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INFLUENCE OF PHYTASE ENZYME ADDITON TO JAPANESE QUAIL RATION ON GROWTH PERFORMANCE, CARCASS CHARACTERISTICS AND SOME BIOCHEMICAL PARAMETERS.

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ABSTRACT

This experiment was conducted to investigate the effects of phytase, on growth performance, carcass characteristics and some biochemical parameters of Japanese quail fed on low phosphorus diet. Japanese quail were divided into 5 equal groups, each group subdivided into 2 subgroup. One of them contain 16 males while the other contain 16 females. Japanese quail supplemented with five diets in both Males and females. First group (Positive control) fed on diet contain recommended level of available phosphorus N.R.C. (1994), second group (negative control) fed on diet contain 2/3 recommended level of available phosphorus while the other three groups fed on negative control diet supplemented with (300,600 and 900 phytase enzyme unit FTU/Kg), respectively. growth performance results showed that body weight gain of negative control group significantly lowered relative to other groups while Feed conversion ratio of the adequate phosphorus groups or of the low phosphorus groups supplemented with phytase significantly better than the negative control groups in both males and females. The data interested in carcass characteristics showed that dressing percentage. breast and thigh muscles were improved in all dietary treatments in both males and females compared with negative control and significantly increased in groups fed on diet supplemented with (600 &900 phytase enzyme unit FTU/Kg when compared with the positive control in case of males However leg muscle increased significantly in case of female (900 phytase enzyme unit FTU/Kg) when compared with the positive control. The present data revealed that serum globulin significantly increased in male group fed low phosphorus diet supplemented with 900 phytase relative to other male groups, the serum phosphorus of female group fed low phosphorus diet supplemented with 900 phytase showed significantly higher relative to other female groups.

Keywords: *Growth, carcass characteristics, phytase, quail, serum.*

INTRODUCTION

Plant origin feedstuffs such as corn and soybean meal represent the major portion of diets for poultry the availability of phosphorus in plant origin feedstuffs is about 30 to 40% (NRC, 1994). This low availability is generally attributed to the existence of about 70% of phosphorus in cereals in the form of phytate (Punna and Roland, 1999). Phytase is the only recognized enzyme that can initiate the release of phosphate from phytin (International Union of Biochemistry, 1979). The addition of the enzyme phytase to grains and feeds was an effective way to increase phosphorus availability to poultry (Nelson *et al.*, 1968) Microbial phytase has a positive influence on the utilization of nutrients other than phosphorus, such as amino acids (Yi *et al.,* 1996; Namkung and Leeson, 1999; Ravindran *et al.,* 1999). The phytase supplementation improved productive performance (Aggoor *et al.*, 2006) it may be possible to reduce supplemental level of inorganic phosphorus with phytase supplementation for quail diets without adverse effect on performance and tibia ash (Ismail *et al.,* 2006) Phytase supplementation increased the availability of phosphorus and subsequently increased body weight and bone mineralization that leads to increasing the bone rigidity in Japanese quail chicks fed low available phosphorus diets. (Osman *et al.,* 2009) Supplementation of phytase to the low-available phosphorus diet improved feed conversion

rate, body weight gain (Lan GanQiu *et al.,* 2012) Plasma total protein and globulin were significantly increased due to phytase supplementation (Attia *et al.,* 2011) Phytase supplementation increased plasma Ca level (Ghahri *et al.,* 2012) phytase improved breast and total meat percentages ($p<0.01$, 0.01 and 0.001, respectively) These findings suggesting that increased muscle mass is partially responsible for the observed increased in body weight on use of enzyme preparation, Serum total protein, calcium and phosphorus were improved as a result of enzyme supplementation (Abudabos 2012) when the broiler feed is supplemented with phytase and amino acids it is possible to reduce the crud protein, availability phosphorus and Calcium (Gomide *et al.,* 2012) microbial phytase could modify some serum enzyme activities and increase the availability and use of minerals for growth and performance improvement of broilers. It is therefore necessary to re-evaluate mineral requirements of broiler chickens when a diet is supplemented with phytase. (Nourmohammadi *et al.,* 2011) substitution of costly grains by 200 g/kg cheaper parboiled rice polish with phytase might reduce the feed cost without affecting feed intake, live weight and meat yield of quails (Sarkar *et al.,* 2011). Byproduct of phytase production can be applicable as chicken feed without giving detrimental effects (Mu KhinSan *et al.,* 2011) therefore the present study was perfomed to investigate the effect of phytase enzyme on growth performance, carcass characteristics and some biochemical parameters of Japanese quail fed on low phosphorus diet.

MATRIALS and METHODS

2.1. Experimental Birds:

A total of 160 healthy Japanese quail 18 day old were used in this experiment. They were obtained from the General Egypt Poultry Organization. They were divided into 5 equal groups: each group subdivided into 2 subgroup. One of them contain 16 males while the other contain 16 females. Males and females of each treatment have the same group number but housed separately.

Each compartment was bedded by fresh clean wood shave forming a deep litter of 4cm depth and changed every week. Each compartment was provided with continuous lightening program, suitable feeder and water supply.

Prophylactic antibiotics program measures against the most common infectious bacterial and Newcastle diseases were carried out.

2.2. Experimental feeding program:

The present feeding trial was lasted 4 weeks. The diets were formulated according to N.R.C. (1994) for Japanese quail (table 1) and the applied experimental feeding design according L-carnitine level (table 2). Small amounts of the basal diet were first mixed with the respective amounts of phytase as a small batch and then with a larger amount of the basal diets until the total amounts of the respective diets were homogeneously mixed.

Table 1: Physical and chemical composition of the experimental diets.

Physical composition	positive control%	negative control%	Chemical composition	positive control%	negative control%
Yellow corn	57.496	57.496	ME Kcal/kg*	2921	2921
Soybean meal (44%)	29.8	29.8	Crude protein%	24.18	24.18
Corn glutine (62%)	5	5	Ether Extract%	3.017	3.017
Fish Meal (60%)	5	5	Calcium%	.8	.8
lysine	0.071	0.o71	total phosphorus%	.7	.59
Dicalcium phosphate	1	0.4	Availablephosphorus%	.3	.2
Lime stone	0.6	1	Lysine%	1.3	1.3
Choline (60%)	0.333	0.333	Methionine+ cystine%	.82	.82
Common salt	0.4	0.4	Cholin chloride (mg)	2000mglkg	2000mglkg
Premix **	0.3	. 03			
Sand	0	0.2			

** The used premix (*Multivita Co.*) composed of vitamin A 12000000 IU, vitamin D_3 2200000 IU, vitamin E 10000 mg, vitamin K_3 2000 mg, vitamin B_1 1000 mg, vitamin B_2 5000 mg, vitamin B_6 1500 mg, vitamin B_{12} 10 mg, Niacin 30000 mg, Biotin 50 mg, Folic acid 1000 mg, Pantothenic acid 10000 mg, Iron 30000 mg, Manganese 60000 mg, Copper 4000 mg, Zinc 50000 mg, Iodine 1000 mg, Cobalt 100 mg, Selenium 100 mg, calcium carbonate ($CaCO_3$) carrier to 3000g .

Table 2: The applied experimental design during the experimental period in both sexes.

Group	Diet
1	**Positive control contain recommended level of available phosphorus N.R.C. (1994)**
2	**Negative control contain 2/3 recommended level of available phosphorus N.R.C. (1994)**
3	**Negative control supplemented with 300 phytase enzyme unit (FTU/Kg)**
4	**Negative control supplemented with 600 phytase enzyme unit (FTU/Kg)**
5	**Negative control supplemented with 900 phytase enzyme unit (FTU/Kg)**

This design used in both sexes at the same arrangement for each treatment.

2.3 Experimental Parameters:

2.3.1 Growth performance measurements: Body weight measured according to (Vohra and Roudybush, 1971). Relative growth rate according to Brody (1968). Feed conversion ratio according to (Lambert *et al.,* 1936). And body weight gain. Body weight gain was calculated by the difference between two successive weeks or periods weights.

2.3.2. Dressing percentage, Total edible carcass %: At the end of growing period (45days), 10 birds were taken randomly from each group(5males and 5 females) weighed and slaughtered to complete bleeding and weighed to determine Abdominal fat, breast muscle, leg muscle, organs weight and their relative weights to body weight. And also to determine biochemical parameters.

2.3.3. Serum total protein was determined according to Duomas *et al.* (1981), Serum albumin was determined according to Reinhold (1953), Serum globulin was calculated by substract the total serum albumin from total serum protein according to (Coles, 1974). Albumin/ globulin ratio was determined by devision of serum albumin value on serum globulin value according to (Saffinaz, 2001). Calcium and phosphorus measured by flame photometer according to Fuhrman and Crismon, (1951).

2.4 Statistical analysis:

The obtained numerical data were statistically analyzed using S.P.S.S., (1997) for one-way analysis of variance. When F- test was significant, least significant difference was calculated according to Duncan (1955).

RESULTS

3.1. Growth Performance:

Table 3: Influence of phytase Enzyme level dietry supplementation on growth performance of male during experimental period (45days):

Parameter	Groups				
	Positive control	**Negative control**	**Negative control plus 300phytase**	**Negative control plus 600 phytase**	**Negative control plus 900 phytase**
Initial body weight	94.48 ± 1.67a	94.27 ± 2.11a	94.58 ± 1.54a	93.94 ± 1.72a	93.9 ± 1.82a
final body weight	211.5 ± 4.56bc	193.75 ± 4.52ac	207.5 ± 4.36bc	205.5 ± 5.15c	211.75 ± 3.18bc
Body weight gain	116.97 ± 2.99b	99.48 ± 2.49a	112.92 ± 2.97b	111.56 ± 3.55b	117.85 ± 1.39b
Feed conversion	4.33 ± 0.16bc	5 ± 0.23ac	4.45 ± 0.18c	4.49 ± 0.18c	4.21 ± 0.16bc

Values are expressed as mean ± standard errors. Means in the same row had different letters significantly differ at ($p<0.05$).

Table 4: Influence of phytase Enzyme level dietry supplementation on growth performance of female during experimental period (45days):

Parameter	Groups				
	Positive control	**Negative control**	**Negative control plus 300phytase**	**Negative control plus 600 phytase**	**Negative control plus 900 phytase**
Initial body weight	93.28 ± 2.19a	94.16 ± 1.79a	93.36 ± 2.25a	93.19 ± 1.83a	92.98 ± 1.89a
final body weight	216.88 ± 3.76bc	191.75 ± 4.89ac	203.88 ± 6.08c	214.63 ± 5.06bc	213.38 ± 4.99bc
Body weight gain	123.54 ± 1.76c	97.59 ± 3.34a	110.52 ± 3.98b	121.44 ± 3.25c	120.4 ± 3.17c
Feed conversion	4.17 ± 0.15b	5.22 ± 0.25a	4.52 ± 0.19b	4.14 ± 0.15b	4.23 ± 0.16b

Values are expressed as mean ± standard errors. Means in the same row had different letters significantly differ at ($p<0.05$).

3.2. Carcass Characteristics:

Table 5: Influence of phytase Enzyme level dietry supplementation on Carcass traits percentage of male at the end of experimental period (45days):

Item	Groups				
	Positive control	**Negative control**	**Negative control plus 300phytase**	**Negative control plus 600 phytase**	**Negative control plus 900 phytase**
Dressing %	68.24±0.53b	65±0.81a	68.44±0.92b	68.16±0.13b	69.34±0.82b
Head %	4.93±0.14c	5.09±0.07c	5.1±0.09c	5.13±0.07bc	4.86±0.03ac
Liver %	1.96±0.14a	1.97±0.11a	1.92±0.13a	1.98±0.18a	1.98±0.12a
Heart %	1.07±0.06a	1.08±0.08a	1.06±0.11a	1.01±0.06a	1.07±0.07a
Gizzard %	2.39±0.08a	2.44±0.09a	2.39±0.07a	2.45±0.08a	2.34±0.05a
Breast Muscle %	17.12±0.15b	16.01±0.08a	17.07±0.15b	18.5±0.36c	18.14±0.38c
Leg Muscle %	12.92±0.06b	11.9±0.09a	13.37±0.14c	13.26±0.13c	13.66±0.05c
Abdominal Fat %	0.53±0.05a	0.59±0.04a	0.55±0.03a	0.55±0.06a	0.56±0.07a

Values are expressed as mean ± standard errors. Means in the same row had different letters significantly differ at ($p<0.05$)

Table 6: Influence of phytase Enzyme level dietry supplementation on Carcass traits percentage of female at the end of experimental period (45days):

item	Groups				
	Positive control	**Negative control**	**Negative control plus 300phytase**	**Negative control plus 600 phytase**	**Negative control plus 900 phytase**
Dressing %	66.07±0.07c	64.39±0.55ab	65.67±0.57bc	68.04±0.78d	67.62±0.42cd
Head %	4.69±0.03a	4.74±0.07a	4.61±0.08a	4.58±0.06a	4.68±0.04a
Liver %	2.43±0.06a	2.38±0.03a	2. 4±0.08a	2.37±0.06a	2.44±0.04a
Heart %	0.93±0.05a	0.91±0.04a	0.93±0.05a	0.92±0.06a	0.92±0.06a
Gizzard %	2.44±0.03a	2.45±0.04a	2.38±0.08a	2.36±0.06a	2.43±0.05a
Breast Muscle %	17.17±0.13b	15.57±0.17ab	16.58±1.16b	17.87±0.27bc	17.85±0.24bc
Leg Muscle %	12.77±0.08b	11.62±0.18a	12.72±0.08b	12.66±0.14b	13.21±0.21c
Abdominal Fat %	0.55±0.11a	0.56±0.07a	0.59±0.07a	0.58±0.08a	0.58±0.07a

Values are expressed as mean ± standard errors. Means in the same row had different letters significantly differ at ($p<0.05$).

3.3. biochemicl parameters:

Table 7: Influence of phytase Enzyme level dietry supplementation on biochemicl parameteres of male at the end of experimental period (45days):

Item	**Groups**				
	Positive control	**Negative control**	**Negative control plus 300phytase**	**Negative control plus 600 phytase**	**Negative control plus 900 phytase**
Total Serum protein(g/dl)	4.03 ± 0.24c	3.67 ± 0.12ac	3.4 ± 0.06a	4.03 ± 0.23c	4.37 ± 0.09bc
Serum albumin(g/dl)	1.83 ± 0.12a	1.5 ± 0.12a	1.43± 0.09a	1.8 ± 0.21a	1.8 ± 0.06a
Serum globulin(g/dl)	2.2 ± 0.15b	2.17± 0.03b	1.97 ± 0.07b	2.23 ± 0.03b	2.57 ± 0.13a
Albumin /globulin ratio	0.84 ± 0.06 a	0.69 ± 0.05a	0.73 ± 0.07a	0.80 ± 0.08a	0.73 ± 0.06a
Serum Calcium(M Eq/ g)	8.11 ± 0.91a	8.10 ± 0.69a	7.99 ± 0.92a	9.19 ± 0.45a	8.39 ± 1.22a
Serum phosphorus(M Eq/ g)	13.22 ± 0.37a	11.50 ± 0.84a	10.77 ± 2.28a	9.4 ± 0.22a	15.1 ± 3.5a

Values are expressed as mean ± standard errors. Means in the same row had different letters significantly differ at ($p<0.05$).

Table 8: Influence of phytase Enzyme level dietry supplementation on biochemicl parameteres of female at the end of experimental period

Item	Groups				
	Positive control	Negative control	Negative control plus 300phytase	Negative control plus 600 phytase	Negative control plus 900 phytase
Total Serum protein(g/dl)	4.33 ± 0.09a	4.17 ± 0.12a	4.3 ± 0.31a	4.17 ± 0.03a	4.6 ± 0.15a
Serum albumin(g/dl)	1.73 ± 0.09a	1.87 ± 0.12a	1.8± 0.25a	1.77± 0.03a	2.13 ± 0.12a
Serum globulin(g/dl)	2.6 ± 0.15ac	2.33± 0.03bc	2.5± 0.06c	2.4 ± 0c	2.47 ± 0.07c
Albumin/globulin ratio	0.67 ± 0.07a	0.8 ± 0.06a	0.73 ± 0.1a	0.73 ± 0.02a	0.86 ± 0.05a
Serum Calcium(M Eq/ g)	9.57 ± 0.5a	9.59 ± 0.15a	8.31 ± 0.95a	10.09 ± 0.08a	10.13 ± 0.72a
Serum phosphorus(M Eq/ g)	11.34 ± 1.86bd	12.67 ± 0.84d	15.53 ± 1.11cd	13.06 ± 1.07d	19.29 ± 0.33a

Values are expressed as mean ± standard errors. Means in the same row had different letters significantly differ at ($p<0.05$).

The analysis of variance of obtained data of growth performance presented in tables (3&4) showed that body weight gain of the low phosphorus groups without phytase was significantly lowered relative to other groups in both males and females, while feed conversion ratio of the adequate phosphorus groups or of the low phosphorus one supplemented with phytase significantly better than group fed on diet low- available phosphorus without phytase.

The statical analysis of the obtained data regarding carcass traits percentage illustrated in tables (5&6) demonstrated that dressing percentage of male groups increased significantly in groups supplemented with phytase compared with the negative control, while breast and leg muscle improved significantly with phytase supplemented diet (600 & 900 phytase enzyme unit FTU/Kg) when compared with both the negative and positive control. However dressing percentage of female groups increased significantly in birds fed on diet supplemented with600 and 900 phytase enzyme unit FTU/Kg when compared with both the negative and positive control and female group fed on diet supplemented with900phytase enzyme unit FTU/Kg improved significantly when compared also with both the negative and positive control.

The data concerning biochemicl parameteres represented in tables (7&8) revealed that no significant differences in serum total Protein, albumin, globulin Albumin/globulin ratio Calcium and phosphorus in both male and female groups except Serum globulin significantly increased in males fed low phosphorus diet supplemented with 900 phytase relative to other male groups, and Serum phosphorus of females fed low phosphorus diet supplemented with 900 phytase showed significant higher relative to other female groups.

DISCUSSION

This results concerning growth performance are in agreement with those obtained by Shaw *et al.* (2011) who found a reducing dietary non-phytate phosphorus requires phytase supplementation to obtain normal growth performance. The present results are in accordance with Motawe *et al.* (2012) who added phytase500 U phytase/Kg to the basal diet and he found a significant improved body weight gain and. feed conversion ratio. In contrast to our results Rekhate *et al.* (2011) supplemented of Ayuphytase with reduced dicalcium phosphate level at 50 and 65% and he found the supplementation could not effective to achieve performance of broilers in terms of gain in weight.

These results agreed with the findings reported by Abou-Ashour *et al.* (2011) who found that the dressing percentage was significantly increased with phytase dietry supplementation compared to the negative control (low available phosphorus). The obtained data confirmed by Jadhav *et al.* (2011) who supplemented chicken Phytase at a level 500 FTU/kg and he found that the chicken fed this diet recorded significant higher dressing yield. The results supported also by Abudabos (2012) who mentioned an enzyme supplementation (phytase) significantly improved breast and total meat percentages. The obtained results were disagree with those obtained by (Rekhate *et al.,* 2011) who found that a supplementation of Ayuphytase with reduced dicalcium phosphate level at 50 and 65% could not be effective to achieve performance of broilers in terms carcass.

The findings of biochemicl parameteres incase of male similar to those obtained Attia *et al.* (2011)

Plasma globulin significantly increased due to phytase supplementation. While the data of female similar to those obtained by Abou-Ashour *et al.* (2011) who demonstrated that Plasma phosphorus were increased at 6000 and 12000 U phytase/kg diet. The findings supported by those obtained by Ghahri *et al.* (2012) who found that the Serum total protein, calcium and phosphorus were improved as a result of phytase supplementation.

CONCLUSION

It could be concluded that supplementation of phytase Enzyme could be effective to achieve performance of Japanese quail fed on reduced level of available phosphorus at 2/3 of recommended level (N.R.C1994) and showed better results in some parameters than the Japanese quail fed on adequate phosphorus diet.

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تأثير إضافة أنزيم الفايتيز الى علائق السمان الياباني على النمو ومواصفات الذبيحة وبعض المكونات البيوكيميائية فى الدم.

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أجريت هذه التجربة على عدد ١٦٠من طيور السمان عمر ١٨ يوم نصفهم من الذكور والنصف الآخر من الإناث ٣٢طائر لكل مجموعة حيث تتكون كل مجموعة من مكررين إحداهما من الإناث والأخرى من الذكور ، حيث يحمل كل من الذكور والإناث نفس الرقم لكل مجموعة وبنفس ترتيب المجموعات حيث تم مقارنة الذكور بالمجموعة الضابطة الخاصة بها وكذلك مقارنة الإناث بالمجموعة الضابطة الخاصة بها. وفي هذه الدراسة تغذت المجموعة الأولى على عليقه تحتوى على كمية كافية من الفوسفور واعتبرت مجموعة ضابطة ايجابي وتغذت المجموعة الثانية على عليقه ناقصة في الفوسفور٢/ ٣ النسبة الموصى بها في N.R.C. (1994) واعتبرت مجموعة ضابطة سالبة تم أضافة أنزيم الفايتيز إلى عليقة المجموعة الثانية بنسب (٣٠٠ وحدة /كجم عليقة و٦٠٠ وحدة /كجم عليقة و٩٠٠وحدة /كجم عليقة) للمجموعات الثلاث الأخرى على الرتيب من عمر١٨ يوم و لمدة أربع أسابيع. تم وزن الدواجن أسبوعيا وحساب العليقة لقياس كفاءة النمو. وفى نهاية فترة التسمين (٤٥يوم) تم ذبح عدد١٠ من كل مجموعة نصفهم من الذكور والنصف الآخر من الإناث لقياس مواصفات الذبيحة. وأخذت عينات دم لقياس مستوى عنصر الكالسيوم والفوسفوروالبروتين الكلى والألبيومين والجلوبيولين ونسبة الألبيومين الى الجلوبيلين. وأظهرت نتائج البحث أن جميع المعاملات أدت إلي زيادة معنوية في متوسط الزيادة في الوزن ومعامل التحويل الغذائي بالمقارنة بالمجموعة الضابطة السالبة. أما نتائج مواصفات الذبيحة قد أظهرت تحسن ملحوظ في نسبة التصافي ولحم الصدر والفخذ مع كل المعاملات بالمقارنة مع المجموعة الضابطة السالبة وكذلك المجموعة الضابطة الايجابية فى بعض المعاملات. أما نتائج تحليل المصل فقد ظهرت نتائج معنوية فى المعاملة الخامسة الخاصة بالذكور بالنسبة للجلوبيلين ولقد أظهرت نتائج معنوية فى المعاملة الخامسة الخاصة بالإناث بالنسبة لعنصر الفوسفور.

الخلاصة: إضافة أنزيم الفايتيز يحقق نتائج ايجابية على النمو ومواصفات الذبيحة وبعض المكونات البيوكيميائية للسمان الياباني.