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EFFECT OF DIETARY PHYTASE SUPPLEMENTATION ON CERTAIN HEMATOLOGICAL AND SKELETAL PARAMETERS IN WHITE LEGHORN STRAIN CROSS BIRDS

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A study was conducted in one hundred and fifty White Leghorn strain cross (Athulya) pullets to evaluate the effect of phytase supplementation on certain haematological and skeletal parameters. The birds were divided into five treatments, viz. T1/control (fed with standard layer ration), T2/ negative control (fed with layer ration having low available phosphorus), T3, T4 and T5 (fed with low available phosphorus layer ration supplemented with 200, 300 and 400 units of phytase enzyme/ kg feed respectively). Phytase supplementation in diets having low available phosphorus (T3, T4 and T5) improved ($p<0.05$) the serum calcium levels and the bioavailability of phosphorus. However, serum inorganic phosphorus, tibial bone ash content, tibial bone phosphorus content and the bioavailability of calcium were not improved by phytase supplementation ($p<0.05$). It can be concluded that 200 units of phytase enzyme per kg feed can be incorporated in layer diets having low available phosphorus content, to improve the serum calcium level and the bioavailability of phosphorus.

Key words: - Phytase, Bioavailability, Calcium, Available phosphorus and Tibial ash

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Cereals and plant materials which constitute major part of poultry feeds contain phosphorus in the form of phytic acid. In addition, the phytic acid may combine with inorganic elements such as calcium, magnesium, sodium and potassium in the diet and make it unavailable for the birds. Only 30 percent of plant phosphorus can be utilized by poultry and the remaining is excreted. So, incorporation of phytase can fully or partially eliminate the addition of dicalcium phosphorus. Though the idea of addition of phytase in poultry ration was known several years back (Nelson et al., 1968), due to high production cost of this enzyme, its incorporation in poultry ration was not considered economical. But presently due to the biotechnological innovations, production of phytase from fungus like *Aspergillus ficuum, Aspergillus niger* and bacteria like *Bacillus subtilis* has become cheaper. Hence a study on supplementation of phytase enzyme in layer chicken was conducted to determine its effect on serum calcium, serum inorganic phosphorus, tibial bone ash content, tibial bone phosphorus content and the bioavailability of calcium and phosphorus.

MATERIALS AND METHODS

One hundred and fifty, 21 weeks old White Leghorn strain cross (Athulya) pullets formed the subjects of this experiment. The experiment was conducted for a period of twenty weeks. The birds were grouped into five treatments, each with three replicates of ten birds and reared up to forty one weeks of age. Two types of ration viz. standard layer ration (BIS, 1992) and a layer ration with low available phosphorus were used in this study. Low available Phosphorus layer ration was formulated keeping the level of available phosphorus at 0.3 % (whereas 0.5% in the standard layer ration). The levels of all other nutrients in low available phosphorus layer ration were similar to that of standard layer ration. Initially, a ration with 0.3 % available phosphorus was formulated and then by the addition of appropriate levels of dicalcium phosphate to this ration, standard layer ration was formulated. The enzyme used in this study was NATUPHOS -5000® a phosphatase enzyme of fungal origin (*Aspergillus sp)*

containing phytase as the only component. Jugular blood samples of four birds from each treatment group were collected at the end of the experiment for the estimation of serum calcium and serum inorganic phosphorus. The estimation of serum calcium was done using atomic absorption spectrophotometer (Parkin Elmer Model-3110). The estimation of serum inorganic phosphorus was done by modified metol method, using a commercial kit (Qualigens®, India). At the end of the twenty weeks, a metabolism trail of three days duration was conducted using four birds randomly selected from each treatment group. During the metabolism trial, feed intake and excreta voided by each bird was recorded daily on dry matter basis. Samples were pooled for each replicate and analyzed for bioavailability of calcium and phosphorus. At the end of the metabolism trial, four birds from each treatment were randomly selected and sacrificed to collect the tibia as per the method described by Kalango and Ademosun (1973). The data's collected were subjected to statistical analysis as per the methods described by Snedecor and cochron (1985)

RESULTS AND DISCUSSION

Serum calcium, serum inorganic phosphorus, tibial bone ash content, tibial bone phosphorus content and the bioavailability of calcium and phosphorus in various treatment groups is presented in Table-2. Irrespective of different levels of phytase addition, all supplemented groups had higher ($p<0.05$) serum calcium levels. Birds offered a low available phosphorus diet, without phytase had lower calcium level of 18.14±0.57 mg%. Perusal of mean serum inorganic phosphorus presented in Table-2 revealed, no significant difference was noticed between treatments of various levels of phytase supplementation and standard layer ration. Overall assessment of these haematological parameters clearly indicated that phytase supplementation to low available phosphorus layer diets did cause an increase in their numerical values compared to the negative control.

Mean percent tibial ash and phosphorus content of representative birds given in Table 2, revealed that numerical differences existed between different treatments with regard to these traits. Lowering the available phosphorus content from 0.5 to 0.3 per cent in layer ration resulted in a 3.44 percent reduction in tibial ash. Supplementation of low available phosphorus layer ration with 200, 300 and 400 units of phytase/kg feed caused an increase in tibial ash content to the extent of 4.07, 3.19 and 3.35 percent respectively. Similarly, a reduction of 1.84 percent in the tibial phosphorus content was observed when available phosphorus in the diet was reduced from 0.5 to 0.3 percent. An increase of 2.10, 2.10 and 2.12 percent in tibial phosphorus content could be found when the low available phosphorus layer ration was supplemented with 200, 300 and 400 units of phytase/kg respectively. However, the data pertaining to tibial ash and phosphorus content had no significant difference between the various feeding regimens employed. Panda et al (2010) opined that addition of phytase to a low phosphorus diet alleviated the adverse effects on tibial strength. A reduction of 3.17 percent in the bio-availability of calcium was found when the available phosphorus content of layer feed was reduced to 0.3 percent. Supplementation of low available phosphorus rations with 200, 300 and 400 units of phytase/kg feed, resulted in an increase in the bioavailability of calcium by 3.17, 2.83 and 1.69 percent respectively. However, phytase supplemented groups failed to show a significant difference in the bioavailability of calcium. Feeding a ration with an available phosphorus content of 0.3 percent resulted in a significant reduction in the bioavailability of phosphorus. Percent bioavailability of phosphorus was enhanced ($p<0.01$) by phytase supplementation. Addition of phytase in the diet acts upon the bound phytate phosphorus liberating the inorganic phosphorus molecules, resulting in an increase in the phosphorus availability (Gordon and Roland, 1998). Carlos and Edwards (1998) also found that supplementation of phytase enzyme had a positive effect on phytate phosphorus retention in laying hens. Based on the findings of this study it can be concluded that by the inclusion of 200 units of phytase

Table 1.Percent chemical composition of experimental diets (on dry matter basis)

Nutrients	Standard Layer ration	Low available phosphorus layer ration
Crude Protein	18.30	18.20
Ether extract	4.13	4.18
Crude fiber	6.81	6.97
Total ash	16.43	16.63
Acid insoluble ash	3.81	3.74
Calcium	3.12	3.03
Total Phosphorus	0.92	0.78
Available Phosphorus*	0.50	0.32

*Calculated value

Table 2. Haematological and skeletal parameters of layer chicken as influenced by phytase supplementation

Parameters	Treatments				
	T1	T2	T3	T4	T5
**Serum calcium (Mg %)	20.14^{ab} ±0.51	18.14^{b} ±0.57	21.11^{a} ±0.65	21.11^{a} ±0.53	20.99^{a} ±1.01
Serum inorganic phosphorus (Mg %)	4.38 ±0.23	3.76 ±0.29	4.33 ±0.23	4.18 ±0.16	4.12 ±0.11
Tibial bone ash %	52.14 ±0.99	48.70 ±0.90	52.77 ±0.93	51.89 ±1.20	52.05 ±1.23
Tibial bone phosphorus %	16.90 ±0.78	15.06 ±0.31	17.16 ±0.49	17.16 ±0.65	17.18 ±0.56
Bioavailability of calcium %	60.85 ±0.85	57.68 ±0.61	60.85 ±0.71	60.51 ±0.82	59.37 ±0.97
*Bioavailability of Phosphorus %	52.14^{a} ±0.58	46.85^{b} ±0.84	54.66^{a} ±0.94	53.03^{a} ±1.46	54.85^{a} ±2.65

*Significant ($p<0.01$)
**Significant ($p<0.05$).

enzyme per kg feed in layer diets having low available phosphorus content, improves the serum calcium level and the bioavailability of phosphorus.

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