

Effect of Enzyme Supplementation to Improve Gut Performance of Broilers Fed Diets Containing Varying Levels of Wheat

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Abstract

An experiment was conducted in order to evaluate the effect of enzyme supplementation (Roxazyme[®] G) on gut performance of broilers fed diets containing varying levels of wheat. Six isonitrogenous and isocaloric diets containing 30, 40 and 50 % wheat with or without supplemental enzyme fed to one hundred and eighty day-old broiler chicks for four weeks. There was significant ($P < 0.05$) difference in the foregut digesta viscosity of birds fed on different experimental rations with and without enzyme supplementation and for the interaction of wheat and enzyme. Carcass data was not affected with different levels of wheat with or without enzyme supplementation.

Introduction

Wheat is a common source of energy and an excellent ingredient for poultry, but its high dietary inclusion have resulted consistently poor chick performance (Friesen *et al.*, 1992). The most probable hindrance, which restricts the inclusion of wheat at higher levels in poultry diets, seems to be its chemical nature. Wheat contains relatively high level of non-starch polysaccharides (NSPs) as structural carbohydrates in the endosperm cell walls for which poultry do not have required endogenous enzymes. These NSPs are polymeric carbohydrates which differ in composition and structure from starch (Morgan *et al.*, 1995) and possess chemical cross linking among them therefore are not well digested by poultry (Adams and Pough, 1993 and Annison, 1993). A part of these NSPs is water-soluble which is notorious for forming a gel like viscous consistency in the intestinal tract (Ward, 1995) thus by reducing gut performance. Predominantly water soluble and viscous arabinoxylans, which belong to pentosan group, are assumed the factor responsible. These pentosans also greatly increase the water intake by the birds, which lead to unmanageable litter problems caused by wet and sticky droppings. This deteriorates the hygienic conditions and carcass quality (Dunn, 1996). On the other hand, β -glucans adversely affect all nutrients, especially protein and starch, utilization and are known to give rise highly viscous conditions in the small intestine of the chicks (Hasselman and Aman, 1986).

Research work has suggested that the negative effects of NSPs can be overcome by dietary modifications including supplementation of diets with suitable exogenous enzyme preparations (Creswell, 1994). Enzymes break down the NSPs, decreases intestinal viscosity and eventually improve the digestibility of nutrients by improving gut performance. The present study was, therefore, conducted in order to evaluate the effects of enzyme supplementation (Roxazyme[®] G) on gut performance of broilers fed diets containing varying levels of wheat.

Materials and Methods

One hundred and eighty day old broiler chicks of mixed sex were randomly divided into six groups of 30 birds, which were subdivided into three experimental units of 10 chicks each. These were randomly assigned to one of the six experimental rations, which were isonitrogenous and isocaloric containing 30, 40 and 50 % wheat with or without supplemental enzyme (Roxazyme[®] G). Feed and water were available *ad libitum* and the chicks had access to 24-hour light throughout the experimental period. Foregut digesta viscosity was determined during experiment by employing the principle of rotational viscometry (sensing the torque

required to rotate a spindle at constant speed while immersed in the sample fluid). Total intestinal contents were collected from gizzard to Meakel's diverticulum (foregut) and sub sample is centrifuged at 2700 rpm for five minutes. The supernatant was withdrawn and the viscosity was determined using digital viscometer measuring viscosity in centipoises (Cps) units, (Bedford and Classen, 1993). Occurrence of sticky droppings (wet excreta sticking to the down of cloaca) of the bird was noticed based on visual score, 1 to 4, i.e., 1 = dry and 4 = very wet (ward, 1995). Litter quality was determined by the comparative difference between moisture content of litter at day first and at 28th day of the experiment, i.e., increase in moisture content of the litter during the experiment (Graham, 1996). At the end of experiment two birds from each replicate were randomly slaughtered and recorded slaughter data including dressing percentage, weight of pancreas and proventriculus, GIT length, relative length of duodenum, jejunum and ileum and duodenal thickness.

Completely randomized design (CRD) with factorial arrangement (3 x 2) was employed. Analysis of variance was conducted using General Linear Model procedure of SAS (SAS, 1986) and Duncan's multiple range test was applied to compare the significance of mean difference.

Results and Discussion

Statistical analysis of data revealed significant differences ($P < 0.05$) in the foregut digesta viscosity of birds fed on different experimental rations with and without enzyme supplementation and also for the interaction of wheat and enzyme supplementation. The results showed that enzyme supplementation of wheat based diets significantly reduced foregut digesta viscosity of birds. These findings agree with the results of Morgan *et al.*, (1995) and Muramatsu *et al.*, (1992). The reduction in foregut digesta viscosity was achieved primarily by reducing the molecular weight through hydrolysis of xylan backbone by endo-xylanase into smaller compounds and thus reduction in viscous effects of the feed because foregut digesta viscosity is directly proportional to the molecular weight of wheat arabinoxylans (Bedford and Classen, 1993). Similar findings on digesta viscosity were also reported by Dunn (1996), Bedford and Classen (1993) and Bhatt *et al.*, (1991).

Average Foregut Digesta Viscosity of Chicks Fed on Different Experimental Rations

| Ration | Foregut Digesta Viscosity (Cps) |
|---|---------------------------------|
| 30 % wheat without enzyme supplementation | 3.127 ^{bc} |
| 40 % wheat without enzyme supplementation | 5.083 ^b |
| 50 % wheat without enzyme supplementation | 7.943 ^a |
| 30 % wheat with enzyme supplementation | 4.193 ^b |
| 40 % wheat with enzyme supplementation | 3.033 ^{bc} |
| 50 % wheat with enzyme supplementation | 2.997 ^c |

Means with different superscript differ significantly ($P < 0.05$)

Sticky dropping score revealed that excreta of birds fed on high level of wheat (50%) become wetter and stickier than that of birds fed on diets containing lower levels of wheat. Similar findings were also observed by Dunn, (1996) who revealed that the high viscosity in the gut contents caused by the pentosans led to increase water intake of the birds, which resulted in the wet and sticky droppings. More moisture was observed in the litter of the replicates fed on higher level of wheat without enzyme supplementation. This is in accordance with the findings of Graham, (1996) who reported an increased water uptake and excretion in broilers given diets containing higher levels of viscous cereal grains.

Dressing percentage both with and without viscera was calculated. The data showed that enzyme supplementation of wheat-based diets did not influence ($P>0.05$) the dressing percentage. The results of present study were in accordance with the findings of Brenes *et al* (1993) and Dunn (1996). However, these results did not support those of Muramatsu *et al.*, (1992) who observed that enzyme supplementation of diets improved the growth rate and deposition of carcass fat thereby increasing the dressing percentage.

Statistical analysis of data on pancreas weight, proventriculus weight, length of GIT, duodenum, jejunum plus ileum and duodenum thickness revealed no differences ($P>0.05$) between different levels of wheat, enzyme and their interaction. The results are in accordance with the findings of Brenes *et al.*, (1993) who reported that the size of GIT was not affected by enzyme addition in the birds fed wheat-based diets.

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