NAQAAE
2013 كلية معتمدة

EFFECT OF PREBIOTIC ON PHYSIOLOGICAL STUDIES IN JAPANESE QUAIL.

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A B S T R A C T

The objective of the current study was to evaluate the effects of a commercial prebiotic (Bio-Mos®) feed additive as a growth promoter on growth performance and some growth-related hormones of Japanese quail. A total number of 480 one day old Japanese quail chicks were randomly allocated into 4 equal groups. Group 1(control group) fed on the basal diet that did not supplemented with prebiotic, group 2 fed on basal diet with 0.5 gm Bio Mos/kg diet, group 3 fed on basal diet with 1gm Bio Mos /kg diet and group 4 fed on basal diet with 2 gm Bio Mos /kg diet. To evaluate growth parameters, 30 birds from each group were weighed weekly for eight successive weeks. Feed consumption per group was measured weekly for calculating feed conversion ratio. Blood samples were collected weekly from six birds from each group, and then plasma was separated for evaluation of insulin concentrations. At the end of the experiment, The results of the current study revealed that, addition of Bio Mos to Japanese quail ration resulted in improvement of growth parameters (Body weight, weight gain, RGR) when compared with control group. Plasma insulin concentrations in treated groups showed significant differences when compared with control group.

Key Words: Japanese quail, prebiotic, Bio-Mos®, body weight, RGR, insulin.

(BVMJ 24(2):201-209, 2013**)**

1. INTRODUCTION

Recently, Japanese quail (Coturnix coturnix japonica) has gained attention in poultry industry. It is becoming more popular as a source of meat and eggs in various countries including Egypt due to rapid growth-enabling quail to be marketed for human consumption at 5-6 week of age, early sexual maturity, high egg production rate and much lower feed and space requirement than domestic fowls [1, 2]. In the modern poultry production, several types of growth promoters are used as feed additives. Antibiotics have been used in poultry diets for about 50 years to improve their performance and to reduce medication costs [3]. However, their prolonged use may increase bacterial resistance against antibiotics [4] and increase level of drug residues in edible poultry products [5]. Consequently, new products are needed to be used as growth promoters. Prebiotics are non-digestible complex carbohydrates such as fructo-oligosaccharides and mannan-oligosachharides [6] that are added to the feed to provide a substrate for beneficial gastrointestinal microbes [7], [8]. Mannan-oligosaccharides (MOS) derived from the cell walls of Saccharomyces cerevisiae yeast improve growth performance, body weight and feed conversion when added to broiler diets [9], [10] by altering bacterial population in the gut of birds [11]. Studies on the effect of prebiotics on physiological parameters and hormones in birds are scarce. Therefore, the objective of this study was to investigate the effects of the prebiotic (Bio-Mos®) supplementation on growth performances, feed conversion ratio, some growth-related hormones of Japanese quails.

2. MATERIALS AND METHODS

The experiment was conducted at the experimental house of the Faculty of Veterinary Medicine, Moshtohor, Benha University.

2.1. Birds and housing:

A total number of 480 healthy unsexed one-day-old Japanese quail chicks were used in this experiment. Birds were randomly assigned into four equal groups. Chicks of each group were housed in brooding batteries for the first 5 weeks then birds were transferred into batteries with individual cages, each cage contains one male and three females**.** The birds were reared under 23 hr light: 1hr dark then after 5 weeks of age, birds were given 16 hr of light: 8 hr dark. The ambient temperature was 37°C for the first 2 days and then decreased stepwise by 3°C at 4 days intervals to reach 21°C. Birds were allowed *ad libitum* access to feed and fresh water. Diets were formulated as starter and breeder diets (table 1).

2.2. Experimental design:

Chicks were randomly allocated into four equal groups. Group 1(control group)fed on the basal diet that did not supplemented with prebiotic, group 2fed on basal diet with 0.5 gm Bio Mos/kg diet, group 3 fed on basal diet with 1gm Bio Mos /kg and group 4 fed on basal diet with 2 gm Bio Mos /kg diet

2.3. Growth performance parameters:

The Japanese quail chicks were weighed individually at the start of experiment, then every week for recording of live body weights diet and body weight gains (differences between each two successive weights).

Table 1: Composition of the ration.

Ingredients	***Ration***	
	Starter	***Breeder***
Maize (%)	54	62
Soya bean meal, 44 % CP (%)	33	22
Concentrate (%)	10	10
Wheat bran (%)	3	-
Limestone (%)	-	5.7
Sodium chloride (%)	-	0.3
Calculated nutrient content		
Metabolizable energy (kcal/Kg)	2825	2809
Crude protein (%)	24.8	20.2
Methionine (%)	0.46	0.648
Cysteine (%)	0.325	0.257
Methionine + Cysteine (%)	0.211	0.211
Crude fiber (%)	3.99	3.061
Crude fat (%)	3.02	3.15
Linoleic acid (%)	1.37	1.45
Calcium (%)	0.84	2.95
Available phosphorus (%)	0.49	0.46

Concentrates providing the following per kilogram of diet: crude protein 520g; vitamin A 120000 IU; vitamin E 100 mg; vitamin K_3 21 mg; vitamin $B_1$10 mg; vitamin B_2 40 mg; vitamin B_6 15 mg; pantothenic acid 100 mg; vitamin B_{12} 0.1 mg; Fe 0.3 mg; Mn 600 mg; Cu 50 mg; Co 2 mg; Se1 mg and Zn 450 mg.

2.4. Determination of growth related hormones:

Blood samples were taken weekly (from 6 birds of each group) on clean dry heparinized tubes, starting from the 1st till the 8th week of age. Blood was taken by slaughtering, centrifuged at 2500 g for 20 minutes and plasma was separated and stored at -20°C for subsequent hormonal evaluation. Plasma samples were used for estimation of insulin by ELISA [12].

2.5. Statistical analysis:

Results are expressed as mean ± standard error (SE). Differences between means in different groups were tested for significance using a one-way analysis of variance (ANOVA) followed by Duncan's test and *P* value of 0.05 or less was considered significant (using the statistical analysis system, SPSS.

3. RESULTS

Results obtained in tables 2 and 3 showed that, mean body weights of males and females supplemented with the prebiotic were higher than those of control across the whole experimental periods.

Results in table 4 presented that, body weight gain of males Japanese quail were higher in treated groups than in the control across the whole observed periods. After 8weeks of age, body weight gains were 26.67 g in control males, 26.97 g in 0.5 g BioMos supplemented males, 28.00 g in 1 g BioMos supplemented males and 28.82 g in 2 g BioMos supplemented males.

Mean body weight gain of female Japanese quail were higher in treated groups across the whole observed periods when compared with control group. After 8 weeks of age, weight gain of control females was about 27.94 g, in 0.5 g BioMos supplemented group was about 31.53 g, in 1 g BioMos supplemented group was about 31.54 g and in 2 g BioMos supplemented group was about 31.26 g (table 5).

The present study demonstrated that dietary supplementation of Bio-Mos resulted in increase in male and female RGR during all experimental period when compared with control group and dietary supplemented with Bio-Mos® groups, but the significance of these increases differed with Bio-Mos® concentration and over different weeks of age (table 6).

This study demonstrated that dietary supplementation of Bio-Mos resulted in significant (p<0.05) increase in plasma Insulin during all experimental periods, but this significance differed with Bio-Mos® concentrations and over different weeks of experiment (table, 7, 8).

Table (2): Effect of dietary BioMos supplementation on male live body weight (g) Japanese quail**.**

Period / Group	Initial body weight	1st week	2nd week	3rd week	4th week	5th week	6th week	7th week	8th week	W8-w1
Control	9.64 ± 0.21[a]	27.28 ± 0.45[b]	61.25 ± 1.11[b]	97.39 ± 1.82[b]	147.53 ± 1.54[a]	175.56 ± 2.2[b]	185.6 ± 1.27[c]	201.39 ± 3.1[b]	223.67 ± 1.02[c]	213.36 ± 1.19[b]
0.5 g Bio Mos	9.95 ± 0. 23[a]	30.54 ± 0.94[ab]	63.07 ± 1.69 [b]	111.7 ± 1.79[a]	151.34 ± 2.7[a]	177.45 ± 3.4[ab]	196.09 ± 2.10[b]	214.85 ± 2.47[a]	226.32 ± 4.04[c]	216.05 ± 2.06[b]
1 g Bio Mos	9.64 ± 0.21[a]	31.52 ± 0. 65[ab]	65.14 ± 1.08[ab]	113.51 ± 1.04[a]	151.78 ± 1.44[a]	180.3 ± 2.60[ab]	205.97 ± 0.5[a]	219.79 ± 2.39[a]	234.17 ± 2.7[b]	224.36 ± 2.07[a]
2 g Bio Mos	9.64 ± 0.21[a]	33.39 ± 0.64[a]	67.46 ± 0.86[a]	114.39 ± 1.12[a]	152.41 ± 1.48[a]	184.00 ± 2.9[a]	204.00 ± 1.35[a]	219.81 ± 3.24[a]	241.33 ± 4.1[a]	231.69 ± 3.88[a]

Means ± standard errors.
Means with different letters at the same column differ significantly at (P<0.05)

Table (3): Effect of dietary BioMos supplementation on female live body weight (g) Japanese quail.

Period / Group	Initial body weight	1st week	2nd week	3rd week	4th week	5th week	6th week	7th week	8th week	W8-W1
Control	9.64 ± 0.21[a]	29.28 ± 0.45[c]	65.37 ± 1.11[b]	104.39 ± 1.82[b]	145.53 ± 1.54[c]	186.72 ± 2.2[c]	207.37 ± 1.27[c]	221.79 ± 3.1[c]	233.67 ± 1.02[b]	223 ± 0.81[b]
0.5 g Bio Mos	9.95 ± 0. 23[a]	33.4 ± 0.94[b]	70.17 ± 1.69 [a]	116.3 ± 1.79[a]	167.69 ± 2.7[b]	190.54 ± 1.4[b]	234.9 ± 2.10[a]	244.74 ± 2.47[ab]	262.98 ± 4.34[a]	253.03 ± 4.11[a]
1 g Bio Mos	9.64 ± 0.21[a]	32.30 ± 0. 65[b]	67.62 ± 1.08[ab]	115.51 ± 1.04[a]	167.49 ± 1.44[b]	188.34 ± 1.40[bc]	227.67 ± 0.5[b]	250.67 ± 2.39[a]	262.47 ± 3.7[a]	252.83 ± 3.49[a]
2 g Bio Mos	9.64 ± 0.21[a]	35.39 ± 0.64[a]	69.93 ± 0.86[a]	120.39 ± 1.12[a]	175.28 ± 1.48[a]	196.09 ± 2.9[a]	228.32 ± 1.35[ab]	241.25 ± 3.24[b]	260.55 ± 3.1[ab]	250.91 ± 2.89[a]

Means ± standard errors.
Means with different letters at the same column differ significantly at (P<0.05)

Table (4) Effect of dietary BioMos supplementation on body weight gain of male Japanese quail.

Period / Group	1st week	2nd]week	3rd week	4th week	5th week	6th week	7th week	8th week	W8-w1
Control	23.22 ± 0.74[ab]	34.62 ± 0.57[a]	35.30 ± 0.51[b]	34.98 ± 1.45[a]	27.95 ± 0.85[a]	10.07 ± 0.24[c]	15.76 ± 1.53[a]	22.0 ± 1.75[a]	26 ± 0.15[c]
0.5 g Bio Mos	24.61 ± 1.12[ab]	32.23 ± 0.90[a]	48.91 ± 1.00[a]	39.57 ± 2.33[a]	26.29 ± 2.12[a]	18.64 ± 0.57[b]	18.76 ± 1.40[a]	11.47 ± 0.76[b]	26.97 ± 0.2[c]
1 g Bio Mos	22.70 ± 0.66[b]	33.62 ± 0.84[a]	48.50 ± 1.16[a]	38.64 ± 1.46[a]	28.50 ± 1.78[a]	25.66 ± 1.71[a]	13.83 ± 1.49[a]	14.37 ± 1.23[b]	28.00 ± 0.21[b]
2 g Bio Mos	25.52 ± 0.67[a]	33.86 ± 1.10[a]	47.10 ± 1.15[a]	37.61 ± 0.92[a]	31.14 ± 1.23[a]	19.99 ± 1.03[b]	15.82 ± 1.69[a]	21.12 ± 2.76[a]	28.82 ± 0.08[a]

Means ± standard errors.
Means with different letters at the same column differ significantly at (P<0.05)

Table (5) Effect of dietary BioMos supplementation on female weight gain of Japanese quail.

Period / Group	1st week	2nd week	3rd week	4th week	5th week	6th week	7th week	8th week	W8-w1
Control	23.22 ± 0.74[ab]	35.62 ± 1.07[a]	39.30 ± 1.31[b]	41.98 ± 1.45[b]	40.25 ± 0.85[a]	21.87 ± 1.44[c]	13.24 ± 1.83[b]	26.25 ± 1.75[a]	27.94 ± 0.21[b]
0.5 g Bio Mos	24.61 ± 1.12[ab]	36.23 ± 1.40[a]	46.91 ± 1.00[a]	50.92 ± 2.33[a]	23.47 ± 2.12[b]	43.45 ± 4.86[a]	9.96 ± 1.40[b]	18.65 ± 3.76[ab]	31.53 ± 0.48[a]
1 g Bio Mos	22.70 ± 0.66[b]	35.51 ± 0.84[a]	48.50 ± 1.16[a]	51.85 ± 1.46[a]	21.23 ± 1.78[b]	39.59 ± 1.81[ab]	23.25 ± 5.49[a]	11.79 ± 1.23[b]	31.54 ± 0.44[a]
2 g Bio Mos	25.52 ± 0.67[a]	33.28 ± 1.10[a]	51.10 ± 1.15[a]	54.36 ± 0.92[a]	20.99 ± 1.23[b]	32.12 ± 0.70[b]	13.34 ± 2.69[a]	19.72 ± 0.76[ab]	31.26 ± 0.38[a]

Means ± standard errors.
Means with different letters at the same column differ significantly at (P<0.05)

Table (6): Effect of dietary BioMos supplementation on feed intake (g)/ one chick of Japanese quail.

Period / Group	1st week	2nd week	3rd week	4th week	5th week	6th week	7th week	8th week
Control	100 ± 2.05[a]	56.02 ± 3.04[b]	44.50 ± 2.33[b]	41.38 ± 1.12[a]	17.18 ± 0.97[a]	5.86 ± 1.39[b]	8.17 ± 0.91[a]	14.06 ± 3.82[b]
0.5 g Bio Mos	100 ± 1.43[a]	69.07 ± 1.46[a]	55.69 ± 1.18[a]	30.43 ± 0.3[b]	15.89 ± 1.51[a]	9.96 ± 1.42[ab]	9.12 ± 0.42[a]	19.75 ± 1.74[a]
1 g Bio Mos	100 ± 1.41[a]	69.44 ± 1.23[a]	53.51 ± 1.78[a]	29.80 ± 0.84[b]	17.27 ± 1.51[a]	13.29 ± 0.98[a]	6.48 ± 0.82[a]	12.41 ± 0.96[b]
2 g Bio Mos	100 ± 0.82[a]	67.90 ± 1.20[a]	51.46 ± 1.08[a]	28.30 ± 0.96[b]	18.70 ± 0.83[a]	10.31 ± 0.74[ab]	7.45 ± 1.04[a]	18.65 ± 0.42[a]

Means ± standard errors.
Means with different letters at the same column differ significantly at (P<0.05)

Table (7): Effect of dietary Bio Mos supplementation on relative growth rate (%) of male of Japanese quail.

Period / Group	1st week	2nd week	3rd week	4th week	5th week	6th week	7th week	8th week
Control	100 ± 2.05[a]	74.02 ± 3.04[a]	46.50 ± 2.33[b]	32.78 ± 1.12[a]	19.88 ± 0.97[a]	10.86 ± 1.39[c]	6.18 ± 0.91[ab]	11.06 ± 0.82[ab]
0.5 g Bio Mos	100 ± 1.43[a]	70.07 ± 2.46[a]	49.99 ± 1.18[ab]	35.37 ± 2.10[a]	13.12 ± 1.51[b]	20.62 ± 2.42[a]	4.17 ± 0.32[b]	14.55 ± 1.74[a]
1 g Bio Mos	100 ± 1.41[a]	70.44 ± 2.23[a]	49.99 ± 1.78[a]	36.2 ± 0.94[a]	11.9 ± 1.51[b]	18.82 ± 0.68[a]	9.73 ± 0.42[a]	8.96 ± 0.96[b]
2 g Bio Mos	100 ± 0.82[a]	63.90 ± 1.20[b]	54.13 ± 1.08[a]	36.59 ± 1.96[a]	11.3 ± 0.83[b]	15.13 ± 0.23[b]	5.66 ± 0.84[b]	15.12 ± 0.42[a]

Means ± standard errors.
Means with different letters at the same column differ significantly at (P<0.05)

Table (8): Effect of dietary BioMos supplementation on plasma insulin µIU/ml.

Period / Group	1st week	2nd week	3rd week	4th week	5th week	6th week	7th week	8th week
Control	0.69 ± 0.3[a]	0.5 ± 0.00[b]	1.73 ± 0.52[b]	1.60 ± 0.00[a]	2.00 ± 0.79[a]	1.1 ± 0.00[a]	1.7 ± 0.46[a]	0.50 ± 0.00[C]
0.5 g Bio Mos	0.80 ± 0.29[a]	0.97 ± 0.67[b]	3.55 ± 0.99[a]	1.65 ± 0.32[a]	2.30 ± 0.40[a]	1.10 ± 0.40[a]	3.2 ± 1.03[a]	2.20 ± 0.0[b]
1 g Bio Mos	0.40 ± 0.06[a]	1.10 ± 0.40[b]	1.10 ± 0.12[b]	1.47 ± 0.29[a]	2.90 ± 0.00[a]	1.90 ± 0.55[a]	2.17 ± 0.21[a]	5.80 ± 0.52[a]
2 g Bio Mos	0.67 ± 0.3[a]	2.9 ± 0.00[a]	1.20 ± 0.28[b]	1.50 ± 0.00[a]	3.07[a] ± 1.53[a]	1.3 ± 0.00[a]	1.93 ± 0.38[a]	5.78 ± 0.50[a]

Means ± standard errors.
Means with different letters at the same column differ significantly at (P<0.05)

4. DISCUSSION

Groups supplemented with Bio-Mos® have improved live body weight and body weight gain. This is in agreement with the study which observed that adding yeast at levels of 1 or 2 % to the basal diet improved body weight and body gain of Japanese quail [13]. Similar results were obtained in broilers [14]. Groups supplemented with Bio-Mos® have non-significant increase in FCR at the end of experiment (0-8 weeks). These results are similar to those which investigated the effects of mannan-oligosaccharides (at a level of 0.05%, 0.1% and 0.15% to starter and finisher diets) on the growth performance of broilers. Body weight gain [15].

In contrast the present results are dissimilar with previous work studied the effect of a natural growth promoter mannan-oligosaccharide (MOS), derived from the cell wall of yeast Saccharomyces cerveisae (was added at 1g/kg diet from 1 to 28 days of ages and at 0.5 g/kg diet from 29 to 42 days of age) on performance of broiler chicks [16]. Dietary supplementation of Bio-Mos resulted in significant ($p<0.05$) increase in plasma Insulin during all experimental periods; These results have agreement with the study which examined the effects of feed additives intake on three growth-related hormones in Japanese quail and found that consumption sarcchomysis cervisae caused elevation of insulin concentration [17]. One can emphasize on the role of insulin in growth in respect with its role in entrance of five necessary amino acid to cells (phenylalanine, leucine, isoleucine, valine and tyrosine), and so that, elevation of insulin in blood is positive for bird growth.

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تأثير البروبيوتك على الوظائف الحيوية في السمان الياباني

الملخص العربي

كان الهدف من الدراسة الحالية لتقييم آثار (بيو موس ®) كإضافات أعلاف كمشجع النمو على أداء النمو وبعض الهرمونات المتصلة نمو السمان الياباني. تم تخصيص عدد 480 واحدة من كتاكيت السمان الياباني اليوم بشكل عشوائي إلى 4 مجموعات متساوية. المجموعة 1 (المجموعة الضابطة) التي تتغذى على نظام غذائي لم يتم اضافه أي اضافات اعلاف اليها، المجموعة 2 التي تغذت على عليقة اضافه 0.5 جم بيو موس / كغ غذاء، المجموعة 3 التي تغذت على عليقة تحتوي على 1 جم بيو موس / كغ غذاء والمجموعة 4 التي تتغذى على 2 جم بيو موس / كغ عليقة. لتقييم المؤشرات النمو، تم وزن 30 طائر من كل مجموعة أسبوعي لمدة ثمانية أسابيع متتالية. وقد تم قياس استهلاك العلف لكل مجموعة الأسبوعية لحساب نسبة التحويل الغذائي. تم جمع عينات الدم أسبوعيا من ستة طيور من كل مجموعة، وبعد ذلك تم فصل البلازما لتقييم تركيزات الأنسولين. في نهاية التجربة، وكشفت نتائج الدراسة الحالية التي، إضافة إلى السيرة الذاتية موس التموينية السمان اليابانية أدى إلى تحسين مقاييس النمو (وزن الجسم، وزيادة الوزن، وزن الجسم النسبي) بالمقارنة مع مجموعة المراقبة. وأظهرت تركيزات الانسولين البلازما في المجموعات المعالجة فروق ذات دلالة إحصائية عند مقارنتها مع مجموعة السيطرة.

(مجلة بنها للعلوم الطبية البيطرية: عدد 25(1):201-209, سبتمبر 2013)