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Using feed additives as a way to improve growth performance in weaned piglets

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Abstract:

A combined probiotic preparation of $1x10^9$ CFU/kg, *Enterococcus faecium* DSM 7134 and $2x10^9$ CFU/kg *Saccharomyces cerevisiae* E 1703 was supplemented to a basal diet with 1g/kg feed. The effects on growth performance, on thirty weaned piglets (28 days) were studied for six weeks experimental period. At the end of experimental period the supplementation of combined probiotic improved slightly Daily Weight Gain (DWG) g/day (2.7%) and Feed Conversion Ratio (FCR), kg feed/kg weight gain (4.4%). Because of the high coefficient of variations the differences were not significant. Based on the achieved results in the present investigations, it could be concluded that the utilization of probiotis led to an improvement of the production parameters in pigs, especially under the extensive farm conditions.

Keywords: Combined probiotic, weaned piglets, daily weight gain, feed conversion ratio.

1. Introduction

The first concept of probiotics was originally developed by [12]. He suggested that ingested bacteria could have a positive influence on the normal microbial flora of the intestinal tract. Probiotics are considered as growth and health stimulators and are used extensively in animal feeding, especially in pig and poultry production.

Probiotics have been defined also by [3] as "*a live microbial feed supplement which beneficially affects the host animal by improving its intestinal balance*". There is a relatively large volume of literature that supports the use of probiotics to prevent or treat intestinal disorders. Currently, the best studied probiotics are the lactic acid bacteria, particularly *Lactobacillus sp* and *Bifidobacterium sp.*

Therefore, an intensive research work is carrying out in this topic from many researcher groups in different countries. Many years later, probiotics were determined as: *viable microbial feed supplements, which are believed to stimulate growth and the health as well as to modify the ecology of the intestine in a beneficial manner for the host,* [1, 10, 15]. Probiotics should lead to beneficial effects for the host animal due to an improvement of the intestinal microbial balance [5, 6] or of the properties of the indigenous micro-flora [8]. There are also many mechanisms by probiotics enhance intestinal health, including stimulation of immunity, competition for limited nutrients, inhibition of epithelial and mucosal adherence, inhibition of epithelial invasion and production of antimicrobial substances [13].

Since probiotics are discussed as alternatives to antimicrobial growth promoters their impact on performance of farm animals is of prime interest. For authorization of microorganisms as feed additives it is also required to show significant effects on performance data [2, 15]. By far most experiments were performed with piglets. According to a literature review in [16] no significant positive effects could be found from the hitherto results with piglets and fattening pigs. Later, the evaluation of studies conducted with raising piglets drew a different picture [4]. [16] was used the strict criteria of biostatistics and only significant effects were documented. Today, trends without statistical significance are also considered as positive effect [15]. It is obvious that majority of the experiments show trends toward positive effects, however the significance level of $p \leq 0,05$ was reached only in 5% of experiments. Due to the complexity of the intestine, individual variations of animals to probiotic inclusion may be the rule and not the exception. Considering this concept, the range between no effect and significant effects seem to be reasonable.

2. Material and Methods

2.1. Keeping conditions

The experiment was carried out in a private farm of pigs. Thirty piglets (White x Duroc) were

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transferred after weaning (28 days) to flat deck and randomly allocated to two groups. The basal diet was also supplemented with 1g/kg of the probiotic preparation (experimental group) or without supplementation (control group). The diet was offered ad-libidum and animals had free access to water. The probiotic preparation included the following strains: $1x10^9$ CFU/kg, *Enterococcus faecium* DSM 7134 and $2x10^9$ CFU/kg *Saccharomyces cerevisiae* E 1703. During six weeks experimental period, Daily Weight Gain (DWG) g/day and Feed Conversion Ratio (FCR), kg feed/kg body weight gain was measured weekly. Data are presented as arithmetic means with standard deviations (Mean ± SD). One-way analysis of variance and Student's t-test ($P< 0.05$) were performed to test the differences between two groups.

Table 1. Diet composition and calculated nutrient concentration.

Diet composition (g/kg feed)		*Nutrient concentration (g/kg feed)*	
Maize	620	ME (MJ/kg)	12.82
Soybean meal	275	Crude protein	197.8
Soya oil	50	Crude fat	34.3
Fish meal	30	Crude fibre	31.4
Limestone	10	Calcium	9.10
Monocalcium phosphate	15	Posphorus	7.68
Vitamin -mineral premix[a]	12	Lysine	11.77
L-Lysine	10	Methionine+Cystine	7.64
Methionine+cystine	10	Threonine	8.04
Threonine	10	Tryptophane	2.37
Tryptophane	3		

[a] Contents in 1 kg: 1,200,000 IE vit. A, 120,000 IE vit. D_3, 4000 mg vit. E, 200 mg vit. B_1, 600 mg Vit. B_2, 2500 mg Niacin, 400 mg Vit. B_6, 4500 µg Vit. B_{12}, 20,000 µg Biotin, 1800 mg Pantothenic acid, 160 g Na, 50 g Mg,10,000 mg Zn, 7500 mg Fe, 7500 mg Mn, 150 mg J, 70 mg Co and 40 mg Se.

Table 2. The experiment design**.**

Period	Day	Control group	Experimental group
Preparatory	5	Basal diet	Basal diet
Experimental	42	Without supplementation	With combined probiotic

2.2. Experiment design:

- Preparatory period as an adaptation period lasted for 5 days.
- Experimental period lasted for six weeks or 42 days. The animals were feed with the same nutritive ration, but with probiotic (experimental group) and without supplementation (control group).

3. Results and Discussion

After six weeks experimental period Daily Weight Gain was improved 2.7% and Feed Conversion Ration 4.4%. The differences were not significant.

In last ten years, most of the experiments with probiotics were performed with piglets [17],[18]. According to the literature review, in many trials showed positive effects of probiotics on weaned piglets and also there were no significant effects of growing and finishing pigs. [7] on the experiments with weaned piglets and growing-finishing swine, used 1g/kg *Lactobacillus acidophilus,* which contains $4x10^6$ viable cells per gram. Supplementation of the diet with 1g/kg *Lactobacillus acidophilus* on weaned piglets did not improve daily gain, feed intake or feed efficiency. Daily weight gain and feed intake of pigs, treated with 500 mg/kg *Lactobacillus acidophilus* showed non significant trends .

Table 3. The effect of combined probiotic on production parameters.

Parameters		*Control group*	*Experimental group*
Production	n[1]	X ± SD	X ± SD
-Initial BW, kg	15	7.1 ± 1.01	7.2 ± 1.07
-BW 6th week [2]		20.8 ± 2.10	21.3 ± 2.33
DWG, g [3]		326 ± 23	335 ± 27
FCR [4]		1.84 ± 0.48	1.76 ± 0.31

[1] Number of animals, (15 piglets/ every group, at the beginning of the experiment); [2] BW at the end of the trial.; [3]DWG for whole experimental period.; [4]FCR for whole experimental period.

In a trial with 90 treated and 90 untreated *Bacillus cereus* –preparation weaned piglets; the probiotic treated animals gained 7% more live weight during 6 weeks after weaning with a reduced feed conversion ratio of 2.4%. Both results were not significant [9]. This point towards a high variation in the response of the individual animals to this type of feed additives [11, 15]. With regard to the evaluation of animal performance, the same conclusion can be draw for experiments with fattening chicken [14]. This is also reflected by a series of experiments with turkey, poultry under field conditions using three probiotics [10]. Again none of the effects in performance were significant, on average weight gain was improved by 1,5% (+0,1 to + 3,8) and feed conversion by –2% (-7 to –3,5). A further observation was a more pronounced effect of additive during weeks 1 to 5. However again no significance was seen in the period's week 1 plus 2 and 3 to 5, respectively [15].

Simon et al[15] concluded that the inconsistency of the effectiveness of a feed additive is of course not convenient, but on the other hand comprehensible for this type of feed additive. Probiotic do not act like essential nutrients in term of a clear dose-response until the requirements are met. Due to the complexity of intestine, individual variations of animals to probiotic inclusion may be the rule and not the exception. Considering this concept the range between no effect and significant effects seem to be reasonable.

4. Conclusions

Based on the achieved results in the present investigations, it could be concluded that the supplementation of combined probiotic as a feed additives led to an improvement of the production parameters in piglets, especially under the extensive farm conditions. However the differences were not significant. Feeding combined probiotic preparation slightly increased respectively Daily Weight Gain 2.7% and Feed Conversion Ration 4.4%.

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6. References

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