Egypt Poult. Sci. Vol (26) (I): (159-178)

THE EFFECT OF DIETARY PHOSPHORUS LEVEL WITH AND WITHOUT SUPPLEMENTAL PHYTASE OR DRIED YEAST ON THE PERFORMANCE OF DANDARAWI LAYING HENS

By

M.A., Metwally

Dept. of Animal and Poult., Prod., Fac. of Agric., Assiut Univ., EGYPT.

Received: **29/10/2005** Accepted: **25/12/2005**

Abstract: *One hundred eighty, Dandarawi laying hens were used in sixteen-week experiment (through 32-48 wks old). Birds were divided into six groups and fed experimental diets containing normal (high) nonphytate phosphorus (NPP) level (0.45%) or low-NPP level (0.25%), supplemented or not with microbial phytase (1000 U/kg of diet) or dried yeast (0.3% of the diet). Criteria of response were performance for egg production, some egg quality traits, calcium (Ca) and phosphorus (P) retention, tibia bone ash %, plasma Ca and P concentrations and economical evaluation. The obtained results showed that:*

1. *Neither dietary P level nor supplemental phytase and yeast influenced feed intake or egg weight.*
2. *Hens fed on 0.45%-NPP-diets performed better than those fed on 0.25%-NPP-diets for egg production and feed conversion. Dietary supplementation with phytase or dried yeast enhanced egg production in hens fed 0.25%-NPP-diets, among which hens fed 0.3%-yeast-diet only restored their egg production to be significantly similar to those fed the unsupplemented 0.45%-NPP-diet.*
3. *Regarding egg quality traits, erratic significant differences were detected among dietary treatments only in weights of egg albumen and yolk.*
4. *Increased Ca retention % was observed in hens fed the unsupplemented 0.45%-NPP-diet, but the opposite was true for those fed the unsupplemented 0.25%-NPP-diet. Dietary supplementation with phytase or yeast significantly increased Ca retention % only in hens fed the 0.25%-NPP-containing diet. Even though supplemental phytase or yeast increased the P retention %, hens fed 0.45%-NPP-diets with or without supplementation had lower P retention % than their counterparts on the 0.25%-NPP-diets.*

5. *A lower tibia ash % was observed in hens fed on the unsupplemented 0.45%-NPP-diet than those fed the unsupplemented 0.25%-NPP-diet. Supplemental phytase or yeast increased the tibia ash % in hens fed on the 0.45%-NPP-diet.*
6. *Hens fed on the 0.45%-NPP-diet had higher Ca and lower plasma P concentrations than those fed the the 0.25%-NPP-diet. Dietary supplementation particularly with yeast increased both levels of plasma Ca and P.*

In conclusion, Dandarawi laying hens fed on the 0.25%-NPP-diets, whether supplemented or not with phytase or yeast performed less efficiently for egg production and feed conversion than those fed on the 0.45%-NPP-diets. Additionally, from an economic point of view, it would appear that dietary supplementation of Dandarawi laying hens diet with phytase or yeast; under the conditions of the present study, was an undue extravagance; with the exception of groups of hens fed on the 0.45%-NPP-diet with supplemental phytase which performed for egg production and feed conversion similarly, but economically had an advantage over those of the control on the unsupplemented 0.45%-NPP-diet.

INTRODUCTION

Dietary requirements for phosphorus (P) and its availability in feedstuffs of plant origin are key issues in poultry nutrition. Phosphorus from plant sources is only 30-40% available (Perney *et al.*, 1993) because much of the P is in the form of phytate (myo-inositol hexaphosphate) and is poorly used by poultry.

Phytate is a naturally occurring organic compound in plants. Phytate can complex with several cations such as Ca, Mg, Zn, Fe, K and Cu, as well as with amino acids (Ravindran *et al.*, 1998). Because of inadequate amounts of endogenous phytase, secreted by the gastrointestinal tracts of poultry to hydrolyze phytate and release the phytate-bound P (Ravindran *et al.*, 1998; Sebastian *et al.*, 1998), their diets are usually supplemented with an inorganic source of P. This supplementation is not only expensive but also with excessive dietary supply P excretion is concomitantly increased, leading to a potential environmental P pollution in soil and ground water. In areas of concentrated animal production, the excretion of excess P in the manure has posed an environmental concern (Ravindran *et al.*, 1998). As a result of economic and environmental concerns, there is a renewed interest in using phytase to reduce the need for inorganic P supplements and to improve utilization of P present in feedstuffs.

Supplementation of poultry diets with microbial phytase or dried yeast may increase P availability and enhance their performance. An improved performance has been observed due to supplementation of diets with microbial phytase in broilers (Kiiskinen *et al*., 1994; Mitchell and Edwards, 1996; Sohail and Roland, 1999), turkeys (Ledoux *et al.*, 1995; Qian *et al*., 1996) and laying hens (Gordon and Roland, 1997, 1998; Van der klis *et al*., 1997; Carlos and Edwards, 1998; Um and Paik, 1999).

Jalal and Scheideler (2001) reported that supplementation of corn-soybean meal diets for laying hens with phytase at a level of 250 or 300 units/kg improved feed conversion and egg mass and elicited a favaurable effected shell quality and egg components for hens fed a low nonphytate phosphorus (0.1%).

Keshavarz (2003) reported that a level of supplementary phytase (300 units phytase/kg diet) was more effective than a lower level (150 units) in restoring the performance of laying hens fed low-P diets (0.25, 0.20 or 0.15% to that of their control level (0.45% P diet).

Lim *et al.* (2003) found that supplementation of microbial phytase at level a of 300 U/kg can improve egg production and decrease the number of broken and soft eggs produced as well as P excretion.

Some work have been published however, concerning the effect of dietary supplementation with dried yeast on the performance of growing chicks (Abdel-Azeem, 2002 and Abdel Wahed *et al.*, 2003), laying hens (Lee *et al*., 2001; Kim *et al*., 2001., Yossef *et al*., 2001a,b) and japanese quail (Yamny and Fadel, 2004).

Lee *et al.* (2001) reported that egg production of birds fed diets containing 0.1 or 0.3% yeast was significantly higher than that of their counterparts fed control or a 0.5% yeast-diet. Also, they found that daily egg mass produced by birds fed the diet of 0.3% supplemental yeast was significantly greater than that of the control.

The objective of the present study was to investigate the effects of feeding diets containing two levels (0.45% and 0.25%) of nonphytate phosphorus (NPP) in the absence or presence of supplemental microbial phytase (1000 U/kg) or dried yeast (0.3% of the diet) on performance, calcium and phosphorus utilization and economic efficiency of Dandarawi laying hens.

MATERIALS AND METHODS

Experimental design and diets.

This experiment was carried out at the Poultry Farm, Animal and Poultry Production Department, Faculty of Agriculture, Assiut University, Assiut, Egypt. One hundred eighty, 30-week-old, local Dandarawi hens were used in eighteen-week experiment; where the first two weeks were assigned for adaptation and the rest sixteen weeks for experimental period (4 intervals of 30 days each). Birds were randomly distributed into six equal groups of thirty birds each (three replicates of ten birds each). The birds were housed in individual wire cages in an open sided room with a daily photoperiod of 16 hours. Whereas ambient temperature was maintained at 22 °C. Two levels of nonphytate phosphorus (NPP): Control (0.45%) and low (0.25%) were used. Three supplements were used: 1. Control (without supplementation). 2. Microbial phytase (1000 U phytase/kg). 3.Dried yeast (0.3% of the diet). Hens in group 1 were fed diet 1 (control) a corn-soybean meal diet containing 0.45% nonphytate phosphorus (NPP). Birds of group 2 were fed diet 1 supplemented with microbial phytase at a level of 1000 U/kg. Birds of group 3 were fed diet 1 supplemented with dried yeast at a level of 0.3% of the diet. Birds of group 4 were fed diet 2 containing a lower phosphorus level (0.25% NPP). Birds of group 5 were fed diet 2 supplemented with microbial phytase at a level of 1000 U/kg of. While birds of group 6 were fed diet 2 supplemented with dried yeast at a level of 0.3% of the diet. Composition of the experimental diets are presented in Table 1.

Samples of experimental diets and dry yeast were taken for proximate chemical analyses according to AOAC (1995). All birds were given feed and water *ad libitum*. The experimental diets were formulated to meet the nutrient requirements of laying hens (NRC, 1994).

Criteria of performance and egg quality.

Individual body weight was recorded at the beginning and at the end of the experiment. Eggs were collected and recorded daily. Mortality was also recorded daily. Feed consumption was determined weekly and feed conversion was calculated for each interval as well as for the whole experimental period. Egg quality measurements were determined on whole eggs collected of the last 4 days of the experimental period. Yolk index % (Well, 1968) was calculated as yolk height times 100 divided by yolk diameter.

Calcium and phosphorus retention.

At the end of the experiment, a digestibility trial using total collection technique was conducted to determine calcium and phosphorus retention. Four hens from each group were chosen randomly and housed individually in wire cage. Birds of each group were fed on their respective experimental diet for a preliminary period of 4 days to become adjusted to cages then the excreta were quantitatively collected for a 3-days period during which feed consumption data were also recorded. Just after collection, the excreta were dried in an oven at 60 C for 24 hours, then ground. Three pooled samples of excreta voided from each group were taken for calcium and phosphorus determination. The analyses of feed and dried excreta was carried out according to AOAC (1995).

Plasma calcium and phosphorus, and bone ash.

At the end of the experiment, four birds/group were randomly taken and slaughtered. Blood samples were collected in a sterile heparinized centrifuge tubes. The samples were then centrifuged for 20 min. at 3000 r.p.m. and plasma samples were separeted then stored frozen at – 20 C untill analyzed. Concentrations of plasma calcium and phosphorus were measured using commercial kits supplied by Diamond Diagnostic (Cairo, Egypt).

Left tibia was severed, and traces of adhering meat were removed. Fat was extracted from crushed tibia bones by ether. Tibia bones were dried, and then ashed in Muffle furnace to measure bone ash percentage.

Statistical analysis.

Data were analyzed using one way analysis of variance by GLM procedure of SAS (1996). Duncan's multiple range test was used detect the significant differences among means of dietary treatments. (Duncan, 1955).

RESULTS AND DISCUSSION

1. *Body weight, body weight change, feed intake, feed conversion and mortality rate.*

Results of initial and final body weight, body weight change, feed intake, feed conversion, egg weight, egg number, egg mass and egg production % are presented in Tables 2.

Results showed that dietary phosphorus levels had no significant effects on final body weight or body weight change. This result is in agreement with those reported by Roush *et al.*, (1986) and Yossef *et al.*, (2001a,b), they reported that no significant effects on body weight due to phosphorus level. Although, the differences were not significant, final body weight and body weight change were lower in hens fed on the low-NPP (0.25%) diets than those fed control high-NPP (0.45%) diet. Similar trend was found by Keshavarz (2003) who reported that body weight decreased significantly when NPP content of the diet reduced from the content level (0.45%) to 0.2%, and was decreased further when the NPP content of the diet was reduced to 0.1%.

No significant differences were noticed in feed intake due to the effect of dietary phosphorus level.

On the other hand, feed conversion was significantly (P<0.05) affected by dietary phosphorus level. Birds fed low-NPP diets (0.25%) exhibited inferior feed conversion compared to those fed on high-NPP diets (0.45%).

For, mortality rate, only 3 to 5 birds from each group were died throughout the whole experimental period, and this was not related to the effect of dietary treatments.

Although, there was no significant effects of dietary supplementation with phytase enzyme or dried yeast on final body weight and body weight change, the birds fed low-NPP (0.25%) diet supplemented with phytase enzyme or dried yeast had higher final body weight and positive body weight change compared to the unsupplemented birds. Also, birds fed high-NPP (0.45%) diet supplemented with phytase or dried yeast had superior body weight change compared to control birds.

Feed conversion was significantly (P<0.05) better for birds fed diets supplemented with microbial phytase or dried yeast than those fed control diets throughout the entire experimental period. Also, results showed that birds fed high-NPP (0.45%) diets supplemented with dried phytase had insignificantly better values of feed conversion than those fed diets supplemented with dried yeast. While, birds fed low-NPP (0.25%) diets supplemented with dried yeast had significantly (P<0.05) better values of feed conversion than those fed diets supplemented with phytase.

Gordon and Roland (1997, 1998), Van der Klis *et al.* (1997); Carlos and Edwards, (1998) and Um and Paik (1999) stated beneficial effects of dietary supplementation with phytase on feed intake of laying hens. Jalal and Scheideler (2001) reported that supplementation of phytase (250 or 300 units) in normal corn-soybean meal diets improved feed intake and feed conversion. Lee *et al.*, (2001) found that feed conversion of laying hens was significantly improved as dietary supplemental yeast increased from zero to 0.5% in their diets.

As for the whole experimental period, Dandarawi laying hens fed the low-NPP (0.25%) diets exhibited the poorest feed conversion which was improved by supplemental phytase or yeast. On the contrary, hens fed on the high-NPP diet achieved a significantly a better feed conversion, but no beneficial effect of supplemental phytase or yeast was observed in that respect (Table 2).

2. Egg production parameters.

Results in Table 2 showed that egg weight was not significantly affected by dietary NPP level, dietary supplements (phytase or dried yeast). Regarding the effect of dried yeast on egg weight, Lee *et al.*, (2001) reported that average egg weight was not influenced by feeding laying hens on diets containing up to 0.3% live yeast.

Egg number, egg mass and egg production % were significantly ($P<0.05$) affected by dietary NPP level. Hens fed 0.45% NPP-diet achieved significantly ($P<0.05$) greater egg number, egg mass and egg production % than those fed diets with 0.25% NPP.The average of egg production (%) for birds fed the 0.45% NPP-diet during the entire experimental period was 57.11%. It was higher by about 19% than that attained by those fed the 0.25% NPP-diet. Peter (1992) reported that laying hens fed a low-NPP diet with phytase had significantly higher egg production, egg weight and feed consumption than hens consuming the same low-NPP-diet without supplemental phytase.

Dietary supplements (phytase or dried yeast) had significant ($P<0.05$) effects on egg number and egg mass compared to unsupplemented birds during the whole experimental period.

The averages of egg number and egg mass for birds fed high-NPP (0.45%) diet supplemented with dried yeast (72.24 eggs and 3029 g) were higher than those fed control diets (68.53 eggs and 2900 g) and those fed diets with supplemental phytase (72.40 eggs and 3035 g, respectively). Insignificant increase in the averages of egg number and egg mass were observed for birds fed low-NPP (0.25%) diet supplemented with 0.3% dried yeast compared to those fed diets supplemented with 1000 units of phytase/kg. Lee *et al.*, (2001) found that daily egg mass produced by laying hens fed 0.3%-yeast-diet was significantly increased compared to that of control.

Egg production % was significantly ($P<0.05$) affected by dietary supplements (yeast and phytase) with advantage over the control during the entire experimental period. But no significant difference was observed in egg production % of hens fed either yeast or phytase-supplemented diet. Hens fed high-NPP (0.45%) diet supplemented with 0.30% dried yeast had average egg production of 60.19% compared to 57.11% for control birds. The obtained results are in agreement with that reported by Lee *et al.*,

(2001) who found that egg production of birds fed a diet containing 0.1 or 0.3% yeast was significantly higher than that of birds fed a control (0.0%) or a 0.5% yeast-diet. Kim *et al.*, (2001) reported that egg production and daily egg mass and feed conversion of birds fed a 0.3% yeast diet were significantly higher than those of control birds. Lim *et al.*, (2003) reported that dietary supplementation with microbial phytase at a level of 1000 units/kg resulted in an improvement in egg production rate of laying hens.

Interactions between dietary NPP and supplements (phytase or dried yeast) had significant ($P<0.05$) effect on egg number and egg mass and egg production %. Hens fed on the higher-NPP-diets (0.45%) with or without either supplements (yeast or phytase) significantly surpassed those fed on the low-NPP-diets (0.25%) in egg number, egg mass and rate of egg production %. Hens fed on the high-NPP-diet (0.45%) performed for egg number, egg mass and egg production % similarly to their counterparts fed on the same diet supplemented with yeast or phytase with no significant differences. Even though the beneficial effect of these dietary supplements was more pronounced on the performance of hens fed on the low-NPP-diet (0.25%), they still performed significantly less than their counterparts on the high-NPP-diets (0.45%) as shown in Table 2.

3. *Egg quality traits.*

Results of egg quality traits (albumen height, weight and percentage; yolk height, weight and percentage; yolk index; shell thickness and percentage) are presented in Table 3.

Dietary NPP level did not significantly influence on albumen and yolk heights, yolk index, shell % and shell thickness.

Albumen and yolk weights and percentages were significantly ($P<0.05$) affected by dietary NPP level. Hens fed 0.45% NPP-diet achieved significantly ($P<0.05$) greater yolk % than those fed diets with 0.25% NPP. On the other hand, birds fed low-NPP (0.25%) diet achieved greater albumen weight and albumen % than those fed diets with 0.45% NPP.

Also, results in Table 2 showed that there were a significant ($P<0.05$) differences in egg quality traits of eggs produced by the experimental hens due to the effects of dietary phytase or dried yeast supplementation. Hens fed 0.45% NPP-diet supplemented with phytase achieved greater albumen weight and albumen % than those fed control diets or those fed the same diet supplemented with dried yeast. Yeast supplementation at level of 0.3% of the diet enhanced yolk weight and yolk % in birds fed low-NPP (0.25%) diet compared to those fed the same diet supplemented with 1000 U of phytase. There are inconsistencies in the literature regarding the effect of dietary supplemental phytase on egg shell quality. Several investigators reported a beneficial effect of dietary supplementation with phytase on egg shell quality (Gordon and Roland, 1997; Punna and Roland, 1999), whereas others did not observe any beneficial effect (Van der Klis et al., 1997; Parsons, 1999). On the other hand, Lee *et al.,* (2001) observed no significant differences in eggshell thickness of eggs produced by laying hens fed control-diet or 0.3% dried yeast at 30 weeks of age.

4. Calcium and phosphorus retention, and percentage of tibia ash.

Results of calcium and phosphorus retention % and percentage of bone ash are presented in Table 4.

Calcium retention % was significantly ($P<0.05$) affected by the dietary NPP level. Birds fed the 0.45% NPP-diet had higher calcium retained % (45.03%) than that (30.80%) of birds fed the 0.25% NPP-diets. On the other hand, phosphorus retention % was significantly increased as dietary NPP was decreased. Hens fed low NPP-diets (0.25%) had average of 30.80% phosphorus retention compared to 19.50% for those fed high-NPP (0.45%). Tibia ash % was affected significantly ($P<0.05$) by dietary phosphorus level, yet it was significantly higher in hens fed the 0.25% NPP-diets (42.13%) than those fed the 0.45%-NPP-diets (31.15%).

A significant increase was observed in calcium and phosphorus retention % due to effect of dietary supplementation with phytase or yeast. Also, significant variation were observed in tibia ash % due to the effect of supplementary phytase or yeast (Table 4).

The effects of dietary NPP level and supplemental phytase and yeast on calcium and phosphorus retention % and tibia ash % were significantly ($P<0.05$) interrelated.

Dietary supplementation with phytase or yeast enhanced the calcium retention % in both of the two groups (birds fed the low-NPP (0.25%) diet and those fed the high-NPP (0.45%) diet).

Even though dietary supplementation with phytase or yeast increased phosphorus retention % in both of the two groups, hens fed on the high-NPP (0.45%) diets still exhibiting a lower phosphorus retention % than their counterparts on the low-NPP (0.25%) diets. Boling *et al.*, (2000) reported increased P excretion by hens fed a high NPP diet over hens fed a low NPP diet. Nair *et al.*, (1991), Sebastian *et al.* (1996); Carlos and Edwards (1998) and Um and Paik (1999) found that laying hen diets supplemented with phytase can increase phosphorus retention by increasing the liberation of the phytate-bound phosphorus, which would be a positive indicator that phosphorus excretion in the manure is reduced due to the inclusion of phytase. Lim *et al.* (2003) found an increase in phosphorus retention and a decrease in phosphorus excretion due to the addition of phytase at a level of 1000 U/kg of a low NPP (0.25%) diet.

Tibia bone ash percentage was significantly ($p<0.05$) lower in birds fed the unsupplemented high-NPP (0.45%) diet than in those fed the unsupplemented low-NPP (0.24%) diet. Dietary supplementation with phytase or yeast significantly increased the tibia ash % in birds fed the high-NPP (0.45%)-diets and the opposite was true with those fed the low-NPP (0.25%) diets. Jalal and Scheideler (2001) found that bone ash % was higher in birds fed low-NPP (0.10%) without phytase than those fed the low-NPP (0.10%) or high-NPP (0.25%) diets supplemented with phytase.

5. Plasma calcium and phosphorus concentrations.

Data on the levels of calcium and phosphorus in the plasma of the experimental birds are shown in Table 5. Significantly ($P<0.05$) higher calcium and lower phosphorus concentrations were observed in the plasma of hens fed on the unsupplemented high-NPP (0.45%) diet compared to those fed on the unsupplemented low-NPP (0.25%) diet. Dietary supplementation with phytase or yeast increased the level of both two elements in the plasma. However, this respect was more pronounced in hens fed on yeast-containing diets. These findings are in partial agreement with those of Triyuwanta *et al.*, (1992) who reported an increase in plasma Ca of laying hens when dietary available P was increased from 0.44 to 0.64 %. In this connection, Frost *et al.*, (1991) reported that feeding low-P diets caused an increase in plasma Ca but noted that higher levels actually suppressed this response.

On the contrary, Keshavarz, (1986) and Triyuwanta *et al.*, (1992) reported that plasma P is positively correlated with dietary P level.

6. Economical evaluation.

Economical evaluation of the different experimental diets is shown in Table 6. Results indicated that inclusion of phytase at a level of 1000 U/kg of high-NPP (0.45%) diet improved the relative economic efficiency to be 109.2% as compared to that (100%) of the control group fed on the unsupplemented 0.45% NPP-diet.

In conclusion, Dandarawi laying hens fed on the 0.25%-NPP-diets, whether supplemented or not with phytase or yeast, performed less efficiently for egg production and feed conversion than those fed on the 0.45%-NPP-diets.

Additionally, from an economic point of view, it would appear that supplementation of Dandarawi laying hens diet with phytase or yeast, under the conditions of the present study, was an undue extravagance, with the exception of groups of hens fed on the 0.45%-NPP-diet with supplemental phytase which performed for egg production and feed conversion similarly but economically had an advantage over those fed on the unsupplemented 0.45%-NPP-diet (control).

Table (1): Composition of experimental diets.

Ingredients (%)	0.45%-NPP (Control)	0.45%-NPP +yeast)	0.25%-NPP	0.25%-NPP + yeast)
Yellow corn	65.93	65.93	66.38	66.13
Soybean meal, 44%	23.75	23.75	23.50	23.75
Sodium chloride	0.35	0.35	0.35	0.35
Limestone	7.50	7.50	8.35	8.35
Dicalcium phosphate	1.80	1.80	0.75	0.75
Vitamin and mineral mix.[1]	0.30	0.30	0.30	0.30
Methionine	0.07	0.07	0.07	0.07
Dried yeast [2]	0.00	0.30	0.00	0.30
Sand	0.30	0.00	0.30	0.00
Total	100	100	100	100
Calculated analysis:				
ME, kcal/kg	2800	2800	2806	2806
Crude protein, %	16.20	16.20	16.20	16.20
Crude fiber,%	3.16	3.16	3.16	3.16
Ether extract,%	2.69	2.69	2.69	2.69
Lysine,%	0.85	0.85	0.85	0.85
Methionine·%	0.35	0.35	0.35	0.35
Met.+Cys,%	0.64	0.64	0.64	0.64
Calcium%·	3.32	3.32	3.32	3.32
Phosphorus (avail),%	0.45	0.45	0.25	0.25
Phosphorus (total),%	0.67	0.67	0.48	0.48
Determined analysis:				
Crude protein, %	16.28	16.18	16.15	16.26
Crude fiber,%	3.12	3.11	3.21	3.09
Ether extract,%	2.60	2.67	2.59	2.77
Calcium,%	3.50	3.41	3.30	3.39
Phosphorus,% (total)	0.71	0.69	0.42	9.44

[1]Each Kg of vitamin and mineral premix contains: Vit. A. 8.000.000 IU; vit.D3. 1.600.000 IU;vit.E. 7.000 mg; vit. K, 1500 mg; vit. B1. 1000 mg; vit.B2, 3500 mg; vit.B6, 1000 mg; vit.B12, 10000 ug; Nicotinic acid, 20000 mg; pantothenic acid, 7000 mg; folic acid, 1.000.000 ug; biotin, 40.000 ug; choline chloride, 350.000 mg; manganese, 40.000 mg; iodine 300 mg; cobalt, 0.75 mg; zinc 40.000 mg; copper, 3.000 mg; iron 25.000 mg; selenium, 100 mg; ethoxyquin (antioxidant), 5.000 mg; scorbic acid (antimold) 500 mg.

[2]Dried yeast have 44.8% crude protein, 1.06% ether extract, 3.2% crude fiber, 0.13% calcium, 1.44% phosphorus.

Table (2): Effect of dietary supplementation with microbial phytase or dried yeast on the performance (X±SE) of Dandarawi laying hens fed two levels of nonphytate phosphorus (NPP).

Dietary treatment	0.45% NPP (control)	0.45% NPP + phytase	0.45% NPP + yeast	0.25% NPP	0.25% NPP + phytase	0.25% NPP+ yeast
Initial body weight, g	1207±40	1169±21	1190±24	1153±34	1210±36	1204±49
Final body weight, g	1359±54	1347±52	1346±34	1277±40	1325±42	1321±49
Body weight change; %	+9.87	+11.42	+10.92	+7.49	+9.02	+7.97
Egg number; egg/hen	68.53±2.0 ^{ab}	72.40±2.0 ^{a}	72.24±1.36 ^{a}	55.50±0.68 ^{ad}	60.56±1.08 ^{c}	64.05±2.0 ^{bc}
Egg production;%	57.11±1.6 ^{ab}	60.33±1.6 ^{a}	60.19±1.13 ^{a}	46.25±0.58 ^{d}	50.46±0.91 ^{c}	53.38±1.7 ^{bc}
Egg weight; g	42.4±0.26	42.0±0.28	42.0±0.34	42.3±0.25	41.9±0.19	42.4±0.18
Total egg mass (g/hen)	2900±86 ^{ab}	3035±91 ^{a}	3029±50 ^{a}	2347±36 ^{d}	2535±50 ^{cd}	2716±92 ^{bc}
Total egg mass (g/hen/day)	24.2±0.72 ^{ab}	25.3±0.75 ^{a}	25.2±0.41 ^{a}	19.6±0.30 ^{d}	21.1±0.42 ^{cd}	22.6±0.76 ^{bc}
Total feed intake (kg/hen)	10.374±64	10.370±98	10.476±57	10.394±50	10.283±72	10.279±81
Total feed intake (g/hen/day)	86.5±0.54	86.4±0.80	87.3±0.48	86.6±0.41	85.7±0.59	85.7±1.0
Feed conversion (g feed/g egg)	3.58±.08 ^{cd}	3.42±.08 ^{d}	3.46±.07 ^{d}	4.43±.06 ^{a}	4.07±.08 ^{b}	3.78±.10 ^{c}

$^{a-d}$Means in the same raw with different superscr'pts are significantly different (P<0.05).

Table (3): Effect of dietary supplementation with microbial phytase or dried yeast on egg quality traits (X±SE) of 48-week-old Dandarawi laying hens fed two levels of nonphytate phosphorus (NPP).

Diertary treatment	Egg weight (g)	Albumen height (mm)	Albumen Weight (g)	Albumen (%)	Yolk Height (mm)	Yolk Weight (g)	Yolk index	Yolk (%)	Shell (%)	Shell Thickness (mm)
High-NPP (0.45%)	45.5±0.8	6.9±0.3	23.0± .6[ab]	50.5±1.3[ab]	18.1±0.3	15.3±.4[ab]	44.1±0.8	33.7± .6[ab]	8.7±0.6	0.28±0.02
High-NPP (0.45%)+ phytase	46.6±1.2	6.9±0.6	24.7± .8[a]	53.1±0.6[a]	17.8±0.3	14.9± .4[b]	44.1±0.6	32.0± .5[b]	9.5±0.5	0.31±0.02
High-NPP (0.45%)+yeast	46.8±1.2	7.1±0.3	23.8± .8[ab]	51.7±1.6[ab]	17.9±0.3	14.9± .7[b]	43.6±0.9	32.3± .9[b]	9.6±0.5	0.33±0.02
Low-NPP (0.25%)	46.9±1.0	7.1±0.3	24.4± .4[a]	52.2±1.0[ab]	18.4±0.5	15.1±.4[ab]	46.2±1.6	32.2± .7[b]	9.3±0.4	0.29±0.01
Low-NPP (0.25%)+phytase	44.8±0.8	6.5±0.4	22.2± .7[b]	49.4±0.9[a]	18.3±0.2	15.2±.3[ab]	44.8±0.4	34.0± .5[ab]	9.2±0.4	0.30±0.02
Low-NPP (0.25%)+yeast	46.5±0.9	6.7±0.3	23.5± .8[ab]	50.4±0.8[ab]	18.2±0.2	16.3± .3[a]	44.7±0.6	35.0±.9[a]	8.4±0.5	0.28±0.01

[a-d]Means in the same column with different superscripts are significantly different (P<0.05).

Table (4): Effect of dietary supplementation with microbial phytase or dried yeast on calcium and phosphorus retention % and tibia ash % (X±SE) of Dandarawi laying hens fed two levels of nonphytate phosphorus (NPP)

Diertary treatment	Daily intake; g/bird		Daily excretion; g/bird		Daily retention;g/bird		Retention; %		Tibia ash;%
	Ca	P	Ca	P	Ca	P	Ca	P	
High-NPP (0.45%)	3.03[a]	0.614[a]	1.666[b]	0.494[a]	1.364[b]	0.1197[d]	45.03[c]	19.50[f]	31.15[d]
High-NPP (0.45%)+ phytase	3.02[b]	0.613[b]	1.602[e]	0.461[b]	1.418[b]	0.1520[b]	46.95[a]	24.86[e]	36.67[bc]
High-NPP (0.45%)+yeast	2.98[c]	0.612[c]	1.626[d]	0.442[c]	1.354[c]	0.1603[a]	45.43[b]	26.62[d]	38.11[b]
Low-NPP (0.25%)	2.86[e]	0.364[e]	1.827[a]	0.252[d]	1.033[f]	0.1121[e]	36.10[f]	30.80[c]	42.13[a]
Low-NPP (0.25%)+phytase	2.83[f]	0.360[f]	1.639[c]	0.240[f]	1.191[e]	0.1198[d]	42.07[e]	33.28[b]	35.77[c]
Low-NPP (0.25%)+yeast	2.91[d]	0.377[d]	1.645[c]	0.250[e]	1.265[d]	0.1266[c]	43.48[d]	33.58[a]	36.80[bc]

[a-d]Means in the same column with different superscripts are significantly different (P<0.05).

Table (5): Effect of dietary supplementation with microbial phytase or dried yeast on plasma calcium and phosphorus concentrations (X±SE) of 48-week-old Dandarawi laying hens fed two levels of nonphytate phosphorus (NPP)

Diertary treatment	Calcium; mg/100 ml	Phosphorus; mg/100ml
High-NPP (0.45%)	10.68 ± 0.44^{ab}	3.58 ± 0.24^{d}
High-NPP (0.45%)+ phytase	11.36 ± 0.42^{ab}	3.90 ± 0.12^{cd}
High-NPP (0.45%)+yeast	11.97 ± 0.62^{a}	4.33 ± 0.26^{bc}
Low-NPP (0.25%)	8.90 ± 0.45^{c}	4.53 ± 0.12^{bc}
Low-NPP (0.25%)+phytase	10.27 ± 0.40^{bc}	4.93 ± 0.08^{ab}
Low-NPP (0.25%)+yeast	10.63 ± 0.52^{ab}	5.45 ± 0.29^{a}

$^{a-d}$Means in the same column with different superscripts are significantly different ($P<0.05$).

Table (6): Economical evaluation of dietary treatments of the present experiment with Dandarawi laying hens.

Items	0.45% NPP (Control)	0.45% NPP +phytase	0.45% NPP + yeast	0.25 % NPP	0.25% NPP + phytase	0.25% NPP + yeast
Average feed intake (kg/hen/4 months), (a)	10.38	10.37	10.48	10.39	10.28	10.28
Price/kg feed, L.E (b)	0.93	0.94	0.98	0.92	0.93	0.98
Total feed cost, L.E (a x b= c)	9.65	9.75	10.27	9.56	9.56	10.07
Egg mass (kg/hen/4 months) (d)	2.900	3.04	3.03	2.35	2.53	2.72
Price/kg egg, L.E (e)	5.500	5.500	5.500	5.500	5.500	5.500
Total retern;L.E. (d x e= f)	15.95	16.69	16.66	12.91	13.94	14.94
Net revenue, L.E (f - c = g)	6.3	6.94	6.39	3.35	4.38	4.87
Economical efficiency (EE) = g/c	0.65	0.71	0.62	0.35	0.46	0.48
Relative economical efficiency % of control	100	109.2	95.4	53.8	70.8	73.8

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الملخص العربي

تأثير مستوي الفوسفور المأكول مع أو بدون إضافة إنزيم الفيبتيز أو الخميرة الجافة على معدل أداء دجاجات الدندراوى البياضة

محمد متولى احمد حامد

قسم الانتاج الحيوانى ـــ كلية الزراعة ـــ جامعة أسيوط ـــ مصر

أجريت تجربة على ١٨٠ دجاجة دنداراوى بياضة لفترة ٤ شهور (استمرت من عمر ٣٢ حتى ٤٨ أسبوع). قسمت الطيور الى ٦ مجموعات، غذيت على أعلاف بها مستويين من الفوسفور المتاح (إحداهما مستوى الكنترول وهو٠,٤٥% والأخر منخفض في الفوسفور ٠,٢٥ %) أضيفت أليها أو لم يضاف أنزيم الفيبتيز بمعدل ١٠٠٠ وحدة /كجم أو الخميرة الجافة بمعدل ٠,٣ % من العلف. تم قياس معدل أداء الدجاجات بالنسبة لإنتاج البيض وصفات جودة البيض والمحتجز من الكالسيوم والفوسفور وتركيز كل من الكالسيوم والفوسفور فى بلازما الدم وكذلك الكفاءة الاقتصادية.

وكانت أهم النتـــــــائج ما يلي :

١- لم يؤثر أي من مستوى الفوسفور أو إضافة إنزيم الفيتيز والخميرة على الغذاء المــأكول أو وزن البيضة.

٢- الطيور المغذاة على علائق عادية في مستوى الفوسفور (٠,٤٥%) كان لها معدل أداء افضل في كل من انتاج البيض والكفاءة الغذائية عن الطيور المغذاة على علائق منخفضة في مستوى الفوسفور (٠,٢٥ %). إضافة إنزيم الفيتيز او الخميرة الجافة حسن معدل إنتاج البيض فــي المجموعة المغذاة على أعلاف منخفضة في مستوى الفوسفور (٠,٢٥ %). كما لــوحظ ان معدل إنتاج البيض للمجموعة المغذاة على أعلاف منخفضة فى الفوسفور والمــضاف إليهــا الخميرة بمعدل ٠,٣% كان مشابه معنويا مع معدل إنتاج البيض للمجموعـــة المغــذاة علـــى أعلاف عادية فى الفوسفور وغير مضاف إليها الخميرة.

٣- بالنسبة لصفات جودة البيض فقد وجد فروق معنوية بين المعـــاملات فـــى أوزان البيـــاض والصفار فقط.

٤- ازدادت % للمحتجز من الكالسيوم فى الدجاجات المغذاة على أعلاف عادية فـــى الفوســـفور (٠,٤٥%) وغير مضاف إليها الفيتيز او الخميرة والعكس صحيح بالنسبة للمجموعة المغذاة على أعلاف منخفضة في الفوسفور(٠,٢٥%). وان إضافة إنزيم الفيتيز او الخميرة الجافـــة الى الأعلاف المنخفضة في مستوى الفوسفور (٠,٢٥ %) أدى الى زيادة % للمحتجز مـــن الكالسيوم. لوحظ ايضا انه على الرغم من ان إضافة إنزيم الفيتيز او الخميرة الجافة اليها ادى الى زيادة % للمحتجز من الفوسفور فقد وجد انخفاض % للمحتجـــز مـــن الفوســـفور فـــى الدجاجات المغذاة على أعلاف عادية فى الفوسفور (٠,٤٥%) مع أو بدون إضافة عن مثيلتها المغذاة على الأعلاف المنخفضة في مستوى الفوسفور (٠,٢٥ %).

٥- انخفاض % للرماد فى عظمة الـــ Tibia فى الدجاجات المغذاة على أعلاف عاديـــة فـــى الفوسفور، (٠,٤٥%) وبدون إضافة عن الدجاجات المغذاة على أعلاف منخفضة فى الفوسفور (٠,٢٥ %) وبدون إضافة. وان إضافة الفيتيز او الخميرة أدى الى زيادة % للرماد فى عظمة الـــ Tibia فى الدجاجات المغذاة على أعلاف عادية فى الفوسفور (٠,٤٥%) .

٦- زيادة تركيز الكالسيوم وانخفاض تركيز الفوسفور فى بلازما دم الطيور المغذاة على أعلاف عادية فى الفوسفور (٠,٤٥%) عن الطيور المغذاة على أعلاف منخفـــضة فـــى الفوســـفور

(٠,٢٥ %)، وان اضافة الخميرة اليها ادى الى زيادة كل من تركيزى الكالسيوم والفوسـفور فى بلازما الدم.

وتخلص الدراسة الى آن دجاجات الدنداراوى البياضة المغذاة على أعلاف منخفضة فى الفوسفور (٠,٢٥ %) سواء أضيف إليها أو لم يضاف إليها إنزيم الفيتيـز أو الخميـرة أعطـت معدلات أداء منخفضة بالنسبة لانتاج البيض والكفاءة الغذائية عن الدجاجات المغذاة على أعلاف عادية فى الفوسفور (٠,٤٥%). ومن وجهـــة النظر الاقتصادية فيبدو ان إضافة أنزيم الفيتيز او الخميرة تحت ظروف التجربة الحالية لم يحقق النتائج المرجوة فيما عدا أن الدجاجات المغذاة على الأعلاف العادية في الفوسفور (٠,٤٥%) والمضاف اليها انزيم الفيتيز أعطت معدلات أداء بالنسبة لانتاج البيض و الكفاءة الغذائية مشابه للدجاجات المغذاة علـى الأعـلاف العاديـة فـي الفوسفور (٠,٤٥%) وبدون إضافة بل تفوقت عليها أيضا من ناحية التقييم الاقتصادي.