Journal of Animal and Feed Sciences, 14, Suppl. 1, 2005, 475–479

Response of broiler chickens to *Lactobacillus* and *Bifidobacterium* probiotic strains*

A. Orłowski[1], M. Bielecka[1,5], W. Smoragiewicz[3], S. Kask[2] and J. Jankowski[4]

Institute of Animal Reproduction and Food Research, Polish Academy of Sciences,
[1]Department of Food Microbiology,
[2]EU Centre of Excellence CENEXFOOD
Tuwima 10, 10-747 Olsztyn, Poland
[3]University of Quebec, Department of Biology Sciences
C.P. 8888, succursale Centre-ville Montreal, Québec H3C 3P8, Canada
[4]University of Warmia and Mazury in Olsztyn, Poland
Faculty of Bioengineering of Animals, Department of Poultry Science
Oczapowskiego 5, 10-719 Olsztyn, Poland

ABSTRACT

The effects of two *Lactobacillus* and two *Bifidobacterium* probiotic strains (given daily in an amount of 10^9-10^{10} live cells per bird, in water) as well as an antibiotic, avilamycin (8 mg/kg of diet), were determined. The live body weight of chickens in groups receiving probiotics or avilamycin (2625-2665 g) was higher than in the control group (2564 g), however the differences were not significant. The feed conversion ratio was significantly better in most of the investigated groups in comparison with the control. Chemical, physicochemical and sensory evaluation of the meat did not show significant differences between groups. The relatively high population count of *Bifidobacterium* and *Lactobacillus* in the control group (~10^8 cfu/g of caecal contents) was slightly lower in comparison with the investigated groups (10^8-10^9 cfu/g).

KEY WORDS: *Lactobacillus*, *Bifidobacterium,* probiotics, performance, broiler chickens

INTRODUCTION

Using subtherapeutic doses of antibiotics as prophylactic supplements or growth-promoting agents in poultry production caused an increase of antibiotic

* Support from the EU project CENEXFOOD (scholarship for S. Kask within the framework of the Centre of Excellence project), and Ministere de l'Agriculture, des Pecheires et de l'Alimentation, CORPAQ, Quebec, Canada, Projet No. 100073 is greatly appreciated

[5] Corresponding author: e-mail: mabiel@pan.olsztyn.pl

resistance among pathogens, and consequently limited the therapeutic value of antibiotics. Therefore, many authors are looking for other protectors against infections and/or growth stimulators. The aim of the study was to investigate the effect of the selected *Lactobacillus* and *Bifidobacterium* probiotic strains as an alternative for antibiotics in broiler feeding.

MATERIAL AND METHODS

Two hundred and forty one-day-old male broiler chickens (Ross 308) were randomly allocated to 6 groups, 40 birds each, in two replicates. The chickens received a diet containing all of the necessary nutrients and coccidiostatic diclazuril (1 mg/kg of diet). The starter diet was fed until the 21 day and the grower diet, from 22 day, providing 2950 and 3100 MJ/kg ME, and 225 and 216 g/kg crude protein, respectively. The control group received a standard diet without supplements, the antibiotic group - a diet supplemented with 8 mg avilamycin/kg. From the first day, chickens in the probiotic groups received the standard diet and different cultures of probiotic strains in the amount of $\sim 10^9$ cfu to $\sim 10^{10}$ cfu per bird per day in gradually increasing concentrations, twice a day in water. The strains used were: *Lactobacillus salivarius* AWH (isolated from chicken crop), *L. acidophilus* BS (from bio-yoghurt), *Bifidobacterium longum* KNA1 (from infant faeces) and *B. animalis* Bi30 (from bio-yoghurt).

All chickens were weighed, feed consumption and mortality were recorded. On day 39, six randomly selected chickens from each group were sacrificed and dissected, and meat parameters (chemical, physicochemical and sensory) were evaluated. *Bifidobacterium and Lactobacillus* counts in caecum content, as the most beneficial genera to host health, were determined on modified Garche's and MRS media, respectively, as previously described by Biedrzycka et al. (2003).

The results were subjected to statistical analysis using analysis of variance with Statistica 6.0pl software. The microbiological results were expressed as log colony forming units (cfu) per gram of caecal content. Arithmetic means in groups of chickens as well as significance of differences between groups were calculated with Student's *t*-test for less numerous groups.

RESULTS AND DISCUSSION

The average live body weight (LBW) of 39-day-old chickens receiving probiotics ranged from 2625 g (group receiving *L. acidophilus* BS) to 2665 g (*B. animalis* Bi30), was comparable with that receiving the feed supplemented with avilamycin (2655 g) and slightly higher than in the control group (2564 g) (Table 1). The feed conversion ratio (FCR) in the groups receiving

L. salivarius AWH, *L. acidophilus* BS and *B. longum* KNA1 was significantly lower than in the control (1.593 kg/kg LBW) and avilamycin groups (Table 1). Using diets supplemented with unknown strains of *L. acidophilus* and *S. faecium* (250 mg/kg), Pietras (2001) observed no effect on final body weight

Table 1. Performance of broilers

Item	Dietary treatment						SEM
	Control	Avilamycin	AWH	BS	KNA1	Bi30	
Live body weight, g	2564	2655	2647	2625	2661	2665	14.93
FCR, kg/kg LBW	1.593^{ac}	1.576^{a}	1.546^{b}	1.555^{b}	1.553^{b}	1.608^{c}	0.007

probiotic strains applied: *Lactobacillus salivarius* AWH, *L. acidophilus* BS, *Bifidobacterium longu m* KNA1 and *B. animalis* Bi30; *n*=40
FCR - feed conversion rate; LBW-live body weight; significance level: ^{a,b,c} - P≤0.05

of chickens and feed utilization. Also, Patidar and Prajapati (1999) did not find a significant influence of microbial preparation on body weight gain or feed utilization. The authors concluded that the effectiveness of probiotics could depend on bacterial strains. Our results confirmed that conclusion. In the experiment, mortality was limited to one bird in each group. No significant differences in slaughter yield, chemical and physicochemical parameters, or sensory evaluation of meat between chicken groups were observed (data not shown).

The examined probiotic strains of *Lactobacillus* and *Bifidobacterium* did not significantly change the population count of these genera in the chicken caecum (Table 2). The *Bifidobacterium* population count varied between 7.83 (group

Table 2. Caecal microflora of broilers, log cfu/g

Bacteria	Dietary treatment					
	control	avilamycin	AWH	BS	KNA1	Bi30
Bifidobacterium	8.14 ± 0.47	7.91 ± 0.77	7.83 ± 0.51	8.15 ± 0.99	8.46 ± 0.44	7.85 ± 0.67
Lactobacillus	8.53 ± 0.34	8.66 ± 0.27	8.57 ± 0.10	7.85 ± 0.30*	8.96 ± 0.47	8.92 ± 0.44

probiotic strains used: *Lactobacillus salivarius* AWH, *L. acidophilus* BS, *Bifidobacterium longum* KNA1 and *B. animalis* Bi30; *n*=6; significance level: * - P≤0.01

L. saliavrius AWH) and 8.46 log cfu/g (*B. longum* KNA1) and was comparable with the control (8.14) and antibiotic (7.91 log cfu/g) groups. *Lactobacillus* counts ranged between 8.53 and 8.96 log cfu/g and were similar in all investigated groups with the exception of the one receiving *L. acidophilus* BS (7.85±0.30 log cfu/g) (P≤0.01). It should be stressed that all of the investigated chickens were in very good condition and that the counts of these beneficial bacteria ranged between 10^8 and 10^9 cfu/g of caecum contents, which is relatively high. Similarly, Lan et al. (2003) found no significant difference in faecal population counts of *Lactobacillus* after 40 days of administration of two *Lactobacillus* probiotic strains in comparison with the control chickens. Our experiment was carried out on healthy birds, so this could explain the negligible impact of the applied probiotic strains on their performance and caecal microflora.

REFERENCES

Biedrzycka E., Bielecka M., Majkowska A., Jankowski J., 2003. The effect of *Bacillus cereus* var. *toyoi* and avilamycin on the faecal microflora of turkeys. J. Anim. Feed Sci. 12, 821-823

Lan P.T., Binh le T., Benno Y., 2003. Impact of two probiotic *Lactobacillus* strains feeding on fecal lactobacilli and weight gains in chicken. J. Gen. Appl. Microbiol. 49, 29-36

Patidar S.K., Prajapati J.B., 1999. Effect of feeding lactobacilli on serum antibody titer and faecal microflora in chicks. Microbiol. Alim. Nutr. 17, 145-154

Pietras M., 2001. The effect of probiotics on selected blood and meat parameters of broiler chickens. J. Anim. Feed Sci. 10, Suppl. 2, 297-302

STRESZCZENIE

Reakcja kurcząt brojlerów na probiotyczne szczepy *Lactobacillus* i *Bifidobacterium*

Badano wpływ dwóch szczepów *Lactobacillus* i dwóch *Bifidobacterium* (10^9-10^{10} żywych komórek zawieszonych w wodzie/ptaka) oraz antybiotyku - avilamycyny (8 mg/kg paszy) na wyniki odchowu i mikroflorę jelita ślepego kurcząt. Po 39 dniach masa ciała kurcząt (2625-2665 g) w grupach otrzymujących probiotyki lub avilamycynę była większa niż w grupie kontrolnej (2564 g), jednakże różnice te nie były istotne statystycznie. Wykorzystanie paszy w większości badanych grup było statystycznie lepsze niż w grupach kontrolnej i otrzymującej antybiotyk. Ocena chemiczna, fizyko-chemiczna i sensoryczna mięsa nie wykazała istotnych różnic pomiędzy grupami. Liczebność populacji *Bifidobacterium i Lactobacillus* w grupie kontrolnej (~10^8 jtk/g treści jelita ślepego) była stosunkowo wysoka i tylko nieznacznie niższa od liczebności tych bakterii w grupach badanych (10^8-10^9 jtk/g).