Journal of Animal Research: v.6 n.5, p. 961-965. October 2016

DOI: 10.5958/2277-940X.2016.00125.X

Effect of Xylanase Enzyme in Diets on Performance of Kadaknath Birds

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Received: 15 July, 2016 **Accepted:** 10 September, 2016

ABSTRACT

Kadaknath is well known for having black flesh, aphrodisiac properties, adaptability to hot climate and resistant to certain diseases. Although this breed has many unique characteristics, it has been neglected because of its poor production potential. In recent trends, the higher use of single activity enzymes like xylanase in commercial poultry feed for improving their performance can also improve performance in Kadaknath breed. Efforts for attaining higher body weight in short duration is still a subject of research for this breed. An experiment of ninety days was conducted with total one hundred Kadaknath chicks which were randomly divided into two equal groups with five replicates and each replicate consisted of 10 chicks. Experimental control diet (T_0) is based on BIS (2007) for broilers and treatment diet T_1 was supplemented with 0.1 kg/ton xylanase enzyme with reducing dietary ME and CP. The cost of experimental diets was worked out after considering the cost of ingredients and cost of enzyme supplementation. The average body weight, feed consumption, FCR and EI were not significantly (P>0.05) different in both treatments. Dry matter and crude fibre digestibility were observed significantly (P>0.05) higher in T_1. There was no effect of treatment on carcass traits. The profit per bird was recorded higher in xylanase enzyme supplemented group. In the above study, it was concluded that the growth performance was improved in xylanase enzyme supplemented group in comparison to control group. Supplementation of xylanase enzyme was more profitable in rearing of Kadaknath birds.

Keywords: Kadaknath, xylanase enzyme, growth, profitability

India is home to nineteen breeds of indigenous fowl along with various exotic-indigenous and inter-exotic crosses. Small farming families, landless laborers and people with income below the poverty line are able to raise chickens with low inputs and harvest the benefits as eggs and meat via scavenged feed resources (Khan, 2008). Out of many indigenous poultry breeds one well-known native breed is “Kadaknath” or “Kalamasi” meaning a fowl having black flesh. It is native of Jhabua district of Madhya Pradesh. In all the varieties of Kadaknath most of the internal organs exhibit intense black coloration, which is due to the deposition of melanin pigment in the connective tissue of the organs and in the dermis (Rao and Thomas, 1984). The bird is very popular due to its special capabilities such as adaptability to local environment, resistance to certain diseases, meat quality and many other criteria specific to breed type (Rao and Thomas, 1984). Mohan *et al*. (2008) reported that the meat of the Kadaknath breed contains a high percentage (25.47 %) of protein and is believed to have aphrodisiac properties. Although the Kadaknath breed has many unique characteristics, it has been neglected because of its poor production potential. Kadaknath is reared by most of the tribes in backyard system of farming without any vaccination and hygiene. It is offered only kitchen waste and small amount of grains, therefore it’s growth rate is very low and mortality rate is high. The Kadaknath breed has a lower body weight and average value of 1,303 ± 26.39 g and 1,555.50 ± 21.04 g, respectively has been reported at 21 weeks and 52 weeks of age (Mohan *et al*., 2008). Mondal *et al*. (2007) reported that Kadaknath × Brown Cornish cross attained maximum body weight (1023 g) in 10 weeks. Efforts for attaining higher body weight in short duration is still a subject of research for this breed.

At present the nutrient requirements of Kadaknath is not well established. Central Avian Research Institute (CARI)

and other National poultry organizations recommend same Bureau of Indian Standard (BIS) diet for all indigenous breeds which do not correlate with the performance of individual breed. In recent trends, the higher use of enzymes in commercial poultry feed for improving their performance can also improve performance in Kadaknath breed (Panda *et al.*, 2012).

Proven benefits of feed enzymes include improved feed efficiency, reduced feed cost, improved digestion and absorption of nutrients, improved uniformity within flocks and better maintenance of gut health (Barletta, 2010). Supplementing the feed with specific enzyme improves the nutritional value of feed ingredients, increasing the efficiency of digestion. Feed enzymes help in breakdown of anti-nutritional factors (e.g. fibre, phytate) that are present in many feed ingredients. Use of exogenous xylanase has two well documented benefits, firstly releasing encapsulated nutrients such as starch and protein from the cells and secondly reducing the viscosity of the digesta, both leading to improvement in digestibility (Choct, 2006 and Mirzaie *et al.*, 2012). The breakdown of non-starch polysaccharides by xylanase can also have a beneficial effect on the gut microflora by creating conditions that encourage beneficial bacteria through reduction in viscosity and production of small oligomers that can be used by the beneficial bacteria in the lower gut (Bedford, 2000).

Kadaknath is a bird of choice and is having a better market value as compared to other birds. Therefore, their production in short duration is biggest challenge for Indian poultry nutritionist. Since this is a slow growing breed, this type of work becomes a need for today. Higher acceptability of specific enzymes such as xylanase in commercial poultry farming is because of their positive effect on growth performance resulting in to a short duration for optimum growth of broilers. The similar effect can be expected in indigenous bird like Kadaknath because this breed is adopted to different climatic condition of India.

MATERIALS AND METHODS

Total one hundred straight run, day old Kadaknath chicks belonging to same hatch were weighed individually and randomly distributed into two treatment groups. Each group consisting of five replicates of ten chicks each. The chicks were housed in deep litter system. Corn-soybean meal based feed was formulated for broiler using BIS (2007) and analyzed for proximate nutrients (AOAC, 2012) which are presented in Table 1.

Table 1: Composition and quantities of feed ingredients and additives kg per ton in the rations

	T_0			T_1		
Ingredients	**Pre starter**	**Starter**	**Finisher**	**Pre starter**	**Starter**	**Finisher**
Maize	568	575	613	596	612	650
Soybean meal	340	318	268	327	303	253
Calcite	6	6	6	11	6	6
Di calcium phosphate	4	4	5	4	4	5
Meat & Bone meal	50	50	50	50	50	50
Oil	19	35	46	0	13	24
DL-Methionine	1.8	2.1	2.1	1.8	2.1	2.1
L-Lysine	0.9	0.4	0	1.1	0.6	0
Soda Bicarbonate	1	1	1	1	1	1
Salt	2.5	2.5	2.5	2.5	2.5	2.5
Trace Minerals	1.25	1.25	1.25	1.25	1.25	1.25
Vitamin Premix	0.6	0.5	0.5	0.6	0.5	0.5
Acidifiers	1	1	1	1	1	1
Antioxidant	0.1	0.1	0.1	0.1	0.1	0.1
Herbal choline	1	1	1.2	1	1	1.2
Liver tonic	0.4	0.4	0.4	0.4	0.4	0.4
Betaine	0.5	0.5	0.5	0.5	0.5	0.5
Emulsifier	0.5	0.5	0.5	0.5	0.5	0.5
Toxin Binder	1	1	1	1	1	1
Antidiarrheal	0.25	0.25	0.25	0.25	0.25	0.25
Xylanase	0	0	0	0.1	0.1	0.1
TOTAL	1000	1000	1000	1000	1000	1000
Chemical composition of rations						
Crude Protein (%)	22.96	21.94	20.06	22.61	21.56	19.43
ME (Mcal/ Kg)*	3.00	3.1	3.2	2.9	3	3.1

Calorie protein ratio*	130.43	140.91	160	128.04	138.57	157.76
Crude Fibre (%)	3.75	3.63	3.45	3.71	3.69	3.42
Ether extract (%)	4.43	5.98	7.14	2.61	3.87	5.05
Amino acids						
Lysine* (%)	1.3	1.2	1.03	1.29	1.19	1
Methionine* (%)	0.53	0.55	0.52	0.54	0.55	0.53
Minerals						
Calcium* (%)	1	1	1	1.14	1	1
Avail. phosphorus* (%)	0.45	0.45	0.45	0.45	0.45	0.45

* Calculated values

The duration of the experiment was three months. The standard pre-starter mash (0-15 days), starter mash (16-45 days) and finisher mash (45 days to 90 days) feed were provided *ad libitum* to all the birds using BIS (2007) along with clean drinking water. A weighed quantity of feed was offered to each group of birds two times a day. The feed left over were collected and weighed at fortnightly interval to arrive at fortnightly feed consumption of each group. Experimental control diet (T_0) for pre starter, starter and finisher birds consisted of maize, soybean meal and feed additives based on BIS (2007) for broilers. Treatment diet one (T_1) was supplemented with 0.1 kg/ ton xylanase enzyme (min. 16000 bxu/kg) with reducing dietary ME 100 Kcal/kg and 1.75% CP. The cost of all the experimental diets were worked out after considering the cost of ingredients, supplements and cost of enzyme supplementation.

The average body weight gain, average feed intake, feed conversion ratio and efficiency index were recorded fortnightly. A metabolic trial was conducted during 6^{th} fortnight of growth period for analysed nutrients digestibility. Five birds per treatments were slaughtered after six fortnights of age to study the carcass yield. The data generated through the experimental period were subjected to statistical analysis by General Linear Models (GLM) procedure of the Completely Randomized Design to study the effect of treatment on various parameters (Snedecor and Cochran, 1994).

RESULTS AND DISCUSSION

The data regarding overall growth are presented in Table 2. The growth parameters include body weight, feed consumption, feed conversion ratio and efficiency index were not significantly different ($P > 0.05$) among both treatments.

Table 2: Overall growth of experimental birds

Treatment	T_0	T_1
Body weight (g)	901.67± 166.32	867.00± 53.83
Feed consumption (g)	2785.10± 348.75	2627.80± 129.23
FCR	3.18± 0.32	3.12± 0.35
EI	277.03±31.44	295.79±44.15

Note: Means with in column bearing different superscripts differ significantly ($P < 0.05$)

Each value is a mean of five replicates

However, numerically improved FCR and EI were recorded in xylanase enzyme supplemented group. It may be due to supplementation of single activity xylanase enzyme which compensate reduced level of energy and protein in the diets of T_1 in comparison to T_0. The above results are in agreement with the findings of other researchers (Zanella *et al.,* 1999, Mathlouthi *et al.,* 2002, Abou El-wafa *et al.,* 2013 and Stefanello *et al.,* 2015) who conducted the experiments on different age groups of broiler chicks with single activity xylanase with reducing level of energy and protein in comparison to basal diet and found similar non significantly ($P > 0.05$) different results between groups. It might be due to the fact that reduced energy and crude protein have been compensated by xylanase supplementation for improving nutrient digestibility. Abou El-wafa *et al.* (2013) concluded that xylanase enzyme (16000 u/kg) added to corn-soybean meal based diet could reduce the dietary energy level about 100 kcal/kg, as no significant ($P > 0.05$) difference in growth performance was observed. Odetallah *et al.* (2005) also reported non-significant ($P < 0.05$) differences in feed consumption among the control and enzyme treatment groups. Kocher *et al.* (2003) reported non-significant FCR in an experiment with xylanase supplemented diet in low energy group in comparison to control. The result obtained during metabolic trial for nutrient utilization are presented

in Table 3. The dry matter and crude fibre digestibility was recorded significantly (P > 0.05) higher in xylanase enzyme supplemented group. However, numerically improved crude protein and ether extract digestibility were observed in xylanase enzyme supplemented group.

Table 3: Average nutrient utilization (%) of experimental birds

Treatment	T_0	T_1
Dry matter	59.91^{b}±4.18	64.80^{a}±3.55
Crude protein	48.04±10.12	49.49±7.69
Crude fibre	30.89^{b}±10.10	40.76^{a}±7.85
Ether extract	51.65±11.45	54.54±17.28

Note: Means with in column bearing different superscripts differ significantly (P < 0.05)

Each value is a mean of five replicates

Nian *et al.* (2011) added xylanase in corn/soy-based diet and found no significant (P < 0.05) effect on hemicellulose digestibility. However, hemicellulose digestibility value was numerically increased by 6.6 percentage. The result of carcass traits including dressing, eviscerated and drawn percentage is presented in table 4. There were no significant (P > 0.05) differences recorded in between treatments for dressing, eviscerated and drawn percentage. However, numerically higher carcass traits were recorded in xylanase enzyme supplemented group.

Table 4: Carcass traits (%) of experimental birds

Treatment	T_0	T_1
Dressing percentage	68.43±0.85	69.27±0.94
Eviscerated percentage	52.49±0.73	53.83±1.78
Drawn percentage	57.47±0.59	58.82±1.45

Note: Means with in column bearing different superscripts differ significantly (P < 0.05)

Each value is a mean of five replicates

The economics of feeding Kadaknath birds with xylanase enzyme is presented in table 5. The total cost of production in T_0 and T_1 were recorded as ₹ 102.75 and 96.09, respectively whereas the profit per bird in T_0 and T_1 were observed as ₹ 167.76 and 164.01, respectively. The lower cost of production and higher profit per bird were recorded in xylanase enzyme supplemented group. It might be attributed to compensation of nutrient digestibility of reduced energy and protein which is responsible for almost similar performance as in control group.

Table 5: Economics of experimental birds

Treatments				T_0	T_1
Chick cost			(₹)	30	30
Feed intake and cost of feed/bird	0-2 weeks	Feed intake	(g)	136	137
		Feed cost	(₹)	22.45	21.37
	3-6 weeks	Feed intake	(g)	956.37	938.45
		Feed cost	(₹)	22.77	21.56
	7-12 weeks	Feed intake	(g)	1692.66	1552.37
		Feed cost	(₹)	22.4	21.21
Total feed cost			(₹)	62.75	56.09
Other expenditure***			(₹)	10	10
Total production cost*			(₹)	102.75	96.09
Live wt at 90 days of age			(g)	901.67	867
Gross return **			(₹/ bird)	260.10	270.50
Profit			(₹/ bird)	164.01	167.76
Profit			(%)	163.27	170.69

* Production cost includes chick cost and total feed cost only.

** Birds sold @ ₹ 300/kg live weight.

***Other expenditure include supplementation cost and miscellaneous expenditure.

CONCLUSION

On the basis of the results of this study, it can be concluded that the growth performance was improved in xylanase supplemented group in comparison to control group. Nutrient utilization was also improved by inclusion of xylanase enzyme but carcass traits were not affected by inclusion of enzyme. Inclusion of enzyme supplementation in rations containing reduced ME and CP % as compare to control diet, improved performance. supplementation of xylanase was more profitable in rearing of Kadaknath birds. This experiment proves that the effect of xylanase is similar in Kadaknath birds as they are found in commercial broiler chicken.

ACKNOWLEDGMENTS

The authors are thankful to Dr. Laxmi Chauhan, Assistant Professor, Department of Poultry Science, Mhow for providing necessary facilities and guidance to conduct the research work.

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