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Effect of Phytase Enzyme Supplementation in Low Energy-Protein Layer Diet on Egg Quality Traits

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ABSTRACT

An experiment was carried out using 200 hundred Athulya birds divided into 10 treatments (T1-T10) to find out the effect of phytase enzyme on egg quality traits supplemented at 0, 500 and 1000 units/kg in low energy, low protein and low energy- protein layer chicken diets containing available phosphorus of 0.30 per cent from 21 to 40 weeks of age. A standard layer ration was offered to birds in T1. Experimental diets from T2 to T10 were formulated with two levels of crude protein (18 and 16 percent) and two levels of metabolisable energy (2600 and 2400 ME kcal/kg diet). During the laying period the data on egg quality traits viz. Shape index, shell thickness, albumen index, yolk index and Haugh unit score were measured at the end of every four week. The egg quality traits viz., Shell thickness, albumen index, yolk index and Haugh unit score showed significant (P<0.01) difference among treatments. However, shape index value did not reveal any difference.

Keywords: Phytase, low energy-protein, egg quality and layer

Indian layer industry is growing annually at the rate of 5 to 7 percent. Feed production and availability of feed ingredients are not increasing to meet the demand of industry. Hence, newer technologies have to be developed to improve utilization of nutrients in the diet. Most of the cereals and their by-products used in poultry diet have phosphorus in the form of phytate which is not fully utilized by the birds. Phosphorus is an important mineral nutrient in several metabolic processes in poultry. About two-third of the total phosphorus in poultry feed ingredients present as phytate phosphorus and only one third of phytate phosphorus is absorbed and the balance is excreted as waste. This research work has been accentuated to increase the digestibility of phytate phosphorus by supplementation of exogenous phytase enzyme in low nutrients layer feed and to improve the egg shell quality.

MATERIALS AND METHODS

Two hundred, White Leghorn hybrid pullets at 18 weeks of age were selected and housed in individual cages. They were divided into ten treatments with four replicates each having five hens. A Standard Layer ration (CP-18 per cent, ME-2600 kcal/kg diet, available phosphorus-0.5 per cent) was formulated as per BIS (1992) and offered to birds in T1. Experimental diets from T2 to T10 were formulated with two levels of crude protein (18 and 16 percent), two levels of metabolisable energy (2600 and 2400 ME kcal/kg diet) and three levels of phytase (0,500 and 1000 units/kg) as detailed in Table 1. The available phosphorus level in all treatments except T1 was 0.3 per cent. The experimental rations viz., Standard layer ration (SLR), Low energy ration (LER), Low protein ration (LPR) and Low energy-protein ration (LEPR) were offered *ad libitum* from 21 to 40 weeks of age.

Table 1. Allocation of different dietary treatments to experimental birds

Treatments	Rations	Crude protein percent	Metabolisable energy kcal/kg	Available phosphorus percent	Phytase units/kg
T1	SLR	18	2600	0.5	0
T2	LER	18	2400	0.3	0
T3	LER	18	2400	0.3	500
T4	LER	18	2400	0.3	1000
T5	LPR	16	2600	0.3	0
T6	LPR	16	2600	0.3	500
T7	LPR	16	2600	0.3	1000
T8	LEPR	16	2400	0.3	0
T9	LEPR	16	2400	0.3	500
T10	LEPR	16	2400	0.3	1000

The egg quality traits viz., Shape index, shell thickness, albumen index, yolk index and Haugh unit score were measured at the end of every four week. All the data obtained in this study were subjected to analysis of variance for statistical significance as per the methods of Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The egg quality traits viz., Shape index, shell thickness, albumen index, yolk index and Haugh unit score as influenced by supplementation of phytase in various dietary treatment groups are given in Table 2.

Table 2: Effect of phytase supplementation in low energy-protein layer diet on egg quality traits index in Athulya layer+

Treatments	Egg quality traits				
	Mean eggshell thickness** (mm)	Mean Albumen index**	Mean Yolk index**	Haugh unit score values**	Mean shape index
T1	0.310^{abcd} ± 0.004	0.100^{cd} ± 0.004	0.415^{cd} ± 0.005	82.66^{bc} ± 0.91	75.45^{a} ± 0.50
T2	0.305^{ab} ± 0.005	0.095^{abc} ± 0.003	0.393^{a} ± 0.003	78.39^{a} ± 0.66	74.75^{a} ± 0.63
T3	0.315^{cd} ± 0.005	0.103^{d} ± 0.005	0.420^{d} ± 0.004	84.98^{cd} ± 1.92	74.78^{a} ± 0.62
T4	0.315^{cd} ± 0.008	0.105^{d} ± 0.005	0.410^{bcd} ± 0.006	86.95^{d} ± 1.01	76.07^{a} ± 0.61
T5	0.305^{abc} ± 0.003	0.088^{a} ± 0.005	0.400^{ab} ± 0.004	78.79^{a} ± 1.53	75.46^{a} ± 0.72
T6	0.315^{cd} ± 0.004	0.096^{abcd} ± 0.003	0.420^{d} ± 0.004	81.82^{b} ± 0.57	75.35^{a} ± 1.07
T7	0.320^{d} ± 0.004	0.102^{cd} ± 0.002	0.423^{d} ± 0.005	82.35^{bc} ± 0.57	75.48^{a} ± 0.36
T8	0.300^{a} ± 0.005	0.090^{ab} ± 0.002	0.400^{ab} ± 0.009	78.17^{a} ± 0.40	74.95^{a} ± 0.78
T9	0.318^{cd} ± 0.005	0.102^{cd} ± 0.003	0.413^{cd} ± 0.005	82.30^{bc} ± 0.32	75.79^{a} ± 0.24
T10	0.317^{cd} ± 0.005	0.098^{bcd} ± 0.003	0.418^{d} ± 0.005	82.20^{bc} ± 0.51	75.33^{a} ± 0.42
P-value	0.01	0.00	0.00	0.00	0.90

+Mean of 16 values with SE

Means within a column with no common superscript differ significantly **(P<0.01)

EGG SHELL THICKNESS

Mean egg shell thickness was highest for group fed a low protein ration supplemented with phytase 1000 units/kg (T7) and the lowest for groups offered with low energy protein ration (T8) without phytase. Mean shell thickness was significantly (P<0.01) more among birds fed LER, LPR and LEPR with phytase 500 and 1000 units /kg when compared with their negative controls. The mean shell thickness of SLR fed groups was intermittent and was statistically comparable with all other treatment groups. Irrespective of level of phytase supplementation, all supplemented groups significantly improved the shell thickness values. The improvement in shell thickness due to supplementation of phytase was observed by Sukumar (1999), Ahmadi *et al*., (2008), Hassanien and Elnagar (2011) and Kannan *et al*., (2011).

Albumen index

Mean albumen index value was highest for group fed a low energy diet supplemented with phytase 1000 units/kg (T4) and the lowest for groups offered with low protein ration (T5) without phytase. Significantly (P<0.01) lowest value was noticed in LPR (T5) fed group which was comparable with birds in T2 and T8 negative controls and significantly highest values were noted in birds fed LER with supplemental phytase (T3 and T4) which was comparable with T1, T6, T7, T9 and T10. The result of the present study is in disagreement with Silversides and Hruby (2009) who found that supplementation of phytase at 300 and 600 units/kg in low energy-protein diets of Lohmann resulted no significant difference in albumen index values. Similar observations were recorded by Alps *et al.,* (2010), Hassanien and Elnagar (2011) and Kannan *et al*., (2011).

Yolk index

Mean yolk index value was highest for group fed a low protein diet supplemented with phytase 1000 units/kg (T7) and the lowest for groups offered with low energy ration (T2) without phytase. Mean yolk index values of all phytase supplemented groups (except T4) were higher than that of negative controls. Significantly (P<0.01) highest values were noted in treatments of T3, T6, T7 and T10 respectively when compared with negative controls and was comparable with T1, T4 and T9. However, mean yolk index value of T4 was comparable with T5 and T8. Mean yolk index values of T2, T5 and T8 were statistically comparable. The present findings of the experiment is contrary to Silversides and Hruby (2009), Alps *et al.,* (2010), Hassanien and Elnagar (2011) and Kannan *et. al.,* (2011).

Haugh unit score

Mean Haugh unit score value was highest in birds fed a low energy diet supplemented with phytase 1000 units/kg (T4) and the lowest for birds offered with low energy-protein ration (T8) without phytase. Mean Haugh unit score values of all phytase supplemented groups were higher than that of negative controls. Significantly (P<0.01) highest Haugh unit score was recorded in birds (T4) received LER supplemented with phytase 1000 units/kg when compared with all other dietary treatment groups and was comparable with birds in T3. Mean Haugh unit score of birds in T1, T6, T7, T9 and T10 were significantly (P<0.01) higher when compared with negative controls and lower than T4 and statistically comparable values within them. It was recorded significantly lowest for all the negative controls. Haugh unit score values for LER supplemented with both level of phytase was superior when compared with other phytase supplemented groups. The present finding is contrary to the observations recorded by Alps *et al.,* (2010), Hassanien and Elnagar (2011) and Kannan *et al.,* (2011) who found addition of phytase have no influence on HUS.

Shape index

Mean shape index value was ranged from 74.75 to 76.09. Statistical analysis of data on mean shape index value showed no significant difference among various dietary treatments groups. Period-wise analysis of mean shape index value showed significantly ($P<0.01$) lower value for T2 and T8 treatment groups when compared with others in the first period only. The difference in shape index in the first period may be due to start of lay with different sizes of eggs at the beginning. Irrespective of phytase supplementation, mean shape index value of all dietary treatment groups were statistically comparable. The result of the present findings is in close agreement with Alps *et. al.,* (2010)), Hassanien and Elnagar (2011) and Kannan *et al*., (2011) who found addition of phytase have no influence on shape index value

Overall, better egg quality traits were observed in all the phytase supplemented groups may be due to extra phosphoric effect of phytase enzyme and best utilization of phytate bound nutrients. It is evident that shell quality improvement is due to release and absorption of phosphorus from phytate. From this study, it may be concluded that addition of commercial phytase enzyme in low nutrients layer diet improves egg qualities in addition to egg shell quality. Improvement of egg shell quality will increase the farm profit by reduction of less breakage of eggs during transportation.

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