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Effect of Exogenous Enzyme in Diet on Broiler Performance

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Abstract: A total of 144 day-old straight run Arbor Acres broiler chicks were fed on 4 iso-nitrogenous and iso-energetic diets; starter control contained 22.1% CP and 2924 Kcal/kg ME and finisher control had 19.25% CP and 3005 Kcal/kg ME. In three test diets exogenous Alquerzim (1g/kg), Roxazyme-G (0.01g/kg) and Feedzyme (0.05g/kg) were supplemented to control diet to observe whether addition exogenous enzyme improves efficiency of broiler production. The growth rate, feed intake, feed conversion, dressing yield and profitability were increased by addition of exogenous enzymes. The addition of enzyme is effective to overcome antinutritive effect of NSP on broiler performances. Enzyme had no effect on survivability. Roxazyme-G and Feedzyme are more profitable than Alquerzim. Therefore, it may be concluded that exogenous enzyme may be used in broiler diet by proper selection of enzyme to get best result.

Key wards: Exogenous enzyme, Broiler, Growth rate, Feed in take, F.C.R., Dressing yield

Introduction

Broiler diet is predominantly composed of plant materials, mainly cereals and vegetable proteins plus little amount of animal protein. Most of the feed ingredients contain non-digested part (Cellulose, xylose arabinose, galactonic acid) and some anti-nutritive factors which inhibit feed utilization and birds performance, Recently, a series of studies by Annison (1991) and Choct and Annison (1990, 1992a) demonstrated that pentosans affect the metabolizable energy value of wheat. Pentosans are comprised principally of arabinoxylans, which are linked to other cell wall components. Soluble arabinoxylans are able to absorb up to 10 times their own weight of water, forming highly viscous solutions. Choct and Annison (1992b) confirmed that it is the viscosity of the arabinoxylan that exerts their anti-nutritive activity. The anti-nutritive effect is manifested by depressed nutrient utilization accompanied by poor growth. These adverse effect can be overcome by supplementation of exogenous carbohydrase (Xylanase) enzymes which have been shown to lower viscosity of intestinal contents and to improve digestibility of starch, protein, fat and AME in broiler fed on diets containing wheat (Annison and Choct, 1991; Bedford, 1995). Moreover, studies with intestinal digesta confirmed that protein was linked to the viscous gels and combined action of proteolytic and pentosanase enzymes lead to a higher reduction of intestinal viscosity than that from pentosanase alone (Finfeed, 1991). Some feed stuffs also contain small amount of tannins which bind with protein (Oh *et al*., 1980) inhibit digestive enzyme (Tamir and Alumot, 1969) and reduce feed intake by virtue of its astringent effect (Burns and Cope, 1974). Pillai *et al*. (1995) reported that 0.2% protease supplementation to low tannin diets may prove beneficial. So, the supplementation of protease enzyme has been suggested to compensate the digestibility losses due to enzyme inhibition. Already some mixed enzymes such as Alquerzim, Roxazyme-G, Feedzyme etc. produced by different pharmaceutical companies are available in Bangladesh. The poultry farmers do not know the comparative efficacy of these enzymes. So, it is very important to study their efficacy on broiler performance.

Table 1: Composition of different mixed enzymes

Name of the enzyme	Amounts		
	Roxazyme-G (IU/kg)	Alquerzim (mg/g)	Feedzyme (IUB/kg)
Alpha amylase	Trace		3.2.1.1
Neutral proteinase	Trace		3.4.24.28
Beta Glucanase	18000000		3.2.1.6
Pentosanase			3.2.1.8
Pepsin		50	
Pancreatin		100	
Lipase		10	
Cellulase	8000000	20	
Xylanase	26000000		
Hemicellulose	Trace		
Pectinase	Trace		

Materials and Methods

The experiment was conducted at the Bangladesh Agricultural University, Mymensingh, with 144 day-old commercial broilers (Arbor acres). The research was carried out to investigate the effect of the supplementation of three different mixed enzymes (Alquerzim, Roxazyme-G and Feedzyme) in diet on body weight, feed intake, feed efficiency, mortality dressing percentage and cost of broiler production. The composition of these enzymes is given in Table 1.

Total birds were divided into four equal groups and were assigned to four dietary treatments. Each diet was fed

Table 2: Percent of ingredient used in broiler starter diets

Feed ingredient	Control diet (CD) without enzyme	CD + Alquerzim	CD +Roxazyme	CD + Feedzyme
Maize	44	44	44	44
Rice polish	20	20	20	20
Til oil cake	4	4	4	4
Soybean meal	22	22	22	22
Protein concentrate (LNB)	5.5	5.5	5.5	5.5
Meat and bone meal	4.0	4.0	4.0	4.0
Salt	0.5	0.5	0.5	0.5
Vitamin-mineral premix*	+	+	+	+
Enzyme**	-	+	+	+
Total	100	100	100	100
Calculated composition				
ME Kcal/kg	2924	2924	2924	2924
CP (%)	22.16	22.16	22.16	22.16
Ca (%)	1.13	1.13	1.13	1.13
Available P (%)	0.58	0.58	0.58	0.58
CF (%)	4.98	4.98	4.98	4.98
Lysine (%)	1.19	1.19	1.19	1.19
Methionine (%)	0.45	0.45	0.45	0.45

* Added vitamin-mineral premix @ 2.5g/kg, ** Added enzyme @ recommended level of manufacturer

Table 3: Percent of ingredient used in broiler finisher diets

Feed ingredient	Control diet (CD) without enzyme	CD + Alquerzim	CD +Roxazyme	CD + Feedzyme
Maize	52	52	52	52
Rice polish	20	20	20	20
Til oil cake	5.5	5.5	5.5	5.5
Soybean meal	14.0	14.0	14.0	14.0
Protein concentrate (LNB)	4.0	4.0	4.0	4.0
Meat and bone meal	4.0	4.0	4.0	4.0
Salt	0.5	0.5	0.5	0.5
Vitamin-mineral premix*	+	+	+	+
Enzyme**	-	+	+	+
Total	100	100	100	100
Calculated composition				
ME Kcal/kg	3005	3005	3005	3005
CP (%)	19.25	19.25	19.25	19.25
Ca (%)	1.004	1.004	1.004	1.004
Available P (%)	0.52	0.52	0.52	0.52
CF (%)	4.7	4.7	4.7	4.7
Lysine (%)	0.98	0.98	0.98	0.98
Methionine (%)	0.41	0.41	0.41	0.41

* Added vitamin-mineral premix @ 2.5g/kg, ** Added enzyme @ recommended level of manufacturer

to 36 birds with three replications (R_1R_2 and R_3) and 12 birds were randomly placed in each replication. In accordance with the treatment groups of the experimental birds, all diets were formulated for two phases (starter and finisher diet). The amount of feed ingredients and nutrient requirement were same in all diets but different in supplementation of mixed enzyme. One diet had no enzymes which was called control diet. But, another three diets contained three different mixed enzymes i.e. Alquerzim, Roxazyme-G and Feedzyme at level of 1g/kg, 0.1g/kg and 0.5g/kg (Recommended level of manufacturer) respectively. Special care was taken for proper mixing of enzyme in experimental diet. The nutrient requirement (ME, CP, Ca, P, EE, CF Lysine, Methionine, Cystine and Tryptophan) were satisfied as per requirements as recommended for broiler (BSTI, 1988). The detailed composition of different experimental ration is shown in Table 2 and 3.

Table 4: Growth performance of broilers on different dietary enzymes

Variable	Age (day)	Dietary Enzyme				SED (LSD) and significance
		D_1	D_2	D_3	D_4	
	Day old	44.72	45.04	45.00	45.00	0.208^{NS}
Live weight (g/bird)	14	179.5^{b}	205.8^{a}	205.6^{a}	203.9^{a}	0.527*
	28	656.9^{b}	704.2^{a}	715.3^{a}	712.5^{a}	9.74**
	42	1371.0^{b}	1525.0^{a}	1563.0^{a}	1519.0^{a}	7.75**
Feed intake (g/bird)	14	403.0	411.0	417.0	410.0	8.08^{NS}
	28	1556.0^{c}	1572.0^{b}	1596.0^{a}	1578.0^{a}	12.76**
	42	3271^{b}	3310^{a}	3332.0^{a}	3298.0^{a}	35.43**
FCR (Feed; Weigh gain)	14	2.64^{a}	2.56^{bc}	2.54^{c}	2.58^{b}	0.0274**
	28	2.54^{a}	2.39^{b}	2.37^{b}	2.36^{b}	0.0866**
	42	2.47^{a}	2.24^{b}	2.19^{c}	2.24^{b}	0.0274**
Survivability (%)	14	100.00	100.00	100.00	100.00	No death
	28	100.00	100.00	100.00	100.00	of births
	42	100.00	100.00	97.22	97.22	2.28^{NS}

NS-Non Significant, * P<05, ** P<0.01, Figures in the same row containing superscript with similar alphabet do not differ significantly. Where, D_1 = Control diet (CD) without enzyme, D_2 = CD + Alquerzim, ,D_3 = CD + Roxazyme ,D_4 = CD + Feedzyme

The experimental birds were exposed to similar care and management in all treatment groups throughout the experimental period. The birds were reared on floor by providing a floor space of 1000 cm^2/bird fresh and dry rice husk was used as litter at a depth of about 4-5cm. The birds were exposed to 23 hours of lighting and a dark period of 1 hr per day throughout the experimental period. Body weight, body weight gain, feed intake, survivability and dressing data of birds were recorded to calculate the feed conversion efficiency and other factors. All data were analyzed statistically using analysis of variance technique with the help of computer package MSTAT software (Freed, 1992). All parameters were analyzed following CRD and the meat yield parameters were for a 2 (sex) × 4 (diet) factorial experiment in CRD. Least significant differences (LSD) of all data were calculated to compare variation among treatment where ANOVA showed significant differences among means.

Results and Discussion

Performance of broiler: The effect of different exogenous enzymes in diet on performance of broiler at different age is shown in Table 4. The result gives an impression that enzymes significantly increases live weight, feed intake and feed efficiency (P<0.01). Broiler fed on enzymatic diets had a tendency to convert efficiently to live weight than control diet (without enzyme). But all these parameters among three enzymatic diets (Alquerzim, Roxazyme-G and Feedzyme diet) did not differ significantly (P>0.05). Among of three enzymes, Roxazyme-G was the best performer followed by Alquerzim and Feedzyme. Enzyme supplementation, however did not influence survivability of broilers, Feed cost (Tk/kg boiler) was the highest in diet containing Alquerzim and followed by Roxazyme-G, Feedzyme and control diet. But profit (Tk/kg broiler) was increased (P<0.01) by the addition of enzyme. Among all diets, profit (Tk/kg broiler) was the highest on Roxazyme-G diet followed by those of Feedzyme, Alquerzim and control diet.

Increased live weight by addition of enzymes found fully agree with many previous findings (Richter *et al.*, 1999; Augelovicova and Michalik, 1997; Al Bastany, 1996; Salobir *et al.*, 1995). They concluded that improved feed utilization for exogenous enzyme was responsible for increased live weight in broiler on similar level of dietary nutrient concentration. Increased feed intake on diet with exogenous enzymes was recorded for broilers than control diet coinciding with Daveby *et al.* (1998); Augelovicova and Michalik (1997); Leeson *et al.*, 1996; Pettersson and Aman (1992, 1989). They suggested increased digestibility of nutrients and partial degrading of cell wall of feed as reasons for increased feed intake on enzymatic diet. On the other hand this result does not agree with the findings of Samarasinghe *et al.* (2000); Richter *et al.* (1995); Ranade and Rajmane (1992); Kadam *et al.* (1991). They found that feed intake decreased by addition of enzymes due to birds fulfill their nutrient requirement by taking less amount of feed. Feed conversion of broiler was better fed on enzymatic diet than control. This finding is supported by Brenes *et al.* (1993); Augelovicora and Michalik (1997); Schutte *et al.* (1995); Ranade and Rajmane (1992); Mohammed (1995); Al Bustany (1996); Scott *et al.* (1997). They reported that feed conversion was increased due to better feed utilization by birds. Exgenous enzymes had no effect on survivability. This result coincides with the findings of Pillai *et al.* (1995) who found that survivability was similar in control and enzyme treated groups.

It was evident that feed cost/kg broiler was reduced for

Table 5: Cost return analysis of broilers on different dietary enzymes at 42 days of age

Variable	Age (day)	Dietary Enzyme				SED (LSD) and significance
		D_1	D_2	D_3	D_4	
Cost per kg diet	28	11.87	13.87	12.27	12.17	-
(Tk.)	42	11.13	13.13	11.53	11.43	-
Feed cost (Tk./kg broiler)	42	27.44^{b}	29.37^{a}	25.50^{c}	25.56^{c}	(0.646**)
Total cost (Tk./kg broiler)	42	51.04^{a}	50.49^{a}	46.05^{b}	46.92^{b}	(1.392**)
Sale (Tk./kg broiler)	42	62.00	62.00	62.00	62.00	-
Profit (Tk./kg broiler)	42	10.96^{b}	11.51^{b}	15.95^{a}	15.08^{a}	(1.392**)

** P<0.01, Figures in the same row containing superscript with similar alphabet do not differ significantly. Where, D_1 = Control diet (CD) without enzyme, D_2 = CD + Alquerzim, D_3 = CD + Roxazyme, D_4 = CD + Feedzyme

Table 6: Dressing yields characteristics of broilers on different dietary enzymes

Variable	Sex	Dietary Enzyme				Mean	SED (LSD) and significance		
		D_1	D_2	D_3	D_4		D	S	D x S
Dressing	M	64.31	71.45	71.33	70.08				
yield (%)	F	63.10	71.90	72.19	70.75	69.39	(1.754**)	0.4246^{NS}	0.849^{NS}
Mean		63.71^{b}	71.67^{a}	71.76^{a}	70.42^{a}				
Blood wt. (%)	M	3.62	3.79	3.68	3.83				
	F	3.64	3.81	3.74	3.91	3.75	(0.1847**)	0.044^{NS}	0.089^{NS}
Mean		3.63^{b}	3.80^{ab}	3.71^{ab}	3.87^{a}				
Shank wt. (%)	M	4.44	4.63	4.59	4.68				
	F	4.36	4.58	4.70	4.56	4.57	0.102^{NS}	0.0718^{NS}	0.144^{NS}
Mean		4.40	4.61	4.65	4.62				
Liver wt. (%)	M	2.20	2.41	2.44	2.46				
	F	2.13	2.33	2.40	2.42	2.35	(0.1192**)	0.0288^{NS}	0.0577^{NS}
Mean		2.17^{b}	2.37^{a}	2.42^{a}	2.44^{a}				
Gizzard wt. (%)	M	2.46	2.56	2.57	2.54				
	F	2.53	2.48	2.52	2.53	2.53	0.0316^{NS}	0.0223^{NS}	0.0447^{NS}
Mean		2.49	2.52	2.55	2.54				
Head wt. (%)	M	2.81	2.82	2.84	2.81				
	F	2.82	2.77	2.83	2.83	2.82	0.0316^{NS}	0.0223^{NS}	0.0447^{NS}
Mean		2.81	2.79	2.84	2.82				
Heart wt. (%)	M	0.61	0.63	0.66	0.60				
	F	0.59	0.66	0.63	0.63	0.63	0.0182^{NS}	0.0129^{NS}	0.0258^{NS}
Mean		0.80	0.65	0.65	0.65				
Feather wt. (%)	M	5.95	6.10	6.02	5.95				
	F	5.96	6.10	6.30	6.08	6.06	0.225^{NS}	0.0126^{NS}	0.0255^{NS}
Mean		5.95	6.10	6.16	6.01				

NS-Non Significant, ** P<0.01, Figures in the same row containing superscript with similar alphabet do not differ significantly. Where, D_1 = Control diet (CD) without enzyme, D_2 = CD + Alquerzim, D_3 = CD + Roxazyme, D_4 = CD + Feedzyme

addition of enzyme, increased profitability of broiler rearing (Table 5). This study coincides with the findings of Augelovicova and Michalik (1997); Morkunas *et al.* (1993); Mikulshi *et al.* (1998). They reported reduced feed cost for improved feed utilization and faster growth rate of broilers. But the profitability may differ among enzymes signifying the importance of proper selection of enzyme to get best result.

Meat Yield Characteristics: The meat yield characteristics of male and female broilers on different enzymatic diets and without enzymatic diet are presented in Table 6. Addition of all three different enzymes in diet significantly increased (P>0.01) meat yield of broilers than that on control. Meat yield of three different enzymatic diets were not significantly different (P>0.05). Highest meat yield was noted on Roxazyme-G diet followed by those of Alquerzim and Feedzyme. Dietary enzymes had no effect on shank weight, gizzard weight, head weight, heart weight and feather weight.

Dietary enzyme did not interact with sex to influence ($P>0.05$) any meat yield characteristic.

Exogenous dietary enzyme supplementation increased meat yield of broilers significantly. This result is consistent with Jamroz *et al.* (1996); Pisarski and Wojcik (1995); Leeson *et al.* (1996). They reported increased carcass yield by addition of enzymes in diet attributable to higher fat deposition in carcass and also for increased breast meat yield. On the other hand, this result contradict with the report of Biswas *et al.* (1999) who found that carcass yield had no significant difference, among enzyme treated and non-treated diet.

Conclusion: A total 144 day old straight run Arbor Acres broiler chicks were fed on four iso-nitrogenous and iso-energetic diets; starter control contained 22.16% CP and 2924 Kcal/kg ME and finisher control had 19.25 CP and 3005 Kcal/kg ME. In three test diets exogenous Alquerzim (1g/kg), Roxazyme-G (0.01g/kg) and Feedzyme (0.5g/ kg) were supplemented to control diet to observe whether addition exogenous enzyme improves efficiency of broiler production. The broilers were randomly allocated to four dietary treatments with three replications treatment were fed adlibitum and reared for a period of 42 days at Bangladesh Agricultural University Poultry Farm.

Body weight of broilers showed in enzymatic diets were higher than control, but Roxazyme-G was the best performer, followed by Alquerzim and Foodzyme.

All enzyme supplementation increased feed intake at above 14 days of age ($P<0.01$). At 42 days, all enzymatic diets were superior to control diet in feed conversion efficacy. Roxazyme-G was better than other 2 enzymes (Alquerzim and Feedzyme) in feed conversion. Enzyme supplementation, however did into influence survivability of broiler.

Feed cost per kg live weight were reduced in addition of exogenous enzyme except Alquerzim. Profit/kg broiler of control diet and Alquerzim diet had no significant difference due to higher price (2 Tk/g) and higher inclusion level (1g/kg) feed) of Alquerzim seems to be a major reason for decreased profitability than on other two enzymes.

Dressing yield was significantly increased on all enzymatic diets than that on control. Apparently, dressing yield was the highest for Roxazyme-G followed by those of Alquerzim and Feedzyme. Considering the above facts and findings, it may be concluded that enzymes improved live weight, feed intake, feed utilization, dressing yield and profit. It indicates that anti-nutritive effects of NSP on the performance of broiler were overcome by addition of enzymes. From whole observation, Roxazyme-G diet showed apparently the highest performance due to more different enzyme combination than other two enzymes; Alquerzim and Feedzyme. So, enzyme may be supplemented in broiler diet by proper selection to get best result.

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