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EFFECTS OF PHYTASE SUPPLEMENTATION ON THE PERFORMANCE OF BROILER CHICKS FED LOW PHOSPHORUS DIETS

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ABSTRACT: ***This study was conducted to evaluate the overall performance of 1- to - 42 d old, unsexed Ross broiler chicks when graded levels of dietary phytase were supplemented in excess of industry standards. A total of 315 Ross broiler chicks, were distributed at random into 7 groups each in 3 replicates. The experimental diets consisted of a basal corn-soybean meal diets that contained 0.90% Ca, low total P (t P) level of 0.46 % and calculated ME of 3100 kcal /kg diet, in addition to a positive control diet that contained 0.70% t P. The dietary microbial phytase levels evaluated were 750, 1500, 3000, 6000 and 12000 U / kg diet. The results showed that body weight and body weight gain were significantly ($p \le 0.05$) increased with increasing dietary phytase levels. Also, feed intake (86.23 vs.74.37), feed conversion (1.94 vs. 2.40) and performance index (PI) (91.13 vs. 50 21) were significantly ($p \le 0.05$) improved with increasing dietary phytase levels up to 3000 FTU / kg low P diet (T5) vs. T2 (low P, no phytase supp.). Dressing percentage was significantly affected but liver percentage was not affected. Tibia length and tibia breaking strength were affected. Tibia calcium % was not affected but tibia phosphorus % was significantly increased. Findings of this study indicate that broilers consuming a t P- deficient corn – soybean meal diet can achieve maximum performance and economical efficiency when supplemented with 3000 FTU phytase / kg diet.***

Key words: ***Broiler, microbial phytase, performance, phosphorus.***

INTRODUCTION

About 2/3 of the total phosphorus in cereal grains and oil seed meals exist in a phytate – bound form. The availability of phytate phosphorus from plant – derived feedstuffs is low in monogastric animals, such as chickens, because of very low or no phytase activity in their digestive tract (Common, 1989). A large proportion of phytate in the feed consumed by chickens is passed through the digestive tract and excreted in the manure. Hence, in poultry production, producers have to supplement expensive phosphates to feeds to meet poultry requirements (Lan *et al*., 2002). Attention has been focused on means of reducing phosphorus excretion while maintaining productivity. Because of the demands for adequate skeletal development of rapidly growing broilers, it is necessary to provide adequate levels of

phosphorus with a sufficient margin of safety in broiler diets (Yan *et al.,* 2003). The low availability of phytate phosphorus poses two problems: 1) the need to add inorganic phosphorus supplements to diets thereby increasing the cost of the diet. 2) The excretion of large amounts of phosphorus in the manure. This excess phosphorus eventually finds its way into either crop, adsorbed onto soil particles or in the runoff water (BASF). Broilers lack adequate endogenous enzymes to effectively hydrolyze the phosphorus from the phytate present in corn and soybean meal. Phytate is an anionic acid that binds phosphorus and other cationic substances, which does not allow them to be completely utilized by broilers (Payne *et al*. 2005). To help increase the availability of phytate P (PP), exogenous phytase enzymes are added to commercial diets. The phytase enzyme dephosphorylates the phytate molecules, which releases P and other cations to be used by the broilers. The increased availability of PP decreases the need for supplementing inorganic phosphorus sources to meet the broiler's P requirement, and the increase in available P decreases P excretion by improving use of phytate bound P (Payne *et al.* 2005). Phytase belongs to the group of acid phosphatases which catalyze the hydrolytic cleavage of phosphoric acid esters of inositol. Thus, it liberates ortho-phosphates which can be absorbed. This phytase releasable phosphorus account for about 2/3 of the total P present in most cereals. For instance, the PP availability in corn and soybean is nearly zero. At the same time, minerals like Ca and Mg or trace elements may be liberated into an absorbed form. Therefore, the hypothesis of this study is the supplementation of different levels of phytase up to 12,000 U/ kg of a corn – soybean meal diet to improve both broiler performances and overall nutrient utilizations when compared to a diet with an adequate level of total phosphorus.

MATERIALS AND METHODS

The present study was conducted at the Poultry Research Farm, Minufiya University, Shebin EL- Kom, in order to investigate the efficacy of microbial phytase supplementation to basal diet on growth performance, carcass traits and some bone measurements of broiler chicks under Egyptian conditions. In this study, a total number of 315 unsexed one day old Ross broiler chicks were randomly distributed and divided equally into seven experimental groups nearly similar in average body weight (43g). Each group was represented in three replicate pens of 15 chicks each and kept under similar management conditions. The 1st group was fed the basal diet contained 0.70% total phosphorus without microbial phytase addition (positive control). Groups 2 to 7 were fed the low phosphorus diet which contained 0.46% total phosphorus with microbial phytase supplementation at levels 0 (negative control), 750, 1500, 3000, 6000 and 12000 FTU phytase/ kg diet, respectively. The used microbial phytase was Natuphos[1] (10,000 phytase units (FTU) / g).

[1]BASF Crop, Mt. Olive, NJ. After the experiment was conducted, this product was assayed by BASF using their in- house procedure. The product was determined to have 6,054U/g, where 1 U is equivalent to one phytase unit (FTU) and is the amount of enzyme that liberates 1 µmol of inorganic P per minute from 0.0051 mol / L sodium phytate at 37 C◦ and pH 5.50 under the condition of the test.

Two experimental diets were used in the two stages of this study (0-21d as starter and 22-42 d as finisher). The diet contained 22 % CP and 3100 kcal ME /kg diet was fed during the first stage and that contained 20 % CP and 3100 kcal ME / kg diet was offered to birds during the second stage of growth. All diets were formulated to meet the nutrient requirements of the chicks according to the strain catalog recommendations. Artificial light was used beside the normal day light to provide 24- hours / day photo period. Feed and water were provided *ad libitum.* Dietary composition and chemical analysis of the experimental diets are shown in Table (1). Feed consumption and body weight of the birds were recorded weekly. Body weight gain, feed conversion, and economical efficiency were calculated.

Performance index (PI) was calculated according to North, 1984.

Where PI=live body weight (kg) × 100 / feed conversion.

Table (1): Composition and chemical analysis of the experimental diets fed during starting (0 – 21) and finishing (22-42 days) periods of age.

Ingredients	Starter period		Finisher period	
	Positive control	Negative control	Positive control	Negative control
Ground yellow corn (8.5 %)	50.25	51.68	57.54	58.65
Soybean meal (44 %)	40.36	39.91	34.42	34.17
Cottonseed oil	5.86	5.46	4.57	4.26
Limestone, ground	1.11	1.83	1.08	1.83
Dicalcium phosphate	1.61	0.32	1.71	0.43
Vitamin and mineral mixture[1]	0.30	0.30	0.30	0.30
DL- methionine[2]	0.21	0.20	0.08	0.06
Sodium chloride	0.30	0.30	0.30	0.30
Total	100	100	100	100
Calculated nutrient content[3]:				
Dry matter%	89.96	89.96	89.98	89.98
Crude protein, %	22.03	21.95	20.03	20.02
ME , k cal / kg	3099	3101	3098	3102
C/P ratio	141	141	155	155
Lysine, %	1.20	1.20	1.07	1.07
Methionine , %	0.55	0.54	0.39	0.38
Methionine + Cystine, %	0.90	0.89	0.72	0.72
Calcium, %	0.90	0.90	0.90	0.90
Total phosphorous, %	0.70	0.46	0.70	0.46
Chemical analysis:				
Crude protein,%	22.00	21.75	19.62	19.89
Ether extract,%	6.02	6.02	8.28	8.28
Crude fiber, %	3.76	3.76	3.57	3.57

[1] Vitamin and mineral mixture at 0.30 % of the diet supplies the following / kg of the diet: Vit. A, 12000 IU; Vit. D_3 ,2500 IU; Vit. E, 10 mg; Vit. K_3 ,3 mg ;Vit B_1, 1 mg; Vit. B_2 ,4 mg; Pantothenic acid ,10 mg ;Nicotinic acid ,
20 mg; Folic acid, 1 mg; Biotin, 0.05 mg; Niacin, 40 mg; Vit.B_6 ,3. Mg; Vit B_{12}, 20 mcg; Choline chloride, 400 mg; Mn, 62 mg; Fe, 44 mg; Zn, 56 mg; I, 1 mg; Cu, 5 mg and Se, 0.01 mg.

[2] DL – Methionine: 98% feed grade (98 % Methionine).

[3] Calculated according to NRC (1994)

At 21 and 42days of age, 6 birds were randomly taken from each treatment, weighed and slaughtered to complete bleeding, followed by plucking the feathers. Dressing, giblets and abdominal fat weight were expressed relative to live body weight. The left tibia of each chick was oven dried at 75C°. Bone breaking strength (force necessary to break bone) was tested. The proximate analysis of feed, Ca and P were carried out according to the methods of (A.O.A.C., 2003).

The economical efficiency was calculated from the input – output analysis (Heady and Jensen, 1954), assuming that other head costs were constant, as follows: [(price of kg weight gain- feed cost /kg gain)/ feed cost /kg gain × 100] under local conditions. The data obtainedwere statistically analyzed by the completely randomized design using SPSS 9.05 (1993) program and the differences among means were determined using Duncan's multiple range test (Duncan1955).

Percentages were transformed to the corresponding arcsine values before statistical analysis.

The model applied was:

$Y_{ij}=\mu + \alpha_i + E_{ij}$ **, Where:**

Y_{ij} **= an observation,** μ **= Overall mean.**

α_i **= effect of treatment (I = 1,2,3,4,…..7), and**

E_{ij} **= Random error.**

RESULTS AND DISCUSSION

Broiler chick performance:

Body weight, Body weight gain, and protein efficiency ratio and protein index.

Results on the effect of microbial phytase supplementation on body weight (BW) and body weight gain (BWG) of broiler chicks at 21 and 42 days are presented in Table (2). Results showed that at 21 days, the average values of BW and BWG were significantly (p≤0.05) increased with phytase supplementation to low phosphorus diets. Chicks consuming the control diet (0.70%tP) had a BWG of 452.26 g /chick. Chicks consumed the basal diet without phytase addition had a BWG of 414.00 g/chick compared to 553.33 g / chick fed diet supplemented with 6000 FTU phytase / kg diet (T6). In general, at 42 days; birds fed diet with 3000 FTU microbial phytase /kg diet (T5) had heavier body weights (1822.57 g/ chick) and better weight gains(1780.1 g /chick) in comparison with the positive (T1) and the basal negative control (T2) being 1514.28 vs. 1349.92 (LBW) and 1470.11 vs. 1306.59 g (BWG) , respectively. Performance index (PI) at 42 d of age was significantly higher in broiler chicks fed diets supplemented with microbial phytase at 3000 FTU / kg compared to those fed low phosphorus diet without phytase supplementation *(91.13 vs. 50. 21)*. However, there was no significant detected between the different levels of supplementation except at the level of 3000 FTU phytase / kg diet in protein efficiency ratio (PER) at 21 and 42

days. The improvement in growth performance observed herein may be due to that phytase enzyme releases phosphorus and other minerals from phytate mineral complex and liberates proteins from phytate – protein complex making them more available to the bird (Sebastian *et al.* 1996).These results are in agreement with those obtained by Ahmed *et al.* (2000); Shirely and Edwards (2003); Onyango *et al.* (2004); Watson *et al.* (2006) and Ghazalah *et al.* (2006) who found that supplemental microbial phytase to low P diets improved the average values of BW and BWG. In contrast to these results, Sohail and Roland (1999) observed significant decreases in BW when P was reduced from 0.325 to 0.225% beside, phytase addition significantly increased BW at the lower AP level but not at the higher AP level. While, Lesson *et al.* (2000); Waldroup *et al.* *(*2000); and Yan *et al.* *(*2003) found that there were no significant differences in the average values of BW and BWG when microbial phytase was added to low AP broiler diets. Also, Abo EL- Wafa *et al.* (2005) noted that there were no significant differences in BW and BWG values due to the use of different sources of phosphorus (bone meal or di- calcium phosphate) in broiler chicks diet.

Table (2): Effect of dietary phytase supplementation on the performance of broiler chicks at 21 and 42 days.

Treatments[1]	Body weight (g) at		Body weight gain (g) at		Performance index at	
	21d	42d	21d	42d	21d	42d
T1	496.44±26.09[cd]	1514.28±85.36[b]	452.26±26.10[cd]	1470.11±85.45[b]	21.57±1.00[cd]	63.67±1.14[c,2,3]
T2	457.33±17.30[d]	1349.92±49.64[c]	414.00±17.20[d]	1306.59±49.52[c]	19.03±0.37[d]	50.21±0.25[d]
T3	513.21±19.09[bcd]	1762.96±43.11[a]	469.94±19.11[bcd]	1719.02±43.58[a]	23.23±0.52[c]	77.22±1.73[b]
T4	549.18±17.97[abc]	1758.65±43.52[a]	505.24±17.86[abc]	1715.39±43.06[a]	24.77±0.58[bc]	77.42±0.96[b]
T5	561.67±1.91[ab]	1822.57±43.82[a]	519.28±19.87[ab]	1780.1±848.22[a]	29.25±0.70[a]	91.13±2.08[a]
T6	569.78±17.86[a]	1713.46±43.24[a]	553.33±17.76[a]	1670.02±43.08[a]	26.88±0.46[ab]	74.83±0.83[b]
T7	594.38±20.98[a]	1752.37±36.30[a]	551.49±20.18[a]	1709.57±36.24[a]	24.32±2.71[bc]	76.87±0.61[b]

[1] T1; Positive control, T2; Negative control+ 0 FTU phytase / kg diet, T3; Negative control+ 750 FTU phytase / kg diet,T4; Negative control+ 1500 FTU phytase / kg diet,T5; Negative control+ 3000 FTU phytase / kg diet,tT6; Negative control+ 6000 FTU phytase / kg diet and T7; Negative control+ 12000 FTU phytase / kg diet.

[2]means ± S.E. of 3 replicates / treatment.

[3]a,b,c………etc: Means within the same column with different superscripts are significantly different (P≤0.05).

Feed intake and feed conversion ratio.

Feed intake (FI) was significantly (p≤0.05) increased with phytase supplementation from 750 FTU/ kg (T3) to 12000 FTU / kg (T7) relative to the low P diet without phytase addition (T2) either at 21 or 42 days. Feed conversion ratio (FCR) was significantly (p≤0.05) improved due to phytase supplementation at 21 or 42 days (Table, 3). The best ratios (1.88 and 1.94) were achieved at the level of 3000 FTU phytase /kg (T5) at 21 or 42 days compared to the positive control or T1 (2.24 and 2.29) at the same order, respectively. These results are in harmony with findings of Shirely and Edwards (2003); Banks *et al.* (2004); Dilger *et al.* (2004); Ibrahem (2006) ; Watson *et al.* (2006) and Ghazalah *et al.* (2006) who reported a significant improvement in FCR values due to addition of different levels of microbial phytase to broiler chick diets. On the other hand, Yan *et al.* (2000) ; Lan *et al.*

(2002); Viveros *et al.* (2002) and Yan *et al.* (2003) noted that, the level of non-phytate phosphorous (NPP) or phytase supplementation had no significant effect on FCR during 6-9 wks. of age, indicating that the lowest dietary levels of NPP were sufficient to support these live parameters for chicks.

Table (3): Effect of dietary phytase supplementation on feed intake and feed conversion* of broiler chicks at 21 and 42 days.

Treatments[1]	Feed Intake(g/bird/day)at		Feed conversion at	
	21d	42d	21d	42d
T1	49.50±0.57[d]	86.15±0.88[b]	2.24±0.01[b]	2.29±0.01[b]
T2	41.77±0.71[g]	74.37±1.14[c]	2.29±0.02[a]	2.40±0.02[a]
T3	47. 82±0.60[e]	90.49±1.12[a]	2.09±0.01[c]	2.19±0.02[d]
T4	51.64±0.64[c]	91.11±1.07[a]	2.13±0.02[d]	2.17±0.05[c]
T5	46.71±0.56[f]	86.23±1.47[b]	1.88±0.20[f]	1.94±0.02[e]
T6	55.78±0.80[b]	87.88±1.36[b]	2.07±0.01[e]	2.17±0.02[d]
T7	56.96±0.46[a]	90.80±0.93[a]	2.13±0.01[d]	2.20±0.02[c]

[1] T1; Positive control, T2; Negative control+ 0 FTU phytase / kg diet, T3; Negative control+ 750 FTU phytase / kg diet,T4; Negative control+ 1500 FTU phytase / kg diet,T5; Negative control+ 3000 FTU phytase / kg diet,tT6; Negative control+ 6000 FTU phytase / kg diet and T7; Negative control+ 12000 FTU phytase / kg diet.
[2] means ± S.E. of 3 replicates / treatment.
[3]a,b,c………etc: Means within the same column with different superscripts are significantly different (P<0.05).
*Feed conversion=g feed/ g gain.

Carcass characteristics.

Experimental results on the effect of phytase supplementation on carcass characteristics at 21 and 42 days of age are shown in Tables (4 and 5). At 21 days of age, data indicated that the addition of phytase enzyme significantly (P≤0.05) affected dressing, heart and gizzard percentages, while no significant differences in liver percentage were observed. Also, at 42 days, no significant differences were observed in percentages of liver and gizzard. However, phytase supplementation significantly increased dressing percentage. These finding are in agreement with those reported by Korngay *et al.* (1998), Soliman *et al.* (1999), Attia *et al.* (2001) and EL-Sherbiny *et al.* (2005).

On the other hand, Abd- ELSamee (2002) and Abd EL- Hakim *et al.* (2003) found that there were no significant differences in carcass composition due to microbial phytase supplementation.

Bone measurements at 42 days of age.

Similar to BW, BWG, FI and FCR, data were indicative of a better phytate phosphorus utilization due to phytase supplementation. Data regarding bone measurements are presented in Tables (6 and 7). At 21 days, addition of phytase at the level of 3000 FTU / kg diet significantly (P≤ 0.05) increased tibia length (5.70 cm) and % of tibia P (33.40) in comparison to the low phosphorus diet without enzyme addition (5.32 cm and 27.56 %). Though not significant, tibia breaking strength and tibia Ca were, in general, slightly increased. At 42 days, microbial phytase supplementation did not affect tibia length or % of tibia Ca. While, tibia breaking strength (20.50 vs. 14.80kg / cm^2) and % of tibia P 34.26 vs. 31.04) were significantly affected by phytase

supplementation up till 12000 FTU/ kg (T7). These findings are in agreement with Cheng *et al*. (2004), Onyango *et al*. (2004), Snow *et al.* (2004) and Timmons *et al*. (2004) who noted that bone characteristics were improved as the level either of t P or phytase was increased in the diet.

Table (4): Effect of dietary phytase supplementation on carcass characteristics of broiler chicks at 21 days*.

Treatments[1]	Carcass traits (%) at 21 days			
		Giblets		
	Dressing	Liver	Heart	Gizzard
T1	67.82±0.82[abc]	2.70±0.10	0.73±0.10[a]	2.85±0.10[a,2,3]
T2	67.33±0.33[bc]	2.60±0.10	0.63±0.10[c]	2.50±0.15[b]
T3	68.36±0.36[ab]	2.50±0.10	0.64±0.10[c]	2.60±0.10[b]
T4	67.83±0.17[abc]	2.50±0.10	0.65±0.10[c]	2.60±0.10[b]
T5	68.26±0.38[ab]	2.54±0.10	0.60±0.10[c]	2.75±0.10[a]
T6	68.43±0.43[ab]	2.60±0.10	0.57±0.10[d]	2.70±0.10[ab]
T7	68.92±0.08[a]	2.60±0.10	0.71±0.10[b]	2.70±0.10[ab]

[1] T1; Positive control, T2; Negative control+ 0 FTU phytase / kg diet , T3; Negative control+ 750 FTU phytase / kg diet,T4; Negative control+ 1500 FTU phytase / kg diet,T5; Negative control+ 3000 FTU phytase / kg diet,tT6; Negative control+ 6000 FTU phytase / kg diet and T7; Negative control+ 12000 FTU phytase / kg diet.
[2]means ± S.E. of 3 replicates / treatment.
[3]a,b,c………etc: Means within the same column with different superscripts are significantly different ($P<0.05$).
*Calculated as % of live body weight.

Table (5): Effect of dietary phytase supplementation on carcass characteristics of broiler chicks at 42 days*.

Treatments[1]	Carcass traits % at 42days				
	Dressing	Giblets			
		Liver	Heart	Gizzard	Abdominal fat
T1	74.18±0.18[a]	2.20±0.10	0.65±0.10[a]	1.70±0.10	1.24±0.06[cd,2,3]
T2	71.76±0.24[c]	2.60±0.10	0.62±0.10[a]	1.80±0.10	1.52±0.02[b]
T3	73.73±0.52[b]	2.10±0.10	0.49±0.10[b]	1.70±0.10	1.42±0.08[bc]
T4	73.48±0.52[b]	2.04±0.10	0.43±0.10[cd]	1.90±0.10	1.07±0.07[d]
T5	75.52±0.19[a]	1.90±0.10	0.42±0.10[d]	1.90±0.10	1.19±0.01[d]
T6	74.19±0.19[ab]	2.03±0.10	0.44±0.10[cd]	1.90±0.10	1.83±0.07[a]
T7	73.68±0.32[b]	2.90±0.10	0.46±0.10[bc]	1.90±0.10	1.83±0.07[a]

[1] T1; Positive control, T2; Negative control+ 0 FTU phytase /kg diet, T3; Negative control+ 750 FTU phytase / kg diet,T4; Negative control+ 1500 FTU phytase / kg diet,T5; Negative control+ 3000 FTU phytase / kg diet,tT6; Negative control+ 6000 FTU phytase / kg diet and T7; Negative control+ 12000 FTU phytase / kg diet
[2]means ± S.E. of 3 replicates / treatment.
[3]a,b,c………etc: Means within the same column with different superscripts are significantly different ($P<0.05$).
*Calculated as % of live body weight.

Table (6): Effect of dietary phytase supplementation on bone measurements of broiler chicks at 21 days.

Treatments[1]	Tibia measurements at		21days	
	Tibia length(cm)	TBS*	Tibia Ca (%)	Tibia P (%)
T1	5.50±0.13[ab]	9.00±0.37	37.21±3.91	30.70±0.96[ab]
T2	5.32±0.07[b]	8.83±0.60	32.45±1.46	27.56±0.86[c]
T3	5.25±0.17[b]	8.88±1.00	29.74±1.54	29.67±2.10[b]
T4	5.63±0.13[a]	9.00±0.43	30.48±0.51	29.79±2.46[b]
T5	5.70±0.26[a]	9.65±0.75	34.00±3.61	33.40±1.56[a]
T6	5.57±0.10[ab]	10.33±0.42	40.41±7.11	32.42±0.32[a]
T7	5.48±0.06[ab]	10.33±0.49	48.07±10.57	32.55±0.78[a]

[1] T1; Positive control, T2; Negative control, T3; Negative control+ 750 FTU phytase / kg diet,T4; Negative control+ 1500 FTU phytase / kg diet,
T5; Negative control+ 3000 FTU phytase / kg diet,tT6; Negative control+ 6000 FTU phytase / kg diet,T7; Negative control+ 12000 FTU phytase / kg diet
[2] means ± S.E. of 3 replicates / treatment.
[3]a,b,c………etc: Means within the same column with different superscripts are significantly different (P<0.05).
*TBS: tibia breaking strength kg /cm[2.]

Table (7): Effect of dietary phytase supplementation on bone measurements of broiler chicks at 42 days.

Treatments[1]	Tibia measurements at 42days			
	Tibia length(cm)	TBS*	Tibia Ca(%)	Tibia P (%)
T1	7.85±0.24	15.00±0.82[b]	32.73±0.89	32.33±0.54[cde2]
T2	7.24±0.19	14.80±1.32[b]	30.71±0.62	31.04±0.33[e]
T3	7.73±0.27	16.50±1.44[ab]	32.21±0.97	31.25±1.73[de]
T4	7.75±0.14	16.50±1.44[ab]	35.02±2.45	33.04±2.31[c]
T5	7.50±0.20	18.25±1.65[ab]	35.07±1.88	34.11±3.65[b]
T6	7.28±0.10	19.17±1.01[ab]	36.29±1.39	32.67±0.92[d]
T7	7.73±0.25	20.50±1.75[a]	35.88±1.03	34.26±1.71[a]

[1] T1; Positive control, T2; Negative control+ 0 FTU phytase / kg diet, T3; Negative control+ 750 FTU phytase / kg diet,T4; Negative control+ 1500 FTU phytase / kg diet,T5; Negative control+ 3000 FTU phytase / kg diet,tT6; Negative control+ 6000 FTU phytase / kg diet and T7; Negative control+ 12000 FTU phytase / kg diet.
[2] means ± S.E. of 3 replicates / treatment.
[3]a,b,c………etc: Means within the same column with different superscripts are significantly different (P<0.05).
*TBS: tibia breaking strength kg /cm[2.]

Economical efficiency.

In general, the results indicate that supplementation of microbial phytase to low – phosphorus containing broiler diets increases economical and relative economical efficiency. The best values were obtained with 3000 FTU microbial phytase / kg diet (Table 8).

It could be concluded that the addition of 3000 FTU phytase / kg diet (T5) to corn-soybean meal broiler diets with low phosphorus content improved growth performance, carcass characteristics, bone mineralization and economical efficiency.

Table (8): The economical efficiency of the experimental diets which contains different levels of phytase supplementation.

Items	Dietary treatments[1]						
	T1	T2	T3	T4	T5	T6	T7
Initial body weight, (g)	44.17	43.33	43.26	43.94	42.39	43.44	42.80
Final body weight, (kg)	1.51	1.35	1.76	1.76	1.82	1.71	1.75
Body weight gain, (kg)	1.47	1.31	1.72	1.71	1.78	1.67	1.71
Total revenue,(L.E)	17.64	15.68	20.64	20.57	21.36	20.04	20.52
Feed intake, (kg) / chick	3.63	3.20	3.81	3.83	3.62	3.65	3.82
Price of kg feed,(L.E)	2.00	1.99	2.01	2.03	2.05	2.10	2.20
Feed cost, (L.E)	7.26	6.36	7.67	7.75	7.43	7.66	8.42
Net revenue,(L.E)[2]/ chick	10.38	9.32	12.97	12.83	13.93	12.38	12.10
Economical efficiency,(%)[3]	143.00	146.45	169.05	165.50	187.51	161.48	143.73
Relative economical efficiency, (%)[4]	100	102.42	118.23	115.74	131.14	112.93	100.52

[1] T1; Positive control, T2; Negative control+ 0 FTU phytase / kg diet, T3; Negative control+ 750 FTU phytase / kg diet,T4; Negative control+ 1500 FTU phytase / kg diet,T5; Negative control+ 3000 FTU phytase / kg diet,tT6; Negative control+ 6000 FTU phytase / kg diet and T7; Negative control+ 12000 FTU phytase / kg diet.

Price of one kg live body weight was 12 L.E.   Price of one kg phytase 170 L.E.

[2]Net revenue = Total revenue – Feed cost.

[3]Economical efficiency = (Net revenue / Feed cost)× 100.

[4] assuming that the relative economical efficiency of the positive control diet = 100.

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تأثير إضافة إنزيم الفيتيز على أداء كتاكيت التسمين المغذاة على علائق منخفضة فى الفوسفور

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أجريت هذه الدراسة بهدف تقدير الأداء الإنتاجى لكتاكيت التسمين Rossعمر (١- ٤٢ يوم) بإستخدام مستويات متدرجة من إنزيم الفيتيز. إشتملت علائق التجربة على عليقة أساسية من الذرة الصفراء وكسب فول الصويا حيث تحتوى على ٩,. % كالسيوم و منخفضة فى محتواها من الفوسفور الكلى (٤٦,. %) و طاقة ممثلة ٣١٠٠كيلو كالورى / كجم بالإضافة لعليقة المقارنة والتى تحتوى على ٧,. % فوسفور كلى. تم إضافة مستويات مختلفة من إنزيم الفيتيز ٧٥٠، ١٥٠٠، ٣٠٠٠، ٦٠٠٠ و ١٢٠٠٠وحدة / كجم عليقة إلى العلائق المنخفضة فى مستوى الفوسفور الكلى . و قد استخدم فى هذة التجربة ٣١٥ كتكوت غير مجنس قسمت عشوائيا إلى ٧ مجموعات بكل منها ٤٥ كتكوتموزعة فى ٣ مكررات .

أوضحت النتائج زيادة كل من وزن الجسم و معدل الزيادة فى وزن الجسم معنويا (عند مستوى ٠٥, %) بزيادة إضافة إنزيم الفيتيز . كما تحسن معنويا كل من الغذاء المستهلك (٨٦٫٢٣ مقابل ٧٤,٣٧جم) ومعدل التحويل الغذائى (١,٩٤ مقابل ٢,٤٠) ودليل الأداء الإنتاجى (٩١,١٣ مقابل ٥٠,٢١%) فى المعاملة الخامسة (٣٠٠٠وحدة / كجم عليقة منخفضة الفوسفور) مقارنة بالمعاملة الثانية (منخفضة الفوسفوروبدون إضافة إنزيم). كذلك تأثر معنويا كل من نسبة التصافى وطول عظمة الساق ومقاومتها للكسر.

وقد أوضحت نتائج هذة الدراسة أن تغذية كتاكيت التسمين Ross على عليقة أساسية تتكون من الذرة الصفراء وكسب فول الصويا ومنخفضة فى محتواها من الفوسفور الكلى (٠,٤٦%) من الممكن أن تحقق أفضل أداء إنتاجى وكفاءة اقتصادية بإضافة إنزيم الفيتيز الميكروبى بمعدل ٣٠٠٠ وحدة / كجم عليقة.