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INFLUENCE OF DIFFERENT LEVELS OF DIETARY SUPPLEMENTATION PHYTASE ENZYME UPON GROWTH PERFORMANCE, CARCASS TRAITS AND SOME BIOCHEMICAL PARAMETERS OF LOCAL JAPANESE QUAIL

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Abstract

This experiment was carried out to investigate the effect of different levels of phytase enzyme upon the growth performance, carcass traits and some biochemical parameters of local Japanese quail during the growth period. A total 120 local Japanese quail at 10 days old assigned to 4 treatments in a completely randomized design. Each treatment had 5 replicates (cages of multi floor battery) accommodating 6 birds per replication. The four dietary treatments were : 1) control diet with no phytase enzymes, 2) diet containing 0.01 % (100 gm/ton diet) phytase enzymes, 3) diet containing 0.02 % (200 gm/ton diet) phytase enzymes, 4) diet containing 0.03 % (300 gm/ton diet) phytase enzymes. Results showed that birds fed diet containing phytase enzymes was significantly (pd≤0.05) better than control group for the feed intake, body weight gain and feed converter ratio, while the difference were no-significant for the carcass parts and some internal organs percentage, Also treatments containing phytase enzymes increased significantly (pd≤0.05) in serum glucose, cholesterol, total protein and phosphor while showed no-significant in serum calcium between all treatments.

Key words : Phytase, performance, quail.

Introduction

The primary constituents or diets for poultry are plant based ingredients which comes primarily from the seeds of plants as cereal grains, oil seeds meal and beans, have a relatively high content of phosphorus (Vali, 2010 and Sharifi *et al.,* 2012). Approximately up to 75 phosphorus found in poultry diet ingredients is in the form phate phosphorus which called phytin or phytic acid and Phytase (Islam *et al.,* 2014; Vali 2010; Sharifi *et al.,* 2012; shad *et al.,* 2014; Ssabastian *et al.,* 1998; Jalali and Babaei 2011 and Cowieson *et al.,* 2006). phytic acid or phytin is also know to complex or chelate with protein, amino acids, energy (lipids) and minerals, thus led to poor utilization of the nutrients (Shad *et al.,* 2014; Driver *et al.,* 2005; Ravindran *et al.,* 1999; Sebastian *et al.,* 1998; Sharifi *et al.,* 2012). studies indicate that phytic acid or Phytase reduce the activity of endogenous enzymes or poultry digestive enzymes as pepsin, trypsin and α-amylase (Sebestian *et al.,* 1998; Singh and Krikorian 1982 and Deshpande and Cheryan 1984) this behavior of Phytasehas led it being categorized as anti-nutritional factor (Swick and Ivey 1992; Shad *et al.,* 2014; Angel *et al.,* 2002 and Islam *et al.,* 2014). phytic acid in foods derived from plants forms complexes with dietary essential elements such as calcium, zinc, copper, iron, and magnesium and makes them biologically unavailable (Oberleas 1973; Nelson 1967; Sebestian *et al.,* 1998; Hulan *et al.,* 1985; Rao *et al.,* 2003, 2006; Englmaierova *et al.,* 2014; sharifi *et al.,* 2012; Ravindran *et al.,* 2006; Selle *et al.,* 2000 and Islam *et al.,* 2014). Phytase (Myo-inositol hexaphosphate phospho hydrolase) is an enzyme that hydrolyses Phytase to inositol and inorganic phosphate (Sebastian *et al.,* 1998; Ravinavan *et al.,* 1999; Liu *et al.,* 1998; Wyss *et al.,* 1999; Cowieson *et al.,* 2004; Islam *et al.,* 2014 and Thacker *et al.,* 2009). The industrial production of microbial phytase started in the early 1990s (Wodzinski and Ullah 1996). A variety of microorganisms including bacteria, yeast and fungi had been screened (Yanke *et al.,* 1998; Yoon *et al.,* 1996

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and Greiner *et al.,* 1993). The beneficial effect of exogenous phytases in poultry diet has been supposed to be due to the direct hydrolytic effects on Phytase and subsequent improvement in the availability of minerals, amino acids and energy (Selle and Ravindran 2007) and improves the efficiency of utilization of energy, amino acids and improve the bird performance (Pirgozliev 2007, 2008; Ravindran *et al.,* 1999, 2001; Selle *et al.,* 2000; Newkiek and Classen 2001; Rutherfurd *et al.,* 2002 and Cowieson *et al.,* 2006 a, b). Improvements in P digestibility and reductions in P excretion have also been reported as a result of inclusion of the enzyme phytase into poultry diets (Li *et al.,* 2001 a; Leytem *et al.,* 2007; Bhanja *et al.,* 2005; Sacakli *et al.,* 2006; Selle *et al.,* 2007 and Leytem *et al.,* 2008 ab). Phytase research that has focused on the effect of varying levels of supplemental phytase has shown increases in broiler performance, bone ash and Phytase P utilization with each additional unit or level of phytase (Shirley and Edwards 2003). Feeding broiler chicks from 5 to 21 days of age with five level of exogenous phytase (300, 600, 1200. 2400 and 24000 FTU/kg diet), the addition of exogenous phytase above 600 FTU/kg diet and 1200 FTU/kg diet improved significantly ($p \leq 0.05$) feed conversion ratio and body weight gain of birds (Jalali and Babaei 2001). The aim of this experiment was to determine the influence of different levels of dietary supplementation phytase upon the growth performance of the local Japanese quail.

Materials and Methods

Diets

Ingredient and nutrient composition of the experimental diets is shown in table 1 the diets were formulated to be iso caloric and iso nitrogenous according to NRC (1994). three levels of phytase (100, 200 and 300 gm/ton diet) were added to each basal diet (control diet).

Bird and data collection

Ten-day-old unsexed local Japanese quail were used for this experiment. each birds were housed in cages (cages of battery system). each experimental diet was tested with five replicates cages of 120 chicks. birds from 10-45 days age were fed by four experimental diets. Growth performance of quail were recorded from 10-45 d of age such as feed consumption, body weight gain of chicks, conversion ratio of feed, energy, protein, methionine and lysine. at the end of experiment (45 d of age) 20 birds were selected randomly and slaughtered from measuring the carcass traits and internal organs. serum were collected from quails to measuring some biochemical parameters as glucose, cholesterol, total protein, phosphor and calcium.

Table 1 : The feed ingredients of the dietary treatments.

Feed stuff (%) \ Treatments	T1	T2	T3	T4
Wheat	59	58.99	58.98	58.97
Soybean meal (48% cp)	28.47	28.47	28.47	28.47
Animal protein concentrate	10	10	10	10
Sunflower oil	2	2	2	2
Vitamin-mineral premix	0.1	0.1	0.1	0.1
Choline chloride (60%)	0.32	0.32	0.32	0.32
Salt (Nacl)	0.2	0.2	0.2	0.2
Phytase enzyme	0	0.01	0.02	0.03
TOTAL (%)	100	100	100	100
Chemical calculated analysis*				
Metabolism Energy (kcal/kg feed)	2902	2902	2902	2902
Crude protein (%)	25.33	25.33	25.33	25.33
Methionine (%)	0.67	0.67	0.67	0.67
Lysine (%)	1.36	1.36	1.36	1.36
Calcium (%)	0.56	0.56	0.56	0.56
Available phosphorus (%)	0.46	0.46	0.46	0.46

*According to NRC, (1994).

Statistical analysis

All data were analyzed using the GLM procedure of SAS software (SAS, 2004) for analysis of variance as completely randomized design (CRD). Significant difference among treatments means were tested by applying Duncan's multiple range test (Duncan, 1955).

Results and Discussion

Fig. 1 shown the effect of using three levels of phytase enzyme (100, 200 and 300 g/ton diet) on feed intake, body weight gain and the feed conversion ratio. Second treatment (100 gm phytase/ton diet) recorded lowest amount of feed intake (26.37 g/bird) compared with first treatment (30.56 g/bird), also three treatments (200 gm phytase/ton diet) and four (300 gm phytase/ton diet) reduced of feed intake by 8.02% and 7.87% respectively compared to control treatment. Figure 2-b shown that third treatment was significantly higher ($Pd \leq 0.05$) in body weight gain (6.06 g/bird/d) compared with control treatment (5.41 g/bird/d) while second and fourth increased arithmetically to control treatment by 1.99 % and 5.25 %, respectively. Treatments addition of phytase supplementation improved significantly ($Pd \leq 0.05$) of feed conversion ratioin 4.81, 466 and 4.99 for second, third and fourth treatments respectively compared with control treatment in 5.63, and the amount of improvement by adding phytase supplementation was reached 14.56%, 17.22% and 11.36% for second, third and fourth treatments respectively compared with non-addition the

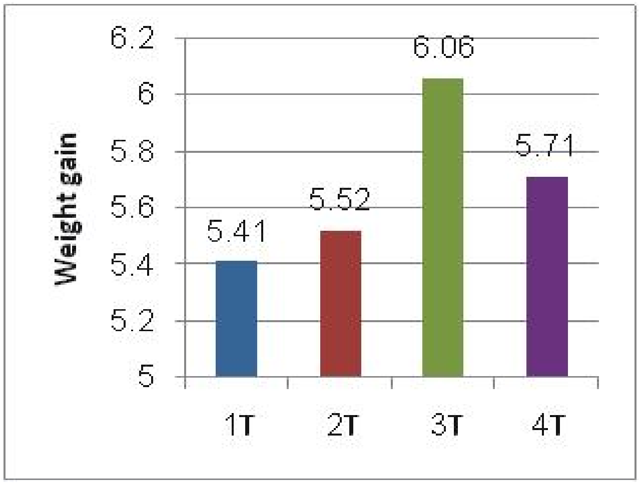

Fig. 1-b

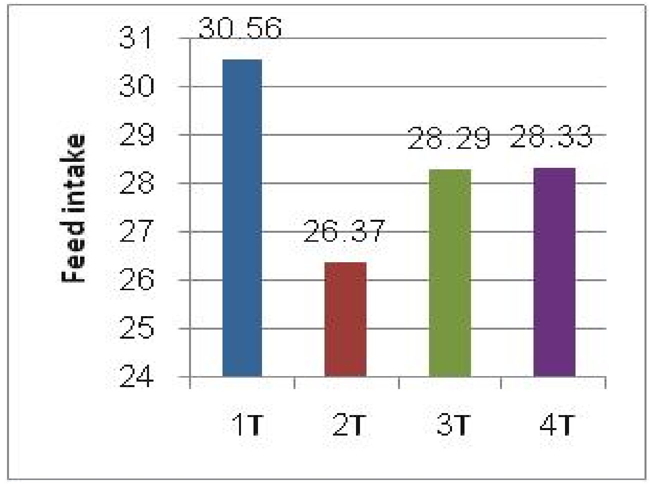

Fig. 1-a

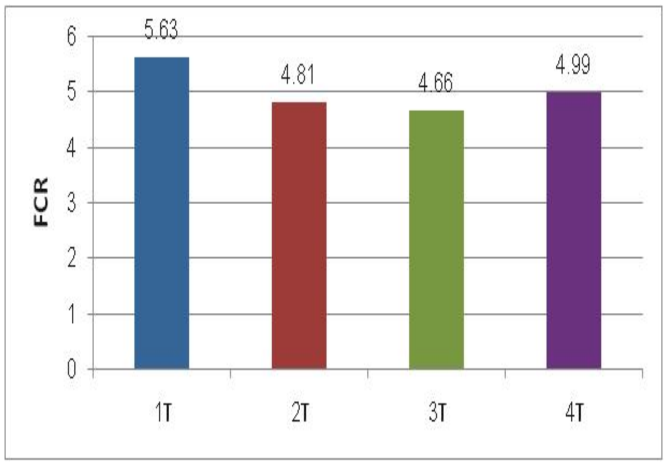

Fig. 1-c

Fig. 1: Influence of different levels of dietary supplementation phytase upon the growth performanceof quail. T_1 = Control, T_2 = Control + 100 gm phytase/ton diet, T_3 = Control + 200 gm phytase/ton diet, T_4 = Control + 300 gm phytase/ton diet.

Table 2: Influence of different levels of dietary supplementation phytase upon intake and conversion ratio of Energy, protein, methionine and lysine of quail (mean ± SE).

Traits / Treatment	T_1	T_2	T_3	T_4
Energy intake(Kcal/bird/day)	88.70±3.60a	76.52±1.66b	82.12±2.90ab	82.23±1.30ab
Energy conversion ratio (Kcal /g GW)	16.36±0.52a	13.97±0.67b	13.53±0.42b	14.49±0.67b
Protein intake(g/bird/day)	7.74±0.31a	6.67±0.14b	7.14±0.25ab	7.17±0.11ab
Protein conversion ratio(g protein/g GW)	1.42±0.04a	1.22±0.05b	1.18±0.03b	1.16±0.05b
Methionine intake (mg/bird/day)	204.23±8.32a	176.68±3.84b	189.60±6.71ab	189.85±3.01ab
Methionineconversion ratio(mg meth./g GW)	37.77±1.22a	32.27±1.56b	31.24±0.98b	33.46±1.56b
Lysine intake(mg/bird/day)	415.70±16.90a	385.63±7.79b	384.86±13.62ab	385.37±6.11ab
Lysine conversion ratio (mg lys./g GW)	76.68±2.47a	65.50±3.18b	63.42±2.00b	67.92±3.17b

Values followed with the same letters are not significantly different from each other according to Duncan's Multiple Range test at (5%) level. T_1 = Control, T_2 = Control + 100 gm phytase/ton diet, T_3 = Control + 200 gm phytase/ton diet, T_4 = Control + 300 gm phytase/ton diet.

enzyme on first treatment. These findings agree with Shad *et al.*, (2014)*;* Jalali and Babaei, (2001) and Watson *et al.*, (2006) which concluded there was significant improvement (Pd≤0.05) by addition of phytase to quail diets, but did not agree with Sharifi *et al.*, (2012) and Sacakli *et al.,* (2006) who pointed that the addition of phytase supplementation to quail diets did not improve feed intake, body weight gain and feed conversion ratio.

Table 3: Influence of different levels of dietary supplementation phytaseupon dressing (%) and carcass parts (%) of quail (mean ± SE).

Traits \ Treatment	T_1	T_2	T_3	T_4
Live body weight (g)	196±11.76a	192±9.43a	196±8.12a	184±9.40a
Dressing percentage (%)	74.83±3.92a	72.57±1.85a	68.19±3.92a	72.56±1.19a
Breast (%)	38.20±0.95a	37.24±0.88a	38.63±1.38a	37.29±0.82a
Thigh (%)	21.17±0.30a	21.86±0.21a	21.52±0.25a	22.34±0.76a
Back (%)	27.20±1.49a	28.14±0.93a	27.72±0.49a	27.53±0.84a
Wings (%)	7.70±0.24a	8.03±0.21a	8.03±0.37a	7.87±0.37a

Values followed with the same letters are not significantly different from each other according to Duncan's Multiple Range test at (5%) level.
T_1 = Control, T_2 = Control + 100 gm phytase/ton diet, T_3 = Control + 200 gm phytase/ton diet, T_4 = Control + 300 gm phytase/ton diet.

Table 4: Influence of different levels of dietary supplementation phytase upon internal organs weight (%) of quail (mean ± SE).

Traits \ Treatment	T_1	T_2	T_3	T_4
Proventriculus (%)	0.478±0.06a	0.431±0.03a	0.490±0.01a	0.446±0.02a
Gizzard (%)	2.84±0.11a	2.42±0.18a	2.58±0.04a	2.54±0.23a
Small intestine (%)	3.62±3.13a	3.37±2.95a	4.01±2.91a	3.45±2.94a
Liver (%)	3.13±0.44a	2.95±0.26a	2.91±0.28a	2.94±0.33a
Heart (%)	1.12±0.06a	1.14±0.04a	1.25±0.12a	1.14±0.05a
Pancreas (%)	0.33±0.02a	0.28±0.01ab	0.24±0.02b	0.25±0.02b

Values followed with the same letters are not significantly different from each other according to Duncan's Multiple Range test at (5%) level.
T_1 = Control, T_2 = Control + 100 gmp hytase/ton diet, T_3 = Control + 200 gm phytase/ton diet, T_4 = Control + 300 gm phytase/ton diet.

improved significantly (Pd≤0.05) the intake of energy, protein, methionine and lysine, also improved conversion ratio of energy, protein, methionine and lysine compared with treatments of non-addition phytase enzyme. This improvement due to positive role of phytase enzyme to reduce feed intake and feed conversion ratio.

Tables 3 and 4 shown the effect of the addition of the phytase enzyme on carcass parts and percentage of internal organs of the quail. concluded from table that the addition of this enzyme has no significantly effect to improvement percentage weight of dressing, chest, thigh, back and wings, also had no significantly effect to increasing percentage weight of liver, heart, proventriculus, gizzard and small intestine, while the results showed that the addition of phytase enzyme due to reducing percentage weight of pancreas for third and fourth treatments (200 and 300 g/ phytase/ton. respectively)

The positive improvement of production performances due to addition of the phytase enzyme may be to referred of Oatway *et al.*, (2001); Gatlin *et al.*, (2007); Hardy, (2010) who indicated that phytase enzyme plays analytical role of phytic acid to decomposition and releasing of nutrition compounds and minerals elements associated with it such as proteins, carbohydrates, minerals or vitamins to meet the nutritional needs of quail. Phytase enzyme works to increase phosphor level and make it more available and improve perform vital functions because of its role to metabolic of carbohydrates, amino acids and fat, and participate to synthesis of nucleic acids and many enzymes and energy storage in the body (Cao *et al.*, 2007). Also phytase enzyme works to releasing calcium element, which enters of many processes and metabolic pathways to increases the permeability of cell membranes and helps absorption the nutrients elements in intestine and encourage passage of fluids and some ions into and out of cells, thus, maintaining the cell balance contents and control the arrival of nutritional compounds (Fleet *et al.*, 2008; Schoch *et al.*, 2012). Table 2 shown that treatments addition phytase supplementation compared with control treatment. This finding was agree with Shad *et al.*, (2014); Ahmad *et al.*, (2004); Lessen and Summers, (1984) and Liblurn *et al.,* (1989) who indicated that the addition of phytase supplementation had no significantly effect (Pd≤0.05) to increasing percentage weight of carcass and chest but did not agree with result found by Rutkowski *et al.*, (1997) which indicated that the addition of the phytase enzyme had a significant effect (Pd≤0.05) to increasing weight of the carcass, also agree with Englmaierova *et al.*, (2014) who indicated that addition of phytase enzyme to quail diets did not have a significantly effect (Pd≤0.05) to increasing percentage weight of gizzard and small intestine.

Table 5 shown the effect of the addition of phytase enzyme to some biochemical parameters of quail. The addition of phytase with a concentration 200 and 300 gm phytase/ton diets was significantly reduced (Pd≤0.05) glucose level and significantly increased (Pd≤0.05) cholesterol, total protein and phosphor in blood serum compared with control treatment, while non-significantly differences between all treatments in level of serum calcium. The low level of glucose in addition of Phytase

Table 5: Influence of different levels of dietary supplementation phytase upon some biochemical parameters of quail (mean ± SE).

Traits \ Treatment	T_1	T_2	T_3	T_4
Glucose (mg/dl)	139.71 ± 9.25a	121.071 ± 11.74a	95.42 ± 1.82b	91.07 ± 5.8b
Cholesterol (mg/dl)	169.03 ± 10.84b	190.86 ± 6.58ab	200.51 ± 10.76ab	215 ± 22.08a
Total protein (g/dl)	3.78 ± 0.24c	4.27 ± 0.52c	6.06 ± 0.29b	7.97 ± 0.13a
Calcium (Ca) (mg/dl)	7.46 ± 0.19a	8.77 ± 0.99a	9.08 ± 1.17a	9.48 ± 0.91a
Phosphor (P) (mg/dl)	5.14 ± 0.25b	6.40 ± 0.43ab	7.49 ± 0.60a	7.75 ± 0.51a

Values followed with the same letters are not significantly different from each other according to Duncan's Multiple Range test at (5%) level.
T_1 = Control, T_2 = Control + 100 gm phytase/ton diet, T_3 = Control + 200 gm phytase/ton diet, T_4 = Control + 300 gm phytase/ton diet.

enzyme may be to the ability of the enzyme on decomposition phytic acid and release inositol that considered as a source of vitamin C, which plays an important role to reducing synthesis of corticosterone hormone which responsible to synthesis sugar from non-carbohydrate sources, thus, reduce the process of gluconeogens is within limits that allow the bird to meet energy needs (Panda *et al.*, 2008). The high level of protein in treatments of addition phytase supplementation may be due to the essential role of this enzyme in analysis of phytic acid and releasing of protein and associated amino acids (Ruthoford *et al.*, 2004). Increasing of phosphor level in serum may be due to what Garikipati, (2004) said; that the phytase enzyme has a high efficiency to releasing of phosphor from phytic acid and make it availability and absorbable. The phosphor is associated with six particles of phytic acid (Meanz, 2001). Thus, making phosphor element most usefully by increasing its level in the blood serum of quail birds.

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