EFFECT OF PROBIOTICS IN THE PIG NUTRITION ON THE PATHOGENIC BACTERIA COUNTS IN THE GUT

Pavla Pospíšková, Gabriela Zorníková, Miroslava Kolářová, Zbyšek Sládek, Tomáš Komprda, Jana Geršiová

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Abstract

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The objective of the present study was to evaluate the efficacy of a probiotic culture in the digestive tract of sows. Two groups of healthy sows with 40 animals each were fed a standard feed three weeks after weaning. From the beginning of the fourth week (day 0), one group received the same diet enriched with the probiotic monoculture of Enterococcus faecium SF 68, the second (control) group was given the same diet without probiotics. The samples of faeces were collected (to the sterile containers) at days 0, 15, 30 (end of the probiotic consumption) and 40 (end of the wash-out period), respectively. In the probiotic group, significant decrease (P < 0.05) of numbers of E. coli and Clostridium spp. in faeces was found. The results indicate a positive effect of probiotics consumption on the digestive tract of sows and it can be used for a decrease of the incidence of the diarrhoeic diseases that are frequent in the pig husbandry.

probiotics, intestinal microflora, pigs, Enterococcus faecium

Genus Enterococcus belongs to the lactic acid bacteria and it is a regular constituent of the digestive tract. Some species of this genus, namely E. faecium and E. faecalis, are used as probiotics both in humans and in animals due to their ability to adhere on the gut mucosa and their resistance to the broad spectrum of antibiotics. These species are often used also in the form of the pharmaceutical preparations. In humans, probiotics are administered for treatment of diarrhea, irritable bowel syndrome, decreasing plasma cholesterol level and boosting the host’s immune system (Lojanica et al., 2010).

In animals, enterococcal probiotics are used mainly for prevention and treatment of diarrhea, immune stimulation and improvement of growth. Probiotics can be advantageously used in farm animals for reduction of the zoonotic pathogenic agents occurring in the digestive tract (Franz et al., 2011; Gaggia et al., 2010). It is evident that probiotics
have a positive effect on the animal performance and consequently on an economic profit of a breeder (Václavková, Lustyková, 2011).

Results of the many recent experiments (Lojanica et al., 2010; Maré, 2009; Simon, 2005; Steiner, 2009) confirm favourable effect of probiotics on growth of sows after weaning and feed intake and conversion. Application of probiotics in the fattening pigs improves daily weight gains and nutrients conversion (Václavková, Lustyková, 2011).

The objective of the present experiment was to evaluate an effect of the probiotic culture of Enterococcus faecium SF 68 on the optimal feed utilization and intestinal colonization in sows.

MATERIALS AND METHODS

The research was focused on evaluation of an effect of the probiotic strain Enterococcus faecium SF 68 on counts of Escherichia coli, Escherichia coli O157:H7 and Clostridium perfringens A isolated from the digestive tract of the weaned sows. Sows of the hybrid Czech Improved White x Landrace x Duroc in the mean initial live weight of 27 kg at the age of 9 weeks (at the start of the experiment), originating from the private South Moravian farm were used in the experiment. Sows were kept in the pens with the area of 24 m² with relative humidity in the stable was 18 °C and 70% respectively. Sows were divided in two groups with 40 animals each: experimental probiotic group and a control group without probiotics. Both groups were fed the same standard feed mixtures A1 and A3 with counts declared by the producer.

Counts of the tested microorganisms in the sow faeces E. coli O157:H7 and Clostridium perfringens A were detected in both groups of sows already at the beginning of the experiment (day 0, Fig. 1), which is very undesirable in the pig breeding due to the high pathogenicity of the aforementioned species. Significant differences (P < 0.05) between experimental and control group of sows were established only in the case of the genus Clostridium. At the day 15, a positive effect of the probiotic mixture was already found in experimental group as compared to the control group in comparison to control, namely in the genus Clostridium and the species of E. coli (Fig. 2); significant increase (P < 0.05) of the counts of the species of Enterococcus faecium was also established at this phase of the experiment. Therefore, a positive effect of an application of the probiotic feeding mixture on the occurrence of the pathogenic microorganisms was confirmed. It is very important that the pathogenic microorganisms play an important role in an incidence of the diarrhoeic diseases in the weaned sows (Franz et al., 2011).

It is evident from Fig. 3 that counts of the Clostridium spp., Clostridium perfringens, E. coli and E. coli O157:H7 decreased (P < 0.05) in faeces of the experimental group as compared to the control.
Effect of probiotics in the pig nutrition on the pathogenic bacteria counts in the gut

1: Counts of the tested microorganisms (log cfu/g) in faeces of the control (C) and experimental (EF) group of sows at the beginning of the experiment (day 0)
Data are mean and indicate significant differences (A: P < 0.01, B: P < 0.05). Comparisons were made between the experimental group and control group.

2: Counts of the tested microorganisms (log cfu/g) in faeces of the control (C) and experimental (EF) group of sows in the middle of the probiotic administration (day 15)
Data are mean and indicate significant differences (A: P < 0.01, B: P < 0.05). Comparisons were made between the experimental group and control group.

3: Counts of the tested microorganisms (log cfu/g) in faeces of the control (C) and experimental (EF) group of sows at the end of the probiotic administration (day 30)
Data are mean and indicate significant differences (A: P < 0.01, B: P < 0.05). Comparisons were made between the experimental group and control group.
group. Regarding species *E. faecium*, significant increase of its counts established at the day 15 still persisted (P < 0.05) at the end of the administration period (day 30; Fig. 3). The effect of the probiotic culture of *Enterococcus faecium* SF 68 on the decrease of the deleterious bacteria still persisted ten days after the administration. It was demonstrated by significant differences (P < 0.05) between C- and EF-group (Fig. 4). Only one exception was *E. coli* O157:H7, where the significant differences between groups of sows were not established.

The final effect of probiotics on the animal performance and consequently on an economic profit of a breeder is an important measure for their evaluation in the pig nutrition. The present study found a positive effect of the probiotic culture of *Enterococcus faecium* SF 68 added to the feed mixture on the growth performance of sows, daily live weight gains and nutrients conversion, respectively. However, significant differences (P < 0.05) between C- and EF-groups were established only at the end of the experiment (day 40). The same results reported also Veizaj-Delia et al. (2010). According to Jorgensen and Hansen (2006), probiotics administration to sows in the period from two weeks ante partum till weaning affected positively the losses of sows until weaning.

Number of studies (e.g. Franz et al., 2011) demonstrated a favourable effect of probiotics on the composition of the gut microflora, namely an increase of the microorganisms favourably influencing host's health and a decrease of the potentially deleterious microorganisms, which was confirmed also in the present study. Administration of probiotics can play an important role in constipation, diarrhoea, intestinal inflammations and boosting the resistance of an organism (Viet et al., 2009). The present study (Figs. 2–4) demonstrated not only the increase of numbers (cfu/g) of the probiotic strain *E. faecium* SF 68 in the course of the whole experiment, but also the growth reduction of the tested potentially pathogenic bacteria *E. coli* and *Clostridium* spp. These bacteria can cause various infections and diarrhoeic diseases that are very undesirable in the pig farming from the economic viewpoint (De Angelis et al., 2007).

Despite the positive effects of the probiotic enterococci on the pathogenic bacteria (*E. coli*, *Clostridium* spp.) in the farm animals, the studies dealing with this topic are very exceptional in the available literature (Szabó et al., 2009). Taras et al. (2007) and Apás et al. (2010) reported an increase of numbers of enterococci, where a positive effect in mice and goats was observed.

**SUMMARY**

Results of the present study indicate a positive effect of the addition of the probiotic strain *Enterococcus faecalis* SF 68 on the composition of the intestinal microflora in pigs. A favourable increase of numbers of *E. faecium* was observed in the course of the present experiment with the concomitant decrease of the counts of the tested pathogenic microorganisms (*E. coli*, *Clostridium* spp.) that are the agents of both the diarrhoeic and other diseases of pigs. Moreover, a positive effect of the tested probiotic strain was demonstrated regarding the growth performance of sows, daily weight gain and nutrients conversion rate, which are the important markers of the economics in the pig fattening.
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Address
Ing. Pavla Pospišková, Ph.D., Department of Food Technology, Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic, Ing. Gabriela Zorníková, Ph.D., Department of Food Technology, Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic, Ing. Miroslava Kolářová, Department of Food Technology, Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic, prof. MVDr. Ing. Tomáš Komprda, CSc., Department of Food Technology, Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic, prof. MVDr. Zbyšek Sládek, Ph.D., Department of Morphology, Physiology and Animal Genetics, Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic, Ing. Jana Geršiová, Department of Animal Breeding, Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic, e-mail: pavla.sladkova@menedelu.cz, gabriela.zornikova@menedelu.cz, skolaro1@node.mendelu.cz, tomas.komprda@menedelu.cz, zbysek.sladek@menedelu.cz, xgersiov@node.mendelu.cz