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Effects of Probiotic Supplementation on Broiler Performance

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ABSTRAK

Satu kajian mengenai kesan penambahan probiotik ke atas prestasi ayam pedaging telah dijalankan dengan 600 ekor anak ayam pedaging berumur sehari baka Avian. Tempoh kajian ialah selama 35 hari dan kultur laktobasilus komersial telah diberikan kepada ayam rawatan melalui air minuman sepanjang tempoh percubaan. Keputusan kajian menunjukkan pertambahan pencapaian berat badan akhir yang bererti (P<0.05) pada kumpulan ayam rawatan pada umur 21, 28 dan 35 hari. Kadar pertukaran makanan untuk ayam rawatan juga menunjukkan pertambahan prestasi yang bererti (P<0.05) selepas ayam berumur lebih dari 1 minggu. Kumpulan ayam rawatan mempunyai pertambahan berat badan harian dan jumlah pengambilan makanan yang lebih tinggi daripada ayam kawalan tetapi pertambahan ini tidak berbeza secara bererti daripada kumpulan kawalan. Penggunaan probiotik dalam air minuman akan meningkatkan pendapatan penternak ayam pedaging sebanyak 11.76 sen/ekor ayam.

ABSTRACT

A study on the effect of probiotic supplementation on broiler performance was carried out with 600 one day-old Avian broiler chicks. The duration of study was 35 days and a commercially prepared lactobacillus culture was given to the treated birds via drinking water throughout the 35 days. The results showed that the live weight of the treated bird was significantly (P<0.05) improved at 21, 28 and 35 days of age. Feed conversion ratio of the treated bird was significantly (P<0.05) improved after the first week. The treated bird had a better, but not significantly different, daily live weight gain and total feed intake than the control bird. Probiotic supplementation via drinking water increases the income of the broiler farmer by as much as 11.76 cents/bird.

INTRODUCTION

The extensive use of many types of nutritive and non-nutritive additives in broiler production is inevitable with large scale intensive production. Antibiotics have been used to promote growth rate, improve feed conversion ratio and reduce mortality in broiler flocks. However, the extensive use of antibiotics has resulted in the occurrence of an antibiotic residue problem in poultry meat and an increase in both the proportion and persistence of antibiotic-resistant faecal bacteria (Smith and Crabb, 1957), a problem of concern to public health and which may affect the exportation of poultry meat and products. Thus, a product similar to antibiotics which maintain good health, improving weight gain and feed conversion ratio in broilers without any residue in the meat is highly desirable in broiler production.

Probiotic is defined as a microorganism or substance which contributes to the intestinal microbial balance (Parker, 1974; Jerningan and Miles, 1985). The inclusion of probiotic to poultry diet results in a significant improvement in weight and feed efficiency (Tortuero, 1973; Dilworth and Day, 1978; Adler and DaMassa, 1980). Chick mortality decreased from 100 to 0% in gnotobiotic chicks fed *L. acidophilus* even though they were challenged with pathogenic *E. coli* (Watkins *et al.*, 1982). Recently, a probiotic was introduced into the Malaysian market by a few pharmaceutical companies for the livestock

industry. Since the majority of research on probiotics has been concerned with topics other than its role as a growth promoter, a study was conducted to assess its effects on broiler performance.

MATERIALS AND METHODS

Broiler Stock and Experimental Design

A total of 600 one day-old chicks (Avian) from the Universiti Pertanian Malaysia Hatchery Unit were reared under the deep litter system with wood shavings as the bedding material. The birds were randomly allocated to six pens with 100 birds/pen. The control and treated groups were randomly assigned to the pens with three replicates each of 100 birds per treatment. The treated group was given probiotic (0.15g/300 birds or 200,000 viable lactobacilli per bird per day) in the drinking water throughout the 35 day experimental period.

Probiotic

The probiotic used was a commercially prepared freeze-dried viable lactobacillus culture packed in aluminium sachets. Each sachet contained 5 lactobacilli and 4 x 10^8 (400 million) viable lactobacilli per g. The viability of the lactobacilli was monitored by isolation of lactobacilli from the faeces of birds daily during the first week and thereafter weekly according to the procedure of Gilliland *et al.* (1975). The culture medium used was lactobacillus selective agar (LBS).

Husbandry

The broiler house used in this trial was an open-type housing with wire-netting walls and monitor roofing made of asbestos with 8 pens, 6 of which were used in this trial. The birds were fed from day 1 to day 21 with a commercially prepared broiler starter crumble containing 21% crude protein and which from day 22 was gradually changed to broiler finisher containing 19% crude protein. Both feed and water were provided *ad libitum*. The birds were vaccinated against Newcastle disease with the Newcastle disease (F) vaccine at day 7 and day 26 and against fowl pox at day 26. The wood shavings used as litter material were monitored for the presence of salmonella (Ellis, 1976).

Data Collection

Feed intake and mortality were monitored daily. All the birds in each replicate were weighed weekly. The feed intake, live weight, live weight gain and feed conversion ratio were calculated on a per bird basis. The data collected were statistically analyzed using the SAS computer software for student-t test. Economic evaluation of the administration of this probiotic was also calculated on a per bird basis.

RESULTS AND DISCUSSION

Table 1 summarises the performance of the birds. The effect of probiotic supplementation on broiler production is shown to be favourable as birds on probiotic supplementation had significantly higher ($P<0.05$) live weight at day 35 and a better feed conversion ratio than the control. There was no significant difference in daily live weight gain, total feed consumption and mortality of both groups. Table 2 shows the weekly live weight and weekly feed intake of the control and treated birds. Although there was no difference in feed intake between treated birds and the control birds, birds on the probiotic supplementation had a significantly higher ($P<0.05$) live weight at day 21, 28 and 35. This is in agreement with the findings of Dilworth and Day (1978), Adler and DaMassa (1980) and Tortuero (1973), where live weight per bird improved by as much as 66 g at age 35 days. Improvement in live weight could be ascribed to improved digestion and absorption of nutrients in the digestive tract due to the presence of amylase derived from the lactobacilli. The improvement in feed conversion ratio of the treated birds is an indication that treated birds had better feed utilization than control birds due to the presence of the lactobacilli. The mortality rate of the control and treated groups during the brooding period (first three weeks of life) was 1.67% and 0.67%, respectively. The overall mortality rate from day 1 to day 35 was 3% for the control group and 2% for the treated group. Thus, mortality rate for the treated group was not significantly lower than that of the control group. Post-mortem and laboratory diagnoses indicated that two birds from the control group died of colibacillosis, which is in agreement with the finding by Watkin *et al.* (1982) and further strengthens the "Nurmi

TABLE 1
Performance of birds with and without probiotic supplementation (35 days duration)

Parameter	Control	Treated
Initial weight (g/bird)	39.9 ± 0.38[a]	40.1 ± 0.38[a]
Final live weight (g/bird)	1411.5 ± 14.0[a]	1477.9 ± 8.9[b]
Liveweight gain (g/bird/d)	39.2 ± 0.4[a]	41.1 ± 0.3[a]
Feed intake (g/bird)	2405.8 ± 8.4[a]	2346.5 ± 14.6[a]
Feed conversion ratio (g feed/g gain)	1.75 ± 0.01[a]	1.69 ± 0.01[b]
Mortality (%)		
1-3 weeks	1.67[a]	0.67[a]
1-35 days	2.00[a]	3.00[a]

[ab] Means ± SEM in a row with different superscripts differ significantly (P<0.05)

TABLE 2
Weekly live weight (g/bird) and feed intake (g/bird) of birds with and without probiotic supplementation

Age (days)	Live weight		Feed intake	
	Control	Treated	Control	Treated
1	39.9 ± 0.38[a]	40.1 ± 0.38[a]		
7	147.8 ± 1.20[a]	141.3 ± 3.12[a]	121.9 ± 0.83[a]	117.0 ± 1.89[a]
14	344.4 ± 3.45[a]	347.2 ± 4.65[a]	301.1 ± 4.38[a]	293.7 ± 3.94[a]
21	622.4 ± 9.67[a]	650.8 ± 7.58[b]	459.6 ± 8.64[a]	463.3 ± 5.92[a]
28	992.1 ± 10.93[a]	1036.5 ± 7.26[b]	667.0 ± 2.56[a]	681.0 ± 8.18[a]
35	1411.4 ± 13.95[a]	1477.9 ± 8.85[b]	856.4 ± 12.05[a]	881.5 ± 8.49[a]

[ab]Means ± SEM in a row for the same parameter with different superscripts differ significantly (P<0.05)

TABLE 3
Economic analysis of probiotic supplementation in broiler diets

Parameter	Control	Treated
Cost (sen/bird)		
Probiotic	0	2.66
Starter feed (RM746/tonne)	81.42	80.69
Finisher feed (RM728/tonne)	95.68	98.63
TOTAL	177.11	181.98
Income (sen/bird) (RM2.50/kg)	352.84	369.47
Gross income (sen/bird)	175.73	187.49
Difference between treated and control group (sen/bird)	11.76	

concept" of competitive exclusion of pathogenic microorganism from the gastrointestinal tract of chickens fed with probiotic (Nurmi and Rantala, 1973; Impey and Mead, 1989).

When the price of starter feed and grower feed was RM746/tonne and RM728/tonne, respectively, and the cost of probiotic was 2.66 sen/bird/day; the extra income a farmer will get is 11.76 sen per bird (Table 3). Thus the usage of probiotic may potentially increase the income of broiler farmers by 6.7%. This clearly indicates that the inclusion of probiotic in the broiler diet can be profitable. Table 3 shows the analysis of the economic advantage of probiotic supplementation, with the result that an extra income of 11.76 sen per bird is achieved with supplementation of probiotic via the drinking water.

In conclusion, the supplementation of freeze-dried viable culture of lactobacillus or probiotic in broiler diet via drinking water showed an improvement in the live weight gain and feed conversion ratio of broilers indirectly providing an extra production margin to the broiler farmer.

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