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Partial Replacement of Sunflower Meal with Phytase Enzyme on Nutrient Digestibility of Broiler

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Abstract **– Poultry required enzymes which help in feed breakdown because chicken have not enzyme for fibres break down. Enzymes which are biological catalyst composed of amino acids with minerals and vitamins. The using of enzyme have many benefits in poultry diets include not only enhanced feed conversion and bird performance but also reduced output of excreta problems of environment. The present study was undertaken in order to determine the partial replacement of sunflower meal with phytase enzyme on nutrient digestibility of broiler. Birds were arbitrarily separated in four groups, i.e. Group A (control) was offered 0 g/kg, 0.05 g/kg (group B), 0.075 g/kg (group C) and 0.025 g/kg (group D) phytase enzyme provided in broiler feed. Parameters measured were weight gains, feed intake, nutrient digestibility and Feed conversion ratio calculated. Results showed that the maximum chicken body weight was noted in group C and Feed intake was minimum in group C, as compare to other groups. Feed conversion ratio was significantly ($p<0.05$) better in group C, followed by other groups the non-significantly variance founded respectively. Furthermore, significantly higher in crude protein digestibility starter/finisher was recorded in group C followed by control group A, B and D. Maximum Metabolizable energy starter/finisher was in group C followed by control (A), group B and group D.**

Keywords **– Broiler Birds, Phytase Enzyme, Feed Conversion Ratio, Body Weight Gain, Nutrient Digestibility.**

I. INTRODUCTION

The poultry sector one of the highest energetic sections in different organized of the industries of agriculture in Pakistan. The industries of poultry are facing some problems in early growth and active biological activities as per the requirement of the market for enhancing the socio-economic status of the poultry oriented community in the under developing country. The cost amount of feed to a significant proportion of comprehensive livestock production system [1]. According to a report that, cost of feed represents up to 60% - 80% of the whole broiler chicken production cost [2]. Sunflower, which is one of the conventional feed resource and used for the purpose of animal protein and poultry diets due to unavailability of cheaper alternative protein sources in many countries.

Poultry required enzymes which help in fed breakdown because chicken have not enzyme for fiber break down. Enzymes which are biological catalyst composed of amino acids with minerals and vitamins. The using of enzyme have many benefits in poultry diets include not only enhanced feed conversion and bird performance but also reduced output of excreta problems of environment. It is common practice to name enzymes by adding the suffixase and protease which breakdown protein, pancreatic lipase which splits lipid /fat. Those enzymes added to feed as a supplement are exogenous [3, 4]. In nutrient of poultry the enzyme usage in animal feed have great importance Fig. 1.

In most of the developing countries in the price of feed ingredients has been a major constriction. As a consequence nonconventional feed ingredients and cheaper have to be used which contain higher percentage of

insoluble/crude fiber and soluble beside with starch. Non Starch Polysaccharides are polymeric carbohydrates which differ in structure from starch and composition [5] and possess chemical cross linking among them therefore, poultry are not well digested well [6]. In the intestinal tract part of these Non-Starch Polysaccharides is water-soluble which is notorious for forming a gel like viscous consistency [7] thus gut performance reducing. Phytase enzyme use in the feed industry enzymes in the feed industry have mostly been used for poultry to neutralize the effects in cereals viscous, polysaccharides. These antinutritive carbohydrates are undesirable, as in the diet they reduce absorption and digestion of all nutrients, especially protein and fat. Phytase enzyme not only increases the availability of phosphate in plants and also decreases pollution of environmental. Several other enzyme products are currently being evaluated in the poultry feed industry to assist in the digestion of starch in early-weaned animals and to neutralize certain antinutritive factors in noncereal feedstuffs. The phytase enzyme reduces the inorganic phosphorus quantity (40% in broilers) which needed in poultry diet, in environment decreases the excreted amount makes more phosphorus available for the bird [8]. The importance of enzyme using in animal feed. Recently, considerable attention has been shown as a feed phytase enzyme in combination with poultry feed. The current mission was scheduled to carry out the influence of partial replacement of sunflower with phytase enzyme on nutrient digestibility of broiler.

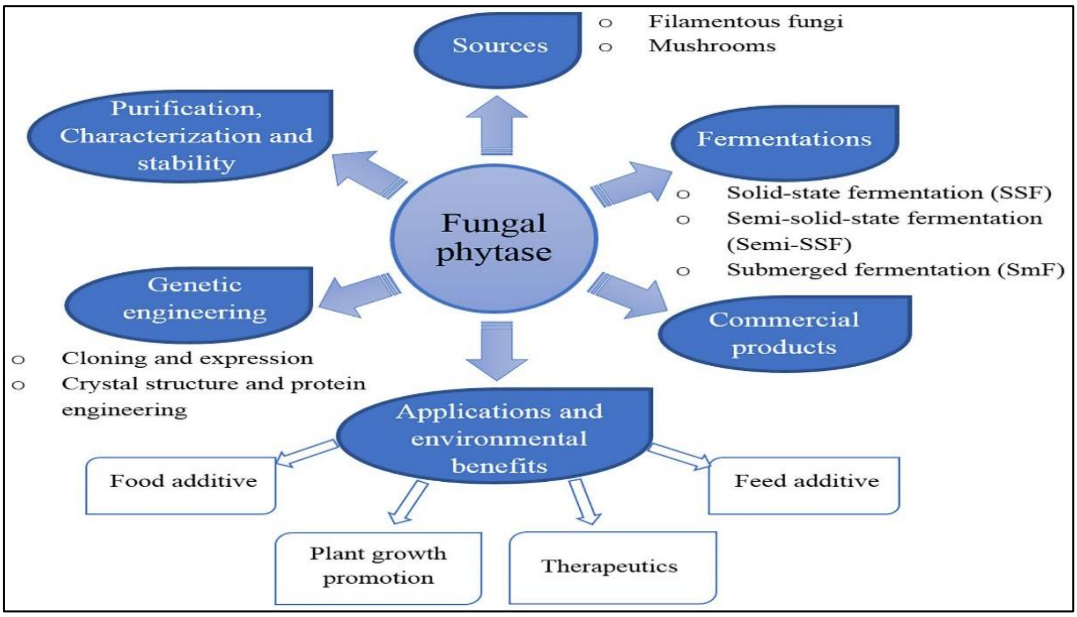

Fig. 1. Importance of phytase enzyme (SSF, Semi-SSF, SmF).

II. Materials and Methods

The experiment was carried out at the Poultry Research Unit of the Department of Poultry Nutrition, Sindh agriculture university, Tandojam, Pakistan, with the approval of the Committee for Animal Experiments of the Institution.

2.1. *Phytase for Poultry Feed Industry*

Phytase enzyme which are produced commercially for utilization and improve nutrient digestibility added to poultry feeds. In the poultry feed industry ideal phytase enzyme is acidic pH unaffected and in the small intestine and stomach, where is cost-effective to produce, phosphorus absorption takes place and high temperatures resistant (65 - 80°C), through feed pelleting are encountered [9]. In many others scientist and

scholar's research focused on the testing of efficacy and identification of the former for use of Phytase enzyme in the animal feed industry ability to hydrolyze Phytic acid in the gastro intestinal tract [2].

2.2. *Microbial Phytase Enzyme Activity Sites*

In poultry the site activity of microbial phytase enzyme at tract of poultry gastro intestinal sections. In proventriculus and crop followed by the jejunum and duodenum of poultry have greater activity of a microbial phytase (fungal phytase) and irrelevant action in the ileum [10].

2.3. *Experimental Birds and Housing*

Two hundred day-old Ross chicks (*Gallus gallus domesticus*) were purchased from a commercial distributor hatchery of Hyderabad. After initial weight the chicks were first brooded together on deep litter system for one week. Than chicks were arbitrarily separated in four groups, i.e. A (control) was offered 0 g/kg group A (control), 0.05 g/kg (group B), 0.075 g/kg (group C) and 0.25 g/kg (group D) phytase enzyme provided in broiler feed. Each group were consisted of 50 birds these are presented in (Table 1).

Table 1. Experimental birds design and housing.

Groups	**A**	**B**	**C**	**D**
Supplementation	Basil diets	0.005g/kg Phytase enzyme of Feed	0.0075g/kg Phytase enzyme of Feed	0.0025g/kg Phytase enzyme of Feed
No. of chicks	50	50	50	50

2.4. *Feed Intake (g)*

Feed was given twice a day, the feed which refused was collected daily to each group chickens *ad libitum.* Fig. 2.

Fig. 2. The feed given twice a day which refused was collected daily and finally consumed feed was recorded using the formula bellow.

$$\text{Feed intake (g)} = \frac{\text{Total feed offered –Total feed intake}}{\text{Total broiler}} \times 100 \quad (1)$$

2.5. *Body Live Weight (g/b)*

Before the research work, by electric weight balance chicken were weighed. In every week the birds were randomly selected from each group and weighed during experimental duration. Figure 3.

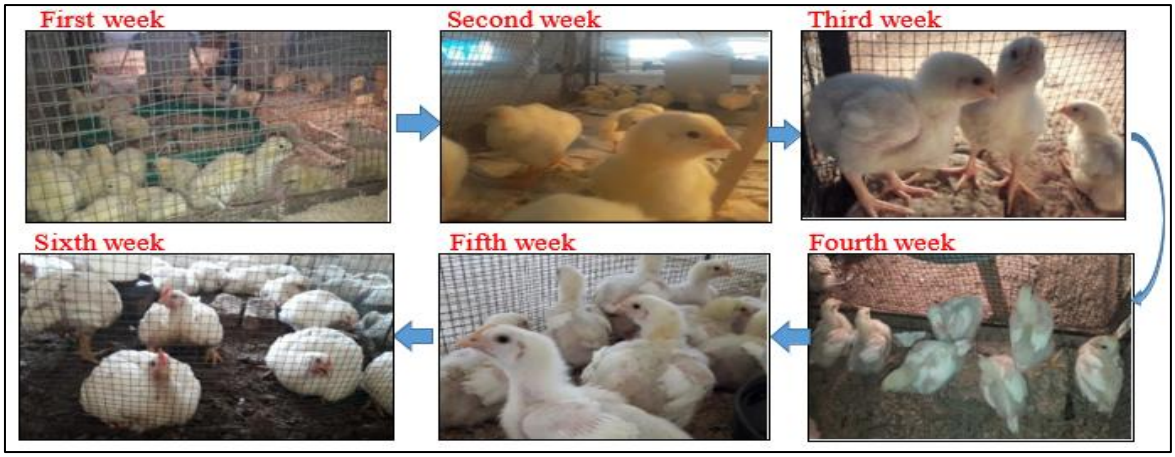

Fig. 3. Different stages of live body gain of broiler chicks calculated in first week to sixth weeks.

2.6. *Feed Conversion Ratio (F.C.R)*

To calculate FCR, increasing weight and intake of feed, were noted by following formula;

$$\text{FCR} = \frac{\text{Total feed consumed}}{\text{Total weight gain}} \times 100 \quad (2)$$

2.7. *Nutrient Digestibility (%)*

Digestibility is estimated from the determined values as follow;

2.8. *Data Analysis*

In Microsoft excel the data was formulated then further analyzed in One-way analysis of difference (ANOVA) through (statistix 8.1 software) and significant variances were associated using the LSD examination procedure ($P<0.05$).

$$= 100 - 100\{\frac{\%\text{ maker in diet}}{\%\text{ maker in faces}} \,,, \frac{\%\text{ nutrient in feaces}}{\%\text{ nutrient in fees}}\} \quad (3)$$

III. RATION FORMULATION (STARTER/FINISHER)

Initially, the chicks were offered commercial starter/finisher ration. The starter ration was supplied for first three weeks and finisher ration was given for last three weeks.

3.1. *Ration Formulation of Experimental Diets:*

Crude protein Value for Phytase enzyme was based on proximate analysis. The following steps were taken in formulating the experimental diets poultry as (Table 2) and (Table 3), according to the recommendation of NRC (1994). The diets were made iso-nitrogenous and iso-energetic to produce broiler starter and finisher 20% and 18% crude protein respectively.

Table 2. Ingredients and formulation of basal diet (Starter/kg).

Ingredients	**Starter /kg**			
	A	**B**	**C**	**D**
Rice Broken	31.3	31.3	31.3	31.3

Ingredients	Starter /kg			
	A	B	C	D
Maize	30.5	30.5	30.5	30.5
Fish meal	6.5	6.5	6.5	6.5
Soy bean meal	24.4	24.4	24.4	24.4
Sunflower meal	4.8	5	5	5
Molasses	0.552	0.552	0.552	0.552
Lime stone	0.554	0.554	0.554	0.554
Salt	0.20	0.25	0.25	0.25
Soda Bi Carbonate	0.0111	0.0111	0.0111	0.0111
Premix Vitamin	0.05	0.05	0.05	0.05
Premix Minerals	0.05	0.05	0.05	0.05
Dietary Methionine	0.3155	0.3155	0.3155	0.3155
L-Methionine	0.05	0.05	0.05	0.05
Lysine Sulphate	0.3498	0.3473	0.3423	0.3448
L-Threonine	0.0876	0.0876	0.0876	0.0876
Diclazulin	0.02	0.02	0.02	0.02
Antibiotics	0.01	0.01	0.01	0.01
Phytase enzyme	0	0.005	0.0025	0.075
Over-all	100.00	100.00	100.00	100.00

Table 3. Finisher ration was given for last three weeks. Ration formulation of diet (Finisher/kg).

Ingredients	Finisher /kg			
	A	B	C	D
Rice Broken	25.6	25.6	25.6	25.6
Maize	38	38	38	38
Fish meal	6.5	6.5	6.5	6.5
Soya bean meal	21.6	21.6	21.6	21.6
Sunflower meal	5	5	5	5
Molasses	0.3	0.3	0.3	0.3
Oil	1.3817	1.3817	1.3817	1.3817
Lime stone	0.4	0.4	0.4	0.4
Salt	0.187	0.187	0.187	0.187
Soda Bi Carbonate	0.0829	0.0829	0.0829	0.0829
Premix Vitamin	0.05	0.05	0.05	0.05

Ingredients	Finisher /kg			
	A	B	C	D
Premix Minerals	0.05	0.05	0.05	0.05
Dietary Methionine	0.312	0.312	0.312	0.312
L-Methionine	0.05	0.05	0.05	0.05
Lysine Sulphate	0.3756	0.3731	0.3681	0.3706
L-Threonine	0.1008	0.1008	0.1008	0.1008
Diclazulin	0	-	-	-
Antibiotics	0.01	0.01	0.01	0.01
Phytase enzyme	0	0.005	0.0025	0.0075
TOTAL	100	100	100	100

Vaccination

The following vaccination program were adopt according to the approval of Pakistan Poultry Association time to time which are given under schedule (Table-4) during experiment.

Table 4. Schedule of vaccination for experimental broiler chicks.

Vaccines	Days	Routes
I.B + N.D	1 – 3	Eye Drops
IBD vaccine	10 - 12	Distal Water
H.P. Syndrome	16 - 17	S/C. (½ cc)
IBD vaccine	22	Distal Water
Newcastle disease (ND)	28	Distal Water

IV. RESULTS AND DISCUSSION

In current study, feed intake, live body weight, feed conversion ratio and nutrient digestibility was observed high in supplementation of phytase enzyme in different treatment groups as compare to control.

4.1. *Body Weight*

Analysis of variance showed that there were significant differences between the weight of birds amongst the four treatments ($P<0.01$). The results of body weight of birds were noted in treated groups which were supplemented of phytase enzyme compared with un-supplemented group A. The maximum chicken body weight was noted in group C, as compare to control group A. The average body weight was further decreased in group D and minimum in group A (control). The presence of *phytase enzyme* in group C diet recorded significantly ($P<0.05$) the maximum body weight gain Fig. 4 (A).

In instances where phytase enzyme is supplemented, the higher body weight gain may be attributable to an increase in P availability and, maybe feed intake [11]. According to [12], that the higher CP (crude protein) content may be due to greater content of crude fiber (CF), which may impair nutrient absorption and digestion

while the reduced weight gain of broilers fed the control diet group A may be ascribed to low crude protein content of the diet compared to other diets.

4.2. *Feed Intake*

The intake of feed was analysis in different groups of chicks the feed intake was maximum in group A, as compare to treatments groups. The average intake of feed was further decreased in group C. Feed intake was minimum in group C. The results showed that in group A feed intake was higher than group C, B and D, Fig. 4 (B). In view of investigation the visible increase in feed intake might be attributed to increased largeness of the feed and metabolizable energy concentration of the diets. In instances where phytase enzyme is added, to rise in P availability and, may be feed intake 11 According to [13] that unpalatability nature of a feedstuff will consequently inhibit chicks from consuming adequate quantity of the feed.

4.3. *FCR %*

The FCR of different groups were examined and the FCR was minimum in treatment group C and in group B was higher than treatments groups the non-significantly variance founded respectively, Fig. 4 (C). This was in agreement with the report by [14], that non-conventional feed stuff often decreases feed cost. This confirms that there is better economic gain by feeding Phytase enzyme to broilers since it has the potential of reducing feeding cost of broilers. This supports the conclusion of several researchers that leaf meal supplementation in poultry rations has been proved as means of reducing cost and improving profit margin.

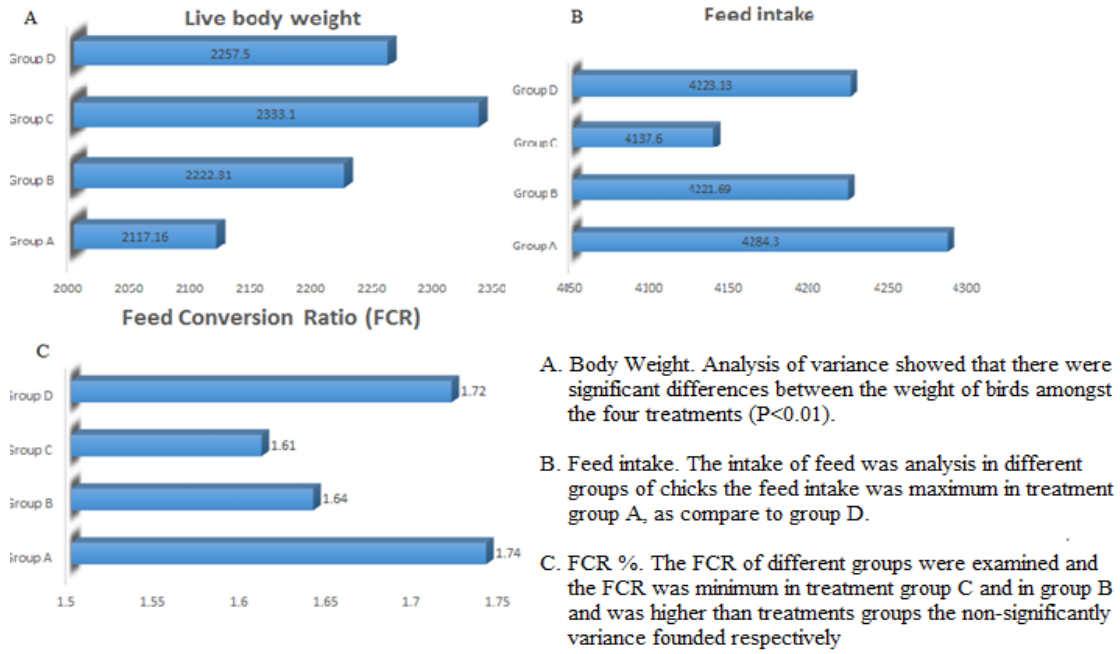

Fig. 4. (A) Body Weight, (B) Feed intake, (C) FCR % of broiler.

4.4. *Digestibility Percentage*

4.4.1. *Crude Proteins (%)*

The samples of feces were analyzed for CP digestibility results figure 5. The average crude proteins digestibility starter/finisher of control group (A) was 73.95/71.98%, it was increased in different groups when they supplied with Phytase enzyme on broiler feed. The average crude protein digestibility of treatment groups

B, C and D were 77.01/75.06%, 85.52/81.22% and 83.95/77.98% during starter and finisher phase. Statistically all four groups means were significantly different (starter/finisher) from one another.

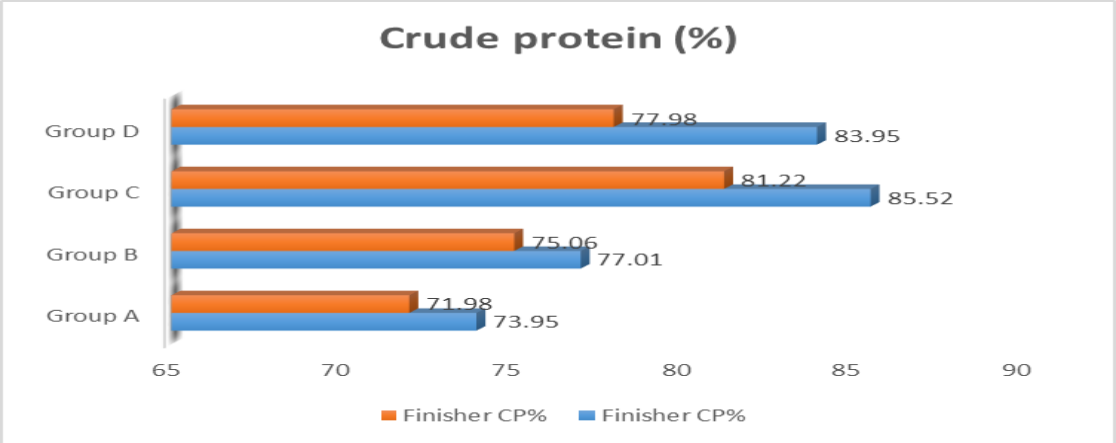

Fig. 5. CP% digestibility results Starter/Finisher.

4.4.2. *Metabolizable Energy (%)*

Metabolizable energy results are presented in figure. 6. The average metabolizable energy starter/finisher of control (A) group was 71.06/73.12, metabolizable energy was increased in different treated groups when supplied Phytase enzyme in feed of broiler.

The average metabolizable energy of different treatment groups B, C and D were (76.18/77.75, 82.81/81.44 and 79.44/78.44%. Statistically all four groups means were significantly different (starter/finisher) from one another. Metabolizable energy was increased in different groups when they had taken Phytase enzyme in broiler fed. The velocity at which the diet passes the digestive tract is a crucial digestion parameter, which differs on the basis of dietary fiber levels [16] Polyphenols have properties that may inhibit digestive enzymes and reduce digestibility [15]. Moreover, plant additives are assumed to have a positive impact on nutrient digestibility due to reduced competition for nutrients between the bird and its gut micro-flora.

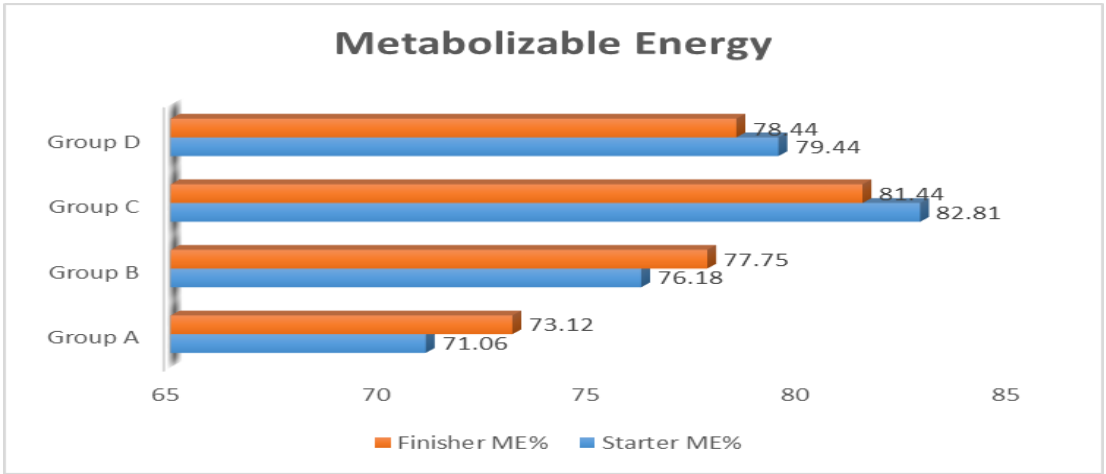

Fig. 6. ME% digestibility results Starter/Finisher.

V. CONCLUSIONS

From the present study, it was concluded that supplementation with 0.0075 g / kg phytase enzyme have better

effect on nutrient digestibility, live body weight gain, of broiler and shows good Feed conversion ratio.

VI. SUGGESTIONS

On the Basis of Conclusion it Could be Suggested:

For better nutrient digestibility conversion ratio, the broiler feed should be added with supplementation of 0.0075 g/kg Phytase enzyme.

Research may conducted to investigation the optimum dose of supplementary of 0.0075 g/kg phytase enzyme under different production system of avian birds.

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REFERENCES

[1] Ekenyem, B. U., & Madubuike, F. N (2001), Non-ruminant livestock production in the tropics. Gust Chucks Graphics Center, Owerri, Nigeria, 120-145.
[2] Pandey A, Szakacs G, Soccol C R, Rodriguez-Leon J A, Soccol V T. 2001. Production, purification and properties of microbial phytases. Review paper. Bioresource Technol. 77: 203-214.
[3] Classen, H. L., (1996). Successful application of enzymes relies on knowledge of the chemical reation to be affected and conditions under which the reaction will occur. Feed Mix 4: 22-28.
[4] Classen, H. l., M. R. Bedford. (1991). the use of enzymes to improve the nutritive value of poultry feed. In recent advances in animal nutrition. (eds. W. Haresign and D. J. A. Cole. Butterworth, London, pp79-102.
[5] Morgan, A.J. and M. R. Bedford. (1995). Advances in the development and application of feed enzymes. Australian Poultry Science Symposium 7: 109– 115.
[6] Adams, E.A. and R. Pough. (1993). Non-starch polysaccharides and their digestion in poultry. Feed Compounder 13: 19-21.
[7] Ward, N.E. (1995). With dietary modifications, wheat can be used for poultry. Feedstuffs 7 Aug, 1416.
[8] Simons, P.C.M. and H. A. J. Versteegh. (1991). Application of microbial phytase in poultry nutrition. Poultry Science 70: (Suppl. 1), 110.
[9] 3Lei X, Stahl C. (2001). Biotechnological development of effective phytases for mineral nutrition and environmental protection. Appl. Microbiol. Biotechnol. 57: 474-481.
[10] Yu B, Jan Y C, Chung T K, Lee T. T, Chiou P W S. 2004. Exogenous phytase activity in the gastrointestinal tract of broiler chickens. Anim. Feed Sci. Technol. 117: 295-303.
[11] Rao, S. V. R., Reddy, V. R. and Reddy, V. R. (1999). Enhancement of phytate phosphorus availability in the diets of commercial broilers and layers. Anim. Feed Sci. Tech. 79: 211 – 222.
[12] Onu, P.N and Otuma, M.O. (2008), "Utilization of heat-treated sheep dropping in the diets of broiler finisher chicks". International journal of Poultry science, 8 (10: 995 – 998.
[13] Omekam V.N (1994), Studies on nutrition and health implication of dietary inclusion of dried poultry waste for broiler. MSc Thesis, Federal University of Technology; Owerri, Nigeria 41.
[14] Issa, K.J., and Omar, J.M.A. (2012). Effect of garlic powder on performance and lipid profile of broilers. Open Journal of Animal Sciences, 2 (2): 62-68.
[15] Hernández, F., Garci´a, V. Madrid, J. Orengo, J. Catala´, P. and Megi´as, M.D. (2006). Effect of formic acid on performance, digestibility, intestinal histomorphology and plasma metabolite levels of broiler chickens. British Poultry Science, 47 (1): 50 – 56.
[16] Liu, N., Ru, Y.J. Tang, D.F. Xu, T.S and Partridge, G.G. (2010). Effects of corn distillers dried grains with solubles and xylanase on growth performance and digestibility of diet components in broilers. Animal Feed Science and Technology, 163: 260–266.

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