piglet performance (Blecha. 2001; Davis et al.. 2004; Zvekić. 2006; Gallois et al.. 2009; Williams. 2010; Kenny et al.. 2011; Zvekić et al.. 2012; Potočnjak et al.. 2012; Lazarevic et al.. 2012 Apić et al.. 2013; Apić and Zvekić. 2013). In addition. the occurrence of microbial resistance to conventional antibiotics can be avoided by the application of probiotics (Wray and Gnanou. 2000; McEwen and Fedorka-Cray. 2002; Ozawa et al.. 2012). Consequently. this prevents the appearance of residual antibiotics in the feed of animal origin used in human nutrition. and their harmful impact on the health of the human population (Perreten. 2005; Marshall and Stuart. 2011; Kjeldgaard et al.. 2012).

Results of other authors show that treatment with preparations containing live yeast culture. increases natural sows immunity (effect of Glucans + Mannan Oligosaccharide). This results in the significant decrease of sows puerperal uterus and/or udder diseases (Blecha. 2001; Maxwell et al.. 2003; Kogan and Kocher. 2007; Gallois and Oswald. 2008; Gallois et al.. 2009; Bass et al.. 2012; Sallamon. 2012). Furthermore. adding a live yeast culture (*Saccharomyces cerevisiae*) in diets of sows during gestation and lactation increases the gamma globulin (IgG and IgA) in colostrum and early milk of sows (Jurgens and al.. 1997; Hung and Lindemann. 2011; Zanello et al.. 2012; Jang et al.. 2013). Sufficient milk production of healthy sows and increased content of immunoglobulins in colostrum and milk. significantly reduce piglets mortality from starvation and infectious diarrhea during the first days after farrowing (Miguel et al.. 2004; Zvekić. 2006; Wilcock. 2011; Shen et al.. 2011; Apić and Zvekić. 2013).

Conclusion

The results of this study clearly show that the use of probiotic preparation "Actisaf 47" (live yeast culture of *Saccharomyces cerevisiae*) in the diets of pregnant and lactating sows significantly improves the health status of their piglets in the lactation period. In addition. litter productive parameters (the number of weaned piglets per litter and litter weight at weaning) were also significantly higher in treated than in untreated (control) sows.

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