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

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**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

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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 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>
<thead>
<tr>
<th>Item</th>
<th>Control</th>
<th>Avilamycin</th>
<th>AWH</th>
<th>BS</th>
<th>KNA1</th>
<th>Bi30</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live body weight, g</td>
<td>2564</td>
<td>2655</td>
<td>2647</td>
<td>2625</td>
<td>2661</td>
<td>2665</td>
<td>14.93</td>
</tr>
</tbody>
</table>
| FCR, kg/kg LBW        | 1.593
|                       | 1.576
|                       | 1.546
|                       | 1.555
|                       | 1.553
|                       | 1.608     | 0.007 |
probiotic strains applied: Lactobacillus salivarius AWH, L. acidophilus BS, Bifidobacterium longum KNA1 and B. animalis Bi30; n=40
FCR - feed conversion rate; LBW-live body weight; significance level: a,b,c - P≤0.05

L. salivarius 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

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>control</th>
<th>avilamycin</th>
<th>AWH</th>
<th>BS</th>
<th>KNA1</th>
<th>Bi30</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bifidobacterium</td>
<td>8.14 ± 0.47</td>
<td>7.91 ± 0.77</td>
<td>7.83 ± 0.51</td>
<td>8.15 ± 0.99</td>
<td>8.46 ± 0.44</td>
<td>7.85 ± 0.67</td>
<td></td>
</tr>
<tr>
<td>Lactobacillus</td>
<td>8.53 ± 0.34</td>
<td>8.66 ± 0.27</td>
<td>8.57 ± 0.10</td>
<td>7.85 ± 0.30*</td>
<td>8.96 ± 0.47</td>
<td>8.92 ± 0.44</td>
<td></td>
</tr>
</tbody>
</table>
probiotic strains used: Lactobacillus salivarius AWH, L. acidophilus BS, Bifidobacterium longum KNA1 and B. animalis Bi30; n=6; significance level: * - P≤0.01
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


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 odchowy 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).