


Effect of Spirulina and Probiotic on Growth Performance of Japanese Quail

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Abstract

The aim of current project is to fortify the quail feeds with various types of supplements such as spirulina, Used as a substitute for Prob. & study the growth performance to recognize the best formula of spirulina for best production. untreated was feed on standard diet, Spirulina group was feed with Spirulina , Probiotics complex group was feed with probiotics complex, Mix Spirulina with probiotic complex group was feed with above Spirulina & probiotic. complex. BW, BWG, FI & FCE were daily recorded. Results noted at highest significant increase ($P \leq 0.05$) for the addition of spirulina occurred in the average body weight of Japanese quail compared to the control and other treated groups. The highest significant increase ($P \leq 0.05$) occurred in the BWG rates of birds treated with the addition of spirulina for weeks (1 and 4) and the cumulative (1-6) weeks. the highest rate ($p \leq 0.05$) of feed consumption was recorded in the group of birds treated with spirulina for weeks (2, 3, 4, 5, and 6). and the cumulative feed consumption rate from (1-6) weeks compared with the other treatments and the control group. Results showed FCE rates recorded a significant improvement in adding spirulina during (1,2,3,4,6) weeks and the cumulative feed conversion efficiency average (1-6) weeks for birds. From this research, we concluded that adding spirulina to quail diets improved productive traits.

Keywords: Growth, Spirulina, Probiotic, Quails.

I. INTRODUCTION

Although animal production is an economic activity, due to the high cost of feedstuffs, it is unable to meet the birds' need for food, which may negatively affect metabolic processes and reduce production (Kýrkpýnar 2011). The current study used the quail bird as a model for the research bird that is resistant to diseases and because of its characteristics that distinguish it from other poultry, for example it is characterized by fast growth and distinctive taste, and its eggs are characterized by a nutritional value estimated at 3-4 times that of chicken eggs. (Tavaniello, *et al.*, 2014). Several types of feed additives have been used to improve productive performance and maintain bird health. Due to the good benefits of probiotics on food digestion, it has been considered a viable option as a dietary supplement. (Mountzoris, *et al.*, 2007). On the other side, Algae is one of the most important natural feed supplements for humans and many animal species. *Arthrospira* (*Spirulina*) *platensis*

blue-green representative of filamentous blue algae, non-N2- Identification of cyanobacteria that have great capacity to enhance food supply and possess many valuable physiological traits (Huili, *et al.*,2013). Spirulina is considered as a super food, this food is greatly used as a dietary supplement, used for more nutritional insurance, energy, and weight control, it is natural green energy and good for everyone (Mahipal & Mahipal, 2016 ; Nasar A,*et al.*,2016). Spirulina rich in Protein, Vit., Essential A.A., Minerals, Essential F.A. & antioxidant pigments such as carotenoids (Belay, *et al.*,1993 ; Belay, *et al.*,1996). Spirulina contains 62% amino acids and is also considered to be the world's richest natural source of Vitamin B12 and contains a whole host of natural carotenoid and mixed plant xanthophyll pigments which appear to be associated with phycocyanin with its antioxidant activity. In addition, the content of highly unsaturated fatty acids (eg, eicosapentaenoic acid, arachidonic acid and docosahexaenoic acid) is of great importance (Reitan, *et al.*, 1997). Therefore spirulina is gaining more attention due to its various nutritional and medicinal properties (Pinero Estrada ,*et al.*, 2001; Rasool,*etal* 2006). Spirulina can be considered as a food supplement that has various health benefits for humans as well as for animals that contain Economic benefits (Parikh & Mani, 2001; Rasool, *et al.*, 2006). Therefore, in this project, an attempt was made to find out effect of feed supplementation (Spirulina and probiotics) to find out which is better on productivity and cost on Japanese quail birds.

II. MATERIALS AND METHODS

Study design:

In the study 180 unsexed chicks was used at one day old and with an initial weight 8.5_10.5g the chicks were randomly distributed into 4 treatments (45 chicks for each) with three replicates per treatment, (15 chicks for each). Treatments categorize depending on a Spirulina and probiotic complex supplemented with feed for about 42 days as following:

1. Untreated G.: birds were feed on standard diet. **2.** Spir. G.: birds were feed with Spirulina. **3.** Prob. Comp. G: Birds were feed with Prob. comp. **4.**Mix Spir. with prob. Comp. G: Birds were feed with mixture of above Spir.& prob. Comp,

BW & FI were Daily Recorded.

Table 1: Feed ingredient & Chemical Analysis

Ingredients	Growth diet (%) (1-45) day
Yellow corn	48
Wheat	11.5
Protein concentrated (50% protein)	5.5

Soybean meal (48% protein)	32
Limestone	1.5
Vegetable oil	1.5
Mixture of vitamins and minerals	-
Total	100
Metabolic energy (kcal/kg)	3049
Protein (%)	22.26
Calcium (%)	0.8
methionine%	0.50
Phosphorus (%)	0.58

NRC 1994

Preparation of Spirulina and Probiotics for use: (Maesem, etal,2020;Alseraih, etal,2022 ;Falah, etal.2022)

1- Spirulina platensis Pills containing (Acacia and Gum Arabic) 250 mg(500 pieces) (DXN company/ Malaysia).

2- Probiotic Complex capsule (30 Capsules) (9 strains of alive microorganisms) 25 mg, 4.5x10⁹ CFU from (*Bifidobacterium bifidum*, *Bifidobacterium breve*, *Bifidobacterium longum*, *Lactobacillus acidophilus*, *Lactobacillus casei*, *Lactobacillus casei subsp. Paracasei*, *Lactobacillus plantarum*, *Lactobacillus rhamnosus*, *Streptococcus thermophiles*. (Grobiotic Company/ France).

The above Spirulina and probiotic complex were used by weighting the products based on birds weight & dose of product by using the following formula:

$$\frac{\text{mean human weight}}{\text{mean Birds' weight}} \times \frac{\text{Dose of Product}}{\text{Dose for Birds}}$$

(Sayah,2022)

Then, Spirulina and probiotic complex mixed with100mg of carrier materials (wheat bran) and distributed with feed of bird.

Studied parameters:

Growth Traits

During the experiment intervals BW, BWG, FC & FCE were weekly recorded.

BW (gram):

Birds were collectively weighed weekly for each of the different experimental treatments, starting from one day old, with an initial weight of 8.10 gm, until the age of 42 days. (Al-Fayyad & Naji, 1989).



BWG (gram):

BWG = average live body weight at the end of the week - average live body weight at the beginning of the week). (Al-Fayyad & Naji, 1989):

FCE (gram):

FCE = feed intake (gm) / weight gain (gm)

(Al-zubidy 1986)

Data analysi

Data of this project were analyzed using the complete random design(CRD)using the ready-made statistical program SPSS (۲۰۱۹) and to test the significance of the differences between the studied averages the Duncan (۱۹۵۵) polynomial test was used and at the level of significance) p (۰,۰۵ and the mathematical model was used in the analysis of the data.

III. RESULTS

Effect of Spirulina and Probiotic Complex additive and their mixture to the diets on Body Weight:

Schedule 1 noted the influence of adding spirulina and probiotics and their mixture on body weight rates for Japanese quail birds up to 6 weeks of age, it is evident from the table that there is the highest significant increase ($P \leq 0.05$) for the addition of spirulina in the average body weight of Japanese quail compared with control and other treatment groups. While the table did not show any significant effect of adding spirulina and probiotics to all treatments & control to birds in one day old of age. It is clear from Schedule 1 that there is a significant effect ($P \leq 0.05$) of adding probiotics on average body weight of Japanese quail birds in different treatments and for all ages, compared to the control group Schedule 1 indicates that there is significant effect ($P \leq 0.05$) of the mixture of adding spirulina and probiotics on diet on average live body weight of Japanese quail birds at all weeks, compared with probiotic treatment and control group.

Schedule 1 Effect of Spirulina and Probiotic Complex additive and their mixture to the diets on Body Weight during Growth period (Mean ± Standard Error)

weeks groups	(1) day	(1) week	(2) week	(3) week	(4) week	(5) week	(6) week
Control	9.20± 0.05	24.77 ^d ±0.40	55.00 ^d ±0.58	89.00 ^d ±1.15	130.03 ^d ±1.45	166.60 ^d ±1.14	206.47 ^d ±1.26
Spirulina. Group	9.24± 0.03	33.75 ^a ±0.80	66.59 ^a ±0.95	103.52 ^a ±0.91	153.07 ^a ±1.17	185.11 ^a ±0.48	232.44 ^a ±1.66
Probiotic complex Group	9.19± 0.11	27.29 ^c ±0.84	58.06 ^c ±1.21	93.26 ^c ±1.26	135.99 ^c ±1.39	173.47 ^c ±1.37	212.42 ^c ±1.61



Mix. (Spir.& Pro.complex Group)	9.25± 0.04	30.09 ^b ±0.50	63.60 ^b ±0.77	97.53 ^b ±0.75	140.58 ^b ±0.98	177.55 ^b ±1.10	225.33 ^b ±0.88
Sig. 0.05	N.S	*	*	*	*	*	*

The letters on the numbers symbolize a clear difference between the groups in ($p \leq 0.05$). N.S referred to no significant difference . * referred to significant difference

Effect of Spirulina and Probiotic Complex additive and their mixture to the diets on Body Weight Gain:

Regarding the effect of adding spirulina and probiotics and their mixture on body weight gain rates, the results of Schedule 2 indicate the presence of the highest significant increase ($P \leq 0.05$) in BWG rates of birds treated with Spirulina addition for weeks (1 and 4) and accumulative (1-6) week, while (2 and 6) week recorded the highest rate for body weight gain in birds treated with the addition of spirulina and probiotic mixture, the treatment of adding probiotics also recorded the highest rate of body weight gain during week (5), while the third week did not record any significant effect for all treatments and control group.

Schedule 2 Effect of Spirulina and Probiotic Complex additive and their mixture to the diets on Body Weight Gain of during Growth period (Mean ± Standard Error)

weeks \ groups	(1) week	(2) week	(3) week	(4) week	(5) week	(6) week	(1-6) Week (Accumulative).
Control	15.57 ^d ±0.35	30.23 ^b ±0.96	34.00 ±1.00	41.03 ^b ±1.02	36.57 ^{ab} ±1.86	39.86 ^b ±0.77	197.27 ^d ±1.30
Spirulina. Group	24.52^a ±0.77	32.84 ^{ab} ±1.14	36.92 ±1.55	49.56^a ±2.07	32.04 ^b ±1.53	47.33 ^a ±1.20	223.20^a ±1.69
Probiotic complex Group	18.10 ^c ±0.91	30.77 ^{ab} ±0.39	35.20 ±0.61	42.73 ^b ±2.09	37.48^a ±0.44	38.95 ^b ±2.55	203.23 ^c ±1.63
Mix. (Spir.& Pro.complex Group)	20.85 ^b ±0.53	33.50^a ±0.77	33.93 ±0.47	43.05 ^b ±1,64	36.97 ^a ±1.39	47.78^a ±1.98	216.09 ^b ±0.88
Sig. 0.05	*	*	N.S	*	*	*	*

The letters on the numbers symbolize a clear difference between the groups in ($p \leq 0.05$). N.S referred to no significant difference . * referred to significant difference

Effect of Spirulina and Probiotic Complex additive and their mixture to the diets on Feed Consumption:-

When adding spirulina, probiotics and their mixture to the diet of quail birds, no significant superiority was observed in the rate of feed consumption during the first week, while the highest rate ($p \leq 0.05$) of feed consumption was recorded in the group of birds treated with spirulina for weeks (2, 3, 4, 5 and 6) and the cumulative feed consumption rate from (1-6) week compared with other treatments and control group. While



the lowest significant difference ($p \leq 0.05$) was recorded for feed consumption in the control group, followed by the probiotic treatment, then the spirulina and probiotic mixture treatment (2, 3, 4, 5 and 6) and the cumulative feed consumption rate from (1-6) week, Schedule 3

Schedule 3 Effect of Spirulina and Probiotic Complex additive and their mixture to the diets on Feed Consumption of during Growth period (Mean \pm Standard Error)

weeks groups	(1) week	(2) week	(3) week	(4) week	(5) week	(6) week	(1-6) Week Week (Accumulative)
Control	35.33 ± 1.07	71.69 ^b ± 0.86	94.34 ^c ± 1.19	107.33 ^d ± 1.20	136.33 ^d ± 0.88	177.00 ^c ± 1.15	622.43 ^d ± 2.86
Spirulina. Group	37.41 ± 0.99	64.86^a ± 0.94	84.90^a ± 0.95	94.67^a ± 0.88	123.06^a ± 0.91	162.72^a ± 0.77	567.61^a ± 2.81
Probiotic complex Group	37.30 ± 0.56	69.40 ^b ± 0.59	92.33 ^c ± 0.53	102.75 ^c ± 0.83	131.44 ^c ± 1.14	170.28 ^b ± 0.92	603.50 ^c ± 1.09
Mix. (Spir.& Pro.complex Group)	38.11 ± 0.90	66.49 ^a ± 0.77	88.82 ^b ± 1.11	99.00 ^b ± 1.15	128.18 ^b ± 0.43	165.66 ^a ± 0.88	586.27 ^b ± 3.43
Sig. 0.05	N.S	*	*	*	*	*	*

The letters on the numbers symbolize a clear difference between the groups in ($p \leq 0.05$). N.S referred to no significant difference . * referred to significant difference

Effect of Spirulina and Probiotic Complex additive and their mixture to the diets on Feed Conversion Efficiency: -

As it is well known in the science of nutrition, that the lower the value of the efficiency of food conversion, the better the result, that is, there has been an improvement in this criterion. In Schedule 4, the feed conversion efficiency rates recorded a significant improvement for the addition of spirulina during (1,2,3,4&6) weeks and the cumulative feed conversion efficiency rate (1-6) week for birds, while no significant difference was recorded for all groups in the fifth week, after that the mixture group, followed by the probiotic group, recorded an improvement in FEC compared to untreated, which recorded highest significant difference ($P \leq 0.05$) in this characteristic

Schedule 4 Effect of Spirulina and Probiotic Complex additive and their mixture to the diets on Feed Conversion Efficiency of during Growth period (Mean ± Standard Error)

weeks groups	(1) week	(2) week	(3) week	(4) week	(5) week	(6) week	(1-6) Week (Accumulative)
Control	2.29 ^a ±0.06	2.37 ^a ±0.06	2.78 ^a ±0.11	2.62 ^a ±0.04	3.75 ±0.17	4.44 ^a ±0.06	3.16 ^a ±0.01
Spirulina. Group	1.53 ^c ±0.08	1.98 ^b ±0.05	2.31 ^b ±0.07	1.92 ^b ±0.09	3.86 ±0.18	3.44 ^b ±0.07	2.54 ^d ±0.02
Probiotic complex Group	2.07 ^{ab} ±0.13	2.25 ^a ±0.03	2.62 ^a ±0.03	2.42 ^a ±0.12	3.51 ±0.04	4.41 ^a ±0.25	2.97 ^c ±0.03
mix. (Spir.& Pro.complex Group)	1.83 ^b ±0.08	1.99 ^b ±0.06	2.62 ^a ±0.02	2.31 ^a ±0.11	3.48 ±0.11	3.48 ^b ±0.13	2.71 ^b ±0.02
Sig. 0.05	*	*	*	*	N.S	*	*

The letters on the numbers symbolize a clear difference between the groups in ($p \leq 0.05$). N.S referred to no significant difference . * referred to significant difference

IV. DISCUSSION

Effect of Spirulina and probiotics supplement on BW & BWG

From the Schedule 1, there is the highest significant increase ($P \leq 0.05$) for the addition of spirulina in the average body weight of Japanese quail compared with control and other treatment groups. These in turn agreement with Jamil, *et al.*(2015) indicated that spirulina is a good natural additive to feed and has a distinctive impact in improving growth of broiler chickens and thus reduces the cost of production. Also, Some studies have been conducted to explore the use of spirulina as a high-quality dry matter in livestock feed, including poultry, especially broiler chickens, as a productive stimulates (Jamil, *et al.*,2015 ; Velten, *et al.*,2018), The reason for this may be due to its composition algae rich in beneficial nutrients.(Dismukes, *et al.*,2008 ; Sujatha and Narahari, 2011 ; Zahroojlan, *et al.*, 2013). While the table did not show any significant effect of adding spirulina and probiotics to all treatments and the control group to birds in one day old of age. It is clear from Schedule 1 that there is a significant effect ($P \leq 0.05$) of adding probiotics on average body weight of Japanese quail birds in different treatments and for all ages, compared to the control.

Zhang *et al.* (2019) noted significant improvement in the growth performance that included BW & BWG compared with control when added by adding 10 ml of the probiotic to water. Hossain *et al.* (2020) noticed increase the rate of body weight due to adding 1 g / liter from 3 types of prob. of in drinking water, In its trial Conducted on broilers for a period of 28 days.



Ismail et al., (2022) attributed the reason for the improvement in average body weight when adding probiotics to an increase in nutrient availability and a reduction in the competition of harmful microorganisms in the intestine.

Schedule 1 indicates that there is a significant effect ($P \leq 0.05$) of mixture of adding spirulina and probiotics on diet on average live body weight of Japanese quail birds at all weeks, compared with probiotic treatment and control group. Some studies have been conducted to explore the use of spirulina as a high-quality dry matter in livestock feed, including poultry, especially broiler chickens, as a productive stimulates (Jamil, *et al.*,2015 ; Velten, *et al.*,2018). Albazaz and Buyukunal-Bal (2014), The addition of probiotics to poultry diets improves the growth characteristics and health of birds. The reason for this is that it enhances the immunity of the mucous membranes that improve resistance to pathogenic bacteria. Therefore, probiotics are used as a growth stimulator in the birds.

In contrast, the results of Schedule 2 indicated the presence of the highest significant increase ($P \leq 0.05$) in BWG rates of birds treated with Spirulina addition for weeks (1 and 4) and accumulative (1-6) week, while (2 and 6) week recorded the highest rate for body weight gain in birds treated with the addition of spirulina and probiotic mixture. This results agrees with Kharade, *et al.*(2012) indicated that the inclusion of Spirulina platensis in the diet improved body weight gain yield as compared to the untreated. The treatment of adding probiotics also recorded the highest rate of body weight gain during week (5), while the third week did not record any significant effect for all treatments and control group. Schedule 2.

This results agrees with Zhang *et al.* (2019) showed Significantly improved growth performance that included body weight & weight. Gain & feed conversion coefficient compared to the control when 10 ml of probiotics were added to the water. Hussain et al. (2020) noted a significant improvement in weight gain, BW, & FCE & did not impact feed consumption rate & percentage of mortality compared to control, when adding 1 g/L of three types of probiotics to drinking water, on broilers for 28 days.

Effect of Spirulina and probiotics supplement on feed intake & feed conversion efficiency: -

Based on the results shown in the Schedule 3 that revealed the highest rate ($p \leq 0.05$) of feed intake was recorded in the group of birds treated with spirulina for weeks (2, 3, 4, 5 and 6) and the cumulative feed consumption rate from (1-6) week compared with other treatments and control group.

Some researchers have noted advantages of spirulina as a natural feed additive, & have reported its potential to enhance animal growth & reproductive traits & health.

While the lowest significant difference ($p \leq 0.05$) was recorded for feed intake in the control, followed by probiotic treatment, then the spirulina and probiotic mixture treatment (2, 3, 4, 5 and 6) and the cumulative feed consumption rate from (1-6) week, Schedule 3.

Due to the remarkable positive effects of probiotics on poultry performance, it has been widely used as a growth promoter in birds. As well as, improving feed intake in layers & broilers & altering bacterial metabolism, releasing bacteria, improving microbial balance and vitamin synthesis. (Sugiharto, *et al.*, 2017 ; Cramer, *et al.*, 2018).



In Schedule 4 The feed conversion efficiency rates recorded a significant improvement for the addition of spirulina during (1,2,3,4&6) weeks and the cumulative feed conversion efficiency rate (1-6) week for birds, while no significant difference was recorded for all groups in the fifth week, after that the mixture group, followed by the probiotic group, recorded an improvement in the FCE compared to untreated, which recorded highest significant difference ($P \leq 0.05$) in this characteristic.

These in turn agreement with Kharade, *et al.*(2012) indicated that the inclusion of *Spirulina platensis* in the diet improved feed conversion as compared to the control group. Kaoud (2015) also reported that feed conversion was improved in birds fed *Spirulina platensis* more than in control birds.

V. CONCLUSION

Our finding of study appear that growth performance was improved when used concentration of spirulina alone according to recommendations.

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