

The effect of probiotics on selected blood and meat parameters of broiler chickens*

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ABSTRACT

The effect of *Lactobacillus acidophilus* and *Streptococcus faecium* bacteria on selected blood and meat indicators of broiler chickens was determined. The studies were carried out on 1200 Hybro G chickens reared on litter until 49 days of age. The chickens received the probiotic (250 mg/kg) for either the whole rearing period (group I), from days 1 to 21 of age (group II), or from days 22 to 49 of age (group III). There were no significant differences in body weight or feed conversion among the groups. At 49 days of age, the chickens given the probiotic up to 21 days of age had significantly lower plasma protein, total cholesterol and HDL levels and significantly higher water binding capacity of white meat compared with the other groups. The meat of chickens given the probiotic for the whole period of rearing had a significantly higher protein content, while their crude fat and total cholesterol contents tended to decrease.

KEY WORDS: broiler, probiotic, blood indicators, meat quality

INTRODUCTION

The use of probiotics in poultry nutrition as an alternative to antibiotics as feed additives is currently the focus of interest of many research centres. Studies done to date have shown that by lowering pH in the digestive tract and producing substances with antibiotic activity, probiotics inhibit the growth of pathogenic microorganisms, resulting in lower mortality of birds during rearing (Patidar and Prajapati, 1999; Tarakanov et al., 1999; Pietras and Skraba, 2000). Numerous studies

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have shown a favourable influence of probiotics on production results, but it has also been suggested that these preparations are less effective under optimal zoohygenic conditions (Kahraman et al., 2000).

The objective of this study was to determine the effect of lactic acid bacteria supplied at various stages of growth on the productivity, biochemical blood indicators, and meat quality of broiler chickens.

MATERIAL AND METHODS

The study was conducted on 1200 broiler chicks in two replicates, randomly allocated to three groups. Until the age of 7 weeks, the chickens were housed on litter under standard thermal conditions. During the entire period of the experiments, the birds in group I were fed starter and grower diets containing 250 mg/kg of a probiotic composed of the lactic acid bacteria, *Lactobacillus acidophilus*, and *Streptococcus faecium*. Groups II and III received probiotic-supplemented feed in the first (1-21 day of life) or second (22-49 day of life) period of rearing, respectively. The feeds used in the experiment did not contain a feed antibiotic. Every week the chickens were weighed, feed consumption and mortality were recorded. After the period of rearing was completed, 10 chickens from each group were sacrificed. In the blood plasma total protein was determined by the Folin method, total and HDL cholesterol were determined using diagnostic kits from Cormay, total fat using diagnostic kits Biohemtests. In samples of white meat, basic chemical composition (Budślawski and Drabent, 1972), total cholesterol (Rhee et al., 1982), pH and water binding capacity (Grau and Hamm, 1953) were determined. Thermal drip was estimated in samples cooked for 30 min in hermetically sealed containers at 80°C.

RESULTS

The starter and grower feeds used in the experiment contained 12.4 and 12.7 MJ/kg metabolizable energy and 22.4 and 19.2% crude protein, respectively. The period during which the probiotic was fed did not significantly affect final body weight of the chickens or feed utilization, but a tendency towards higher mortality in birds that did not receive the probiotic in the second period of rearing was observed (Table 1). The mortality in the group receiving the probiotic during the entire experiment or only in the second period (from days 22 to 49 of life) was nearly identical and relatively low (1.14%). In studies to date on this problem the obtained results are not unequivocal. Some authors have shown a favourable effect of probiotics on lowering mortality and on the body weight of the chickens

TABLE 1

Performance parameters of broiler chickens

Item	Group			SEM
	I	II	III	
Body weight, g	2336.9	2378.0	2388.4	48.3
Feed conversion, kg/kg	1.94	1.92	1.94	-
Mortality, %	1.14	2.02	1.14	-

(Kalbande et al., 1992; Miljkovic et al., 1997; Brzóška et al., 1999). In contrast, Yeo and Kim (1997) and Panda et al. (2000) observed a favourable influence of microbial probiotics only in the initial phases of growth of the chickens, while Wambake and Peters (1995), Seani et al. (1997), and Patidar and Prajapati (1999) did not find a significant influence of this type of preparation on body weight gain or feed utilization. These data show that the effectiveness of probiotics depends on such factors as type and age of chicken, and strain of the probiotic organisms.

No significant differences were found between the studied blood parameters of chickens receiving lactic acid bacteria during part or the entire period of rearing (Table 2). In the group of chickens receiving the probiotic from day 1 to 21 of life, significantly lower crude protein, cholesterol, and HDL levels were found in the fourth week after stopping supplementation with the probiotic. These results are difficult to explain. The effect of probiotics on biochemical blood parameters has been the object of numerous studies. Jin et al. (1998) showed that the addition of *Lactobacillus* bacteria significantly lowered the cholesterol level in the serum of chickens. Gohain and Sapkota (1998) did not observe any impact of a probiotic on the protein and cholesterol levels of broiler chickens. Brzóška et al. (1999), in turn, found a significant increase in this components in the serum of chickens receiving a combination of *Lactobacillus plantarum*, *Bifidobacterium bifidum* and *Saccharomyces cerevisiae*, and lower serum glucose levels.

TABLE 2

Some biochemical indicators of blood plasma of broiler chickens (n=10)

Parameter	Group			SEM
	I	II	III	
Total protein, mg/ml	6.37 ^{Aa}	5.44 ^{Bb}	6.34 ^a	0.14
Total fat, mg/ml	509.6	460.7	455.7	18.421
Total cholesterol, mg/ml	116.3 ^a	103.4 ^b	119.1 ^a	2.370
HDL, mg/ml	76.4 ^a	63.8 ^b	72.4 ^a	1.601
HDL/total cholesterol	0.66	0.62	0.61	0.03

^{a,b} – P<0.05; ^{A,B} – P<0.01

No studies to date have demonstrated a significant effect of probiotics on slaughter yield or carcass composition (Brzóska et al., 1999; Panda et al., 2000). The results obtained in this study (Table 3) indicate that the period when the probiotic is used does not significantly affect the dry matter content in white meat.

TABLE 3

Physico-chemical parameters of white meat (n=10)

Parameter	Group			SEM
	I	II	III	
Dry matter, %	25.6	25.3	25.6	0.18
Crude protein, %	23.2 ^A	22.1 ^B	22.5 ^B	0.15
Crude fat, %	0.76	0.97	1.05	0.11
Total cholesterol, mg/100 g	56.3	59.8	59.9	2.25
pH	5.8	6.0	5.9	0.07
Water binding capacity, %	10.75 ^A	14.2 ^B	11.75 ^A	0.71
Thermal drip, %	28.78	30.19	26.77	1.18

^{A,B} – $P < 0.01$

The chickens receiving the probiotic during the entire period of rearing had significantly higher protein content in meat. The content of crude fat in meat was lower than in the remaining groups, but this tendency did not reach statistical significance. The chickens in this group also showed a tendency for total cholesterol to decline. In turn, at the age of 49 days, those chickens that received the probiotic only in the first period of rearing were characterized by meat with a significantly higher water binding capacity (Table 3). Endo and Nakano (1999) obtained contradictory results, and found higher fat and lower water contents in the meat and liver, and a significantly lower cholesterol content in young broiler roosters given a feed containing a probiotic, whereas Chantsavang and Watcharangkul (1999) found a significantly lower ash content and a tendency for the protein content in the breast meat of ducks to rise.

CONCLUSIONS

The results of this study show that the period during which probiotics are administered in feeds for broiler chickens does not affect production parameters, but determines the level of biochemical blood indicators and influences the protein content and water binding capacity of breast meat.

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STRESZCZENIE

Wpływ probiotyku na wybrane wskaźniki krwi i mięsa kurcząt brojlerów

W doświadczeniu przeprowadzonym na 1200 kurczętach Hybro G, odchowanych do 49 dnia życia, badano wpływ dodatku probiotyku na wybrane wskaźniki krwi i mięsa. Kurczęta grupy I otrzymywały probiotyk (250 mg/kg) przez cały okres odchovu, w grupie II od 1-21 dnia życia, w grupie III - od 22 do 49 dnia życia. Nie stwierdzono statystycznie istotnych różnic w przyrostach masy ciała i wykorzystaniu paszy między grupami kurcząt. W 49 dniu życia, u kurcząt grupy II stwierdzono istotnie niższą zawartość białka, całkowitego i HDL cholesterolu w plazmie krwi oraz statystycznie istotnie większą zdolność wiązania wody w białym mięsie w porównaniu z pozostałymi grupami. Zawartość białka w mięsie kurcząt z grupy I była istotnie większa niż z pozostałych grup, dla zawartości tłuszczu i cholesterolu całkowitego wystąpiła tendencja jej obniżenia.