



Effect of Varying Levels of Probiotic on the Performance of Broiler Chicks

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Authors' contributions

This work was carried out in collaboration between all authors. Authors MSN, MS and ZA designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors MY and FA reviewed the experimental design and all drafts of the manuscript. Authors MSN and MS managed the analyses of the study. Authors MSN, MS and ZA performed the statistical analysis. All authors read and approved the final manuscript.

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ABSTRACT

The experiment was conducted to investigate the effect of varying levels of probiotic (Toyocerin[®]) on the performance of broiler chicks in a completely randomized design. One hundred and fifty broiler chicks were divided into five experimental groups (three replicates of ten chicks each). Broiler chicks were raised for 42 days. Five isocaloric and isonitrogenous broiler starter and finisher diets were formulated. Toyocerin[®] was added at the level of 0, 25, 50, 75 and 100 g/100 Kg of diet and denoted as T₁, T₂, T₃, T₄ and T₅ respectively. Whereas, T₁ was treated as a control group. Weekly body weight gain, feed consumption and feed conversion ratio were recorded. At the end of trial, two birds per replicate were slaughtered randomly for the determination of carcass traits. The addition of Toyocerin[®] in the diet of broilers (8-42 day) significantly improved the body weight gain, feed intake, feed conversion ratio, dressing percentage, breast meat yield and liver weight as

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compared to control group. The findings revealed that addition of Toyocerin[®] improved birds' performance and carcass traits.

Keywords: Probiotic; toyocerin; broiler; growth performance.

1. INTRODUCTION

Poultry farming is now considered to be one of the most integral and dynamic component of the worldwide meat production. Commercial poultry production is ranked one of the best sources of animal protein in the world. Poultry industry in Pakistan flourished incredibly over the last four decades. This fast growth has helped to meet the protein demand in human diet and maintain stability of protein source in the country. Broiler production is the fastest way to get the high quality animal protein in shortest possible time. The ideal broiler rearing for maximum weight gain relies on the strain of bird, feed quality and management practices. In addition; early chick mortality, stress and disease outbreaks are key factors which lead to low growth rate in broilers.

Feed costs up to 70 percent of production cost and is an integral component of a poultry farm budget [1]. Therefore, quality and quantity of feed plays a pivotal role in making the feasibility of poultry sector. Better feed conversion ratio, which can lead to efficient growth rate in broiler production, finally leads to higher profit. Therefore, there is a need to improve the poultry feed quality by adding certain feed additives in it.

Feed additives are the non-nutritive substances added in feed to improve its acceptance and efficiency of utilization, or to be contributive to health and metabolism of birds [2]. These may be classified as probiotics, antibiotics, antifungals, antioxidants, emulsifiers, ionophores, pellet binders, stabilizers, flavoring agents, plant extracts, certain drugs and hormones. Among various feed additives, probiotics are in use for last three decades. Probiotics are live microorganisms and when added in the diet/water in adequate amount, result in health benefit of the host. A number of probiotics are available in the market with the claim that these stimulate growth, improve health and performance of birds.

In Pakistan, little work has been done on the evaluation of some commercially available feed additive probiotics on the performance of broiler

chicks. The advancement in poultry nutrition and introduction of new products in the market invite the researchers to explore the efficiency of new available growth promoters and to compare their efficacy with the already existing in the market. This kind of an innovative research might be helpful in sustaining the meat prices in the years ahead. The following study was planned to check the effect of addition of different levels of Toyocerin[®] (*Bacillus toyoi*) on feed intake, weight gain, feed conversion efficiency and carcass traits in broiler chicks.

2. MATERIALS AND METHODS

The experiment was conducted at Raja Muhammad Akram Animal Nutrition Research Center, Institute of Animal Nutrition and Feed Technology, University of Agriculture, Faisalabad, Pakistan to study the effect of varying levels of probiotic (Toyocerin[®]) on the performance of broiler chicks.

The broiler house was white-washed and disinfected with formalin before the arrival of chicks. The chicks were housed and raised under standard managemental conditions. The temperature was maintained at 95°F for first week and then it was lowered down by 5°F each week till it reached 75°F. Fresh water and light were made available round the clock during the experimental period.

One hundred and fifty broiler chicks (Hubbard) were divided into five experimental groups (T₁, T₂, T₃, T₄ and T₅), three replicates of ten chicks each. Chicks were fed ground maize for first three days and then commercial diet was fed. Five iso-nitrogenous (20% CP), and iso-caloric (2780 Kcal/kg) broiler starter diets were formulated and fed from day 8 to 28. In the same way an iso-nitrogenous (18% CP) and iso-caloric (2880 Kcal/kg) broiler finisher diets were formulated and were fed from day 29 to 42. Toyocerin[®] was added at the level of 0, 25, 50, 75 and 100 g/100 Kg of diet and denoted as T₁, T₂, T₃, T₄ and T₅ respectively. Whereas, T₁ was treated as a control group. The birds were fed *ad-libitum* throughout the experiment.

Table 1. Inclusion rate of ingredients and percent nutrient composition of broiler starter diets

Ingredients	Diets				
	T ₁	T ₂	T ₃	T ₄	T ₅
Maize	37.57	37.57	37.57	37.57	37.57
Rice broken	15.21	15.21	15.21	15.21	15.21
Rice polishing	9.63	9.63	9.63	9.63	9.63
Canola meal	9	9	9	9	9
Corn gluten 60%	5.4	5.4	5.4	5.4	5.4
Soybean meal	15.45	15.45	15.45	15.45	15.45
Fish meal	2.51	2.51	2.51	2.51	2.51
Limestone	1.09	1.09	1.09	1.09	1.09
Di-calcium phosphate	1.4	1.4	1.4	1.4	1.4
Molasses	2	2	2	2	2
L-Lysine	0.14	0.14	0.14	0.14	0.14
Vit. Min. Premix	0.6	0.6	0.6	0.6	0.6
Total	100	100	100	100	100
Toyocerin (g/100 kg diet)	0	25	50	75	100
Nutrient composition					
CP (%)	20	20	20	20	20
ME (Kcal/kg)	2780	2780	2780	2780	2780
CP:ME (Kcal/kg)	1:139	1:139	1:139	1:139	1:139
CF (%)	4.74	4.74	4.74	4.74	4.74
Lysine (%)	1.03	1.03	1.03	1.03	1.03
Methionine (%)	0.5	0.5	0.5	0.5	0.5
Ca (%)	1	1	1	1	1
Av. P (%)	0.45	0.45	0.45	0.45	0.45

Table 2. Inclusion rate of ingredients and percent nutrient composition of broiler finisher diets

Ingredients	Diets				
	T ₁	T ₂	T ₃	T ₄	T ₅
Maize	45.25	45.25	45.25	45.25	45.25
Rice broken	11.9	11.9	11.9	11.9	11.9
Rice polishing	11	11	11	11	11
Canola meal	4	4	4	4	4
Corn gluten 60%	5.4	5.4	5.4	5.4	5.4
Soybean meal	14	14	14	14	14
Fish meal	2	2	2	2	2
Limestone	1.3	1.3	1.3	1.3	1.3
Di-calcium phosphate	1.2	1.2	1.6	1.2	1.2
Molasses	3	3	3	3	3
L-Lysine	0.25	0.25	0.25	0.25	0.25
Vit. Min. Premix	0.7	0.7	0.7	0.7	0.7
Total	100	100	100	100	100
Toyocerin (g/100 kg diet)	0	25	50	75	100
Nutrient composition					
CP (%)	18	18	18	18	18
ME (Kcal/kg)	2880	2880	2880	2880	2880
CP:ME (Kcal/kg)	1:160	1:160	1:160	1:160	1:160
CF (%)	4.43	4.43	4.43	4.43	4.43
Lysine (%)	0.9	0.9	0.9	0.9	0.9
Methionine (%)	0.4	0.4	0.4	0.4	0.4
Ca (%)	0.9	0.9	0.9	0.9	0.9
Av. P (%)	0.35	0.35	0.35	0.35	0.35

Weekly body weight gain, feed consumption and feed conversion ratio were recorded. At the end of trial, two birds per replicate were picked up randomly and were slaughtered in order to get data on dressing percentage, breast meat yield, thigh meat yield and giblet organs weights. Proximate analysis of diets broiler starter (above Table 1) and finisher (above Table 2) for dry matter, crude protein, ether extract, crude fiber and crude ash were analyzed according to standard procedure [3].

The data recorded were subjected to analysis of variance using general linear model procedure of SPSS [4] and means were compared by Duncan's Multiple Range Test [5].

3. RESULTS

During starter phase, feed consumption was significantly higher for T₃ and T₂ groups while birds of T₄ group consumed less feed. During finisher phase, feed consumption was significantly higher for T₂ group as compared to all other groups (Table 3). Average feed intake (at 42 days of age) recorded was 2264.8, 2328.4, 2310.9, 2247.3 and 2277.5 g on rations T₁, T₂, T₃, T₄ and T₅, respectively. It was the lowest in T₁ and T₄ groups. However, feed intake was significantly higher in birds of T₂ and T₃ groups.

Addition of Toyocerin in T₄ and T₅ groups significantly increased the average body weight gain in starter phase. During finisher phase, body weight gain showed significant increase in weight gain in T₂ group as compared to other groups. Body weight of chicks (at 42 days of age) was 1355.4, 1372.1, 1356.3, 1375.3 and 1356.9 g on rations T₁, T₂, T₃, T₄ and T₅, respectively. Overall, a non-significant difference was observed among various treatments (Table 3).

Significant improvement in feed conversion ratio was observed by the addition of Toyocerin in T₄ group as compared to other groups. It was 1.67, 1.69, 1.7, 1.63 and 1.68 at 42 days in chickens fed T₁, T₂, T₃, T₄ and T₅ rations, respectively. Feed conversion ratio showed that birds of group T₄ achieved significantly better feed conversion ratio as compared to all other experimental groups (Table 3).

Dressing percentage was significantly higher in T₄ group as compared to other groups. Whereas, minimum dressing percentage was observed in those birds fed control diet. Supplementation of Toyocerin had significant affect on breast meat yield and liver weight. However, non-significant difference on thigh meat yield, heart weight and gizzard weight were found in birds fed diets containing varying levels of Toyocerin (Table 4).

Table 3. Average values of body weight gain, feed intake and feed conversion ratio per broiler chick fed diets containing varying levels of Toyocerin

Parameters	T ₁	T ₂	T ₃	T ₄	T ₅
Weight gain (g) (8-28 days)	813.2 ^b	808.7 ^b	813.4 ^b	844.4 ^a	829.4 ^{ab}
Feed intake (g) (8-28 days)	1396.3 ^{ab}	1414.9 ^{ab}	1434.5 ^a	1379.6 ^b	1409.2 ^{ab}
Feed conversion ratio (8-28 days)	1.71 ^{ab}	1.76 ^a	1.76 ^{ab}	1.63 ^c	1.69 ^{bc}
Weight gain (g) (29-42 days)	542.1 ^{ab}	563.2 ^a	542.9 ^{ab}	530.8 ^b	527.5 ^b
Feed intake (g) (29-42 days)	868.6 ^b	913.5 ^a	876.4 ^b	867.7 ^b	871.6 ^b
Feed conversion ratio (29-42 days)	1.6 ^c	1.62 ^b	1.61 ^{bc}	1.63 ^{ab}	1.65 ^a
Weight gain (g) (8-42 days)	1355.4 ^a	1372.1 ^a	1356.3 ^a	1375.3 ^a	1356.9 ^a
Feed intake (g) (8-42 days)	2264.8 ^{bc}	2328.4 ^a	2310.9 ^{ab}	2247.3 ^c	2277.5 ^{abc}
Feed conversion ratio (8-42 days)	1.67 ^{ab}	1.69 ^a	1.7 ^a	1.63 ^b	1.68 ^a

^{a, b, c} Means in same row sharing different superscripts differ significantly (P<0.05)

Table 4. Average values of dressing percentage, breast meat, thigh meat and giblet organs (liver, heart and gizzard) (g/100 g body weight)

Parameters	T ₁	T ₂	T ₃	T ₄	T ₅
Dressing percentage	63.11 ^b	64.4 ^{ab}	64.83 ^{ab}	66.15 ^a	64.9 ^{ab}
Breast meat yield	19.5 ^c	21.48 ^b	21.83 ^{ab}	23.26 ^a	21.52 ^b
Thigh meat yield	6.59	6.86	7.58	7.15	7.75
Liver weight	2.34 ^{ab}	2.42 ^a	2.3 ^{ab}	2.37 ^{ab}	2.24 ^b
Heart weight	0.47	0.51	0.5	0.47	0.48
Gizzard weight	2.35	2.17	2.31	2.12	2.22

^{a, b, c} Means in same row sharing different superscripts differ significantly (P<0.05)

4. DISCUSSION

The results of present research are supported by the findings of Ashayerizadeh et al. [6] who found that addition of probiotic (Primalac) at the level of 90 g/100 kg of diet significantly improved body weight gain of chicken. Armut and Filazi [7] also reported that supplementation of probiotic in the diet of broiler chicks improved the average body weight gain when fed at 50 g/100 kg of diet. Dalia et al. [8] described that addition of yeast (*Saccharomyces cerevisiae*) at 3% of diet significantly increased the average weight gain of Japanese quails. Similar results were found by Paryad and Mahmoudi [9] who reported that inclusion of 1.5% yeast (*Saccharomyces cerevisiae*) in broiler ration significantly improved the body weight gain. The findings of research are also in accordance with Mutassim [10] who found that addition of yeast culture at 3 kg/ ton of feed significantly increased the average body weight gain of broiler birds.

The results of Guclu [11] are also in accordance with our findings who reported that addition of mixed probiotic (containing both bacterial and yeast species) in the diet of quail improved average feed intake when fed at 50 g/100 kg and 100 g/100 kg of diet. Similarly, Kaseem and Rabie [12] found that addition of live yeast (Thepax[®]) at 50 g/100 kg of diet and 100 g/100 kg of diet significantly improved the average feed intake values. Mutassim [10] also reported that addition of yeast culture at 3 kg/t of diet improved the average feed intake in broiler chickens. However, the present results do not support the findings of Ghally and Latif [13] that added yeast culture (containing *Saccharomyces cerevisiae*) at 1% or 2% of diet and found no effect on feed consumption in Japanese quails. The results are also contradictory to the findings of Nagharchi et al. [14] who added various probiotic bacteria at 0.25% of diet and did not show significant effect on average feed intake values of broiler chicks.

The results are in agreement with the findings of Ramesh et al. [15] who observed that chicks fed probiotic cultures showed better feed conversion ratio than control chicks. Saadia and Nagla [16] supplemented live yeast (Prolex[®]) containing *Saccharomyces cerevisiae* at varying dietary levels (0.0%, 0.4%, 0.8%, 1.2% and 1.6%) and found that 0.4 % and 0.8% dietary levels showed improved FCR. Mutassim [10] observed that addition of yeast culture at 3 kg/t of diet improved the feed conversion efficiency in broiler chickens.

Our findings were supported by Khan [2] who observed improved dressing percentage in broilers fed distillery yeast sludge. Paryad and Mahmoudi [9] also reported similar findings. Similarly, other researchers (Penkov et al., 2004; [17]) found significant effect on liver weight with probiotic supplementation in the diet. Contrary to this, Sharif et al. [18] reported that supplementation of yeast in the diet resulted in decreased average heart, liver and pancreas weights.

5. CONCLUSION

The results of the study indicates that probiotic (Toyocerin[®]) can be used successfully in the diet of broilers. It helps in improving the body weight gain, feed conversion ratio and carcass traits in the chickens.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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