Original Research Article

Spirulina platensis, A Promising Growth Promoter for Poultry Industry

ABSTRACT:

100-broiler chickens (Vencobb 400 Y) weighing 180 grams at 8 days of age, randomly assigned to five equal groups; each group had four replicates of five checks. The control group was fed a commercial basal ration, while other groups were given the same commercial basal ration supplemented with 0.2 g/kg, 0.3 g/kg, 0.5 g/kg, and 0.7 g/kg Spirulina powder, respectively, for a period of 42 days. Data showed that Spirulina supplementation had a significant effect on chicks' growth performance. The highest significant effect was recorded at the level of 0.7g/kg Spirulina supplementation. It is concluded that Spirulina platensis supplementation had a significant effect on the growth performance of Vencobb 400 Y broilers. Therefore, Spirulina platensis supplementation could be used safely as a growth promoter for broilers.

Keywords: Spirulina platensis, Spirulina platensis supplementation, Growth performance, Live body weight, Body weight gain.

1. INTRODUCTION:

Spirulina is an organism belonging to cyanobacteria: a family of single- celled organisms, which often referred as blue green algae. Spirulina can live and grow in both salt and fresh waters. Spirulina always used as a supplementary food source and growth promoters for almost Spirulina is the blue green algae used as the food source and growth promoter for the livestock due to its high content of iron, protein, phosphorus and all essential and non-essential amino acids. The continuous development of the poultry business and the use of antibiotics for the hindrance of diseases in order to increase production potency for production of meat and eggs, moreover the use of antibiotics in feed resulted in the development of drug-resistant bacteria, antibiotic residues and decreased numbers of natural microflora.

Spirulina is a very safe non-toxic nutritious organism capable of promoting growth, reproduction and immune function of poultry and animals. The dietary use of Spirulina growth promoter increase broiler's performance due to increasing FCR and live body weight gain, (1 & 2). Spirulina was found to be useful for curing diabetes mellitus and arthritis. (3 & 4).

Feeding chicken diets containing Spirulina platensis led to significant increase in meat production comparing to the control. (5). Spirulina improves nutrient digestion and mineral absorption processes along with stopping diarrhea. (6). Moreover, Spirulina has been used extensively in broiler's diets as feed ingredients globally (7). Feed conversion (FC), body weight gain (BWG), the yield of carcass percentage improved after applying a diet containing Spirulina platensis as compared with the control group. (8) in the same way, (9) reported that FC was highly improved when hens fed with diets containing Spirulina platensis. When Spirulina was added to a diet in the ratio of less than 1%, the defense system for the antigen processing was significantly increased as well as T-cell activity and increased microbial killing (10). Spirulina improves reproduction and immune response (10& 11).

European Union already banned the use of antibiotics as growth promoters due to the increase of microbial resistant to different antibiotics and the left over residues in the chicken meat that could be danger to consumers. (12). During the last two decades, feed additives like probiotics and prebiotics have been tested to replace antibiotics. Microalgae are widely viewed as having significant nutritional value and have been the subject of considerable interest among producers. Consequently, great efforts have been devoted to understanding their efficiency as a feedstuff. (13 & 14). Spirulina platensis is rich in protein, essential fatty acids, essential amino acids, vitamins and minerals (15 & 16).

The aim of this study was to investigate the role of dietary Spirulina platensis as a feed additive on growth performance, carcass parameters and blood parameters. The owner of the farm refused to provide for the costs of rearing, so that we were unable to study economic efficiency, but finally he declared that he would save a considerable money by using Spirulina platensis supplementation.

2. MATERIALS& METHODS:

The experimental work done on a poultry farm near Anaheim, California (USA) during the period from December 2019 to February 2020. Chemical analyses done in the chemistry laboratory near Anaheim, California. 100-broiler chickens (Vencobb 400 Y) weighing 180 grams at 8 days of age, randomly assigned to five equal groups; each group had four replicates of five checks. The control group was fed a commercial basal ration, while other groups were given the same commercial basal ration supplemented with 0.2 g/kg, 0.3 g/kg, 0.5 g/kg, and 0.7 g/kg Spirulina powder, respectively, for a period of 42 days. A completely randomized design was used (RCD), where all checks under study were reared on a litter model, where a rice husk was used as litter material in a well-ventilated shed. All checks were provided with standard management conditions and water availability throughout the experiment. Individual broiler weights were checked weekly and feed intakes for all groups were recorded daily.

2.1. Calculations:

Body weight gain= Live body weight at 42 day- Initial body weight at 8 day.
Feed Conversion= Feed Intake/ Body weight gain.
Growth Rate= (Live body weight at 42 day- Live body weight at 8 day)/0.5(Live body weight at 42 day+ Live body weight at 8 day).

2.2. Statistical Analysis:

The analysis of variance of the obtained data of the experiment as Randomized Complete Block Design (RCBD) was applied. MSTAT- Cv.2.10 and SPSS v.27 software package program based on (17).

3. RESULTS& DISCUSSION:

Spirulina is a blue green algae that grows naturally in warm fresh water lakes. Humans have consumed Spirulina since ancient times. In recent years, scientists have discovered that Spirulina contains high levels of protein, vitamins, minerals, essential fatty acids, antioxidants, enzymes, amino acids, chlorophyll, carotenoids, polysaccharides etc.…

Effect of adding Spirulina platensis supplementation on growth performance of Vencobb 400 Y strain broiler chicks during the period from 8 to 42 days of age are listed in Table 1. Live body weight is the total amount of weight a chicken gains throughout its lifetime. Data show that broiler chickens were given spirulina supplementation for 42 days. At the end of the experiment, broilers fed 0.7 g/kg spirulina had significantly higher live body weight (2300g) than those fed other Spirulina supplementations and control diets. This could be due to the fact that Spirulina helps birds and animals maintaining natural microflora healthy, which in turn assist them to assimilate food and perform proper metabolism throughout absorption of vitamins and minerals. This finding in general is similar to that proposed before by (18, 19. 20 and 21) who referred the increase in live body weight in chicks to absorption of mineral and vitamins.

Body weight gain is the difference between initial and final body weights. Broilers fed 0.7g/ kg spirulina had significantly greater body weight gain (2120g) compared to those fed other Spirulina supplementations and control diets, this finding is in agreement with that of (22 and 23)who stated that Spirulina significantly improved the weight gain of chicks compared to the control group. In addition, (24) concluded that Spirulina platensis could be used to replace antibiotics as a growth promoter.

Concerning feed intake. Data revealed that the group fed 0.7g/kg. Spirulina supplementation, consumed more chicken feed (3180g) than other groups; Data also revealed that group fed 0.7g/kg Spirulina supplementation showed better feed conversion (1.5) comparing to other groups. In the same trend, broilers fed 0.7g Spirulina supplementation showed the best growth rate over all the other groups (1.71). These results are in a harmony with data obtained by (25).

Table (1): Effects of addition of Spirulina platensis to chicks' diets on the growth performance.

ITEM	Control.	Spirulina 0.2g	Spirulina 0.3g	Spirulina 0.5g	Spirulina 0.7g	Overall Means± SEM
Initial body weight at 8 day.	180a	180a	180a	180a	180a	180ns±0.0
Live Body weight at 15 day.	455d	460d	480c	493b	512a	480*±23.5
Live Body weight at 22 day.	785e	815d	855c	890b	937a	856.4**±60.1
Live Body weight at 29 day.	1145d	1360c	1439b	1476b	1503a	1384.6**±144.3
Live Body weight at 36 day.	1460c	1500c	1826b	1876b	2050a	1742.4**±254.0
Live Body weight at 42 day.	1700c	1750c	2030b	2085b	2300a	1973**±248.5
Body Weight Gain(g)8-42 d.	1520	1570	1850	1905	2120	1793**±248.5
Feed Intake(8-42 d)	2810	2835	3150	3170	3180	3029**±189.0
Feed Conversion	1.85	1.81	1.70	1.66	1.5	1.704*±0.135
Growth Rate	1.62	1.63	1.67	1.68	1.71	1.662*±0.037

Means within the rows followed by the same letter for each treatment do not differ at the 0.01 probability level

*** & ** indicate significance variance at 5% and 1% levels of probability.**

Table 2 illustrates the weekly increase in live body weight for all groups; it is just a summary to show the significance of differences within the same group.

Table (2): body weight Comparison within the same treatment

ITEM	Cont.	Test 1 (0.2g)	Test 2 (0.3g)	Test 3 (0.5g)	Test 4 (0.7g)
Initial body weight at 8 day.	180f	180e	180f	180e	180f
Live Body weight at 15 day.	455e	460d	480e	493d	512e
Live Body weight at 22 day.	785d	815c	855d	890c	937d
Live Body weight at 29 day.	1145c	1360b	1439c	1476b	1503c
Live Body weight at 36 day.	1460b	1500b	1826b	1876a	2050b
Live Body weight at 42 day.	1700a	1750a	2030a	2085a	2300a
Means	954**	1011**	1135**	1167**	1247**

Means within the column followed by the same letter for each treatment do not differ at the 0.01 probability level.

**** indicate significance variance at 1% level of probability.**

Table 3 show the effect of dietary levels of Spirulina platensis (0.2, 0.3,0.5,0.7g)/ kg diet, and their impact on some blood parameters. Total protein increased significantly (P<0.01), the highest increase was at level of 0.7g/kg diet (3.65). Globulin increased significantly (P<0.01), the highest increase was at level of 0.7g/kg diet (2.67), while Albumin increase significantly at (P<0.05); the highest increase was at level of 0.7g/kg diet (1.35). ALT& AST increased significantly at (P<0.01) the highest increase was at level of 0.7g/kg diet (24.45& 124.75 respectively). Lastly Triglycerides and total cholesterol decreased significantly at (P<0.01) the highest increase was at level of 0.7g/kg diet (78.55&158.54 respectively). These results are in an agreement with the findings of (26, 27& 28).

Table (3) Effects of supplementation of Spirulina platensis to broiler diets on serum parameters.

Item	Cont.	Test1 (0.2g)	Test2 (0.3g)	Test3 (0.5g)	Test4 (0.7g)	Overall Means± SEM
Total protein g/dL	2.88d	2.96d	3.19c	3.35b	3.65a	3.206**±0.31
Globulin(G)g/Dl	1.58e	1.77d	2.13c	2.39b	2.67a	2.108**±0.44
Albumin(A)g/dL	1.29b	1.30b	1,32b	1.34a	1.35a	1.32*±0.03
ALT (U/L)	27.35a	27.00a	25.12b	24.88b	24.45c	25.76**±1.32
AST (U/L)	157.90a	157.35a	136.87b	126.12c	124.75c	140.598**±16.24
Triglycerides mg/dl	90.15a	88.27b	86.33c	82.45d	78.55e	85.15**±4.66
Total cholesterol, mg/dl	180.23a	178.35a	174.45b	163.65c	158.54d	171.044**±9.49

Means within the rows followed by the same letter for each treatment do not differ at the 0.01 probability level

*** &** indicate significance variance at 5% and 1% levels of probability.**

The results of impact of dietary levels of Spirulina platensis (0.2,0.3,0.5, and 0.7g)/kg diet on some slaughter parameters as a percentage of Live body weight at 42 day of age are presented in Table 4. Results showed that Spirulina platensis supplementation had significant effect on some slaughter parameters at 42 days of age except for half rear

Broilers fed without Spirulina supplementation were significantly higher abdominal fat % and half breast %(1.09 and 19.15 respectively). The results are in harmony with those obtained by (23) who reported that, abdominal fat was decreased with inclusion of feed containing 1% of Spirulina platensis compared with the control group and other supplemented group. Furthermore, (29) concluded that, dietary Spirulina supplementation significantly improved carcass parameters of broilers. Also (30) stated that, feeding birds on Spirulina shows significant difference (P<0.01) on meat color in muscles of broilers when Spirulina was added at the levels of 40& 80 g8kg. Chicks' diets.

Concerning total giblet (liver, heart and gizzard) data showed that there is a significant increase at($P<0.05$) compared to other groups; this finding is in agreement with data obtained by(24), while on the other hand this finding is opposite to that of (31) who stated that total giblet was significantly decreased when chicks fed Spirulina supplementation.

Table (4): Effects of supplementation of Spirulina platensis to broiler diets on some slaughter parameters %.

Item (%)	Control	Test 1 (0.2g)	Test 2 (0.3g)	Test 3 (0.5g)	Test4 (0.7g)	Overall Means± SEM
Live Body Weight (at 42 d.)	1890d	1960c	1990c	2060b	2300a	2040**±157.6
Total Giblet	4.10b	4.15a	4.17a	4.09b	4.21a	4.14*±0.05
Abdominal Fat	1.09a	1.05a	0.95b	0.86bc	0.81c	0.95*±0.12
Half Rear	15.86	15.93	15.99	16.05	16.09	15.98ns±0.09
Half Breast	19.15a	18.98a	18.55b	18.35c	18.15d	18.64*±0.42

Means within the rows followed by the same letter for each treatment do not differ at the 0.01 probability level.

*** and ** indicate significance variance at 5% and 1% levels of probability.**

4. CONCLUSION:

It is concluded that Spirulina platensis supplementation had a significant effect on the growth performance of Vencobb 400 Y broilers. Therefore, Spirulina platensis supplementation could be used safely as growth promoters for broilers. Spirulina supplementation diet at a level of 07g/kg showed the highest effect on growth performance.

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