

## Short communication

### Effect of substituting barley malt for corn on performance and histological properties of small intestine in broiler

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#### Abstract

A total of 192 one-old-day broilers were equally divided into six groups to find the effect of different levels (5, 10, 15, 20 and 25%) of substituted barley on the performance and intestinal histology (villus length, width, crypts depth and number of goblet cells). One group served as a control while the other groups were treated with 5, 10, 15, 20 and 25% barley. Results revealed that higher level (20 and 25%) of barley depressed the weight gain and feed conversion ratio and enhanced the feed intake (25%). On the other hand, in 20 and 25% level of barley, the villus height and width decreased significantly without affecting the crypts depth and number of goblet cells. It was concluded that higher level of barley level may be harmful for the growth of performance mainly due to its antinutritional substances.

**Key words:** Barley; broiler; weight gain; villus

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#### Introduction

Broilers fed with high energetic diet causes an increase in growth rate and feed efficiency. The rate of this efficiency depends on the used diet. Corn is the main grain that is used in broiler industry, but recently, due to use of corn in ethanol production, the price of this product is increasing day by day. To solve this problem, substituting of wheat and barley are recommended. Barley has more total protein, amino acids, vitamins and minerals than corn and is relatively safe from fungal and moldy contamination. Growth of broiler depends on gastro-intestinal health. Rate of renovation of epithelium layer is affected by factors such as age and type of diet. Bedford (2000) showed that adding commercial enzymes into basic corn diet causes some changes in intestinal histology (sabet Moghadam, 2009).

#### Materials and Methods

A total of 192 one day-old broiler chickens (ROSS 308) were randomly allocated into six experimental treatments. Each treatment consisted of four replicates of eight birds. The experiment lasted for 42 days. Basal diets for starter, grower and finisher were formulated according to NRC (1994) as shown in Table 1. Experimental diets were formulated by replacement of 5, 10, 15, 20 and 25% barley malt for corn. At the end of experiment (day 42), the chickens were fasted for 12 hours. Then from each pen, two chickens were randomly selected, weighed, slaughtered and eviscerated.

After slaughter, ileum of each chick was completely evacuated and rinsed with physiologic saline solution. Each ileum sample (upper ileum and one sample from lower ileum) was taken and was

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preserved in 10% formalin. To determined villus height, width, crypts depth and number of goblet cells, ileum from each sample was processed histologically. Data were analyzed with SAS (SAS, 2002) program and the means were compared with Duncan multiple range test (Duncan, 1955).

## Results

Weight gain was significantly depressed in broilers fed 20% while feed intake was significantly high in 25% fed barley. However, feed conversion ratio was significantly high in 20 and 25% fed barley (Table 2). Villus height and width decreased significantly in 20 and 25% fed barley diet. However, no significant change was observed in crypt depth and number of goblet cells in control and treated birds (Table 3).

**Table 1: composition of experimental diets**

Ingredient (%)	Starter	Grower	Finisher
Corn	57.90	63	66
Soybean meal (48%)	32.50	29.00	27.00
Menhaden Meal	3.00	2.00	0
Soybean oil	2.50	2.30	3.50
Dicalcium phosphate	1.30	0.90	0.90
Vitamin premix <sup>1</sup>	0.25	0.25	0.25
Mineral premix <sup>2</sup>	0.25	0.25	0.25
Common salt	0.31	0.23	0.21
DL-methionine	0.25	0.20	0.20
Oyster shells	1.60	1.50	1.50
Bicarbonate	0.14	0.12	0.09
Calculated nutritive value (%)			
Metabolizable Energy (kcal/kg)	<b>3.04</b>	<b>3.08</b>	<b>3.18</b>
Protein	<b>22.81</b>	<b>20.93</b>	<b>19.01</b>
Calcium	<b>1.13</b>	<b>0.95</b>	<b>0.84</b>
Total phosphorus	<b>0.69</b>	<b>0.58</b>	<b>0.52</b>
Available phosphorus	<b>0.42</b>	<b>0.33</b>	<b>0.29</b>
Lys	<b>1.25</b>	<b>1.11</b>	<b>0.97</b>
Met, Cys	<b>0.97</b>	<b>0.87</b>	<b>0.80</b>

Each Kg of vitamin premix contained: vitamin A, 3500000 IU; vitamin D3, 1000000 IU; vitamin E, 9000 IU; vitamin K3, 1000 mg; vitamin B1, 900 mg; vitamin B2, 3300 mg; vitamin B3, 5000 mg; vitamin B5, 15000 mg; vitamin B6, 150 mg; vitamin B9, 500 mg; vitamin B12, 7.5 mg; choline, 250000 mg; biotin, 0.1 mg; <sup>2</sup>Each Kg of mineral premix contained 50000 mg; iron, 25000; zinc, 50000; copper, 5000 mg; iodine, 500 mg; selenium, 100 mg.

## Discussion

Hosseini et al. (2010) showed that feed conversion in broiler fed 15% malt was lower in the group than 7.5%. These results are in agreement with findings of this study. Results showed that high levels of barley malt substitution with corn (20 and 25 percent) resulted in the lower size of length and width of villus. Antinutritional factors in barley reduced the morphogenetic changes in intestines which resulted in

decreased absorption of essential nutrients and ultimately decreased the performance of the birds (Burnell, 1966; Friesen et al., 1992). B-Glucans is the major antinutrient in barley that causes viscosity and decreases the contact of enzymes with substrates and absorption surface in villi (Annison et al., 1993).

In conclusion, the higher level of barley in the feed of broilers resulted in poor performance.

**Table 2: Effects of barley treatment on performance of broilers**

Level of barley malt used	Weight gain (gram/day)	Feed intake (gram/day)	Feed conversion ratio
Control treatment	58.84 <sup>a</sup>	107.91 <sup>b</sup>	1.83 <sup>c</sup>
5%	56.15 <sup>ab</sup>	108.92 <sup>ab</sup>	1.94 <sup>b</sup>
10%	54.36 <sup>bc</sup>	107.70 <sup>b</sup>	1.98 <sup>ab</sup>
15%	53.31 <sup>bc</sup>	107.51 <sup>b</sup>	2.01 <sup>ab</sup>
20%	52.70 <sup>c</sup>	106.97 <sup>b</sup>	2.03 <sup>a</sup>
25%	53.98 <sup>bc</sup>	110.50 <sup>a</sup>	2.05 <sup>a</sup>
SE	0.94	0.80	0.02

<sup>a,b</sup>Means with the dissimilar letter are significantly different (P<0.05)

**Table 3: Effects of barley treatment on ileum micrometry and number of goblet cells of chickens**

Level of barley malt used	Villus height (µm)	Villus width (µm)	Crypt depth (µm)	Number of goblet cells
Control treatment	85.37 <sup>a</sup>	11.00 <sup>a</sup>	14.93	4.60
5%	82.87 <sup>a</sup>	9.50 <sup>ab</sup>	12.64	3.87
10%	84.60 <sup>a</sup>	9.93 <sup>ab</sup>	17.50	4.49
15%	80.25 <sup>ab</sup>	8.50 <sup>b</sup>	13.00	4.06
20%	67.18 <sup>b</sup>	8.50 <sup>b</sup>	13.87	3.12
25%	69.50 <sup>b</sup>	8.66 <sup>b</sup>	13.19	4.06
SE	19.34	2.70	6.69	2.21

<sup>a,b</sup>Means with the dissimilar letter are significantly different (P<0.05)

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