Pertanika J. Trop. Agric. Sci. 39 (4): 577 - 587 (2016)

PERTANIKA JOURNALS

TROPICAL AGRICULTURAL SCIENCE

Journal homepage: http://www.pertanika.upm.edu.my/

Impact of Daily Supplement of Probiotic on the Production Performance of Akar Putra Chickens

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ABSTRACT

This study was conducted to investigate the effects of prepared probiotic (PP) on the live body weight, weight gain, feed intake and feed conversion ratio in Malaysian chicken (Akar Putra). A total of 72 day-old Akar Putra chicks were reared for 12 weeks and randomly assigned to three dietary treatments (24 chicken/treatment), with 3 replications for each (8 chicken/replicate). The treatments consisted of a control group (T1), and the supplemented diet with probiotic in the second treatment was prepared at the rate 1:1 (1 kg of commercial broiler feed + 1 g PP). While the rate was 1:2 (1 kg of commercial broiler feed + 2 g PP) in the third treatment. Supplementing probiotic in both rates revealed significant improvement in terms of males' and females' growth rates, final live body weight, weight gain and feed conversion ratio. Based on the research findings, the best results were obtained when chickens received 1 g PP in males and 2 g in females.

Keywords: Akar Putra chicken, probiotic, production performance

ARTICLE INFO

Article history:
Received: 15 December 2015
Accepted: 27 May 2016

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INTRODUCTION

Akar Putra is a Malaysian chicken species that is characterised by a slow growth rate compared to modern broiler chicken (Jawad et al., 2015). Since 2006, antibiotics has been banned for use as feed additives by the European Union because the continued use results in common problems such as

ISSN: 1511-3701

development of drug resistant bacteria, imbalance of normal microflora and drug residues in animal products (Chen et al., 2009). This necessitates the need for other alternatives like probiotics. Probiotics have become important as replacement feed additives (Steiner, 2006). A probiotics is a live microbial feed supplement that beneficially affects the host animal by improving its intestinal microbial balance. Probiotics have been classified as Generally Recognised as Safe (GRAS) by Food and Drug Administration (FDA). The concept of their use relates to maintaining the equilibrium of intestinal microflora by the addition of beneficial microorganisms (Goldin, 1998). Many studies have reported the benefits of probiotic utilisation on productive indices (Cavazzoni et al., 1998; Jin et al., 1998). Dhama et al. (2012) and Al-Gharawi (2012) also reported that use of probiotics, including *Lactobacillus sp.*, improved the growth performance, feed efficiency, immunity parameters and disease resistance. The major probiotic strains include *Lactobacillus*, *Saccharomyces*, *Streptococcus* and *Aspergillus* (Tannock et al., 2001). At present, *Bacillus*, *Lactobacillus* and *Saccharomyces* are the major strains commonly used in broilers (Zhang et al., 2005; Chen et al., 2009).

The mixture of *Lactobacillus acidophilus*, *Bacillus subtilis*, *Bifidobacterium* and *Saccharomyces cerevisia* was used as

Table 1
Composition of basal diet

Items	Basal Diet	
	1 to 22 d	23 to 84 d
Corn	44.9	53.10
Wheat	18.0	15
Soybean meal (45%)	33	27
Mineral and vitamin premix	1	1
Oil	2	3
Limestone	0.8	0.6
Dicalcium phosphate	0.3	0.3
Total	100 %	100 %
Calculated analysis		
Crude protein (%)	21.92	19.70
Metabolism energy (kilo calorie per kg. Diet)	2990	3100
Calcium (%)	0.93	0.85
Phosphorus (%)	0.48	0.45
Methionine (%)	0.55	0.50
Lysine (%)	1.35	1.25
Methionine + Cysteine (%)	0.85	0.91
Folic acid	1.1	1.2

Calculated analysis according to NRC (1984).

probiotic for the first time by Lokman et al. (2015) when one and two gram of the prepared probiotic was fermented with the daily feed of Akar Putra chicken. The authors reported that noticeable enhancement in the production parameters was obtained especially for 2g of the probiotic. Moreover, a few studies have investigated the production effectiveness of adding a mixture of probiotics in the chicken diet. Thus, the present study was undertaken to evaluate the effects of daily supplementing probiotic including *Lactobacillus acidophilus*, *Bacillus subtilis*, *Bifidobacterium* and *Saccharomyces cerevisia*, with feed (without fermentation) on the production performance of Malaysian chicken (Akar Putra).

MATERIALS AND METHODS

Preparation of Probiotic

Feed shown in Table 1 was offered *ad libitum* the same diets (1–13 days: starter; 14 day-slaughter: finisher) with continuous provision of water.

Prepared probiotic (PP) was made at Universiti Putra Malaysia (UPM). Each one g of PP contained at least 10^9 CFU (Colony Forming Unit) of *Lactobacillus acidophilus*, *Bacillus subtilis*, *Bifidobacterium* and at least 10^8 CFU of *Saccharomyces cerevisia*.

Chicken Husbandry and Experimental Design

The experiment was carried out at the poultry farm of the Faculty of Veterinary Medicine in Universiti Putra Malaysia (UPM), Malaysia, for the period of three months (15th December 2014 to 15th March, 2015). A total of 72 one-day old Akar Putra chicks were randomly assigned as (CRD) chicks in the three experimental groups were fed, as follows:

T1: Control group fed on dry feed (without probiotic supplementation).

T2: Fed on supplemented diet prepared at the rate 1:1 (1 kg of commercial broiler feed+ 1 g PP).

T3: Fed on supplemented diet prepared at the rate 1:2 (1 kg of commercial broiler feed+ 2 g PP).

Each treatment group was replicated three times with 8 chicks per replicate. The birds were housed in the battery cages with eight birds (4 males and 4 females) per pen (5”x 4”x1.5”). Since the chicks were reared in the open house, stable temperature, humidity and constant light schedule were therefore provided, along with *ad libitum* access of water and feed throughout the experiment. It is important to note that no vaccination was used during the whole experiment period.

Sampling Procedure and Analytic Methods

Body weight, weekly weight gain, feed intake and feed conversion ratio for the males and females were recorded separately from week 1 until week 12. Growth rate was calculated at the marketing age based on the formula proposed by Brody (1945). In the same regard, the variation ratio of the production performance parameters was calculated based on the formula, which was mentioned by Jawad et al. (2015).

Statistical Analysis

Data generated from the present experiment were subjected to statistical analysis using the General Linear Model (GLM) procedure of SAS (2001) statistical software package. When significant differences were noted, means were compared by using Duncan's multiple range tests (1955).

RESULTS AND DISCUSSION

The effects of diet supplementation with probiotic at the rate of (1 and 2g PP: 1 Kg food) on the mean weekly body weight (g) of males and females Akar Putra chicks reared to 12 weeks of age are presented in Tables 2 and 3. Supplementing 1 and 2 g of PP caused improvement ($P<0.01$, $P<0.05$) in the final body weight of males and females chicken. The best results were observed in T2 for males (1503.3g) and T3 for females (1274.7g). These findings are the opposite to the results described by Ahmad (2004), and Yousefi and Karkoodi (2007). These authors reported that the production parameters were not affected by the dietary probiotic and yeast supplementation. Alternatively, the results consistently showed that natural feed additives such as probiotic are very important materials that can improve, growth rate, daily weight gain, feed efficiency utilisation and productive performance (Wysong, 2003).

Total feed intake in males did not significantly differ between the groups receiving probiotic and the control group (Table 4), corroborating some previous results reported for feed intake at 21 days (Sato et al., 2002) and at 42 days of age (Mohan et al., 1996). Nevertheless, total

Table 2
Effects of diet supplementation with probiotic at the rate of (1 and 2g PP: 1 Kg food) on mean weekly body weight (g) and growth rate gauge of males Akar Putra chicks reared to 12 weeks.

Week	Treatments		
	T1	T2	T3
1	62±2.887	62.333±2.728	63.667±2.963
2	104±2.887^{b}	128±2.082^{a}	126.333±2.333^{a}
3	150±4.041^{b}	217±3.215^{a}	210.333±3.48^{a}
4	277±6.928^{b}	303.333±4.807^{a}	306±5.292^{a}
5	345±11.547^{b}	443±9.074^{a}	443.333±10.138^{a}
6	499±14.434^{b}	582.667±12.468^{a}	609±13.577^{a}
7	610±9.815^{c}	737.333±9.244^{b}	772.667±8.686^{a}
8	869±11.547^{b}	890±10.693^{b}	988±9.866^{a}
9	1037.667±15.103	1033±16.197	1059±15.373
10	1165±19.053	1157.333±18.478	1219±18.193
11	1290±20.207	1323.333±18.782	1324±19.348
12	1390±20.785^{b}	1503.333±19.359^{a}	1484±19.925^{a}
Growth Rate	190.455±0.178^{b}	191.837±0.242^{a}	191.132±0.251^{ab}

- Mean values with common superscript in row differ significantly ($P < 0.01$).
- Mean values at weeks 4 and 12 differ significantly ($P<0.05$).
- The values of growth rate differ significantly ($P<0.05$).

Table 3
Effects of diet supplementation with probiotic at the rate of (1 and 2g PP: 1 Kg food) on mean weekly body weight (g) and growth rate gauge of females Akar Putra chicks reared to 12 weeks.

Week	Treatments		
	T1	T2	T3
1	61.667±3.756	63.733±3.813	65±4.041
2	104.2±3.062[b]	129.667±3.48[a]	128±3.786[a]
3	178.3±4.304[b]	218.333±4.333[a]	211.667±4.631[a]
4	276.667±6.642[b]	305.333±6.36[a]	307±6.083[a]
5	344.667±11.26[b]	444.667±10.414[a]	444.333±10.975[a]
6	468.333±13.86	517.667±14.146	507±14.434
7	516.667±9.528[b]	640±9.815[a]	626±8.963[a]
8	624.267±11.779[c]	810±11.547[a]	741.667±11.26[b]
9	714.667±17.61[b]	856±17.898[a]	863±17.039[a]
10	815.333±18.478[b]	968.333±17.629[a]	978±19.053[a]
11	876.667±19.919[b]	1075±20.207[a]	1124±19.348[a]
12	937.333±20.21[c]	1201±20.785[b]	1274.667±20.497[a]
Growth Rate	186.155±0.522[b]	189.405±0.481[a]	189.328±0.52[a]

- Mean values with common superscript in row differ significantly ($P < 0.01$).
- Mean values at week 4 differ significantly ($P<0.05$).

Table 4
Effects of diet supplementation with probiotic at the rate of (1 and 2g PP: 1 Kg food) on weekly feed consumption (g) of males Akar Putra chicks reared to 12 weeks.

Week	Treatments		
	T1	T2	T3
1	44±4.041	44.333±3.48	43.667±3.756
2	82±2.887[b]	110.167±3.032[a]	105.667±2.603[a]
3	126±6.928[b]	174.333±6.36[a]	140±6.083[b]
4	196±5.196[c]	219±4.359[b]	254.333±4.631[a]
5	270±6.928[a]	254.333±4.807[ab]	242.667±5.044[b]
6	269±9.815[b]	218.333±9.244[c]	348±8.963[a]
7	407±11.547[b]	406±10.693[b]	504.333±10.975[a]
8	410±13.279[c]	279±12.423[b]	534.333±12.706[a]
9	500±12.124[b]	627.667±10.99[a]	352.333±11.552[c]
10	440±14.434[b]	386±13.577[c]	585.667±14.146[a]
11	534±16.166[a]	425.333±15.592[b]	375±15.308[b]
12	507±15.588[a]	410.333±15.015[b]	484±14.731[a]
Total	3785±118.934	3554.833±109.406	3970±110.387

- Mean values with common superscript in row differ significantly ($P < 0.01$).
- Mean values at weeks 5 and 12 differ significantly ($P<0.05$).

feed intake was slightly higher when 1 g probiotics were administered in females (Table 5), thus corroborating the previous finding by Lokman et al. (2015).

Tables 6 and 7 show that superiority in the weight gain for birds receiving probiotics than the control group starting from the starter phase (1-21 days). These findings are in contrast to the results reported in previous trials by Fethiere and Miles (1987), Maiorka et al. (2001) and Sato et al. (2002). Moreover, the distinction continued from the growing period until the marketing age.

Noticeable ($p<0.01$) enhancement in the total feed conversion ratio was observed in supplementing 1 g PP with diet in males and 2 g PP with diet in females. This improvement in feed conversion ratio was the principal reason to improve the weight gain indexes since almost the treatments had similar feed intake. These findings are similar to the results described by Jin et al. (1998), Besnard et al. (2000), and Ayanwale et al. (2006). The authors reported worse feed conversion in the control group when compared to groups of broilers, and turkeys fed probiotics based on *Lactobacillus* sp and *Saccharomyces cerevisiae* in the diets, respectively.

Birds fed probiotics had lower feed intake ($p<0.01$) associated to improve the feed conversion in almost the evaluated periods ($p<0.01$), which were decisive to result in the high weight gain ($p<0.01$) seen in these birds. Although the significant differences in performance were observed between these groups in the finishing phase (36-84 days), the increase ($p<0.05$) in the

Table 5
Effects of diet supplementation with probiotic at the rate of (1 and 2g PP: 1 Kg food) on weekly feed consumption (g) of females Akar Putra chicks reared to 12 weeks.

Week	Treatments		
	T1	T2	T3
1	44.1±4.128	44.667±3.756	44±4.041
2	82.3±3.15^{b}	109.667±2.603^{a}	106±2.887^{a}
3	125.333±6.36^{b}	174.667±6.642^{a}	141±6.928^{b}
4	195.667±4.91^{c}	220±5.196^{b}	253.667±4.096^{a}
5	230.667±6.642	255.667±5.812	245±6.928
6	276.333±9.244^{a}	244±8.963^{a}	183±9.815^{b}
7	248.333±10.975^{c}	453.667±10.414^{a}	304.667±9.597^{b}
8	289.667±12.991^{b}	433.667±11.319^{a}	202±12.423^{c}
9	266.667±11.837^{b}	90.333±10.713^{c}	426.333±11.552^{a}
10	357.667±14.146^{b}	501.333±13.017^{a}	301±13.577^{c}
11	260±15.308^{b}	373±14.468^{a}	374.667±15.026^{a}
12	307.333±14.17^{b}	400.333±13.346^{a}	320.333±12.548^{b}
Total	2684.067±113^{b}	3301±106.209^{a}	2901.667±109.266^{b}

- Mean values with common superscript in row differ significantly ($P < 0.01$).
- The total feed consumption value differ significantly ($P<0.05$).

Table 6
Effects of diet supplementation with probiotic at the rate of (1 and 2g PP: 1 Kg food) on weekly weight gain of males Akar Putra chicks reared to 12 weeks.

Week	Treatments		
	T1	T2	T3
1	28±1.732	31±1.732	30±1.732
2	42±0^{c}	65.667±0.667^{b}	62.667±0.667^{a}
3	46±1.155^{c}	89±1.155^{b}	84±1.155^{a}
4	127±2.887^{a}	86.333±1.667^{c}	95.667±1.856^{b}
5	68±4.619^{b}	139.667±4.333^{a}	137.333±4.91^{a}
6	154±2.887^{b}	139.667±3.48^{c}	165.667±3.48^{a}
7	111±4.619^{b}	154.667±3.283^{a}	163.667±4.91^{a}
8	259±1.732^{a}	152.667±1.453^{c}	215.333±1.202^{b}
9	168.667±3.844^{a}	143±5.508^{b}	71±5.508^{c}
10	127.333±4.372^{b}	124.333±2.404^{b}	160±3.055^{a}
11	125±1.155^{b}	166±0.577^{a}	105±1.155^{c}
12	100±0.577^{c}	180±0.577^{a}	160±0.577^{b}
Total	1356±19.63^{b}	1472±18.475^{a}	1450.333±18.765^{a}

- Mean values with common superscript in row differ significantly ($P < 0.01$).
- The total weight gain value differ significantly ($P<0.05$).

Table 7
EFFECTS of diet supplementation with probiotic at the rate of (1 and 2g PP: 1 Kg food) on weekly weight gain of females Akar Putra chicks reared to 12 weeks.

Week	Treatments		
	T1	T2	T3
1	28±1.732	31±1.732	30±1.732
2	42.533±0.742^{c}	65.933±0.581^{a}	63±0.577^{b}
3	74.1±1.242^{c}	88.667±0.882^{a}	83.667±0.882^{b}
4	98.367±2.36^{a}	87±2.082^{b}	95.333±1.667^{a}
5	68±4.619^{b}	139.333±4.055^{a}	137.333±4.91^{a}
6	123.667±2.603^{a}	73±3.786^{b}	62.667±3.48^{b}
7	48.333±4.333^{b}	122.333±4.333^{a}	119±5.508^{a}
8	107.6±2.272^{c}	170±1.732^{a}	115.667±2.333^{b}
9	90.4±5.839^{b}	46±6.351^{c}	121.333±5.783^{a}
10	100.667±0.882^{b}	112.333±0.882^{a}	115±2.082^{a}
11	61.333±1.453^{c}	106.667±2.728^{b}	146±0.577^{a}
12	60.667±0.333^{c}	126±0.577^{b}	150.667±1.202^{a}
Total	903.667±18.187^{c}	1168.267±18.707^{b}	1239.667±18.187^{a}

- Mean values with common superscript in row differ significantly ($P < 0.01$).
- Mean values at week 4 differ significantly ($P<0.05$).

Table 8
Effects of diet supplementation with probiotic at the rate of (1 and 2g PP: 1 Kg food) on weekly feed conversion ratio (g .feed/ g .gain) of males Akar Putra chicks reared to 12 weeks.

Week	Treatments		
	T1	T2	T3
1	1.566±0.048	1.426±0.035	1.451±0.043
2	1.952±0.069^{a}	1.679±0.061^{b}	1.687±0.058^{b}
3	2.735±0.082^{a}	1.957±0.046^{b}	1.665±0.05^{c}
4	1.543±0.006^{c}	2.537±0.02^{b}	2.659±0.015^{a}
5	3.994±0.17^{a}	1.822±0.024^{b}	1.769±0.029^{b}
6	1.746±0.031^{b}	1.562±0.029^{c}	2.1±0.013^{a}
7	3.688±0.258^{a}	2.63±0.123^{b}	3.091±0.16^{ab}
8	1.582±0.041^{c}	1.826±0.064^{b}	2.481±0.046^{a}
9	2.965±0.031^{c}	4.396±0.094^{b}	4.998±0.234^{a}
10	3.456±0.046^{b}	3.103±0.056^{c}	3.66±0.033^{a}
11	4.27±0.09^{a}	2.562±0.09^{c}	3.569±0.107^{b}
12	5.069±0.127^{a}	2.279±0.076^{c}	3.024±0.081^{b}
Total	2.79±0.047^{a}	2.414±0.044^{b}	2.736±0.041^{a}

- Mean values with common superscript in row differ significantly ($P < 0.01$).
- Mean values at weeks 2 and 7 differ significantly ($P<0.05$).

Table 9
Effects of diet supplementation with probiotic at the rate of (1 and 2g PP: 1 Kg food) on weekly feed conversion ratio (g .feed/ g .gain) of females Akar Putra chicks reared to 12 weeks.

Week	Treatments		
	T1	T2	T3
1	1.569±0.051	1.436±0.042	1.461±0.051
2	1.938±0.105	1.664±0.05	1.683±0.055
3	1.689±0.058^{b}	1.969±0.056^{a}	1.684±0.066^{b}
4	1.989±0.005^{c}	2.529±0.014^{b}	2.661±0.016^{a}
5	3.41±0.135^{a}	1.836±0.012^{b}	1.785±0.013^{b}
6	2.233±0.028^{c}	3.348±0.055^{a}	2.921±0.016^{b}
7	5.263±0.7^{a}	3.724±0.217^{b}	2.579±0.201^{b}
8	2.689±0.065^{a}	2.55±0.041^{a}	1.744±0.073^{b}
9	2.958±0.062^{b}	1.974±0.041^{c}	3.521±0.074^{a}
10	3.551±0.11^{b}	4.464±0.131^{a}	2.615±0.074^{c}
11	4.232±0.152^{a}	3.495±0.063^{b}	2.566±0.098^{c}
12	5.064±0.21^{a}	3.176±0.092^{b}	2.125±0.068^{c}
Total	2.968±0.066^{a}	2.824±0.046^{a}	2.339±0.054^{b}

- Mean values with common superscript in row differ significantly ($P < 0.01$).
- Mean values at weeks 3 and 7 differ significantly ($P<0.05$).

growing rate was enough to positively influence the performance of birds fed probiotics in the total period of rearing (1-84 days). Similar results were obtained when fermented feed with probiotic in a dry form was used as a daily diet of Akar Putra chickens (Lokman et al., 2015). The results of that experiment revealed remarkably significant ($P<0.01$) enhancement for supplementing treatments than the control group in all of the males' and females' body weight, weight gain, feed intake and feed conversion ratio measurements. Furthermore, the best results were obtained in the chickens fed on dry feed mixture with 1g of probiotic. Moreover, such results corroborate the findings of Santoso et al. (1995), Yeo and Kim (1997), and Cavazzoni et al. (1998), but are nevertheless opposite to those reported by Buenrostro and Kratzer (1983).

With regard to the growth rate criteria (Tables 2 and 3), the males and females of T2 and T3 treatments outperformed the control group in the growth rate criteria values. The males' growth rate variations ratio of T2 and T3 than the males in control group was 1.315% and 0.486% respectively. Meanwhile, the variation ratios of the growth rate in females were 1.898% for T2 and 1.335% for T3. Genetic and non-genetic factors are controlling growth trait in animals (Selvaggi et al., 2015). Growth in the domestic chicken is commonly measured by body weight and body conformation, which are the most important parameters. The techniques included in the control for the growth in chickens are too complex to be explained only under univariate analysis because all related traits are biologically correlated due to the pleiotropic effect of genes and linkage of loci (Udeh & Ogbu, 2011). Consequently, and based on the view point of animals genetic and improvements, the principal components such as growth rate and live body weight are simultaneously considered as a group of attributes, which may be used for selection purpose (Pinto et al., 2006).

Based on the results of this research, it can be concluded that supplementing 1 and 2g of prepared probiotic caused dependent improvement of the production performance in Akar Putra chickens. Furthermore, the best results were obtained when chickens received 1 g PP in males and 2 g in females. The prominent influence of the probiotic was shown in the live body weight, as well as the growth rate traits.

ACKNOWLEDGEMENTS

This research was supported by Universiti Putra Malaysia in 2015. The authors wish to thank Prof. Saad A. Naji, Poultry Science scientist, Department of Animal Resources, Dean of the Agriculture Faculty, University of Al-qadisiya (Iraq), for the technical assistance.

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