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Effect of graded levels of nucleotide supplementation on certain serum biochemical parameters in Japanese quails

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ABSTRACT

A trial was conducted for a period of 6 weeks to evaluate the effect of graded levels of nucleotide supplementation on serum biochemical parameters in Japanese quails. In the trial, 3 day old Japanese quail chicks were randomly distributed in completely randomized design into 4 treatment groups each with 3 replicates of 10 Japanese quails. The Japanese quails of treatment groups T_1, T_2, T_3 and T_4 were provided feed containing 0, 0.5, 1.0 and 1.5 per cent nucleotide respectively for a period of six weeks. At the end of experiment blood samples were collected for study of serum-biochemical parameters. The results indicated that decreased serum glucose, serum cholesterol and LDL cholesterol and increased HDL cholesterol was noticed in nucleotide supplemented groups at higher levels. Protein profile showed significant improvement in total protein, albumin and globulin while A/G ratio revealed no effect of supplementation. Serum creatinine and SGPT contents showed non-significance whereas, serum uric acid and SGOT contents were significantly ($P<0.05$) reduced in nucleotide supplemented groups of quails. It is concluded that nucleotide supplementation improves serum biochemical parameters without affecting liver and kidney functions.

Key words: Japanese quails, Nucleotide supplementation, Serum biochemical parameters.

INTRODUCTION

Research in human as well as certain animal and aquatic species revealed that dietary supplementation of nucleotides shows various beneficial effects like increased resistance to bacterial and viral infections, increase in plasma HDL cholesterol, decrease in plasma LDL cholesterol, faster recovery of the liver after injury etc. (Wu *et al.*, 2011 and Mohebbi *et al.*, 2013). In contrast, limited information is available in the literature about the need for nucleotides and their role in poultry. For Japanese quails such information is lacking. Therefore, the present investigation was undertaken to study the effects of dietary nucleotide supplementation on serum biochemical parameters in Japanese quails.

MATERIALS AND METHODS

An experiment was carried out in a completely randomized design (CRD) in which nucleotide in the form of yeast extract was supplemented at graded levels through feed to different groups of quail chicks for a period of 6 weeks. In the trial there were four treatments each with 3 replicates. The treatment T_1 served as control in which feed was offered devoid of nucleotide supplementation while T_2, T_3 and T_4 groups were given nucleotide in the form of yeast extract procured from A.A. Biotech Pvt. Ltd., Chennai at the levels of 0.5, 1.0 and 1.5 per cent respectively. After three days of brooding, 120 chicks were divided randomly into four treatment groups consisting of 30 chicks each and each group was subdivided into three replicates of 10 chicks each. Standard feed for starter (1-2 weeks) and finisher period (3-6 weeks) was provided to the quails.

The quail chicks were housed in deep litter system. All the housing and managemental conditions were similar for different treatment groups. All the chicks were provided *ad lib* feed and water throughout the feeding trial period of 42 days. Blood samples were collected at the end of the experiment. On last day of experiment blood was collected from two birds of each replicate aseptically through the jugular vein in sterilized disposable syringe (24 gauge needle). Blood was transferred in a clean test tube for serum separation to study the biochemical parameters. Samples were kept in slant position for clot formation and then centrifuged at 3000 rpm for 10 minutes and supernatant serum was poured in sterile tubes for analysis of biochemical parameters by using Span diagnostic kits and following standard protocol. Glucose and enzyme estimations were done on the same day while the serum samples were stored at 4^0C in refrigerator for estimation of other parameters.

Statistical analysis: All the observation recorded in this study were subjected to statistical analysis using one way ANOVA technique described by Snedecor and Cochran (1994). Differences between group means were considered significant at $P<0.05$.

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RESULTS AND DISCUSSION

The supplementation of nucleotide at graded levels showed significant difference on serum biochemical parameters of Japanese quails.

Serum glucose: A significant effect of nucleotide supplementation was observed on serum glucose level of different groups (Table 1). It was found that the concentration of glucose in serum decreased when the concentration of nucleotide supplement increased in the feed. The results of the present experiment revealed that there was significant decrease in level of glucose at higher levels of nucleotide supplementation. Earlier studies also supported the present results in which the dietary supplementation of nucleotides reduced serum glucose levels in broilers and calves (Shareef and Al-Dabbagh, 2009 and Krol, 2011). However, Abdelrahman (2013) could not find effect of yeast supplementation on serum glucose in broilers. Reduction in the serum glucose level of supplemented groups clearly indicated that dietary inclusion of nucleotides has a role in minimizing the stress.

Serum total cholesterol: Japanese quails of nucleotide supplemented groups at 1.0 and 1.5 per cent level had significantly ($P<0.01$) lower serum total cholesterol as compared to T_1 and T_2 groups (Table 1). Japanese quails of T_2 group showed statistically ($P>0.05$) similar level of serum cholesterol to that of group T_1. The cholesterol content in serum of group T_3 was lowest (176.75 ± 3.84 mg/dl).

Serum triglycerides: Serum triglyceride level (mg/dl) was significantly ($P<0.05$) different among Japanese quails of supplemented groups and control (Table 1). The concentration of triglyceride in all the supplemented groups were significantly higher ($P<0.05$) than the triglyceride level of control group. However, they were statistically ($P>0.05$) similar among themselves.

Serum HDL-cholesterol: Serum HDL cholesterol showed a significant impact of nucleotide supplementation (Table 1). Minimum serum HDL-cholesterol (17.93 ± 0.08 mg/dl) level was recorded in quails of T_1 group which was significantly lower than the serum HDL cholesterol levels of Japanese quails of T_2 and T_3 groups. HDL-cholesterol concentration between Japanese quails of control and T_4 groups were statistically similar. Maximum (59.87 ± 6.04 mg/dl) and significantly higher level of serum HDL-cholesterol was noted in quails of T_3 group.

Serum LDL-cholesterol: There was significant effect of nucleotide supplementation on the serum LDL-cholesterol levels of Japanese quails (Table 1). Minimum (97.74 ± 10.66 mg/dl) and significantly ($P<0.05$) lower level of serum LDL-cholesterol was found in Japanese quails of T_3 group, whereas maximum (203.72 ± 11.71 mg/dl) level of LDL-cholesterol was observed in Japanese quails of control (T_1) group.

Findings of the present investigation regarding effect of nucleotide supplementation on serum lipid profile of Japanese quails corroborated with Gheisari and Kholeghipour (2006) who found significant decrease in total cholesterol and increase in HDL-cholesterol of broilers supplemented with yeast. However, they observed no significant effect on the triglyceride level due to nucleotide supplementation. Recent studies conducted by Aluwong *et al*. (2012) and Abdelrahman (2013) also revealed reduction in the cholesterol level of broilers supplemented with yeast culture.

Serum total protein: Nucleotide supplementation as yeast extract had marked effect on serum total protein levels (Table 2). Maximum and significantly (5.85 ± 0.45 g/dl) higher serum total protein compared to the control was found in Japanese quails of group T_2 which was statistically ($P>0.01$) similar to the serum total protein of group T_3 (4.77 ± 0.22 g/dl).

Table 1: Effect of nucleotide supplementation on serum glucose and lipid profile of Japanese quails

Treatment	Serum glucose* (mg/dl)	Serum total cholesterol* (mg/dl)	Serum triglycerides* (mg/dl)	Serum HDL-cholesterol*(mg/dl)	Serum LDL-cholesterol*(mg/dl)
T_1	119.54^{a} ± 0.66	238.19^{a} ± 11.81	82.72^{b} ± 0.34	17.93^{c} ± 0.08	203.72^{a} ± 11.71
T_2	121.16^{a} ± 0.28	232.79^{a} ± 6.58	105.29^{a} ± 2.70	39.64^{b} ± 5.71	172.10^{ab} ± 11.93
T_3	116.30^{b} ± 0.03	176.75^{b} ± 3.84	95.68^{a} ± 4.21	59.87^{a} ± 6.04	97.74^{c} ± 10.66
T_4	115.88^{c} ± 0.77	198.75^{b} ± 2.24	96.52^{a} ± 5.50	22.42^{c} ± 2.39	157.02^{b} ± 3.52

Values with different superscripts column wise differ significantly ($P<0.05$)

Table 2: Effect of nucleotide supplementation on serum protein profile and health status related parameters of Japanese quails

Treatment	Total serum protein*(g/dl)	Albumin* (g/dl)	Globulin* (g/dl)	A/G ratio	Serum creatinine (mg/dl)	Serum uric acid* (mg/dl)
T_1	3.42^{c} ± 0.32	0.95^{b} ± 0.07	2.47^{c} ± 0.14	0.39 ± 0.01	0.72 ± 0.03	1.09^{a} ± 0.06
T_2	5.85^{a} ± 0.45	1.23^{a} ± 0.06	4.62^{a} ± 0.24	0.27 ± 0.01	0.56 ± 0.06	0.76^{b} ± 0.11
T_3	4.77^{ab} ± 0.22	1.33^{a} ± 0.11	3.44^{ab} ± 0.31	0.39 ± 0.07	0.49 ± 0.05	0.73^{b} ± 0.01
T_4	4.31^{bc} ± 0.30	1.12^{ab} ± 0.02	3.19^{b} ± 0.12	0.35 ± 0.01	0.57 ± 0.10	0.90^{ab} ± 0.05

Values with different superscripts column wise differ significantly ($P<0.05$)

Serum albumin: The concentration of serum albumin (g/dl) was significantly affected by the nucleotide supplement in Japanese quails (Table 2). The groups T_2 and T_3 supplemented with nucleotide were significantly different in the concentration of serum albumin from the control group. The maximum concentration (1.33 ± 0.11 g/dl) of albumin was observed in the T_3 group supplemented with 1.0% of nucleotide whereas, the concentration of serum albumin was minimum (0.95 ± 0.07 g/dl) in control group.

Serum globulin: The supplementation of nucleotide had marked effect on serum globulin concentration of Japanese quails (Table 2). The concentration of serum globulin was significantly (P<0.01) lower in the birds of control group (2.47 ± 0.14 g/dl) compared to the supplemented groups.

Albumin-Globulin ratio (A/G ratio): There was no significant difference in the serum albumin – globulin ratio among different treatment groups (Table 2). The A/G ratio was maximum in Japanese quails of group T_1 (0.39 ± 0.01) and T_3 (0.39 ± 0.07) and minimum (0.27 ± 0.01) in T_2 group of quails. From the result of serum protein profile it is clear that the supplementation of nucleotides significantly increased the serum total protein, serum albumin and serum globulin levels whereas there was insignificant effect on serum albumin-globulin ratio. The results of the present experiment are in accordance with the findings of Prayad and Mahmoudi (2008) and Shareef and Al-Dabbagh (2009) who found significant increase in serum protein, albumin and globulin levels of broilers supplemented with yeast. Recently, Shankar *et al.* (2012) also observed proportional increase in the serum protein level of fresh water prawns with increased concentration of nucleotide in the feed. In contrast to the findings of present experiment Gheisari and Kholeghipour (2006) noted insignificant increase in serum protein of broilers supplemented with powdery yeast compared to the control. Higher value of serum globulin indicates higher amount of immunoglobulin. Since the gamma fractions make the largest portion of globulin, it can be inferred that the dietary supplementation of nucleotide might enhance the immune response.

Serum uric acid: Nucleotide supplementation had marked effect on serum uric acid levels in Japanese quails (Table 2). The uric acid level of Japanese quails in T_2 and T_3 groups were significantly (P<0.05) lower than the control. Numerically, maximum (1.09 ± 0.06 mg/dl) concentration of uric acid was found in the Japanese quails of control whereas, minimum (0.73 ± 0.01 mg/dl) concentration was observed in the quails of T_3 group. The findings of present experiment on serum uric acid are supported by Shareef and Al-dabbagh (2009) who found insignificant decrease in the uric acid level of broilers supplemented with yeast. The concentration of urea (uric acid in birds) in serum is inversely correlated to the net utilization of proteins and reflects the balance between intake, usage and degradation of proteins and the renal excretion of protein metabolites (Taylor *et al.*, 1974). Increased protein intake induces an increase in amino acid oxidation and the subsequent excretion of nitrogen, mainly as urea (uric acid in birds). In this study, the reason for lower concentration of serum uric acid in groups supplemented with nucleotides may be the lower intake and presumably more efficient use of proteins in the diet.

Serum creatinine: The quails of control group had numerically higher (0.72 ± 0.03 mg/dl) value of serum creatinine compared to the treatment groups but no significant difference could be noted (Table 2). Effect of nucleotide supplementation on serum creatinine of birds and animals has not been studied. Therefore, literature pertaining to this aspect is scanty. The serum creatinine level of different groups was similar in the present experiment which clearly indicated that there is no adverse effect of nucleotide supplementation on renal function of Japanese quails.

Enzymatic profile

Serum glutamate oxaloacetate transaminase (SGOT): The SGOT values in the present investigation showed a significant (P<0.05) effect of nucleotide supplementation in Japanese quails (Table 3). The SGOT concentration in Japanese quails of T_1 group (166.90 ± 8.99 IU/L) was significantly (P<0.01) higher than the supplemented groups. However, the SGOT concentrations in Japanese quails of supplemented groups were statistically similar among themselves. Minimum (132.19 ± 0.53 IU/L) concentration of SGOT was noted in the Japanese quails of T_3 group. The findings of present experiment on serum SGOT concentration are in contrast with Shareef and Al-Dabbagh (2009) and Aluwong *et al.* (2012) who found no significant difference in the SGOT values of broilers supplemented with yeast. Similarly, Krol (2011) also found non-significant effect of nucleotide supplementation on SGOT values in calves.

Table 3: Effect of nucleotide supplementation on enzymatic profile of Japanese quails

Treatment	SGOT* (IU/L)	SGPT (IU/L)
T_1	166.90^a ± 8.99	12.13 ± 0.68
T_2	145.60^b ± 2.06	11.76 ± 0.23
T_3	132.19^b ± 0.53	11.32± 0.36
T_4	146.05^b ± 3.46	11.59 ± 0.68

Values with different superscripts column wise differ significantly (P<0.05)

Serum glutamate pyruvate transaminase (SGPT): There was no significant effect of nucleotide supplementation on SGPT value in Japanese quails of different treatment groups (Table 3). The results of the present experiment on SGPT values are supported by Shareef and Al-Dabbagh (2009) who found no significant effect of yeast supplementation on SGPT values in broilers. However, Aluwong *et al.* (2012) found significant reduction in SGPT values in broilers

supplemented with yeast. The decreased values of SGOT and non-significant difference in SGPT values of supplemented groups indicate that there is no adverse effect of nucleotide supplementation on hepatic function of Japanese quails.

From the findings of the present experiment it is concluded that nucleotide supplementation in Japanese quails improves serum biochemical parameters without affecting liver and kidney functions.

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