Journal of Animal and Feed Sciences, 9, 200, 681 – 686

Effects of dietary enzyme on broiler chickens fed diets containing wheat bran

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(Received 17 April 2000; accepted 4 October 2000)

ABSTRACT

Two hundred and eighty-eight 3-week-old mixed-sex broiler chickens were randomly divided into three dietary treatment groups and fed diets containing 0, 100 or 200 g/kg of dietary enzyme, respectively, for four weeks. Feed and water were supplied *ad libitum*. The parameters studied included growth rate, feed consumption, feed conversion ratio, carcass evaluation, and the economics of production.

The addition of dietary enzyme significantly reduced feed consumption ($P<0.05$); on the other hand, feed conversion efficiency and growth rate improved significantly with increasing levels of enzyme incorporation ($P<0.05$). The reduction in feed intake compared with birds on the control diet ranged from approximately 10 to 15%. At seven weeks of age, birds on the 100 g/kg and 200 g/kg enzyme were respectively 1.9 and 5.8% heavier than their counterparts on the diet with no added enzyme. Birds fed diets containing the highest level of enzyme were 21.1% more efficient in converting feed to body constituents. Carcass dressing percentage increased significantly with added enzyme ($P<0.05$).

Dietary enzyme significantly decreased the total cost of feed per bird and the cost per kg gain. Enzyme added at 200 g/kg diet was the most economical.

KEY WORDS: feed enzyme, broilers, wheat bran

INTRODUCTION

Cereal grains have traditionally been the main sources of energy in commercial broiler diets. In many developing economies with a preponderance of small-scale farms, maize is typically the grain of choice. In addition, various locally available cereal by-products may be used as feed ingredients to varying extents. In Ghana, the main by-products are wheat bran, rice bran and maize bran. These contain anti-

nutritional factors, principally non-starch polysaccharides (Fincher and Stone, 1986; Cowan, 1990) that limit nutrient availability (Bedford et al., 1991) and impair broiler performance (Donkoh et al., 1994). According to Ferket (1993) the NSPs include cellulose, β-glucans, pentosans (arabinoxylans) and pectins. The arabinoxylans are of primary concern in wheat and wheat by-products. Chickens lack the endogenous enzymes to hydrolyze NSPs (Easter, 1988), leading to lowered digestibility of fibrous feed ingredients.

The anti-nutritive effects of NSPs may be overcome by the dietary addition of various exogenous enzyme preparations (Annison, 1991; Friesen et al., 1991). Little work has, however, been done with enzymes in situations where high levels of wheat bran are incorporated in broiler diets as is found on small-scale farms. In Ghana, for example, it is not uncommon to formulate broiler diets containing a minimum of 150 g wheat bran/kg.

This work was therefore undertaken to study the effects of the dietary enzyme, Allzyme PT (Alltech, Nicholasville, Kentucky), on broilers receiving diets containing wheat bran. The enzyme preparation contains (according to the producer) primarily xylanase and pentosanase activities. Other carbohydrases present include galactomannase, β-glucanase, cellulase and pectinase.

MATERIAL AND METHODS

Two hundred and eighty-eight 3-week old locally bred Afabro (from Afariwaa Farms and Livestock Products, Tema, Ghana) broiler chickens of mixed sex were randomly allocated to three dietary treatment groups, each in triplicate, in a completely randomized design. The chickens were initially individually weighed to obtain the mean for the population. They were then re-weighed and re-allocated such that the mean weights of the treatment groups were similar. Each treatment was equalized for sex. The birds were reared on raised wire floors in wooden coops that allowed a mean floor space of 0.13 m^2.

The composition and nutrient content of the basal diet for the trial are shown in Table 1. Birds on the control treatment received the basal diet without added enzyme; birds on the other two treatments received either 100 g or 200 g added enzyme per kg of basal diet respectively. Feed and water were provided free choice throughout the experiment.

The parameters measured included daily feed consumption, body weight changes, and feed conversion ratio. Mortalities were recorded as they occurred. At the end of the trials, three birds were randomly selected from each replicate and slaughtered for carcass evaluation. The economics of production was calculated.

All the measured parameters except the economic data were analyzed by the use of the analysis of variance (Wilkinson, 1990).

TABLE I

Composition and nutrient analysis of basal diet

Ingredient	g/kg diet
Maize	580.0
Fish meal	110.0
Soyabean meal	120.0
Wheat bran	170.0
Dicalcium phosphate	10.0
Oyster shell	5.0
NaCl	2.5
Vitamin-mineral premix*	2.5
Metabolisable energy and nutrient contents, g/kg diet	
crude protein	200.2
crude fibre	50.9
methionine + cystine	7.3
lysine	10.1
arginine	11.1
tryptophan	2.2
available P	5.04
Ca	10.1
metabolisable energy, MJ/kg	12.0

* premix supplied the following per kg of diet: vit. A 10,000 IU; D_3 2,000 IU; E 10 IU; K 3 mg; riboflavin 2.5 mg; cobalamine 0.05 mg; pantothenic acid 5 mg; niacin 12.5 mg; choline 175 mg; folic acid 0.5 mg; Mg 2 g; Fe 0.5 mg; Cu 50 mg; Zn 25 mg and Co 625 mg

RESULTS AND DISCUSSION

The effects of dietary enzyme on the performance and carcass traits of broiler chickens are summarized in Table 2. Feed consumption significantly declined as the levels of enzyme in the diet increased ($P<0.05$). The birds on the highest inclusion rate, 200 g exogenous enzyme, on the average, consumed approximately 13% less feed than those on the control. The comparable figure for birds on 100 g enzyme was 9.6%. Similar observations have been made by other workers (Wiseman and Inborr, 1990; Donkoh et al., 1994). Wiseman and Inborr (1990) have suggested that the decrease in feed intake is due to the ability of feed enzymes to increase the apparent metabolisable energy values of diets.

Birds on the 200 g/kg enzyme diet were significantly heavier at seven weeks than those on the other two treatments; however, birds on both enzyme diets gained weight significantly ($P<0.05$) faster than the control birds.

A significant ($P<0.05$) improvement in feed conversion efficiency ranging from 13-21 % was obtained as a result of the addition of enzyme preparation to the basal

TABLE 2

Effects of enzyme* on broiler performance

Trait	Level of enzyme*, g/kg			Pooled standard error
	0	100	200	
Mean initial body weight, g	281.0	282.0	282.0	0.76
Mean final liveweight, g	1656.0[a]	1688.0[a]	1752.0[b]	40.27
Mean body weight gain, g	1375.0[a]	1405.0[b]	1470.0[c]	34.27
Total feed intake, g	3225.0[a]	2901.0[b]	2786.0[c]	50.12
Average daily feed intake, g	115.0[a]	104.0[b]	100.0[c]	-
Feed conversion ratio, feed: gain	2.35[a]	2.06[b]	1.89[b]	0.07
Carcass dressing percentage	74.5[a]	78.1[b]	79.4[c]	1.02

[a,b,c] $P < 0.05$

* Allzyme PT containing predominantly xylanase and pentosanase activities

diet. Pettersson and Åman (1990) and Friesen et al. (1992) earlier reported similar findings. Cowan (1990) reported a 2-3% increase in efficiency of feed utilisation by birds fed on diets containing enzymes compared with controls.

The improvements in broiler performance resulting from the feeding of dietary enzymes have been attributed to their ability to facilitate access of enzymes to intracellular starch granules, proteins and other nutrients by breaking down otherwise intact bonds between non-starch polysaccharides (Marquardt et al., 1994). In addition, enzymes are known to reduce digesta viscosity induced by the presence of high molecular weight non-starch polysaccharides (Pettersson and Åman, 1989). High digesta viscosity causes reduced feed digestion and slows the rate of nutrient absorption (Bedford, 1992).

The feeding of supplementary enzyme had no influence on the weights of all the internal organs studied. However, there was a significant increase in carcass dressing percentage with increasing dietary levels of the enzyme.

The total cost per kg feed was slightly higher for the enzyme diets due to the extra cost of the feed enzyme. The control diet cost US$254 per ton as against $255 and $256 for the diets containing 100 g and 200 g/kg enzyme, respectively. The respective costs of feed to produce a broiler, however, averaged 81.8, 73.9 and 71.4 cents (US) while the corresponding costs per kg body weight gain were 59.5, 52.6 and 48.6 cents.

CONCLUSIONS

One of the major problems facing small-scale commercial poultry farmers is that of providing quality nutrition for birds. The use of cereal brans/by-products, while cutting down on costs, is also accompanied by reduced performance (Easter,

1988). The use of exogenous enzymes enables the small farmer to incorporate some of these otherwise lowly digested by-products and obtain improved performance and a significant economic advantage.

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STRESZCZENIE

Wpływ dodatku enzymu paszowego na rozwój kurcząt żywionych dietami zawierającymi otręby pszenne

Dwieście osiemdziesiąt osiem 3 tygodniowych kurcząt obojga płci podzielono losowo na 3 grupy i żywiono przez 4 tygodnie dietami z dodatkiem 0, 100 lub 200 g/kg enzymu paszowego. Pasza i woda były dostępne do woli. Oznaczono tempo wzrostu, pobranie i wykorzystanie paszy, wydajność rzeźną oraz koszt produkcji.

Dodatek enzymu paszowego istotnie ($P<0,05$) obniżył pobranie paszy od 10 do 15% w porównaniu z grupą kontrolną, wykorzystanie paszy, tempo przyrostów oraz wydajność rzeźna poprawiły się istotnie ($P<0,05$) wraz ze zwiększającym się dodatkiem enzymu. W 7-ym tygodniu życia kurczęta otrzymujące dodatek 100 lub 200 g enzymu do paszy były cięższe odpowiednio o 1,9 i 5,8% od ptaków kontrolnych. Wykorzystanie paszy przez kurczęta otrzymujące 200 g enzymu było o 21% lepsze niż przez kontrolne.

Dodatek enzymu do diet istotnie obniżył całkowity koszt paszy w przeliczeniu na ptaka oraz na kg przyrostu, przy czym lepsze wyniki uzyskano przy większej dawce enzymu.