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EFFECT OF PROBIOTIC SUPPLEMENTATION ON PERFORMANCE OF DIFFERENT BROILER GENOTYPES

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Abstract
This experiment was conducted to investigate the effects of probiotic strain *Lactobacillus fermentum* supplementation on the performance and carcass parameters of different genotypes of broiler chickens. Totally 60 one-day-old chickens of Cobb 500, 60 one-day-old chickens of Hubbard JV and 60 one-day-old chickens of Ross 308 were divided in two groups: control chicken group (n=30) received drinking water without any additives and experimental chickens group (n=30) received probiotic strain *Lactobacillus fermentum* CCM 7158 with concentration of $1x10^9$ colony forming units (CFU) in drinking water from day 1 to day 42 of fattening. Individual body weights of all birds, feed conversion ratio per group were determined in 21 and 42 day, total mortality rate we recorded in 42 day of fattening period. Carcass quality of broiler chickens was determined at the end of the experiment. The supplementation of probiotic affected positively body weight ($P<0.05$) in all broiler chicken genotypes in 21 and 42 day of fattening. Feed conversion ratio in 21 and 42 day was similar in control and experimental groups. The probiotic no significant ($P\geq0.05$) affected percentage of breast and thighs form carcass body, weight of giblets and carcass yield. The probiotic addition significantly ($P<0.05$) reduced the abdominal fat content of the chicken meat.
Key words: *Lactobacillus fermentum*, body weight, feed utility, mortality, carcass parameters

INTRODUCTION

The consumption of chicken meat is of increasing importance in the EU and per head consumption is still rising. One reason for this case might be a more health-conscious nutrition by the consumers. Other reasons like the BSE problem or antibiotic abuse in pig production might also be important for an increase in consumption of chicken meat **(Schedle *et al.*, 2006)**.

Research studies have reported feed residues in chicken meat products and the development of bacterial resistance to antibiotics used both in human medicine and poultry production **(Edens, 2003)**.

On 1st January 2006 the European Union introduced a complete ban on the use of antibiotic growth promoters in feeds for animals for consumption. The ban was introduced at the same time in all Member States. Since then, antibiotics have been allowed to be used as medicines only in medical feeds or prophylactic additives. Resolution No 1831/2003 EC of the European Parliament and Council of 22nd August 2003 devoted to the issue of additives used in feeding animals described probiotics as alternative feed additives to antibiotic growth promoters **(Casewell *et al.*, 2003; Patterson and Burkholder, 2003; Berghmann *et al.*, 2005)**.

Probiotics are additives that can be used to replace antibiotics in poultry nutrition **(Griggs and Jacob, 2005)**. The term probiotic stems from the Greek and means "in favor of life"; its antonym is antibiotics, which means "against life" **(Coppola and Turnes, 2004)**.
Probiotics are defined as live microbial food supplements, which beneficially influence only not human **(Songisepp *et al.*, 2005)**, but also poultry health and performance, chickens **(Haščík *et al.*, 2005; Weis *et al.*, 2010)**, hens **(Capcarova *et al.,* 2010)**, turkeys **(Capcarova, 2008)**, pigeons (**Malíková *et al.,* 2013)** and waterfowl **(Weis *et al.*, 2008; Hrnčár *et al.*, 2013)**.
Probiotics in poultry maintaining normal intestinal microflora by competitive exclusion and antagonism **(Kabir *et al.,* 2005; Kizerwetter-Swida and Binek, 2009)**, alter metabolism by increasing digestive enzyme activity and decreasing bacterial enzyme activity and ammonia production **(Yoon *et al.*, 2004; Nayebpor *et al.*, 2007)**, improve feed intake and stimulate the immune system **(Kabir *et al.*, 2004; Haghighi *et al.*, 2005; Apata, 2008)**. The selection of bacteria such as *Lactobacillus*, *Pediococcus*, *Bacteroides*, *Bifidobacterium*, *Bacillus* and *Streptococcus*, for use as probiotics is based on assessment of their metabolic products and their potential to colonize specific sites **(Lima *et al.*, 2007)**. The ability of lactic acid bacteria to inhibit various G-positive and G-negative bacteria is well known. This inhibition may be related to the production of organic acids, hydrogen peroxide and bacteriocin-like substances that are active against certain pathogens and may be produced by different species of *Lactobacillu*s **(Messaoudi *et al.*, 2005)**.
Lactobacillus sp. are normal inhabitants of the intestinal tract, especially of poultry **(Juven *et al.*, 2001)**. Lactobacilli mainly compose the flora in crop and ileum region in poultry **(Gong *et al.*, 2002)**. *Lactobacilli* are rod shape bacteria and possess different biochemical and physiological properties **(Tannock *et al.*, 1999).** Many *Lactobacillus* strains, isolated from various sources, are being used as probiotic agents and it is unlikely that all functional characters of a probiotic are present in each species/strain. It needs thorough study and documentation. Generally recognized beneficial properties are the origin of the strain being used, the surviving ability within the GI tract, non-pathogenic activities and the modulation ability in immune responses **(Gibson and Fuller, 2000; Dunne *et al.*, 2001; Holzapfel *et al.*, 2001)**.
The objective of this study was to provide a comparison of the effect of probiotic strain *Lactobacillus fermentum* supplementation in drinking water on performance and carcass parameters of different genotypes broiler chickens (Cobb 500, Hubbard JV, Ross 308).

MATERIAL AND METHODS

The experiment was realised in half-operation conditions of experimental basis of Department of Poultry Science and Small Animal Husbandry (Certificate of Authorization to Experiment on Living Animals, State Veterinary and Food Institute of Slovak Republic, no. SK PC 30008).
Totally 60 one-day-old chickens of Cobb 500, 60 one-day-old chickens of Hubbard JV and 60 one-day-old chickens of Ross 308 were divided in two groups: control chicken group (n=30) received drinking water without any additives and experimental chickens group (n=30) received probiotic strain *Lactobacillus fermentum* CCM 7158 with concentration of $1x10^9$ colony forming units (CFU) in drinking water from day 1 to day 42 of fattening. Quantization of drinking water and probiotic strain are presented in Table 1.

Table 1 Dose of drinking water and probiotic strain in experimental group

Week of fattening	Total amount of drinking water per day (l)	Dose of probiotic strain (g)	CFU in 1 ml of drinking water
1.	2.50	6.60	$2.64x10^6$
2.	3.50	6.60	$1.90x10^6$
3.	4.60	3.70	$8.04\ x10^5$
4.	6.70	3.70	$5.52\ x10^5$
5.	8.60	3.70	$4.30x10^5$
6.	10.60	3.70	$3.49x10^5$

The feeding period lasted 42 days. The chickens were fed with starter diet in powdery form from days 1 to 21 and grower diet with granular form from days 22 to 49. The nutrition value of the diets were shown in Table 2. Feeding was provided on an ad libitum basis from containers on the front of the cages.

Table 2 Nutritional value of complete feed mixtures

Nutrient	Unit	Starter	Grower
Crude protein	g/kg	min. 210.00	min. 190.00
ME	MJ/kg	min. 12.00	min. 12.00
Lysine	g/kg	min. 11.00	min. 9.50
Methionine and cistine	g/kg	min. 7.50	min. 7.50
– from that methionine	g/kg	min. 4.50	min. 4.00
Linoleic acid	g/kg	min. 10.00	min. 10.00
Calcium	g/kg	min. 8.00	min. 7.00
Phosphorus	g/kg	min. 6.00	min. 5.00
Sodium	g/kg	1.20–3.00	1.20–2.50
Manganese	mg/kg	min. 50.00	min. 50.00
Iron	mg/kg	min. 60.00	min. 60.00
Copper	mg/kg	min. 6.00	min. 6.00
Zinc	mg/kg	min. 50.00	min. 50.00
Vitamin A	i.u./kg	min. 10000.00	min. 8000.00
Vitamin B_2	mg/kg	min. 4.00	min. 3.00
Vitamin B_{12}	µg/kg	min. 20.00	min. 20.00
Vitamin D_3	i.u./kg	min. 1200.00	min. 1200.00
Vitamin E	mg/kg	min. 15.00	min. 15.00

Birds were stabled in a 3-etage cage technology consisted of 18 cages with proportions 75x50 cm (0.375 m^2).
During the 42 days experimental period was recording body weight (g) a feed conversion ratio (g/g) in 24 and 42 day of fattening. total mortality we recorded in 42 day of fattening period.
At the end of the experiment, 10 broiler chickens of similar body weight to the group average were selected from each group, weighted and killed by severing of the bronchial weight. The weights of carcass, breast, giblets and abdominal fat were recorded individually.

Data were analyzed using analysis of variance (ANOVA) **(SAS, 2001)**. Significant difference was used at 0.05 probability level and differences between groups were tested using the Duncan's procedure **(Duncan, 1955)**.

RESULTS AND DISCUSSION

The effect of probiotic supplement to the drinking water on chickens live weight is shown in Table 3. In Cobb 500, Hubbard JV and Ross 308 hybrids, there was significant (*P<0.05*) difference in body weight of broiler chickens between control and experimental groups on day 21. At the end of the experiment (day 42), broiler chickens of all hybrids supplemented with prebiotic strain *Lactobacillus fermentum* in drinking water had higher body weight in compare of control group (*P<0.05*). These results are in agreement with **Kabir *et al.* (2004)** who observed improvement of final body weight of broiler chickens at addition of probiotic preparate. In contrast, our results are opposite to those of **Lima *et al.* (2003)** and **Awad *et al.* (2008)** who recorded reported that addition of probiotic to broilers diet did not show any significant effect on body weight compared with control group.

Table 3 The effect of probiotic on body weight and feed conversion ratio of broiler chickens

	Body weight (g)		Feed conservation ratio (g/g)	
	21 day	42 day	21 day	42 day
Cobb 500				
Control	724.68±78.05	2137.58±221.43	1.56±0.02	1.84±0.04
Experimental	779.81±77.49[a]	2294.08±221,84[a]	1.54±0.03	1.83±0.04
Hubbard JV				
Control	701.57±69.74	2119.38±211.57	1.54±0.02	1.82±0.03
Experimental	748.25±70.53[b]	2197.98±213.58[b]	1.53±0.02	1.82±0.03
Ross 308				
Control	718.84±71.67	2146.74±223.29	1.55±0.02	1.84±0.03
Experimental	765.74±70.41[c]	2299.81±223.47[c]	1.55±0.02	1.82±0.03

Values shown are mean ± SD (standard deviation)
a,b,c Means in a row with different superscript differ significantly (P<0.05)

During our experiment, there was not any significant (*P≥0.05*) difference in feed conversion ratio (FCR) between groups after application of probiotic strain *Lactobacillus fermentum*. Similar results were found by **Samli *et al.* (2007)** and **Willis and Reid (2008)** who found that addition of probiotic did not have any significant effect on FCR of broiler chickens. However, our findings on feed consumption were in contrast to those of **Aftahi *et al.* (2006), Chafai *et al.* (2007)** and **Mountzouris *et al.* (2007)**, who reported that addition of probiotic to broiler chicken diets decreased FCR significantly (*P<0.05*).

In hybrids Cobb 500 and Hubbard JV we recorded reduced total mortality in benefit of experimental groups on the end of fattening period (3.33 vs. 6.67%). The total mortality rate in the both groups in Ross 308 was identical (6.67 %). **Cmiljanic *et al.* (2001)** proved a reduction of mortality rate of broiler chickens due to the addition of probiotic.

Data presented in Table 4 show that percentage of breast, percentage of thighs, weight of giblets and carcass yield were not affected by using probiotic strain *(P≥0.05)*. We found statistically significant reduction *(P<0.05)* of % abdominal fat in benefit of supplementation of probiotic strains. Similar value of the slaughter are in contrast with results drawn from the study of **Haščík *et al.* (2008)** who concluded that there is statistically significant influence of the supplementation of probiotic on carcass parameters of broiler chickens. Similar values of carcass yields in broiler chickens supplemented or not with probiotic were found by **Pelicano *et al.* (2004)**. Also, **Kalavathy *et al.* (2006)** observed significant reduction of the supplementation of probiotic on abdominal fat content of the poultry.

Table 4 The effect of probiotic on some carcass parameters of broiler chickens

	Percentage of breast (%)	Percentage of thighs (%)	Weight of abdominal fat (%)	Carcass yield (%)	Weight of giblets (g)
Cobb 500					
Control	30.31±2.04	31.74±2.01	33.74±3.87	77.18±2.14	114.74±24.84
Experimental	30.42±1.99	31.58±2.14	48.21±5.74[a]	77.31±2.19	119.26±21.56
Hubbard JV					
Control	29.84±2.01	30.96±1.84	31.08±3.11	76.88±1.91	110.85±21.53
Experimental	29.98±1.96	31.04±1.85	45.53±5.07[b]	76.97±1.96	113.74±22.69
Ross 308					
Control	30.28±1.88	31.77±2.11	34.01±4.19	77.14±2.24	116.85±25.87
Experimental	30.37±1.92	31.62±2.13	48.88±5.27[c]	77.25±2.21	114.65±23.51

Values shown are mean ± SD (standard deviation)
a,b,c Means in a row with different superscript differ significantly ($P<0.05$)

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CONCLUSION

The results from this study show that supplementation of probiotic strain *Lactobacillus fermentum* in drinking water statistically significant affected body weight and no statistically significant affected feed conversion ratio in 21 and 42 day of fattening period. The tested probiotic strain had a no significant effect on percentage of breast and thighs from carcass body, weight of giblets and carcass yield. From carcass parameters we found only reduction of weight of abdominal fat in carcass body in all hybrid genotypes.

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