WHOLE BARLEY-DILUTED DIETS IN BROILERS AND ITS ECONOMY

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ABSTRACT- Whole barley-diluted diets in broilers and its economy
This study was conducted to determine the effect of semi-choice or free-choice feeding using whole barley supplemented diets with a commerical enzyme preparation in broiler chickens. Male broiler chicks were divided into four experimental groups at 19 days of age. The control birds fed a standard mash grower diet. Two groups were fed the standard mash grower diet with whole barley from 19 to 42 days using a training period (semi-choice I) or directly from 24 to 42 days of age (semi-choice II). Remaining one group was fed separately both of the standard grower diet and whole barley within two feeders. Body weight gains were not affected ($P>0.05$) by the treatments. Free-choice-fed broilers consumed more total food and selected whole barley than the others ($P<0.05$). However, gain: feed ratio was lower in free-choice-fed broilers compared to control ($P<0.05$). Broilers given whole barley which mixed with grower diet or free-choice-fed selected less energy and protein in their diets than those fed control ($P<0.05$). Free-choice-fed broilers were also deposited more abdominal fat compared to the control. Whole barley caused an increase in gizzard size. Feed costs per kg of body weight gain were decreased by using whole barley.

Keywords: broilers, whole barley, choice-feeding, costs

INTRODUCTION

Many years ago, feeding chickens with whole cereals was a traditional feeding regimen. However, with the increase of intensive poultry production, poultry producers began to use full-feed mash or pelleted diets. In recent years, there has been an interest on feeding broilers with whole cereals. Thus, the use of whole cereals in diets for poultry has become common place in many countries to decrease feed costs and to increase performance (BANFIELD and FORBES, 2001; BENNETT et al., 2002; KWIECIEN and WINIARSKA-MIECZAN., 2010). Moreover, the use of whole cerals in pelleted or crumbled broiler feeds is a new feed processing method for reducing feed production cost in some European countries. Because of high proportion of corn, whole wheat and whole barley in broiler diets can become more economic (NAHAS and LEFRANCOIS, 2001). Whole cereals have some additional advantages other than ecocomy such as increased gizzard size and performance and decreased coccidiosis risk in practice (BENNET et al., 2002; SHIVUS et al., 2004). Physical form of foods have affect on gizzard development (MUNT et al., 1995). Due to the gizzard development, whole grains increase the ability of birds to grind food, ease digestion and consequently the energy and amino acids may be utilized more efficiently (SHIVUS et al., 1997a).

In broiler production, dietS which is formulated to meet the requirements of the average bird will have inadequate levels of main nutrients such as energy and protein for broilers or above the mean. Broilers have ability to select a well-balanced diet when feeds offered as free-choice or semi-choice (POUSGA et al.,2005). Birds' age are important in the learning process. The optimum age for imprinting to grains is the second week after hatching (FORBES and COVASA, 1995). Broilers will select a diet close to optimal for growth if diet offers free-choice (COVASA and FORBES, 1993b; FORBES and SHARIATMADARI, 1994b). Wheat is known as the main foods for people in many developing countries, but barley is essentially known as an animal feed. Therefore, whole barley supplemented with exagenous enzymes can be prefer to whole wheat in many

countries. The antinutritional effect of beta glucans on broiler chicks is the main problem with barley. Many researchers previously indicated that beta glucans depress broiler growth and cause wet droppings. Adding beta glucanes to broiler diets given broilers can eliminate the wet dropping and gummy dropping problems by increase in digestion and absorbtion of nutrients in gut of broilers (KWIECIEN and WINIARSKA-MIECZAN, 2010). Many researchers (SHIVUS et al., 2004; RAVINDRAN et al.,2006; AMERAH and RAVINDRAN, 2008) previously reported the effects of whole wheat on broiler performance in some feeding regimens. However, using whole barley in broiler diets mainly based on feeding broilers feed hulless barley (ANDERSON and MACISAAC 2001; KWIECIEN and WINIARSKA-MIECZAN., 2010).

Use of whole barley in these feeding regimen may cause a decrease in feed costs consumed by broiler chickens because of lower price of whole cereals compared to mashed feed and decreased costs of grinding. The objectives of this experiment were to examine effects of semi-choice or free-choice feeding regimens of diluted diets with whole barley supplemented with exagenous enzymes on performance and feed costs in broiler chickens.

MATERIAL AND METHOD

In this experiement, broiler chiks obtained from a commercial hatchery and fed together in a littered flor pen and fed *ad libitum* with a standard commercial broiler starter diet. At 19 days of age, a total of 204 male broiler chicks were individually weighed and divided into four experimental groups and exposed to one of four feeding treatments with three replicates per treatment and 17 birds per pen. Broilers kept in a littered floor pens with hanged feeders and drinkers. A 24 hours lightining program was applied throughout the experimental period. The temperature and humidity were arranged by automatically. The contents of standard grower diet given control birds from 19 to 42 days of age were illustrated in Table 1. Grower diet was mixed with 5, 10, 20 and 30% of whole barley containing 11.02% crude protein and 2650 kcal ME /kg, from 19 to 23 days, 24 to 28 days, 29 to 36 days and 36 to 42 days of age, respectively (semi-choice I). Other group of broilers were fed an undiluted grower diet from 19 to 24 days of age. After 24 days of age, they were given a diluted grower diet with 20% whole barley (semi-choice II). Remaining group was fed separately both grower diet and whole barley within two feeders from 19 to 42 days of age (free-choice). Diets containing whole barley were supplemented with a commercial enzyme preparations (2g/kg of total diet). Body weight gain and feed intake were determined at 24 , 28, 35 and 42 days of age. Three birds per replicate were slaughtered at 42 days of age to observe the effect of whole barley on abdominal fat and gizzard. Decrease in feed costs (%) per kg body weight gain compared to control were also calculated. Data were subjected to analysis of variance and significance of differences in means of treatments were compared to according to the procedure of Duncan.

Table 1: The composition of Standard grower diet (%)

Contents basal mash diet	%
Corn	50.15
Wheat	8.00
Soybean meal (44%)	26.00
Fullfat soybean	9.00
Meat-bone meal	1.50
Fish meal	1.00
Soybean oil	3.00
Limestone	0.39
Dicalcium phosphate	0.21
Sodium chloride	0.35
Vitamin premix	0.20
Mineral premix	0.10
Antioxdant	0.10
Metabolisable energy, kcal/kg	3100
Crude protein	21.00
Lysine	1.33
Methionine+cystine	0.92
Calcium	0.94
Available phosphorus	0.44

RESULTS

Effects of whole barley in broiler nutrition are illustrated in Table 2. Body weight gains of broilers were not affected by the feeding treatments. However, total feed (mash feed, barley or mash feed+barley) and whole barley intakes of birds fed free-choice basis were significantly higher ($P<0.05$) than other groups. Gain: feed ratio from 19 to 42 days of age was the highest in control birds ($P<0.05$) compared to free-choice group. Semi-choice groups had medium parameters between control and free choice group in gain:feed ratio.

The relative weight of abdominal fat was increased ($P<0.05$) by the free-choice feeding compared to the control, and tended to increase by feeding semi-choice. The relative weight of gizzard was bigger ($P<0.05$) in groups consumed whole barley than control. However, the biggest gizzards measured in semi-choice I broilers.

Althought the total protein intake of birds were not differed by the feeding strategies, the total energy intakes in free-choice group was higher ($P<0.05$) than control. When mash feed and whole barley supplied by free-choice, the selected diets by the broilers had lower ($P<0.05$) energy levels compared to control. The same results were also determined in selected protein levels and energy: protein ratio.

Feeding strategies depend on semi-choice and free-choice basis using whole barley decreased feed costs per kg of body weight gain between 1.84% and 5.62%. The free-choice feeding strategy with whole barley had an additional income in broiler production.

Table 2: Effects of experimental diets on total feed intake, growth performance (g/bird), whole barley intake (% of total feed intake), relative weight (g/100 g body weight) of abdominal fat and gizzard, intake of energy and protein, and decrease in feed costs(%)

	Diets and feeding regimens				
Parameters	Control	Semi-choice-I	Semi-choice-II	Free-choice	SEM
Initial BW	528.1	528.5	529.3	529.9	0.97
Body weight gain					
19 to 41 d	1790.7	1730.6	1767.9	1834.3	22.44
24 to 42 d	1497.9	1443.3	1482.2	1533.9	22.65
Total feed intake					
19 to 41 d	3677.0^{b}	3899.3^{b}	3829.1^{b}	4221.4^{a}	69.40
24 to 42 d	3139.7^{b}	3376.6^{ab}	3320.9^{b}	3676.1^{a}	67.6
Whole barley intake					
19 to 41 d	-	20.77^{b}	18.89^{b}	31.15^{a}	1.90
24 to 42 d	-	23.20^{b}	21.78^{b}	34.82^{a}	2.06
Gain : Feed					
19 to 41 d	0.488^{a}	0.443^{ab}	0.461^{ab}	0.434^{b}	0.008
24 to 42 d	0.479^{a}	0.427^{b}	0.446^{ab}	0.417^{a}	0.01
Relative weight of					
Abdominal fat	1.51^{b}	2.18^{ab}	2.03^{ab}	2.49^{a}	0.13
Gizzard	1.62^{c}	2.54^{a}	2.31^{ab}	2.14^{a}	0.09
Total energy intake (Mcal ME/bird)	11.39^{b}	11.72^{ab}	11.54^{ab}	12.49^{a}	0.17
Total protein intake (g/bird)	772.0	738.0	732.0	755.0	9.0
In selected diets					
ME,kcal/kg	3100^{a}	3006.5^{ab}	3014.9^{ab}	2959.8^{b}	41.30
Crude protein,%	21.00^{a}	18.92^{b}	19.11^{b}	17.88^{c}	0.21
Energy:Protein ratio	147.6^{b}	158.9^{ab}	157.7^{ab}	165.5^{a}	2.04
Decrease in feed costs per kg of body weight gain compared to control	-	1.84	4.64	5.62	-

^{a,b,c} Means with different supercript letters differ significantly ($P<0.05$)

CONCLUSIONS

In this experiment, broilers offered whole barley as free-choice consumed more mash feed and whole barley without affecting body weight gains. Increase in total feed intake mainly comes from increasing barley consumption and its lower energy level. Because energy deficiency in broiler diets could have created a high appetite. Increased abdominal fat deposition with whole barley consumption in semi-choice or free-choice fed broilers than control birds may also due to the higher total energy intakes. However, increased gizzard size was also a factor of increased feed intake. DEATON et al. (1977) and SHIVUS et al.(1997a) have indicated that diets containing high cellulose increased the sizes of crop and gizzard. Although the relative levels of crop was not determined in this study, the relative weight of gizzard in broilers fed whole barley was high than control birds. In contrast to the present experiment, NAHAS and FRANCOIS (2001) have reported

that increasing levels of whole barley caused a decrease in final body weight and gizzard weight. BENNETT et al. (2002) have found a decrease in body weight and important increase in gizzard size by feeding whole barley changed from 5% to 65%. The similar results on body weight gain with whole barley have determined by the KWIECIEN and WINIARSKA-MIECZAN. (2010). They also measured a decrease in breast meat weight.

Gain: feed ratio in free-choice fed broilers were also lower than control birds. It can be explained by the effect of high whole barley intake, its antinutritional contents and negative effects of them on digestion and body weight gain. SHIVUS et al. (2004) have indicated that the lack of improvement in gain: feed with whole wheat explained the higher energy expenditure on feeding and digestive activity fort he whole wheat diet. It is known that the heteregeneous feeds may increase amount of pecks on feed and thus energy spent on feeding. MARTARESCHE et al. (2000) determined that the pecking rate incresed with a cylindirical form of feeds. BENNETT et al. (2002) repeorted an negative effect of whole cereals on gain:feed , but an improvement in birds' health. ANDERSON and MACISAAC (2001) fed broilers with hulless barley and found a decrease in 36 days body weight and decrease in gain:feed. They suggested that broiler diets can be diluted with whole hulless barley up to a level of 15%. Free-choice fed broilers were also consumed more total energ without changing total protein intake by increased total feed intake. However, the energy and protein levels in selected diets by free-choice broilers were lower than control birds. Semi-choice fed broilers with whole barley diluted diets had lower energ levels in their selected diets. Despite of the increased feed intakes without affecting the body weight gain, an important decrease in energy and protein levels in selected diets by free-choice or semi-choice fed broilers also decreased feed costs per kg body weight gains up to 5.62%. decrease in feed costs could related to the cost of whole barley.

In conclusion, whole barley with exagenous enzyme can offer to broilers in semi-choice or free-choice feeding strategies by the broiler producers. The higher levels of whole barley decrease gain: feed ratio. However the energy and protein levels in standard broiler grower and finisher diets can be decreased by this feeding regimens. Thus, the diluted diets with whole barley will decrease in production costs.

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