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Effects of Caprylic Acid on Performance and Mortality of Growing Rabbits

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Abstract

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Caprylic acid (C8:0) is a compound present in the rabbit milk, active against a variety of microorganisms. The aim of our study was to evaluate the effect of caprylic acid on growth and mortality of young rabbits. Caprylic acid was added to granulated feed at 0, 2 and 5 g/kg. Two feeding trials on different farms were carried out using weaned Hyla 2000 and Hyplus rabbits, 5 weeks old at the start of the experiment (altogether 288 rabbits). Caprylic acid had no significant effect on total weight gains in either trial. No adverse effect of caprylic acid on feed intake was observed. The mortality of rabbits fed diets with caprylic acid at 0 and 5 g/kg was 16.7 and 0% ($P < 0.05$), and 9.3 and 2.0% in the 1st and the 2nd trial, respectively. It can be concluded that caprylic acid is capable to decrease mortality of young rabbits. Its use seems to be more effective on farms where rabbit mortality is high.

Antibiotics alternative, fatty acid, growth

Rabbit breeding is an important branch of animal production. Rabbit meat is of high quality and safety. The susceptibility of rabbits to various infections diseases and high mortality of young rabbits after weaning, however, hinder the development of the rabbit industry. Weanling rabbits often suffer from diarrhoea, which is the major cause of their mortality. Rabbit breeders widely use antibiotics to control enteritis infections. The use of antibiotics, however, is viewed critically in recent times. Some were banned totally, some received no renewal of their license as a measure of preventive consumer protection. There is a pressing need for harmless antimicrobial substances suitable for rabbits nowadays.

In 1965, Smith found that suckling rabbits were unique among seven animal species studied in that their contents of the stomach and small intestine were almost completely sterile. Canas-Rodriguez and Smith (1966) suggested that the rabbit milk fat contained antimicrobial compounds, identified as eight and ten carbon saturated fatty acids (caprylic and capric acid, respectively). Content of these acids in the rabbit milk is very high, they represent from one third to one half of the total fatty acids in the rabbit milk fat (Christ et al. 1996; Lebas et al. 1996). Both acids are practically absent from the feed, thus, rabbits synthesize them in the mammary gland. Bactericidal effect of fatty acids is well known (Nieman 1954; Galbraith et al. 1971; Galbraith and Miller 1973; Henderson 1973; Maczulak et al. 1981; Chalupa et al. 1984). Fatty acids penetrate bacterial membranes, interfere with the metabolism of energy within cells and disturb energy-dependent processes (Galbraith and Miller 1973). Fatty acids bound in triacylglyceroles (triglycerides) did not influence *in vitro* rumen fermentation (Chalupa et al. 1984). The hydrolysis of milk fat by lipase(s) is thus the prerequisite of their antimicrobial action. Antimicrobial activity of caprylic and capric acid confirmed Marounek et al. (2002).

The aim of this study was to test the hypothesis that addition of caprylic acid to a feed mixture could improve health and performance of young rabbits. Two experiments on

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different commercial farms were carried out. For a long time these farms have different results as far as the performance and mortality of rabbits is concerned.

Materials and Methods

1st experiment

A total of 126 weaned rabbits of both sexes (Hyla 2000 breed), 35-day-old at the beginning of experiment, were divided into 3 groups. Rabbits were kept in standard fattening all-wire cages, four per cage. Environmental conditions were as follows: temperature 15 – 17 °C, relative humidity *ca* 65%, 12:12 h light : dark daily photoperiod cycle. Rabbits of the first group were fed a basal diet (Table 1). Rabbits of the second group were fed the same diet supplemented with caprylic acid (Fluka) at 2 g/kg. Rabbits of the third group were fed the diet with caprylic acid added at 5 g/kg. Rapeseed oil concentration in the feed was correspondingly decreased. All diets were granulated and supplemented with Robenidin (a coccidiostat) at 66 mg/kg. Feed consumption per group was measured weekly. The weights of individual rabbits were recorded in two-week intervals. Samples of faeces were examined microscopically for the presence of *Eimeria* oocysts in the State Veterinary Institute, Prague. In the same institute dead rabbits were examined using standard pathological, bacteriological and parasitological methods. The experiment lasted for 42 days.

Table 1
Ingredients and determined chemical composition of the basal diet[a]

Ingredients (%)		Composition (g/kg)	
Wheat bran	27	Dry matter	898
Sugarbeet pulp	26	Crude protein	159
Alfalfa meal	14	Fibre	150
Oats	8	Fat	37
Extracted sunflower meal	7	Starch	126
Barley	6.5	Ash	68
Yeast	5		
Extracted soyabean meal	2		
Rapeseed oil	1.5		
Mineral supplement[b]	1		
Vitamin supplement[c]	1		
Dicalcium phosphate	0.7		
Salt	0.3		

[a] Experimental diets were supplemented with 2 and 5 g of caprylic acid per kg
[b] Composition (kg^{-1}): Ca – 222 g, P – 62 g, Na – 34 g, Fe – 5.6 g, Mn – 4.6 g, Zn – 4.1 g, Cu – 710 mg, I – 22 mg, Se – 9 mg.
[c] Composition (kg^{-1}): Vitamin A – 1200.000 IU, Vitamin D_3 – 100.000 IU, Vitamin E – 5 g, Niacin – 5 g, Pantothenate – 2 g, Riboflavin – 0.7 g, Thiamine – 0.2 g, Pyridoxine – 0.2 g, Folic acid – 30 mg, Biotin – 20 mg, Cobalamin – 2 mg, Choline – 60 g, Lysine – 25 g, Methionine – 10 g, Antioxidant – 10 g.

One-way analysis of variance was used to evaluate the effects of caprylic acid. Comparison of means was done by the Bonferroni test, where appropriate. The effect of caprylic acid on the mortality of rabbits was evaluated by the χ^2-test.

2nd experiment

The same diets and experimental arrangement were used in the second experiment, on another farm. A total of 162 weaned rabbits (Hyplus breed), 35-day-old at the beginning of experiment were used. Environmental conditions on this farm were as follows: temperature 16 – 18 °C, relative humidity not exceeding 68%, 12 : 12 h light : dark daily photoperiod cycle.

Results and Discussion

On average, control rabbits gained 32.4 and 41.0 g per day in the 1st and 2nd experiment, respectively (Table 2 and 3). Caprylic acid had no significant effect on total

Table 2
Effect of caprylic acid on performance and mortality of growing rabbits. Results of the 1st experiment

	Caprylic acid addition (g/kg)		
	0	2	5
Number of rabbits	42	42	42
Initial live weight (g)	940 ± 115	957 ± 109	939 ± 99
Final live weight (g)	2299 ± 304	2371 ± 308	2331 ± 238
Daily gain (g)			
6. – 7. wk of age	27.9 ± 4.7^{ab}	27.7 ± 4.0^{a}	30.1 ± 4.0^{b}
8. – 9. wk of age	28.9 ± 6.9^{a}	31.1 ± 5.7^{a}	34.3 ± 5.0^{b}
10. – 11. wk of age	41.5 ± 7.8^{a}	43.0 ± 9.4^{a}	35.4 ± 6.6^{b}
6. – 11. wk of age	32.4 ± 7.7	33.7 ± 7.6	33.1 ± 6.4
Feed intake per group (kg)	157	187	193
Feed conversion (kg/kg)	3.31	3.23	3.30
Mortality			
6. – 7. wk of age	4	0	0
8. – 9. wk of age	2	1	0
10. – 11. wk of age	1	0	0
6. – 11. wk of age	7^{a} (16.7%)	1^{ab} (2.4%)	0^{b}

Means ± SD

^{ab} Values in the same row with different superscripts differ significantly ($P < 0.05$)

weight gains in either experiment. No adverse effect of caprylic acid on feed intake was observed. The feed intake, however, was measured per group, thus the statistical evaluation of this trait was not possible. Out of 288 animals, 16 rabbits died in the course of both experiments, 8 in the course of the 1st experiment and 8 in the course of the 2nd experiment. Necropsy of dead rabbits revealed enteritis, catarrh of lungs, hyperaemia of liver, hyperaemia of kidney and spleen, hyperaemia of lungs, and poor nutritional status. Bacterial pathogens were identified as *Pasteurella multocida*, *Clostridium perfringens* and *Bordetella bronchiseptica*. Twelve control and 4 treated rabbits died. Treated rabbits died due to a respiratory disease (3 animals) and due to enteritis (1 rabbit). Few faecal samples were free of coccidia in the first two weeks of experiment. The intensity of infection by *Eimeria* sp. was lower on the 2nd farm, where most rabbits were infected only slightly (+), than on the 1st farm (++). *E. magna* and *E. perforans* oocysts were observed more frequently than oocysts of other *Eimeria* species. The effect of caprylic acid on oocyst shedding was not noticeable, possibly because of low intensity of infection.

In the 1st experiment, mortality of control rabbits and those fed caprylic acid at 5 g/kg was 16.7 and 0% ($P = 0.018$). Caprylic acid at this concentration decreased mortality of rabbits also in the 2nd experiment (from 9.3 to 2.0%), but its effect was not statistically significant. (Dierick et al. 2002) observed that the controlled release of medium-chain fatty acids (C_6-C_{12}) from coconut and *Cuphea* seeds oils resulted in significant suppression of the intestinal flora (total anaerobic count, lactobacilli, *E. coli*), improved mucosal health and growth performance of piglets. We are not aware of any other study on use of medium-chain fatty acids in nutrition of other animal species. Caprylic acid exerts both antibacterial and antiviral activity (Isaacs et al. 1995). Further experimentation is needed to specify its health-promoting effect in rabbits in more details.

Table 3
Effect of caprylic acid on performance and mortality of growing rabbits. Results of the 2nd experiment

	Caprylic acid addition (g/kg)		
	0	2	5
Number of rabbits	54	54	54
Initial live weight (g)	956 ± 85	946 ± 77	950 ± 73
Final live weight (g)	2680 ± 257	2602 ± 227	2580 ± 252
Daily gain (g)			
6. – 7. wk of age	36.7 ± 4.7[ab]	38.4 ± 3.3[a]	36.3 ± 4.3[b]
8. – 9. wk of age	39.1 ± 6.5	37.2 ± 4.1	37.1 ± 5.5
10. – 11. wk of age	48.5 ±7.3[a]	46.2 ± 6.5[ab]	43.3 ± 7.2[b]
6. – 11. wk of age	41.0 ± 6.3	39.4 ± 5.3	38.8 ± 6.2
Feed intake per group (kg)	291	349	327
Feed conversion (kg/kg)	3.45	3.91	3.72
Mortality			
6. – 7. wk of age	0	0	0
8. – 9. wk of age	3	2	1
10. – 11. wk of age	2	0	0
6. – 11. wk of age	5 (9.3%)	2 (3.7%)	1 (2.0%)

Means ± SD

[ab] Values in the same row with different superscripts differ significantly ($P < 0.05$)

Účinek kyseliny kaprylové na užitkovost a úhyny brojlerových králíků

Kyselina kaprylová (C8:0) je látka s výraznými antimikrobiálními vlastnostmi, přítomná v mléce králíků. Cílem našich pokusů bylo zjistit účinek této sloučeniny na růst a úhyny mladých králíků ve výkrmu. Kyselinu kaprylovou jsme přidali do granulované krmné směsi v množství 0, 2 a 5 g/kg, a uskutečnili dva pokusy na různých farmách s odstavenými králíky genotypů Hyla 2000 a Hyplus, věku 5 týdnů na začátku sledování (celkem 288 zvířat). V žádném z pokusů neměla kyselina kaprylová vliv na přírůstky hmotnosti. Nepozorovali jsme ani záporný účinek na příjem krmiva. Úhyny králíků v kontrolních skupinách 1. a 2. pokusu byly 16,7 a 9,3%. U králíků přijímajících krmivo s 5 g kyseliny kaprylové v 1 kg byly odpovídající úhyny 0 a 2%. V 1.pokuse byl tento rozdíl statisticky významný ($P = 0.018$). Lze učinit závěr, že kyselina kaprylová je použitelná ke snížení úhynů mladých králíků, na farmách, kde úhyny přesahují únosnou mez.

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