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Full Length Research Paper

The effect of digestive enzyme in barley based rations on broiler performance

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An experiment was conducted in order to investigate the effects of different levels of enzyme (control and 500 g/ton) and different levels of barley (0, 20 and 40% in ration) on broiler performance in a completely randomized design. Body weight and feed conversion ratio were measured weekly, and in the end of week 6, a hen and a rooster were slaughtered and the carcass percent and abdominal fat were measured. The result showed that for up to six weeks, the control ration caused better body gain besides the ration of the enzyme that has the same effect. Feed conversion ratio was the best in the ration that did not have barley (Control), while it was the worst in the ration that had 40% barley. It was observed that different levels of barley had no effect on carcass percent, but they had significant effect on abdominal fat; whereas different levels of enzyme resulted to increase in carcass percent, but they had no effect on abdominal fat.

Key words: Enzyme, barley, broiler, performance.

INTROUDUCTION

Use of enzymes, in recent decades, in the poultry industry has increased. Research on the use of enzymes in poultry diets has shown that enzymes can be used a lot in food that are indigestible by poultry, which later become digestible materials, and the materials are used in poultry diets. Enzymes, such as cellulase and gluconase, increased barley nutritional value for poultry ration (Annison and Choct, 1993). Also, gesilonase caused a reduction in the adhesion of food material mainly by breaking pentosane and they play a vital role in ileum, which increase the overall performance of broilers that are fed wheat based diets (Gao et al., 2007; Steenfeldt et al., 1998).

One important way to reduce anti-nutritional properties of cereal is the use of gluconase in decreasing the adhesion of foods in the intestine (Annison and Choct, 1991; Buchanan et al., 2007; Meng et al., 2005; Mcnab and Smithard, 1992; Steenfeldt et al., 1998). Barley is one of these materials; but due to indigestible compounds, it is not common in poultry rations. However, this study was conducted to investigate the effects of enzymes, in diets containing barley, on broiler performance.

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MATERIALS AND METHODS

In this research, 180 chicks from Arian strain were studied. The first week was the adaptation period, while the second week was the period when the examination of the chicks started. Chicks were placed in 18 cages and were fed with starter and grower diets (Tables 1 and 2). At the end of the third and sixth week, chick weights and feed conversion were determined for each cage. At the end of the sixth week, a male and a female chick closer to the average weight were selected from each cage and were killed. Carcass percent per body weight, feed conversion and abdominal fat were calculated. In this study, to replace barley instead of corn, barley with three levels (0, 20 and 40%) and enzymes with two levels (0 and 500 g) were used; so the six treatments were created.

The six treatments were created with three replications and 18 experimental units, and each unit consisted of 10 chicks. Multi-enzyme Grindazyme GP 5000 enzyme (containing: Glucanase, Celubiase, Hemicelulase, Gzylanase, Arabinase, Pectinase, Amylase and Protease) was used in this study and 500 g per ton was fed to the chicks. This study, based on a 2×3 factorial experiment in the form of a completely randomized design with six dietary treatments and three replications for each treatment, was planned. All the data were analyzed with the use of a linear model GLM and SAS statistical analysis software. Diets without significant enzyme had better growth. For the interaction between diet and enzyme, the age range of 3 and 6 weeks with diets lacking barley enzyme causes more weight than other diets. Also, diets containing 20 and 40 barley, but without enzyme had the lowest weight at age 3 and 6 weeks, and this decreased digestibility due to having anti-nutritional substances in barley.

Enzyme consumption for up to age 6 weeks significantly increased body weight because there are anti-nutritional

Table 1. Components starter diet.

Materials (%)	0% Barley	20% Barley	40% Barley
Barley	0	20	40
Corn	64.81	47.07	31.5
Soybeen meal	26.47	23.17	19.34
Fish meal	6	6	6
DCP	0.56	0.78	0.78
Met	0.1	0.27	0.31
Lys	0	0.04	0.11
Shell	1.26	1.87	1.16
Minerals and vitamins	0.5	0.5	0.5
Salt	0.3	0.3	0.3
Total	100	100	100
ME	2944	2802	2722
%CP	21	20.26	19.52
ME/CP	140	136	139

Table 2. Components growth diet.

Materials	0% Barley	20% Barley	40% Barley
Barley	0	20	40
Corn	69.94	53.29	36.64
Soybeen Meal	24	20.57	17.14
Fish Meal	3	3	3
DCP	1	1	0.9
Met	0.1	0.13	0.17
Lys	0	0.05	0.11
Shell	1.16	1.16	1.24
Minerals and Vitamins	0.5	0.5	0.5
Salt	0.3	0.3	0.3
Total	100	100	100
ME	2968	2862	2755
%CP	18.51	17.86	17.2
ME/CP	160	160	160

substances found in barley (Table 3). Adding enzymes makes up the lost material; and thus, weight loss resulting from the anti-nutritional substances can be compensated (Bedford, 1995; Gang et al., 1999; Mcnab and Smithard, 1992).

Feed conversion

In the first stage of growth (1-3 weeks), diets containing 40% barley significantly reduced feed conversion ratio than the other two diets, but between diets without barley and diets with 20% barley, there was no significant difference; however, diets without barley had better feed conversion ratio. In the second stage of breeding (3 to 6 weeks), diets without barley had significantly better feed conversion than diets containing 40% barley. In this study, it was observed that diets with 20% barley had better feed conversion than diets with 40% barley, but there was no significant difference between all the diets at this time. In the first and second stages of the growing period, adding enzymes to the diet significantly improved feed conversion. Also, diets containing 40% barely without enzyme had the worst feed conversion about the interaction between diet and antibiotics in both growing periods (Table 4).

Fundamentally, the use of enzymes in diets containing barley improved feed conversion (Scott et al., 1999) and it increased the body weight of chicks, but the use of these enzymes in diets containing corn did not have positive effects (Bee et al., 1998; Huyghebaert and Schone, 1999; Meng et al., 2005).

Carcass

Chickens that consumed diets that lacked barley, diets with 20% barley and diets with 40% barely did not have significant difference on carcass percentage. Previous studies also confirmed these results (Annison and Choct,

Table 3. Effect of diet and enzyme on average weight of broiler at the end of different breeding periods.

Treatment	Age (week)	
	3	6
Main effects	**gram**	
Diet:		
0% Barley	493[a]	1787.17[a]
20% Barley	483.67[ab]	1691.83[b]
40% Barley	465.67[b]	1634.50[b]
Standard error (SE)	±7.53	± 21.47
Enzyme (g):		
0	463.56[b]	1641.44[b]
500	498.00[a]	1767.56[a]
Standard error (SE)	± 6.15	± 17.53
Interactions	503.00[ab]	1753.33[a]
Enzyme × Diet:		
0 0% Barley	517.00[a]	1821.00[a]
500 0% Barley	457.33[c]	1623.33[b]
0 0% Barley	474.00[bc]	1760.33[a]
500 0% Barley	464.33[c]	1547.67[b]
0 0% Barley	469.00[bc]	1721.33[a]
500 0% Barley	± 10.65	± 30.36
Standard error (SE)	480.78	1704.50
Mean		

Table 4. Effect of diet and enzyme on average feed conversion during different breeding periods.

Treatment	Feed conversion	
	1-3	**3-6**
Main effects		
Diet:		
0% Barley	2.03[b]	2.15[b]
20% Barley	2.07[b]	2.26[ab]
40% Barley	2.17[a]	2.31[a]
Standard error (SE)	0.029	0.036
Enzyme (g):		
0	2.14[a]	2.29[a]
500	2.04[b]	2.19
Standard error (SE)	0.024	0.030
Interactions		
Enzyme × Diet:		
0 0% Barley	2.11[ab]	2.17[bc]
500 0% Barley	1.94[c]	2.13[c]
0 0% Barley	2.12[ab]	2.18[ab]
500 0% Barley	2.02[bc]	2.18[bc]
0 0% Barley	2.20[a]	2.36[a]
500 0% Barley	2.14[ab]	2.27[abc]
Standard error (SE)	0.041	0.051
Mean	2.09	2.24

Table 5. Effect of diet, enzyme and sex on average carcass and abdominal fat to live weight at the end of breeding.

Treatment	Carcass	Abdominal fat
	Percent	
Main effects		
Diet:		
0% Barley	70.42^{a}	2.74^{b}
20% Barley	70.47^{a}	3.06^{b}
40% Barley	71.03^{a}	$^{3.51}$a
Standard error (SE)	0.354	0.139
Enzyme (g):		
0	69.83^{b}	2.95^{a}
500	71.45^{a}	3.25^{a}
Standard error (SE)	0.289	0.114
Sex		
1	70.04^{b}	2.81^{b}
2	71.24^{a}	3.40^{a}
Standard error (SE)	0.289	0.114

Table 6. Interaction of diet, enzyme and sex on average carcass and abdominal fat to live weight at the end of breeding.

Treatment			Percent	
			Carcass	Abdominal fat
Main effects				
Sex	Enzyme	Diet		
1	0	0% Barley	68.96^{bc}	2.26^{c}
2	0	0% Barley	70.60^{abc}	2.97^{bc}
1	500	0% Barley	70.27^{abc}	2.63^{bc}
2	500	0% Barley	71.84^{a}	3.10^{bc}
1	0	20% Barley	69.04^{bc}	2.22^{c}
2	0	20% Barley	70.55^{abc}	3.02^{bc}
1	500	20% Barley	71.74^{a}	3.52^{b}
2	500	20% Barley	70.55^{abc}	3.48^{b}
1	0	40% Barley	68.58^{c}	2.89^{bc}
2	0	40% Barley	71.27^{ab}	4.34^{a}
1	500	40% Barley	71.67^{a}	3.34^{b}
2	500	40% Barley	72.62^{a}	3.46^{b}
Standard error (SE)			0.71	0.28
Mean			70.64	3.10

1993; Jeroch and Danicke, 1995). Chickens that consumed enzyme-containing diets had a significantly greater carcass than those who consumed diets without enzymes. However, carcass percentage in females was more than that in males, and this is probably because of the carcass fat (Table 5).

Abdominal fat

Abdominal fat in chickens that consumed diets with 40% of barely was significantly more than those without barley and those with 20% of barley, but there was no difference between diets without barley and diets with 20% barley about fat percentage. Generally, adding the barley percent of a particular ration increased fat percentage (Annison and Choct, 1993; Buchanan et al., 2007), whereas consumption or non-consumption of enzymes did not have a significant difference on fat percentage (Table 6).

Conclusion

According to the tables, it is clear that the use of barley in broiler diets and a replacement of it with corn caused weight loss in chickens, but addition of enzymes to the diets prevented the negative effects of barley. Therefore, a significant difference between the weights of chickens fed diets containing barley and those fed diets without barley was observed; but with the addition of barley, less weight gain was observed in chickens. The same results with the feed conversion ratio were also observed. Hence, the use of barley in broiler diets with enzymes is recommended. Barley is cheaper than corn; so replacing barley with corn in broiler and chicken food could be obtained at a lesser price in the poultry industry.

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