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Original Article

Effect of Dietary Enzyme Supplementation on Some Biochemical and Hematological Parameters of Japanese Quails

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Abstract

This study was carried out to evaluate the effect of dietary enzymes supplementation (Kemzyme plus dry® and phytase) on some serum biochemical and hematological parameters of Japanese quails. A total number of two hundred forty (240) healthy Japanese quails of both sexes 14. day-old Japanese quails were divided into 4 groups. The first group of Japanese quails was considered as control group and fed on the basal diet without supplementation of any dietary enzyme; second group fed on basal diet supplemented with 0.5g Kemzyme plus dry®/kg diet, third group fed on basal diet supplemented with 0.1g phytase/kg diet, fourth group fed on basal diet supplemented with Kemzyme® plus phytase. Neither tested dietary enzyme or their combination had any significant effect on some biochemical constituents such as total protein, triglycerides, cholesterol, AST, glucose, uric acid, and creatinine. Results showed that blood thyroxine (T4) was not significantly affected by dietary enzymes, while triiodothyronine (T3) was significantly ($p<0.05$) decrease in group supplemented with phytase. Concerning with serum iron, the obtained data showed that there was significant increase ($p<0.05$) in group supplemented with Kemzyme® plus phytase. The results suggested that degrading enzymes and/or phytase supplementation had no adverse effect on biochemical and hematological constituents of Japanese quails.

Key words: Biochemical parameters, Japanese quails, thyroxin, dietary enzyme

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Introduction

The use of crude enzyme products as animal feed supplements has attracted considerable attention by the feed manufacture and livestock producers as a means of improving animal performance (Marquardt *et al*., 1996). Enzyme supplementation has dramatically increased all over the world, but predominantly in pigs and poultry diets (Officer, 2000). The addition of exogenous enzymes into the diet for improving the performance of animals is one of the alternative measures to solve the problem and it has been extensively studied and applied during the past decades as a means of enhancing and increasing the effectiveness of nutrient utilization (Acamovic, 2001). Viscosity of the digesta increases by the presence of NSP, the diffusion decreases. Moreover, the NSP gel may act as a physical barrier between substrates, enzymes, and digestion end-products (Petterson and Aman, 1989).

Supplementation of non-starch poly saccharides (NSP) degrading enzymes may not only reduce the anti-nutritive effects of NSP, but also releases some nutrients from these, which could be utilized by the birds (Balamurugan and Chandrasekaran, 2009). Dietary supplementation of multi-enzyme improves nutritive value of corn-soyabean diet in broiler chicks (Shirmohammad and Mehhri, 2011). Dietary enzyme can be successfully incorporated in diet of Japanese quail as a growth promoter (Chimote *et al*., 2009).

Phytate, being a strong acid, can also form salts with important minerals such as calcium (Ca), Magnesium (Mg), copper (Cu), Zinc (Zn), iron (Fe) and potassium (K), thereby reducing their solubility (Eardman, 1979). Phytase improved the digestibilities of essential amino acids, crude protein, nitrogen retention, which was also confirmed by (Sharlie, 2005). Phytase, on the other hand, was originally used for one express purpose to increase the availability of plant phytate phosphorus, which reduces phosphorus pollution and allows reductions in the amount of inorganic phosphate used (Bedford, 2000). Enzyme increased the utilisation and reduced faecal excretion of P and Ca in a dose dependent manner. Blood P, Ca and alkaline phosphatase concentrations were restored to their physiologic levels in the piglets receiving the phytase in comparison to non-supplemented diets (Guggenbuhl, 2012). Inclusion of phytase to poultry diets caused the release of these nutrients and increase phosphorus availability and utilization allows their absorption by the bird (Haque and Hossain 2012).

Materials and Methods

The present study was conducted at the Faculty of Veterinary Medicine, Benha, University to investigate the effect of dietary enzyme supplementation as feed additive for quail chicks on some biochemical and hematological parameters. Two types of dietary enzymes were used (Kemzyme plus dry® and Phytase). A total number of two hundred forty (240) healthy 14. day-old Japanese quails of both sexes were randomly arranged into four dietary treatment groups. Each treatment group contained 60 birds which were allotted into three replicates, each replicate contained 20 birds. The first group of chick was considered as control group and fed the basal diet without supplementation of any dietary enzyme, while the other three groups were fed on the basal diet supplemented with dietary enzyme as described in Table (1). Feed and water were provided as ad libitum. Nutrient requirements of the rations were determined according to NRC (1994). Blood samples were collected from each group through slaughtering at the end of experiment. For preparation of serum sample, 5ml of blood was collected without anticoagulant in the sterile test tube. The tube containing blood was placed in slanting position at room temperature for clotting. Blood samples were centrifuged at 3000 rpm for 10 minutes, then collected and stored at -20. serum total protein, triglycerides, cholesterol, Aspartate amino transferse (AST), glucose, uric acid, and creatinine, calcium, phosphorus, potassium and iron were determined color-metrically using available commercial kits. The haematological studies were performed within two hours after the blood collection as per technique described by (Shastry, 1983). Data obtained throughout the trial were analysed using SPSS (10) pocket programme and differences between the averages were examined by Duncan’s multiple-range test.

Table 1: Experimental design

Groups	Number of birds	Diets	Supplemented levels of dietary enzyme (g /kg diet)	
			Kemzyme	Phytase
G1	60	Basal diet	-------	-------
G2	60	Basal diet	0.5 g Kemzyme plus dry® /Kg diet	-------
G3	60	Basal diet	-------	0.1 g Phytase /Kg diet
G4	60	Basal diet	0.5 g Kemzyme plus dry® /Kg diet	0.1 g Phytase /Kg diet

Table 2: Ingredients of the basal diets used in the experiment

Ingredients	Starter and growing diet
Ground yellow corn	55.03
Soyabean meal (CP 44%)	34.61
Corn gluten meal (CP 60 %)	6
Wheat bran	1.36
Lime stone	0.838
Dicalcium phosphate	1.602
Common salt (Nacl)	0.20
DL-Methionine	0.0743
L-lysine	0.085
Vitamin-mineral mix*	0.20

Vitamin-mineral mixture was composed of: Each 3 kg contain: Vit. A 12000000 IU, vit. D_3 2000000 IU, vit. E 10000 mg, vit. K_3 2000 mg, vit $B_1$1000 mg, vit. B_2 5000 mg, vit B_6 1500 mg, vit. B_{12} 10 mg, Biotin 50 mg, pantothenic acid 10000 mg, Nicotinic acid 30000 mg, Folic acid 1000 mg, Manganese 60000 mg, Zinc 50000 mg, Iron 30000 mg, Copper 10000 mg, Iodine 1000 mg, Selenium 100 mg, Cobalt 100 mg, carrier ($CaCo_3$) add to 3 kg . Vitamin-mineral mixture produced by AGRI-VET 10th of Ramadan city A2, Egypt.

Results and Discussion

The analysis of variance of obtained data from the table (3) showed that constituents of blood serum including total protein, glucose, triglyceride uric acid, creatinine, Total cholesterol and liver enzymes Aspartate aminotransferase (AST) were not significantly affected by dietary enzymes. These results are in agreement with (Qota *et al*., 2002; Shakmak, 2003; Al-Harthi, 2006) who found that cell-wall degrading enzymes and/or phytase supplementation had no adverse effect on biochemical constituents of plasma and liver function of broiler chicks. The analysis of variance of obtained data from the table (4) showed that serum calcium, phosphorus, potassium were not significantly affected by dietary enzymes, but there was insignificant increase in phosphorus in group supplemented with phytase (G3) and Kemzyme plus phytase (G4).

Table 3: The effect of dietary enzyme supplementation on some serum metabolites of Japanese quails (mean ± SE)

Parameters	Unit	G1	G2	G3	G4
AST	U/L	241.33± 14.49^{a}	221.33± 19.40^{a}	236.67 ± 4.91^{a}	308.33 ± 72.05^{a}
Total protein	g/ dl	3.073± 0.19^{ab}	2.632± 0.30^{b}	3.033± 0.15^{ab}	3.401± 0.10^{a}
Total cholesterol	mg/dl	238. ± 16.09^{a}	192.6± 17.53^{a}	228 ± 16.28^{a}	218 ± 21.0^{a}
Triglyceride	mg/dl	152.83± 20.27^{a}	144.44± 9.28^{a}	119.76 ±18.75^{a}	113.56 ±11.71^{a}
Glucose	mg/dl	200.76± 23.59^{a}	233.12 ±3.67^{a}	218.68± 25.54^{a}	244.03± 6.43^{a}
Creatinine	mg/dl	2.43±0.26^{a}	2.36± 0.41^{a}	3.210± 0.26^{a}	2.443± 0. 0.17^{a}
Uric acid	mg/dl	3.093±0.56^{a}	2.016 ± 0. 0.33^{a}	1.60± 0.75^{a}	2.31± 0.53^{a}

$^{a, b, c}$ Mean values having different letters in column differ significantly ($P<0.05$).

Table 4: The effect of dietary enzyme supplementation on serum minerals level of Japanese quails (mean ± SE)

Parameters	Unit	G1	G2	G3	G4
Calcium	mg/dl	8.16 ± 0.63^{a}	8.37 ± 0.56^{a}	7.56 ± 0.48^{a}	8.1667 ± 0.13^{a}
phosphorus	mg/dl	3.200 ± 0.73^{a}	3.66 ± 0.84^{a}	4.16 ± 0.54^{a}	4.65 ± 0.63^{a}
potassium	nmol/L	3.25 ± 0.94^{a}	3.40 ± 0.61^{a}	3.50 ± 0.59^{a}	2.72 ± 0.12^{a}
iron	µg/dl	154.33 ± 11.86^{b}	191.67 ± 7.75^{ab}	194.67 ± 18.94^{ab}	211.67 ± 9.76^{a}

$^{a, b, c}$ Mean values having different letters in column differ significantly (P<0.05).

Concerning with serum iron the result showed that there was significant increase (P<0.05) in group supplemented with Kemzyme plus phytase (G4), there was insignificant increase in group supplement with phytase (G3). These improvements may be due to cabohydrases be able to also increase the efficacy of phytase by increasing accessibility of phytase to phytic acid and absorption of nutrients released by phytase (Woyengo and Nyachoti, 2011). (Stahl *et al*., 1999) indicated that phytase addition increased Fe levels in blood in young pigs, and Paik *et al.* (2000) indicated that adding phytase increased serum levels of Fe in chicks. Phytate, being a strong acid, can also form salts with important minerals such as calcium (Ca), Magnesium (Mg), copper (Cu), Zinc (Zn), iron (Fe) and potassium (K), thereby reducing their solubility (Eardman, 1979; Oberleasand Harland, 1996).

The result from the table (5) showed that blood thyroxin (T4) was not significantly affected by dietary enzymes, while triiodothyronine (T3) was significantly decreased in group supplemented with phytase. Some studies suggest that nutrition is an important factor in the regulation of plasma hormones and of their receptors gene expression in many tissues of chickens. Enzyme addition directly or indirectly promoted an enhanced activity of deiodinase in liver and kidney tissues, promoting the transformation of T4 into T3 (Collin *et al*., 2003). Nutritional factors (diet quantity and composition) also affect intermediary metabolism, resulting in the changes of plasma metabolite levels in poultry (Buyse *et al*., 2002; Swennen *et al*., 2005). (Hajati et al., 2009) found that adding enzyme significantly reduced the concentration of blood Thyroxine (T4) at 42 days of age in broilers.

Hematological parameters of Japanese quails

The obtained data from the table (6) showed that heamatological parameters including haemoglobin, PCV, total RBCs count and mean corpuscular volume (MCV) were not significantly affected by dietary enzymes.

Table 5: The effect of dietary enzyme supplementation on T3&T4 hormone level of Japanese quails (mean ± SE)

Parameters	Unit	G1	G2	G3	G4
T3	pg/ml	75 ± 10.59^{a}	52.33 ± 5.23^{ab}	51.66 ± 4.70^{b}	60.0 ± 4.16^{ab}
T4	ng/dl	4.50 ± 1.113^{a}	$2.3\pm0 .321^{a}$	2.2933 ± 0.408^{a}	3 ± 0.529^{a}

$^{a, b, c}$ Mean values having different letters in column differ significantly (P<0.05).

Table 6: The effect of dietary enzyme supplementation on hematological parameters of Japanese quails (mean ± SE)

Parameters	G1	G2	G3	G4
Hb (g/dl)	7.88 ± 0.56^{a}	6.95 ± 1.14^{a}	8.2 ± 0.87^{a}	7.13 ± 0.88^{a}
PCV (%)	49 ± 0.00^{ab}	52 ± 1^{a}	49.33 ± 0.66^{ab}	48.33 ± 1.3^{b}
RBCs(X $10^{6\,/\mu l)}$	3.17 ± 0.31^{a}	3.55 ± 0.52^{a}	3.11 ± 0.37^{a}	3.8 ± 0.35^{a}
MCV (fl)	157.87 ± 17.31^{a}	155.71 ± 27.81^{a}	162.65 ± 17.06^{a}	129.9 ± 16.9^{a}

$^{a, b, c}$ Mean values having different letters in column differ significantly (P<0.05).

Conclusion

The result suggested that degrading enzymes and/or phytase supplementation had no adverse effect on biochemical and hematological constituents of Japanese quails. Concerning with serum iron, the data presented showed that there was significant increase in groups supplemented with and Kemzyme® plus phytase. On my opinion I believed that combination between non starch polysaccharides degrading enzyme and phytase improve the bioavailability of iron.

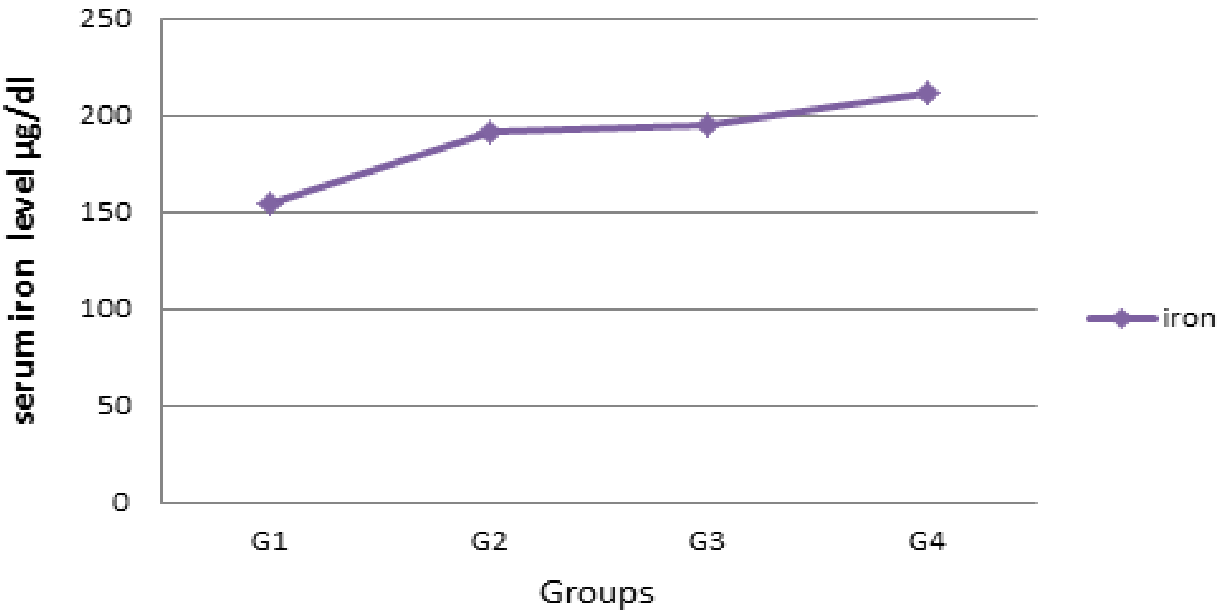

Fig. 1: The effect of dietary enzyme supplementation on serum iron of Japanese quails.

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