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# THE EFFECTS OF PROBIOTIC *Enterococcus faecium* DSM 7134 IN THE WEANED PIGS NUTRITION

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**Abstract:** Placing a ban on the use of antibiotics as additives for animal feed, had raised the producing risk, because of possibility for occurrence of many diseases in rearing piglets. One of alternative solutions is the use of probiotics as supplements, directly or in piglets feed. Aim of this study was to investigate the effects probiotic *Enterococcus faecium* DSM 7134 on the rearing piglets in the period from weaning to fattening start. This experiment included 500 piglets, divided in 2 groups, 250 piglets in experiment group (5 cycles with 50 piglets each) and 250 piglets (5 cycles with 50 piglets) in control group. Difference between experimental and control groups were in the way of feeding, experiment group had *Enterococcus faecium* DSM 7134 supplement and control was without. Influence of these probiotics was observed on the parameters: feed conversion ratio, daily gain increase and mortality. Piglets in the experiment group with probiotic *Enterococcus faecium* DSM 7134 in the ration showed lower feed conversion, higher daily growth increase and lower percentage of mortality, during this experiment. The difference between control and experimental group, for all parameters values, were established as statisticaly very significant ($p<0.01$) effect of the probiotic *Enterococcus faecium* DSM 7134 on rearing piglets in the period from weaning to the beginning of fattening.

**Key words:** probiotics, immunity, piglets, feed conversion, daily gain increasing, fattening

## Introduction

The EU-decision to ban antibiotics as feed additives has increase the pressure on farmers to rear healthy piglets. At weaning, piglets are subjects to momentous nutritional and environmental changes that can dramatically alter the equilibrium of the gastrointestinal microbiota. These changes are coupled with a loss of intestinal immune protection previously provided by biologically active

components of the sow's milk *(Blecha, 1998)*. In this period, colonization of pathogenic microorganisms is possible and cause disease, consequently brings to the low growth performance and mortality of piglets. Many researchers, producers of animal feed and breeders, have tried to answer to this challenge with the use of probiotics in animal nutrition. By definition, probiotics contribute to an improvement of the intestinal microbial balance and consequential beneficial effects for the host animals *(Taras et al. 2007)*. Probiotic preparations generally consist of viable lactic-acid producing bacteria of intestinal origin, which in gastrointestinal environment helps to restore/maintain a beneficial intestinal community, thus preventing digestive disorders and potentially improving growth performance, (Broom, 2006). In the weaning period, the most promising effects of the use of probiotics are related to competitive exclusion against nocuous bacteria *(Lalles et al., 2007)*.

In this study we analyzed the effects of probiotic *Enterococcus faecium* DSM 7134 on production performances of rearing piglets in the period from weaning to beginning of fattening. Influences of probiotic were observed using production parameters such as daily growth, feed conversion and mortality.

## Materials and Methods

Study was conducted during 2008 and 2009 year, with experimental period of 7 month in every year (may/november), on farm ''Stočar'' in Varvarinsko Polje.Influence of probiotic was determined on 500 piglets, divided in 10 cycles by 50 piglets each, 250 piglets in experiment group (5 cycles) and 250 piglets in control group (5 cycles). Piglets were four-race hybrids: sows (Landrace x Yorkshire) and boars (Duroc x Pietrain). Weaning piglets were put in group cages, 7 piglets in each, followed in interval of 42 days, from weaning to beginning of fattening. Temperature in stable was 25°C and water and feed were given ad libitum. Parameters measured during examination period were feed conversion, daily growth and mortality.

Composition of concentrate for control and experiment group is represented in table 1, with difference in probiotic supplement, because control group of piglets had diet without *Enterococcus faecium*. Both groups were fed starter to achieving 15 kg and after that fed grower until beginning of fattening.

At the time of weaning, production of chloride acid is not enough and often it requires intake of small amount of feed for providing adequate acidifying that is prerequisite for normal digestion. In this case, including of organic acid can be helpful in piglets' diet, for optimal gastric pH, that also stops the entrance of feed pathogenic microorganisms as well as their development *(Kovčin, 1993)*.

**Table 1. Composition of concentrate**

| Feed | In mixture (%) | |
|---|---|---|
| | Starter | Grower |
| Corn, ground | 58.00 | 44.00 |
| Soybean meal, 44% | 21.00 | 18.00 |
| Wheat | -- | 14.00 |
| Wheat middlings | 10.70 | -- |
| Barley | 5.00 | 14.00 |
| Soybean, extruded | -- | 5.00 |
| Vit.mineral premix* with *E. faecium* | 4.00 | 4.00 |
| Acidifier* | 1.30 | 1.00 |
| Phytase (mg) | 500.00 | 500.00 |
| Probiotic+acidifier | 1.00 | 1.00 |
| Total | 100 | 100 |
| ME DLG (MJ/kg) | 12.56 | 13.15 |
| Met:Lys | 1:087 | 1:0.85 |
| Lys:MC:Tre:Try | 1:0.59:064:0.17 | 1:0.59:0.3:0.18 |
| Ca:P | 1.21:1 | 1.39:1 |
| Crude protein (g/kg) | 164.00 | 170.00 |
| Calcium | 7.50 | 7.50 |
| Phosphorus | 6.20 | 5.40 |

*Acidifier was combination of 5 organic acids

Because of that, beside the probiotic *Enteroccocus faecium* DSM 7134, acidifier was included in diet for preserving pH of gastrointestinal tract under 4. Also, acidifier increases the permeability of cell membrane, bands the growth of gram-negative bacteria (*E. coli*) and affects formation of protective bio film on digestive tract mucosa, promotes growth of desirable microorganism and activity of intestinal cells.

Experimental period lasted two years. Obtained data were statistically analyzed using Duncan's test *(Statistica v.6. Stat Soft 2003)*.

# Results and Discussion

The effects of using probiotic *Enteroccocus faecium* DSM 7134 on feed conversion, daily gain and piglets' mortality throughout the experimental period are shown in Table 1. Piglets in experimental group fed mixture with probiotic *Enterococcus faecium* showed better feed conversion, greater daily gain and lower mortality.

**Table 2. Observed production parameters of piglets**

| Number of turnusa-n | Feed conversion ratio (kg/kg) | Daily gain (g) | Mortality (%) |
|---|---|---|---|
| 1- control g. | 2.49 | 321 | 4.26 |
| 2- control g | 2.30 | 331 | 4.14 |
| 3- control g | 2.29 | 334 | 3.8 |
| 4- control g | 2.41 | 320 | 5.1 |
| 5- control g | 2.39 | 327 | 6.49 |
| 6 - experiment g. | 1.92 | 474 | 3.7 |
| 7- experiment g. | 1.79 | 448 | 3.18 |
| 8- experiment g. | 1.79 | 460 | 2.24 |
| 9- experiment g. | 1.73 | 452 | 1.98 |
| 10- experimentg. | 1.66 | 460 | 2.1 |
| Average | | | |
| Control group | 2.38 | 327 | 4.76 |
| Experimental group | 1.78** | 459** | 2.65** |

Average feed conversion for experimental group was 1778.57 g, and for control group was 2378.57 g. Greater daily gain was obtained for piglets fed experimental concentrate (459.19 g), whereas daily gain of control group was 327.15 g. Mortality in the experimental group (2.65%) was lower than obtained in the control group (4.76%). Effect of using *Enterococcus faecium* was highly significant ($p<0.01$) for all observed production parameters: feed conversion, daily gain and piglets' mortality.

Effects of used probiotic are shown on Figures 1-3.

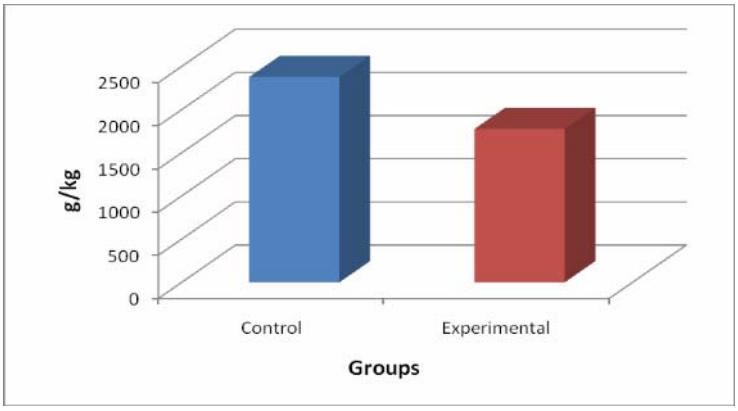


**Figure 1. Feed conversion g kg$^{-1}$ of gain**

Similar results about daily growth and feed conversion, reported *Guerra et al. (2007)* for effect of *Enterococcus faecium* CECT 410. Results obtained in this

study, for the same interval of 42 days, from weaning to fattening start, demonstrated significant effect of probiotic bacteria ($p<0.05$) on weight gain and feed conversion of piglets.

Using of probiotics *Bacillus spp* (0.01%) in fattening pigs diet, improved gain by 11.46% and feed intake by 10.12%, while feed conversion was not affected compared with control group *(Živković et al., 2004)*.

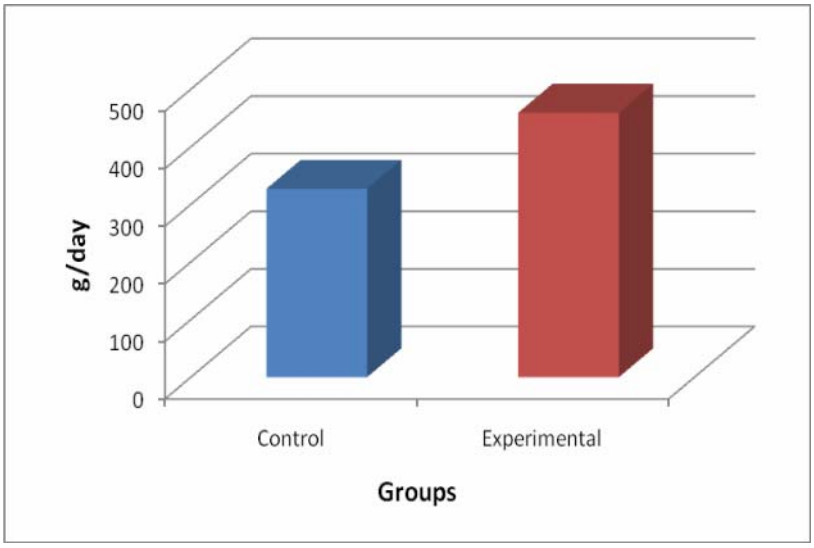


**Figure 2. Daily gain g/day**

In Figure 2 is showed increasing of daily growth of experimental group with added probiotic *Enterococcus faecium* DSM 7134 in diet, comparing the control group. Using of probiotics in piglets nutrition stimulates growing, improves feed conversion, is important for animal health control, stimulates immune response, inactivates and eliminates antinutritive components as phytic acid, trypsin inhibitor etc. *(Pupavac et al., 2002)*. According to this, enzyme phytase is included in the mixture.

The study of *Broom et al. (2006)*, showed different results for using probiotic *Enterococcus faecium* SF 68 as piglets feed supplement, because there were no affect on piglets growth performances. Authors suggest that the reason is origin of E*nterococcus faecium* SF68 that was isolated from human intestinal tract and ability of this strain to survive intestinal transit and remain vialable may warranted.

The genus *Enterococcus* and in particular the species *Enterococcus faecium* are regarded as normal components of the intestinal microbiota of swine

and therefore *E. faecium* DSM7134, used in our study, was isolated from pigs intestinal tract.

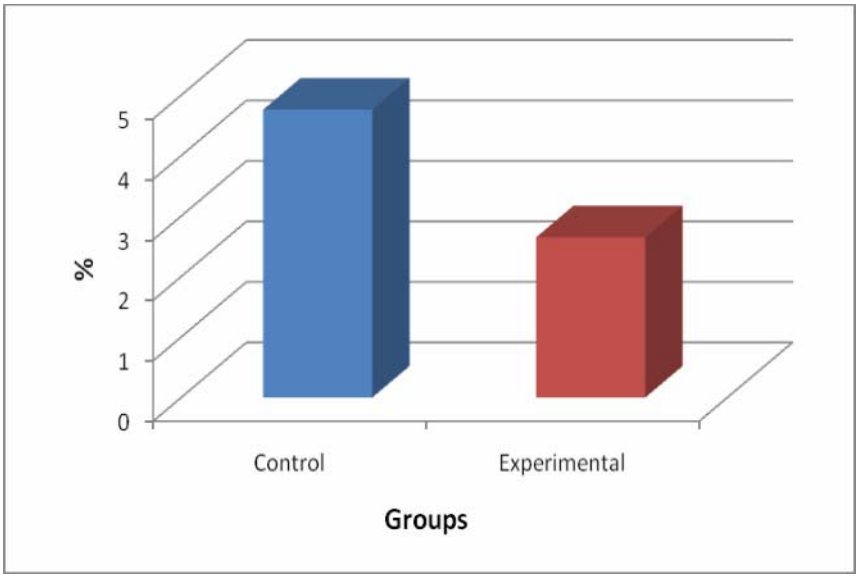


**Figure 3. Mortality of piglets, %**

Because of its economic importance, one of main goals of probiotic supplementation in piglets rearing is the reduction of weaning diarrhea. Mortality of piglets was 4.76% for the control group and 2.65% for the experimental group that is presented in the Figure 3.

Other authors emphasize that especially important effects of using probiotics are increasing number of weaning piglets/sow by 6.63% and decreasing number of piglets' death by 0.48% *(Pupavac et al, 2000)*. Using probiotics *Enterococcus faecium* and *Bacillus cereus,* in study of Taras et al. (2007), led to a significant reduction of incidence of post weaning diarrhea ($p<0.05$) compared to the control group.

During the experiment, that lasted for 2 years (2008 and 2009), management on farm "Stočar" was changed, and that is followed by higher quality control in maintaining optimal condition for pigs production. Nevertheless, the magnitude of the effect of probiotic *Enteroccocus faecium* DSM 7134 on observed production parameters of piglets seems to be strain dependent as well as influenced by farm-specific factors.

## Conclusion

The results indicate that probiotics may well be a contribution to a healthy piglet rearing at least if they are used as integral part of a larger concept including management factors as well as other feed additives. Research of the effect of probiotic *Enteroccocus faecium* DSM 7134 showed better feed conversion ratio for 25.2%, higher daily gain for 40.4%, and lower percentage of mortality 4.76% for the control group versus 2.65 ($P<0.01$) for the experimental one, during this experiment, for piglets in period from weaning to beginning of fattening.

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# Uticaj probiotika *Enterococcus faecium* DSM 7134 u ishrani odbijene prasadi

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## Rezime

Zabrana korišćenja antibiotika, kao aditiva stočnoj hrani, stočarima je povećala rizik u proizvodnji, prvenstveno zbog mogućnosti pojave mnogih oboljenja u periodu odgoja prasadi. Jedno od alternativnih rešenja je dodavanje probiotika i to direktno ili u smeši za ishranu prasadi. Cilj ovog rada bio je istraživanje efekta probiotika *Enterococcus faecium* DSM 7134 na odgoj prasadi u periodu od odbijanja do ulaska u tov. Ogledom je obuhvaćeno 500 prasadi, podeljenih u 2 grupe, i to 250 prasadi u oglednoj grupi (5 turnusa po 50 prasadi) i 250 prasadi u kontrolnoj grupi (5 turnusa po 50 prasadi). Grupe su se razlikovale u pogledu načina ishrane, gde smo imali obrok sa probiotikom u oglednoj grupi i obrok bez probiotika u kontrolnoj grupi. Praćeni parametri kod prasadi su bili konverzija hrane, dnevni prirast i procenat uginuća. Prasad u oglednoj grupi, koja su u ishrani imala zastupljen probiotik *Enterococcus faecium* bila su sa nižom konverzijom hrane, većim dnevnim prirastom i manjim procentom uginuća.

Dobijenim rezultatima efekta probiotika *Enteroccocus faecium* DSM 7134 prikazano je signifikantno poboljšanje odgoja prasadi u periodu od odbijanja do ulaska u tov.

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