



Effect of phytase supplementation on production performance and economics of Kadaknath chickens

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ABSTRACT

Kadaknath is an important indigenous breed of poultry inhabiting vast areas of Western Madhya Pradesh mainly the Jhabua and Dhar districts. Since a long time, Kadaknath breed of poultry was reared by tribes and therefore through many generations of selection and fixation of genes some of the important breed characteristics had been established. The specialty of the breed is that the flesh and internal organs of this chicken are black in colour. It is also to be noted that it is the only black meat chicken breed of India. The meat and eggs are also reckoned to be a rich source of protein. These are slow growers, so for increasing the performance, many enzymes are used specially, phytase. In the present study, 120 chicks were divided into three groups and given Phytase @ 500 and 1000 IU/kg of feed with T0 group kept as control. The results for the growth performance, FCR and carcass characteristics were very encouraging and also the profitable in terms of economics.

Keywords: Carcass characteristics, Economics, FCR, Growth, Kadaknath, Phytase

Poultry development in India has made impressive progress during the last three decades evolving from backyard practices to a full-fledged commercial agro industrial business by the organized private sector. Backyard poultry requiring hardly any infrastructure set-up is a potent tool for upliftment of the poor. It has also been noticed that the demand for rural backyard poultry is quite high in tribal areas. Among the poor villagers, backyard poultry farming is an age-old practice where they keep mostly *desi*/indigenous birds which scavenge in the backyard and nearby field with very little healthcare and management.

Kadaknath (KN) is an important *desi* breed which has poor egg production, slow growth rate, smaller body size as well as late sexual maturity. There are three main varieties of Kadaknath breed, which are found in Dhar and Jhabua districts of Madhya Pradesh, and adjoining areas of Gujarat and Rajasthan, India. They are Jet black, Penciled and Golden Kadaknath. The Jet black adult males and females are black in colour, the Golden adult male and females were basically black in colour with Golden feathers on head and neck, whereas in Penciled variety adult male and female plumage was black with white feathers on neck. In all the three varieties, skin, beak, shanks, toes and soles of males and females were dark gray coloured, whereas tongue was of dark gray or light black colour. Comb, wattles and earlobes were light gray to dark gray coloured. In all the

three varieties of Kadaknath breed most of the internal organs exhibit intense black colouration which is due to the deposition of melanin pigment in the connective tissue of organs and in the dermis (Rao and Thomas 1984).

Kadaknath is well known indigenous bird for its black flesh called as 'Kalamashi' with low cholesterol and high protein, aphrodisiac properties, well adapted to hot climate and resistant to certain diseases. Even after all these characteristics, this breed has been neglected since very long because of its poor production potential. In recent trends, the use of certain enzymes like phytase, xylanase, beta glucanase, etc. in poultry rations for the improvement of the performance can also be applicable in Kadaknath breed (Valavan *et al.* 2019).

Kadaknath birds are in great demand now a days and are very costly. The birds require no extra care and housing which makes them suitable for landless labourers and marginal farmers. The Kadaknath breed reveals appreciable degree of resistance to diseases compared with other exotic breeds of poultry in their natural habitat. These birds are also resistant to extreme climatic conditions like summer heat and cold winter stress and thrive very well under adverse environment like poor housing, poor management and poor feeding (Thakur *et al.* 2006) and reproductive potential along with other traits as a pure breed.

Phytase is the most widely used feed enzyme in the world, included in 90% of poultry and 70% of pig-diets. Feed phytase was introduced to control phosphorus pollution and improve nutrient uptake (Cowieson *et al.* 2018). The dietary inclusion of phytase increases nutrient

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and energy bioavailability for broilers with better effect on performance, gastrointestinal pH, organ and bone composition, and blood biochemistry of broilers (De Souza *et al.* 2015). The conservation and systematic study of this breed using modern technologies is essential for the assessment of its genetic potential along with other traits as a pure breed.

However, due to very little information available regarding description, native breeding areas, morphological and productive traits of the Kadaknath breed of poultry, this work was taken into consideration. The objective of this experiment was to evaluate the influence of phytase supplementation on nutrient and energy bio-availability.

MATERIALS AND METHODS

A total of 120, day old Kadaknath chicks were purchased from local market. On arrival, the chicks were weighed and randomly distributed in three groups of 40 chicks each with four replicate in each group having 10 chicks in each replicate. The experiment was carried out for 90 days. The experimental birds were divided into three groups namely control group (T0), Treatment Groups T1 and T2 given standard ration along with phytase @ 500 IU and 1000 IU/kg feed. The birds were housed in deep litter system in thoroughly cleaned, whitewashed, disinfected, well ventilated and lighted rooms and were given grower and finisher ration as per standard. The experimental birds were vaccinated at appropriate time. The body weights of day old chicks were recorded on arrival. Weighed amount of ration was given every day in morning to all the treatment groups. The birds were offered *ad lib.* fresh and clean water throughout the day along with feed. All observations were analyzed by using ANOVA to compare different treatment group.

All the feed ingredients were purchased from the M.P. Livestock and Poultry Corporation, Indore. The broiler starter and finisher rations were prepared as per BIS (2012), having CP 23%, ME 2800 Kcal/kg and CP 20%, ME 2900 Kcal/kg, respectively. The following parameters were studied.

Weekly body weight: The individual birds were weighed at the end of each week and the total body weight gain per week was calculated by subtracting initial weight of bird by the final weight attained during the particular week.

Weekly cumulative feed consumption: Feed consumed in week = feed offered in week – residue left at the end of week.

Feed Conversion Ratio (FCR):

$$\text{FCR} = \frac{\text{Feed consumption (g)}}{\text{Body weight gain (g)}}$$

Carcass traits: At the end of experimental period edible carcass yield, thigh yield and breast yield were estimated. The meat : bone ratios of the thigh were estimated by taking weight of thigh muscles and femur bone. The length of intestine was measured by tape and the weight of intestine

was estimated in gram.

Economics of broiler production: Economics of the Kadaknath production is calculated on the basis of total expenditure and the total selling price for the chicks.

Statistical analysis: The data was subjected to analysis of variance (Snedecor and Cochran 1994) to compare different treatment groups among themselves and with control.

RESULTS AND DISCUSSION

At the end of the trial, the final body weight of the chicks was significantly increased ($P>0.01$) in treatment groups T1 and T2 as compared to the control group T0. The feed consumption decreased significantly ($P>0.05$) in T1 and T2 as compared to T0. The feed conversion ratio was better in both phytase supplemented groups T1 and T2 as compared to un-supplemented group 3.98 ± 0.25 (Table 1). The results of the present study were in accordance with the values reported by Prajapati (2010), Khan *et al.* (2018) and da Silva *et al.* (2019). As the Phosphorus is predominantly found in bound form as phytic acid (*myo*-inositol 1, 2, 3, 4, 5, 6-hexakis (dihydrogen phosphate; InsP6) and its salt is called as phytate present in most of the plant seeds (Rodehutsord *et al.* 2017). The release of inorganic phosphorus from the bound form phytate molecule is done by phytases (*myo*-inositol hexaphosphate phosphohydrolases) or phosphatases. Along with their P-releasing effect, phytases also increased protein, energy, and trace mineral utilization especially the di and tri-valent ions in poultry by reducing its anti-nutritional effects (Selle *et al.* 2009). However, these effects were not consistent among studies. Supplementing increasing levels of phytase to a corn and soybean meal-based diet with inorganic-P and Calcium reduction improved daily weight gain and feed intake of growing pigs, and such effects were maintained until slaughter age. Phytase enzyme is beneficial for weight gain in broilers. Rations supplemented with phytase increase weight gain, making feed to be efficiently utilized. This has been proved by a number of researchers. Phytase supplementation regardless of Calcium levels, increased body weight gain, feed intake and feed efficiency (Almeida *et al.* 2013, Cowieson *et al.* 2017, da Silva *et al.* 2019). This may be due to increase in the enzyme activity, necessary for growth by causing better feed utilization in the gastrointestinal tract and released minerals for growth (Rajpoot 2009). Protein utilization and amino acid absorption may also be influenced by dietary phytic acid

Table 1. Effect of phytase enzyme on body weight, feed intake, feed conversion ratio in different treatments of Kadaknath birds (Mean $\pm$ SE)

Parameter	T0 (control)	T1	T2
Body weight	672.55 ^a $\pm$ 4.93	786.70 ^b $\pm$ 2.75	913.40 ^c $\pm$ 5.05
Feed intake	2677.67 ^a $\pm$ 3.48	2593.43 ^b $\pm$ 2.92	2470.26 ^c $\pm$ 3.21
Feed conversion ratio	3.98 ^a $\pm$ 0.25	3.30 ^b $\pm$ 0.12	2.70 ^c $\pm$ 0.14

Table 2. Effect of phytase on carcass parameters in different treatments of Kadaknath birds (Mean $\pm$ SE)

Parameter	T0	T1	T2	
Edible carcass yield (g)	279.20 ^a $\pm$ 2.64	309.09 ^a $\pm$ 3.53	384.00 ^b $\pm$ 2.27	**
Breast yield (g)	128.75 ^a $\pm$ 2.28	154.25 ^a $\pm$ 1.79	172.05 ^b $\pm$ 2.19	**
Thigh yield (g)	65.23 ^a $\pm$ 0.91	78.50 ^b $\pm$ 1.04	90.42 ^c $\pm$ 1.70	**
Intestinal length (cm)	131.01 ^a $\pm$ 0.40	123.52 ^b $\pm$ 0.65	119.26 ^b $\pm$ 0.47	**
Weight of intestine (g)	67.50 ^a $\pm$ 0.28	61.75 ^b $\pm$ 0.85	59.25 ^a $\pm$ 0.47	**
Meat weight (g)	38.65 ^a $\pm$ 0.75	46.25 ^{ab} $\pm$ 0.85	59.82 ^b $\pm$ 1.82	**
Bone weight (g)	16.05 ^a $\pm$ 0.85	17.45 ^b $\pm$ 0.85	18.79 ^a $\pm$ 0.91	*
Meat bone ratio	2.41 ^a $\pm$ 0.23	2.65 ^b $\pm$ 0.22	3.18 ^c $\pm$ 0.31	**

levels (Lehnen *et al.* 2011, Walk *et al.* 2012, 2014).

There was a significant increase in the carcass parameters after phytase supplementation in the feed of Kadaknath. All carcass parameters like edible carcass yield, breast yields, thigh yield, meat weight, bone weight, and meat bone ratio were significantly increased ($P>0.01$) and the performance of bird was very good in both the supplemented groups, especially in T2 group as compared to the un-supplemented group. The intestinal length and intestinal weight were decreased significantly (Table 2). The diets with phytase addition reduced the pH of gizzard and proventriculus. Dietary Calcium and Phosphorus increased relative liver and heart weights. The bones of broilers fed phytase-supplemented diets presented higher ash content (Lehnen *et al.* 2011, Walk *et al.* 2014).

Total expenditure per bird in 90 days for groups was lower in T1 and T2 than T0, and total selling price was more in case of T1 and T2 groups, respectively (Table 3). From this calculation we found that group T2 was very much profitable as compared to T1 and control groups.

From the present study, it was concluded that supplementation of phytase in Kadaknath feed had very good effect on production, growth, feed conversion ratio, availability of protein, calcium, phosphorus, and certain other bivalent and trivalent ions, especially at the level of

Table 3. Effect of phytase on economics of Kadaknath production

Cost (₹)	T0	T1	T2
Total feed cost/ bird	80.33	77.82	74.11
Chicks cost/ bird	50.00	50.00	50.00
Electricity cost/ bird	10.00	10.00	10.00
Vaccines and Medicines/ bird	7.00	7.00	7.00
Management cost/ bird	10.00	10.00	10.00
Total expenditure/ bird	157.33	154.82	151.11
Total selling price/ bird	235.39	275.35	319.69
Profit/ bird	78.06	120.53	168.58

1000 IU in diets of Kadaknath. Supplementation of Phytase @1000 IU level is more economical than normal feed. It is more economical and profitable to the farmers as there was no addition of costly feed additives in the ration of Kadaknath birds, so it is concluded that phytase supplementation is beneficial for the growth of native breeds which are slow growers and also improve the socio-economic conditions of the marginal and poor farmers.

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