ADDITIVES LACTURE AND MICROBOND IN NUTRITION OF SOWS AND PIGLETS

ADTIVI LACTURE I MICROBOND U ISHRANI KRMAČA I PRASADI

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Original scientific paper - Izvorni znanstveni članak
UDC: 636.4; 636.087.7
Received - Primljeno: 28. june - srpanj 2006.

SUMMARY

The effects of the use of additives Lacture and Microbond in the nutrition of gestating and lactating sows as well as suckling and weaned piglets are investigated in this paper.

Considering positive experiences in the use of probiotics in the nutrition of sows, gilts, piglets and fattening pigs, the objective of this paper was to continue with the topic of this research and investigate the possibilities for the use of probiotic Lacture based on lactic acid fermentation bacteria and Microbond based on D-glucanes and clynoptilolite in the nutrition of gestating and lactating sows, suckling and weaned piglets.

Investigations were carried out on experimental pig farm of the Institute for the Animal husbandry, Belgrade-Zemun, Serbia.

Obtained results showed that introduction of investigated additives in concentration of 0.1% into diets had positive effects demonstrated as lower losses of body weight of sows in lactation by 29.1%, shorter service period by 0.56 days, reduced losses 4.71% compared to 12.87%, in the case of suckling piglets we determined more piglets per litter by 0.43 piglets/litter, in the case of weaned piglets, better gain by 6.7%, better feed conversion by 8.8%, in case of rearing piglets as well as on economic justification of the use of mentioned additives in nutrition of several pig categories.

In general, obtained results show that the use of additives Lacture and Microbond can be recommended in the nutrition of sows, suckling piglets and rearing piglets.

Key words: additives Lacture and Microbond, sows, suckling piglets and rearing piglets

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INTRODUCTION

One of the important factors of modern and profitable pig production is high standard of hygiene and the ability of piglets to adjust to changes in the environment, especially nutrition.

The concept of probiotics was developed by Elie Mechnikoff who, almost 100 years ago, suggested that bacteria from fermented dairy products could be used for control of fermentation in small intestines of humans and in this way improve their general health status (Simon, 2005).

During the last decade of the 20th century the probiotic concept was applied in animal nutrition. Of 21 probiotic preparations used as additives in nutrition and authorized by the EU, 13 can be used in the nutrition of piglets, and only few in the nutrition of sows and fattening pigs. Seven of these preparations which are used in nutrition of piglets were selected from strains *Enterococcus faecium,* two contain spores of bacteria *Bacillus*, two originate from *Lactobacillus farciminis* and *Pediococcus acidlactici,* which normally can be found and function in the digestive tract and dairy products (Simon, 2005).

Considering our positive experiences in the use of probiotics in the nutrition of sows and piglets (Živković et al., 2003; Živković et al., 2006), gilts and piglets (Živković et al., 2005), weaned piglets (Živković et al., 2001) and fattening pigs (Živković et al., 2004), the objective of this paper as a continuation of our research, was to investigate possibilities for the use of probiotic Lacture based on bacteria of lactic acid fermentation and Microbond based on D-glucanes and clynoptilolite in the nutrition of gestating and lactating sows, suckling piglets and rearing piglets.

MATERIAL AND METHODS

Investigations were carried out on the experimental pig farm of the Institute for Animal Husbandry, Belgrade-Zemun. The trial included total of 22 sows divided into two feeding treatments. One month prior to farrowing gestating sows were successively included into the trial, held in individual boxes up to 10 days before farrowing and fed daily ration of 3.0 kg/head (tab. 1). The first group of animals was fed mixture of standard composition and from additional additives. Sows from the second trial group were fed the same diets but with 0.1% of the investigated additives added to the mixture.

Table 1. Scheme of the experiment
Tablica 1. Plan pokusa

Group - Skupina	1 control - kontrolna	2 experimental - pokusna
Gestating sows – Suprasne krmače		
Lacture+Microbond 30 days before farrowing, % in diet Lacture + Microbond 30 dana prije prašenja, % u obroku	-	0.1 + 0.1
Feed/head/day – Hrana/životinja/dan	3.0	3.0
Lactating sows – Krmače u laktaciji		
Lacture+Microbond during lactation, % in diet Lacture+Microbond za vrijeme laktacije, % u obroku	-	0.1 + 0.1
Feed/head/day – Hrana/životinja/dan	*ad libitum*	*ad libitum*
Suckling piglets - creep feeding – Prasad na sisi - dopunsko hranjenje		
Lacture+Microbond during lactation, % in diet Lacture+Microbond za vrijeme laktacije, % u obroku	-	0.1 + 0.1
Feed/head/day – Hrana/životinja/dan	*ad libitum*	*ad libitum*
Weaned piglets – Odbijena prasad		
Lacture+Microbond during weaning period, % in diet Lacture + Microbond za vrijeme odbića, % u obroku	-	0.1 + 0.1
Feed/head/day – Hrana/životinja/dan	*ad libitum*	*ad libitum*

Table 2. The chemical composition, nutritive value and prices of diets used in the experiment

Tablica 2. Kemijski sastav, hranidbena vrijednost i cijene obroka upotrijebljenih u pokusu

	Evro/kg	Sows - Krmače		Piglets - Prasad		
		Gestation Suprasne	Lactation U laktaciji	Creep feeding Dopunsko hranjenje	Weaning period Razdoblje odbijanja	
					8 – 15 kg	15 – 25 kg
Crude protein, % - Sirove bjelančevine, %		13.5	16	22	20	18
		%	%	%	%	%
Corn - Kukuruz	0,09	69,85*	63,82*	54,50*	60,52*	65,57*
Wheat middlings - Pšenična prekrupa	0,07	10,0	10,0	-	3,0	5,0
Sugar - Šećer	0,65	-	-	3,0	-	-
Soybean oil meal - Sojina sačma	0,25	8,9	13,0	21,9	16,8	19,2
Sunflower oil meal - Suncokretova sačma	0,07	7,5	8,0	-	2,5	3,5
Fish meal - Riblje brašno	0,70	-	2,0	5,0	4,5	4,0
Full-fat soybean - Punomasna soja	0,30	-	-	10,0	10,0	-
Milk replacer for piglets Mliječni nadomjestak za prasad	0,70	-	-	3,0	-	-
Limestone - Vapnenac	0,04	1,2	1,2	0,6	0,7	0,9
Dicalcium phosphate - Dikalcijev fosfat	0,32	1,4	1,0	1,2	1,1	0,9
Salt - Sol	0,10	0,34	0,26	0,1	0,18	0,19
Premix for sows - Premiks za krmače	0,79	0,5	0,5	-	-	-
Premix for piglets - Premiks za Prasad	1,07	-	-	0,5	0,5	0,5
L-lysine HCl - Lizin HCl	1,56	0,11	0,02	-	-	0,04
Lacture - Lacture	4,93	0,1	0,1	0,1	0,1	0,1
Microbond - Microbond	4,93	0,1	0,1	0,1	0,1	0,1
Total - Ukupno:		100,0	400,0	100,0	100,0	100,0
Price, E/kg, without additives Cijena, E/kg, bez aditiva		**0,108****	**0,124**	**0,218**	**0,170**	**0,150**
Price, E/kg, including additives Cijena, E/kg s aditivom		**0,117**	**0,134**	**0,227**	**0,180**	**0,159**
Nutritive value of diets (calculatively), %						
ME, MJ/kg - Metabolička energija		12.88	12.85	13.93	13.66	13.29
Crude protein - Sirove bjelančevine		13.50	16.20	22.20	20.20	18.20
Ether extract - Sirove masti		3.53	3.65	5.15	5.33	3.82
Crude fiber - Sirova vlaknina		4.58	4.81	3.13	3.61	3.73
Ash - Pepeo		5.33	5.40	5.64	5.41	5.23
Calcium - Kalcij		0.90	0.90	0.90	0.85	0.85
Phosphorus, total - Fosfor ukupni		0.65	0.65	0.70	0.70	0.65
Sodium - Natrij		0.20	0.20	0.20	0.20	0.20
Lysine - Lizin		0.67	0.80	1.32	1.14	1.01
Methionine + cystine - Metionin + cistin		0.52	0.60	0.74	0.70	0.65
Tryptophane - Triptofan		0.16	0.20	0.27	0.24	0.22
Threonine - Treonin		0.52	0.63	0.88	0.80	0.72

*) – In control diets, additives were excluded, and the level of corn increased by 0.2%
U kontolnim smjesama su isključeni aditivi i učešće kukuruza je povećano za 0.2%

**) – The ratio of euro:dinar was 1 : 81.367 on the day 18th April 2005. year at the beginning of the experiment.
Odnos dinara i eura je bio 1 : 81.367 na dan 18. travnja 2005. godine na početku pokusa

Approximately 10 days before farrowing all gestating sows were transported to farrowing boxes. Sows from both groups then were fed mixture for lactating sows, investigated additives were still added to the diet for the trial group in the same concentrations as in previous period. Sows in both groups consumed feed ad libitum and individually.

After farrowing, we started to administer food to piglets at the age of 10 days – mixtures for piglets in the control were without Lacture and Microbond, whereas piglets from sows of the second group were also fed mixtures supplemented with probiotics in the concentration of 0.1%. After weaning, a part of the total number of piglets at weaning were included in the continuation of the trial with weaned piglets (24 heads in each group) the piglets of the trial group continued to receive in their mixtures 0.1% of Lacture and 0.1% of Microbond, and piglets in the control received the same mixture but without investigated additives.

As criteria for evaluation of obtained results the following parameters were used: body weight of sows prior to and after farrowing, also at weaning, feed consumption of lactating sows, number of born piglets, losses of piglets during suckling period, number of weaned piglets, average mass of piglets at farrowing and weaning and average daily gain of piglets during lactation, also economic justification of the use of additives in the nutrition of sows and suckling piglets.

In the rearing period the following parameters were monitored: average daily gain, average daily consumption of feed, feed conversion ratio and economic justification of the use of Lacture and Microbond until the end of rearing.

Statistical processing of data relating to gain was done using conventional methods of statistical analysis, analysis of variance and data on average values using t-test.

RESULTS AND DISCUSSION

a) Period of pregnancy and lactation

In the trial the possibility for introduction of additives Lacture and Microbond in the nutrition of gestating and lactating sows, suckling and rearing piglets was investigated.

Obtained results (tab. 3) showed that sows of the control group fed diets without additional Lacture and Microbond lost during lactation 13.68% of their own body weight. Sows of the trial group, fed diets containing investigated additives lost during the lactation period only 9.70% of their body weight, which is the loss reduction by 29.1% compared to the same parameter in the control group. After weaning, sows from the control group needed on average 5.64 days to first insemination, whereas sows in the trial group had average service period of 5.08 days which is shorter by the average of 0.56 feeding days.

With regard to the consumption of feed during lactation (tab. 3), the nutrition of sows using control mixture resulted in average daily consumption of 4.40 kg. The use of probiotics Lacture and Microbond in mixtures during lactation caused increased average consumption of 0.25 kg or 5.68% compared to the control mixture.

Regardless of the slight differences in live born piglets, in the control and experimental groups, investigated probiotic had no effect on the number of live born piglets in the trial. There was, also, no significant difference with regard to the number of still born piglets per litter, 0.27 and 0.20 heads/litter, respectively. At the end of lactation, the use of additives Lacture and Microbond in mixtures caused more weaned piglets per litter by average 0.43 heads or 4.15% compared to the control group fed diets without additives.

Lower body weight of piglets at farrowing in the control group, on average by 0.06 kg or 3.92%, and at weaning by 0.17 kg or 2.21%, shows the positive effect of the introduction of additives which also reflected positively on the gain of piglets during lactation which was higher by 5 g or 2.82% compared to the control group of animals (tab. 4).

Economic analysis of the cost of feed in the nutrition of gestating and lactating sows (tab. 5) showed that the introduction of Lacture and Microbond increased the value of the feed by 7.38% in gestating sows and by 12.43% in lactating sows, compared to parameters in mixtures of the control group of animals. In suckling piglets, inclusion of investigated additives, because of better utilization of pre starter mixtures, reduction in the cost of mixture by 2.44% was established. So, total cost in this production cycle by use of investigated additives and

Table 3. Performance of sows in the experiment

Tablica 3. Rezultati krmača u pokusu

Group - Skupina	1 control - kontrolna	2 experimental - pokusna
Gestating sows – Suprasne krmače		
Lacture+Microbond 30 days before farrowing, % in diet Lacture+Microbond 30 dana prije prašenja, % u obroku	-	0.1 + 0.1
Body mass of sows before farrowing, kg Tjelesna masa krmača prije prašenja, kg	216.3	213.4
Body mass of sows at farrowing, kg Tjelesna masa krmača kod prašenja, kg	210.0	206.3
Body mass of sows at weaning, kg Tjelesna masa krmača kod odbijanja, kg	186.7	192.7
Lactating sows – Krmače u laktaciji		
Lacture+Microbond during lactation, % in diet Lacture+Microbond za vrijeme laktacije, % u obroku	-	0.1 + 0.1
Average daily feed consumption of sows, kg Prosječna dnevna konzumacija hrane krmača, kg	4.40	4.65
Losses of body mass of sows, % - Gubici tjelesne mase krmača, %		
- before farrowing* - just at farrowing – prije prašenja* - tik pre prašenje	2.90	3.33
- at farrowing - at weaning – kod prašenja - kod odbijanja	11.08	6.59
- before farrowing - at weaning – prije prašenja - kod odbijanja	13.66	9.70
Service period, days - Servisno razdoblje, dana	5.64	5.08

*) - 1st control group weighed 9.8 days, and 2nd experimental one on 10.5 days before farrowing.

*) - 1. kontrolna skupina vagana 9.8 dana i 2. pokusna 10.5 dana prije prašenja

Table 4. Performance of suckling piglets in the experiment

Tablica 4. Rezultati prasadi na sisi u pokusu

Group - Skupina	1 control kontrolna	2 experimental pokusna
Lacture+Microbond during lactation, % in diet Lacture + Microbond za vrijeme laktacije, % u obroku	-	0,1 + 0,1
Duration of lactation, days - Trajanje laktacije, dana	34.6	34,4
Number of liveborn piglets/litter - Broj živorođene prasadi/okot	10.64	10.18
Number of stillborn piglets/litter - Broj mrtvorođene prasadi/okot	0.27	0.20
Number of weaned piglets/litter - Broj odbijene prasadi/okot	9.27	9.70
Losses of piglets during lactation period, % Gubici prasadi za vrijeme razdoblja laktacije, %	12.87	4.71
Average body mass of suckling piglets, kg - Prosječna tijelesna masa prasadi na sisi, kg	1.53	1.59
Average body mass of piglets at weaning, kg Prosječna tijelesna masa prasadi kod odbijanja, kg	7.68	7.85
Average daily gain of suckling piglets, grams Prosječan dnevni prirast prasadi na sisi, grama	177	182

compared to controls was increased by 5.92%. Since the realized value of piglets was higher by 6.95% in the trial group of animals fed mixtures containing investigated additives, their inclusion in mixtures was economically justified in sows and piglets prior to weaning.

b) Period of rearing of piglets

In the period of rearing, during 45 feeding days, piglets of the control group, without investigated additives in their feed, realized average daily gain of 311 g (tab. 6). The introduction of Lacture and Microbond into mixtures caused an average improvement of gain by 21 g or 6.75% compared to the control group of piglets. Lower consumption of feed per feeding day by 0.021 kg or 3.11% was determined in piglets from the trial group. The use of additional additives in mixtures caused an improvement in feed conversion ratio by 0.19 kg or 8.76% compared to the nutrition with the control mixture (tab. 6).

In table 7, parameters of the economic justification for the introduction of Lacture and Microbond into mixtures for rearing piglets are presented. Use of additives increased the value of feed by 4.95%, therefore, with better feed conversion ratio by 8.76%, the cost of gain in piglets fed diets containing additives was higher by 4.22% compared to the control group of animals.

The obtained results indicate positive effects of the introduction of probiotics into mixtures for sows demonstrated by better feed consumption (Ignatova et al., 2004; Alexopoulos et al., 2004), lower losses of body weight of lactating sows and more piglets at weaning (Jørgensen and Kürti, 2006), fever incidences of MMA syndrome in sows and shorter service period (Alexopoulos et al., 2004), also less frequent incidences of diarrhea (Taras et al., 2005) and minimal losses of piglets during the first three days of lactation (Taras et al., 2006).

In weaned piglets, positive effects of probiotics equal to positive effects of antibiotics were have been confirmed by Zani et al. (1997), Doyle (2001), Murry and Hinton (2003), Garcia et al.,(2003), Parrot and Rehberger (2003), Lawrence (2005) and Estienn et al. (2005), and they are manifested by improved ability for transport of nutritive substances in small intestines in 14 day old piglets (Lodemann et al., 2004) whose intestinal villi in the duodenum and jejunum are longer (Reiter et al., 2004), and the increase of the glucose level in small intestines (Rychen and Simôes-Nunes, 1995) as well as lactate in the stomach and colon (Vahijen et al., 2004), or even increase of fatty acids of short chains (Jadamus et al., 2002). Adding of probiotics causes improvement in digestibility of dry matter and proteins in mixtures as well as higher number of spores in faeces (Min et al., 2003) although contrary to sows, number of bacteria strains varies in small intestines and faeces of piglets (Bontempo et al., 2003; Masha et al., 2004). If probiotics are not used, up to 40% of piglets can demonstrate classic signs of the presence of enteropathogene E. coli in piglets (Schierack et al., 2004).

Table 5. Economic analysis of the use of Lacture and Microbond in nutrition of sows and suckling piglets in the experiment
Tablica 5. Ekonomska analiza upotrebe Lacture-a i Microbonda u hranidbi krmača i prasadi na sisi u pokusu

Group - Skupina	1 control - kontrolna	2 experimental - pokusna
Lacture + Microbond, % in diet - Lacture + Microbond, % u obroku	-	0.1 + 0.1
Gestating sows - Suprasne krmače		
Price of feed, % - Cijena hrane, %	100.00	107.38
Lactating sows – Krmače u laktaciji		
Price of feed, % - Cijena hrane, %	100.00	112.43
Suckling piglets - creep feeding – Prasad na sisi - dopunsko hranjenje		
Price of feed, % - Cijena hrane, %	100.00	103.65
Total cost of feed till weaning of piglets – Ukupan trošak za hranu do odbijanja prasadi		
Total price of feed, % - Ukupna cijena hrane, %	100,00	105,92
Total value of produced piglets, % - Ukupna vrijednost proizvedene prasadi, %	100.00	106.95

Table 6. Performance of weaned piglets in the experiment

Tablica 6. Rezultati odbijene prasadi u pokusu

Group - Skupina	1 control - kontrolna	2 experimental pokusna
Lacture+Microbond during weaning period, % in diet Lacture + Microbond za vrijeme razdoblja odbijanja, % u obroku	-	*0.1 + 0.1*
Weaned piglets – Odbijena prasad		
Number of piglets on the beginning of experiment Broj prasadi na početku pokusa	24	24
Number of piglets on the end of experiment Broj prasadi na kraju pokusa	18*	18*
Body mass of piglets on the beginning of experiment, kg Tjelesna masa prasadi na početku pokusa, kg	9.44	9.73
Body mass of piglets on the end of experiment, kg Tjelesna masa prasadi na kraju pokusa, kg	23.54	24.80
Duration of experiment, days – Trajanje pokusa, dana	45.3	45.5
Average daily gain of piglets, grams Prosječan dnevni prirast prasadi, grama	311	332
Compared to the control group, % Usporedba s kontrolnom skupinom, %	-	+ 6.75
Average daily feed consumption, kg Prosječna dnevna konzumacija hrane, kg	0.676	0.655
Compared to the control group, % Usporedba s kontrolnom skupinom, %	-	- 3.11
Feed conversion ratio, kg – Omjer konverzije hrane, kg	2.17	1.98
Compared to the control group, % – Usporedba s kontrolnom skupinom, %	-	+ 8.76

*) – In each group one cage with piglets was eliminated.

*) – U svakoj skupini jedan kavez s prasadi je eliminiran

Table 7. Economic analysis of the use of Lacture and Microbond in nutrition of weaned piglets in the experiment

Tablica 7. Ekonomska analiza upotrebe Lacture-a i Microbonda u hranidbi odbijene prasadi u pokusu

Group - Skupina	1 control - kontrolna	2 experimental - pokusna
Lacture+Microbond during weaning period, % in diet Lacture + Microbond za vrijeme razdoblja odbijanja, % u obroku	-	0.1 + 0.1
Weaned piglets – Odbijena prasad		
Price of feed, % – Cijena hrane, %	100.00	104.95
Feed conversion ratio, % – Omjer konverzije hrane, kg	100.00	91.24
Price of gain of weaned piglets, % – Cijena prirasta odbijene prasadi, %	100.00	95.78

CONCLUSIONS

The effects of the use of additives Lacture and Microbond in the nutrition of gestating and lactating sows, suckling and rearing piglets were investigated. The obtained results showed that introduction of Lacture and Microbond in concentrations of 0.1% each in diets had the following effects:

- Lower losses of body weight of sows in lactation by 29.1%,
- Lower losses of piglets during lactation, 4.71% compared to 12.87% established in the control group fed diets without investigated additives,
- Shorter service period by 0.56 days,
- More weaned piglets by 0.43 piglets/litter,
- Increase of cost of feed by 5.92% but realization improved by 6.95% of produced piglets at the end of lactation period,
- Better gain by 6.75%, and better feed conversion ratio by 8.76% in case of piglets in rearing,
- Lower cost of gain by 4.22%, in piglets in rearing.

In general, obtained results demonstrate that the use of additives Lacture and Microbond can be recommended in nutrition of sows, suckling piglets and rearing piglets.

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Acknowledgements

We would like to use this opportunity and thank the company Cenzone Tech Europe Ltd, USA for the provision of Lacture and Microbond used in the trial..

SAŽETAK

Istraživani su učinci korištenja aditiva Lacture i Microbonda u ishrani suprasnih i krmača u laktaciji, kod prasadi na sisi i u uzgoju.

S obzirom na naša pozitivna iskustva korištenja probiotika kod krmača, nazimica, prasadi i svinja u tovu, cilj ovoga rada, nastavka istraživanja ove problematike, je bio ispitati mogućnosti korištenja probiotika Lacture temeljenog na bakterijama mlijčnokiselinske fermentacije i Microbonda temeljenog na D-glukanima i klinoptilolitu u ishrani suprasnih i krmača u laktaciji, prasadi na sisi i u uzgoju.

Ispitivanja su provedena na Eksperimentalnoj farmi svinja Instituta za stočarstvo, Beograd-Zemun u Srbiji.

Dobiveni rezultati su pokazali da je uvođenje ispitivanih aditiva u koncentracijama od 0.1% u obrocima imalo pozitivne učinke izražene manjim gubicima tjelesne mase krmača u laktaciji, za 29.1%, kraćim razdobljem servisa za 0.56 dana, manjim gubicima, 4.71% prema 12.87%, kod prasadi na sisi, većim brojem, za 0,43 prasadi/leglo, odbijene prasadi, boljim prirastom, za 6.7%, povoljnijom konverzijom hrane, za 8.8%, kod prasadi u uzgoju, kao i ekonomskom opravdanošću korištenja ispitivanih aditiva u ishrani navedenih kategorija svinja.

U cjelini, dobiveni rezultati su pokazali da se preporučuje korištenje aditiva Lacture i Microbonda u ishrani krmača, prasadi na sisi i tijekom uzgoja.

Ključne riječi: dodaci Lacture i Microbond, krmače, prasad na sisi i odbijena prasad