Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; SP1: 3265-3267

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Effect of spirulina supplementation on growth performance of broilers

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Abstract
The research was conducted in the poultry house of Department of Animal Husbandry and Dairy Science college of Agriculture, Latur, VNMKV Parbhani during the year 2014-15. The experimental trial of six weeks was undertaken on eighty, day old, 'Vencobb 400Y' broiler chicks divided into four groups. Control (T0) group was fed standard broiler diet and T1, T2 and T3 groups were provided supplemented with 0.04, 0.06, 0.08 per cent spirulina, respectively. Mean live weight of six weeks of the experiment and live weight at the end of experiment were found to be (P<0.05) higher in Spirulina supplemented T2 and T3 groups of broilers than that of Control (T0) and T1 group. Comparatively better mean weekly weight gain and feed efficiency were also observed in spirulina supplemented groups (T1, T2 and T3) with decreased feed consumption as compared to control (T0) group of broilers. It can be concluded that the inclusion of 0.06 per cent of spirulina in broiler diet as a herbal feed additive is beneficial in improving the live weight and weight gain.

Keywords: Broilers, Feed efficiency, Growth, Spirulina

Introduction
Spirulina are the blue green algae used as the food source and growth promoter for the livestock including poultry due to its excellent nutrient profile and high carotenoid content. Spirulina contains high concentration of iron, phosphorus and proteins including all essential and non-essential amino acids. Spirulina is a non-toxic, nutritious food responsible for enhancement of growth, reproduction and immune function of animals and poultry. Spirulina also improves both, cell mediated and mononuclear phagocytic system potential in chicken allowing them to resist diseases. The herbal growth promoters for poultry can create optimum condition for normal vigorous growth by acting various ways. The successful use of herbal growth promoter will fetch more profit to poultry farmer by efficient conversion of feed consumed to body constituents. The dietary use of herbal growth promoter increase the performance of broiler by increasing live weight gain, FCR, Prasad and Sen (1993) and Samarth *et al*. (2002) [8]

Materials and Methods
The experimental trial was six weeks was undertaken for eighty, day old, 'Vencobb 400Y' broiler chicks divided in four treatments of 20 chicks in each treatment with 4 replication of five chicks. The control (T_0) group was fed standard broiler ration and T_1, T_2 and T_3 group were provided same broiler ration supplemented with 0.04 per cent, 0.06 per cent and 0.08 per cent spirulina, respectively. All the experimental chicks were reared on deep litter system of rearing with paddy husk as a litter material in a well-ventilated shed. All the birds reared under standard managerial conditions and provided sufficient drinking water. Weekly body weight of individual broiler and feed intake of chicks under different groups were recorded. The data recorded and was analyzed by using Completely Randomized Design (CRD).

Results and Discussion
Gain in Body Weight
The statistical analysis on the weekly body weight gain of broiler birds under four different treatments during each week revealed significant (P<0.05) difference during all the weeks except first week. After the sixth week it is seen from the Table 1 that the total gain in body weight of bird among treatment groups T_2 and T_3 was significantly superior (P<0.05) as compared to T_0 control group and T_1 group. Average gain in body weight in T_2 did not differ significantly with T_3 group. The treatment T_0 control (2234.30 g) is significantly lower as compared to all the treatments i. e. T_1 (2319.21 g), T_2 (2544.75 g) and T_3 (2511.80 g). The average body weight gain of 2544.75 g obtain in T_2 group was superior over T_0 (2234.30 g) and T_1 (2319.21 g).

On the perusal of Table 1, it could be seen that highest gain in body weight of 2544.75 g obtained in T_2 group broilers receiving 0.06 per cent spirulina followed by 2511.80 g with 0.08 per cent in T_3, 2366.50 g with 0.04 per cent in T_1 and lowest body weight gain i. e. 2234.30 g in T_0 control at the end of 6th week.The broiler chicks in T_2 receiving the spirulina at the level of 0.06 per cent grew faster followed by birds in T_3 (0.08 per cent spirulina) and those in T_1 (0.04 per cent spirulina).

Waghmode (2005) [12] observed the similar effect that the value for weekly gain in body weight indicated that the broiler chicks in T_1 group receiving 0.05 per cent spirulina significantly ($P<0.05$) grew faster as compared to control, T_2 group receiving 0.075 per cent and those in T_3 group receiving 0.1 per cent spirulina. Kharde *et al.* (2011) [5], also reported the same result as the average weekly gain in body weight of spirulina fed T_1 (300 mg of spirulina per kg of feed) and T_2 (500 mg of spirulina per kg of feed) groups of broilers remained significantly ($P<0.05$) higher than that of control T_0 group, with highest value in T_2 group of birds. Shanmugapriya and Saravana (2014) [9], also reported the same result as the 1 per cent of *spirulina platensis* supplemented group had greater body weight gain (2162.14 gm) as compared to control birds (1847.32gm)

The increase in body weight by supplementation of spirulina might be due to anti oxidative nature of spirulina (Yuvaraj *et al*.,2003) [13], Algae meal contained 423 g. Crude protein per kg dry matter, Amino acid composition was analysed and showed that essential amino acids (Methionine and tryptophan) were present in higher concentration in spirulina (Ggongnet *et al*. 2001) [4], spirulina is rich vitamin and mineral (Vyankatraman *et al*. 1994) [11], Biomass from the algae spirulina contained lipids 6.5, nucleic acid 3.97, phycocyanin1.05, allophycocyanin 2.33 %, vit. C 58.90 g/ 100g, caretinoids 0.4% and vit. E 15.24 mg / 100 g, (Sochkan *et al*. 1992) [10]. Due to these high levels of nutrients these nutrients are converted in to live weight.

Table 1: Average weekly gain in body weight

Treatments	Age in weeks						
	1st	2nd	3rd	4th	5th	6th	Total
T_0	110.99	236.91^{ab}	417.90^{c}	535.75^{d}	577.73^{c}	355.02^{c}	2234.30^{c}
T_1	109.39	239.05^{a}	433.10^{b}	564.50^{c}	563.23^{d}	408.77^{b}	2319.21^{b}
T_2	113.13	236.82^{ab}	441.55^{a}	612.35^{a}	593.40^{b}	547.00^{a}	2544.75^{a}
T_3	113.47	233.87^{b}	439.46^{ab}	590.00^{b}	607.50^{a}	537.50^{a}	2511.80^{a}
Mean	111.74	236.66	433.00	575.65	585.46	462.07	2402.51
SE ±	1.13	1.003	2.07	3.13	3.02	3.22	23.28
CD at 5%	N. S.	3.09	6.38	9.64	9.31	9.92	71.75

(Similar superscripts do not differ significantly ($P<0.05$) from each other)

Feed Consumption

It is revealed from Table 2 that there were no significant difference among the treatment group T_0 control and T_1. The broiler chicks in T_1 group consumed significantly ($P<0.05$) lower quantity of feed (4273.6 g) as compared to T_3 (4613.1 g) and T_2 (4478.2 g). After the sixth week it is seen from the Table 4.4 that the total feed consumption of bird among treatment group T_3 was significantly superior ($P<0.05$) as compared to T_0 control group, T_1 group and T_2 group. The highest feed consumption of 4613.1 g obtained in T_3 group broilers receiving 0.08 per cent spirulina followed by 4478.2 g with 0.06 per cent in T_2, 4274.3 g in T_0 control and lowest feed consumption i. e. 4273.6 g in T_1 control at the end of 6th week. It shows highest level of spirulina increases the feed consumption rate in broiler birds.This was close agreement with Waghmode (2005) [12] shows higher level of spirulina (0.1 per cent) increases the feed consumption rate. The higher feed intake at higher level of herbal growth promoter (2 per cent) was also reported by Mishra *et al.* (2000) and Ali *et al*. (1994) [1]. The non significant difference in feed consumption among the broilers feed spirulina was reported by Burne (1982) [3]. Kharde *et al.* (2012) [5] observed that supplementation of spirulina on broilers decreases the feed consumption which are contrary to the findings of this study. The difference in the study obtained from different researchers studies may be dependant on the environment, develop management, value and quality of the spirulina.

Table 2: Average weekly feed consumption (g) per bird

Treatments	Age in weeks						
	1st	2nd	3rd	4th	5th	6th	Total
T_0	152.4	385.6^{a}	742.3^{b}	1027.3^{d}	1178.4^{a}	788.3^{c}	4274.3^{c}
T_1	149.3	377.5^{b}	758.3^{a}	1041.1^{c}	1098.3^{b}	849.1^{b}	4273.6^{c}
T_2	151.2	351.9^{d}	698.4^{d}	1096.9^{a}	1073.6^{b}	1106.2^{a}	4478.2^{b}
T_3	151.3	371.8^{c}	721.1^{c}	1074.8^{b}	1173.1^{a}	1121.0^{a}	4613.1^{a}
Mean	151.05	371.7	730.02	1060.02	1130.85	966.15	4409.8
SE ±	1.08	1.53	2.53	3.80	8.46	10.63	16.84
CD at 5%	N. S.	4.72	7.80	11.71	26.08	32.77	51.90

(Values superscripted differently, differs significantly ($P<0.05$)

Feed Conversion Ratio (FCR)

It is seen from the Table 3 that the average feed conversion ratio from first to sixth week ranged from 1.76 to 1.91 which was significantly ($P<0.05$) better in T_2 (1.76) as compared to T_3 (1.84), T_1 (1.84) and T_0 control (1.91) group. The feed conversion ratio of group T_3 and group T_1 are not significantly differ from each other.

Table 3: Average weekly feed conversion ratio of experimental broilers

Treatments	Age in weeks						
	1st	2nd	3rd	4th	5th	6th	Total 1 to 6th week
T_0	1.37	1.63[a]	1.78[a]	1.92[a]	2.04[a]	2.22[a]	1.91[a]
T_1	1.37	1.58[b]	1.75[b]	1.85[c]	1.95[b]	2.08[b]	1.84[b]
T_2	1.34	1.49[c]	1.58[d]	1.79[b]	1.81[c]	2.02[b]	1.76[c]
T_3	1.33	1.59[b]	1.64[c]	1.82[d]	1.93[b]	2.09[b]	1.84[b]
Mean	1.35	1.57	1.69	1.84	1.93	2.10	1.84
SE ±	0.01	0.009	0.01	0.01	0.01	0.02	0.02
CD at 5%	N. S.	0.02	0.03	0.03	0.03	0.08	0.07

(Values superscripted differently, differs significantly (P<0.05)

It was revealed from Table 3 that the better feed conversion ratio of 1.76 obtained in T_2 group broilers receiving 0.06 per cent spirulina followed by 1.84 with 0.04 per cent in T_2, 1.84 in T_3 group receiving 0.08 per cent spirulina and poor in feed conversion i. e. 1.91 in T0 control at the end of 6th week. It shows 0.06 per cent level of spirulina increases the feed conversion ratio in broiler birds.

The result of present study was closely agreement with Waghmode (2005) [12] that feed conversion ratio were significantly (P<0.01) better in all spirulina feed group T_1 (0.05 per cent spirulina), T_2 (0.075 per cent spirulina) and T_3 (0.1 per cent spirulina) as compared to control T_0 group (0 per cent spirulina). Kharde *et al*. (2012) [5] also reported the higher values of feed efficiency in spirulina fed birds. Hussein (2013) reported similar trend with present study that feed conversion rate (FCR) was lower for birds supplemented with *spirulina platensis* (1.78) than control birds (1.88) and birds supplemented with prebiotic 1 (1.86) and prebiotic 2 (1.85). Slight numerical improvement in feed conversion ratio in spirulina fed birds reported by Baikovaskaya *et al.* (1993) [2].

Conclusions

Based on result it was concluded that the inclusion of 0.06 per cent of spirulina in broiler diet as a herbal feed additive is beneficial in improving the live weight and weight gain. The inclusion of 0.06 per cent of spirulina in broiler diet as a herbal feed additive improves feed consumption and feed conversion efficiency.

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