ISSN 1682-8356
ansinet.org/ijps

INTERNATIONAL JOURNAL OF

POULTRY SCIENCE

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

International Journal of Poultry Science 3 (11): 724-727, 2004

Influence of Replacement of Concentrate by Beer By-product on Performance of Broilers in Central Vietnam

L.Q. Nguyen[1], T.Q. Vui[1], H.T. Hue[2], D.T. Hang[1] and A.C. Beynen[3]*
[1]Research and Practical Training Centre for Animal Sciences, Faculty of Animal Sciences,
Hue University of Agriculture and Forestry, Vietnam, 19/83 Nguyen Khoa Chiem, Hue City, Vietnam
[2]Department of Animal and Plant Breeding, Thua Thien Hue Province, Vietnam
[3]Department of Nutrition, Faculty of Veterinary Medicine, Utrecht University, P.O. Box 80.152,
3508 TD Utrecht, The Netherlands
E-mail: a.c.beynen@vet.uu.nl

Abstract: In an attempt to lower feed costs of small-holder broiler production in the area of Hue City, Central Vietnam, we replaced part of the commercial concentrate component of the diet by locally available wheat brewing by-product. There were three experimental diets containing either 5, 10 or 15% brewing by-product. The three diets were fed on five small-holder farms to groups of 20 broilers each. The results show that beer by-product enhanced growth and improved feed efficiency. Slaughter carcass traits and the weights of breast and drumstick were enhanced by the feeding of beer by-product. The inclusion of 10% beer by-product in the diet increased the antibody titre against Newcastle disease when the birds were aged 9 weeks, but not when they were aged either 4 or 12 weeks. It is concluded that substitution of brewers' wheat for part of the concentrate component can render broiler diets less expense and more efficient.

Key words: Brewing by-product, growth, feed efficiency; carcass characteristics, resistance to diseases

Introduction

In Central Vietnam, poultry meat production typically occurs on small holdings. It is difficult for the farmers to make profits because feed costs are high, Newcastle disease (NCD) is endemic and the selling price of poultry is not stable. Broilers are generally vaccinated against NCD, but often titre development is poor and, as a result, resistance to NCD remains low (Vui, 2001). Broiler diets are usually based on rice bran, maize and a commercial concentrate, the latter being the most expensive component. The concentrate is a major source of protein, minerals, trace elements and vitamins. In Hue City, Central Vietnam, there is intensive beer production and thus beer by-product is abundant. The nutritional value of beer by-product in livestock diets can be considered adequate (Westendorf and Wohlt, 2002). The by-product may contain up to 30% protein and 13% fat in the dry matter fraction. In Hue City, beer by-product may be obtained for 1600 VND per kg dry matter, whereas concentrate costs about 3500 VND. It was reasoned that in broiler diets part of the concentrate component may be replaced by beer by-product without a negative impact on animal production, but reducing feed cost. In this study, which was carried out on five small-holder farms in the area of Hue City, Central Vietnam, we determined the effect of substituting beer by-product for concentrate on broiler performance. On each farm identical diets were fed that contained either 5, 10 or 15% beer by-product which was added at the expense of the concentrate constituent. Brewers' grains may contain yeast rich in beta-glucans, which in turn may act as immunological response modifiers (Vetvicka *et al.* 1996). It could be suggested that beer by-product feeding enhances titre development after vaccination against NCD. Consequently, we measured antibody titres against NCD in the vaccinated broilers fed the experimental diets.

Materials and Methods

Animals, housing and diets: We used 300 feather-sexed, male and female chickens of the Luong Phuong breed, aged one week and with body weight of 70 ± 11g (mean ± SD). The birds had been fed a commercial starter diet. They were divided over 5 farms and fed one of three experimental diets. There were 20 birds (10 males, 10 females) per diet type per farm. They were housed 20 per cage which had a bamboo fence, a thatch and a concrete bottom with above it a bamboo mesh floor with a surface of 5 m^2. During the night, electric heating was applied to maintain part of the mesh floor at a temperature of 37-38°C until the chickens were 6 weeks of age. For 3-5 hours per day the birds had access to a fenced area with natural vegetation. There was natural daylight and electrical bulbs were used during the night. All birds were given Lasota vaccine at the age of 9 days and Newcastle I vaccine (NAVETCO, Ho Chi Minh City, Vietnam) at the age of 42 days.

The experimental diet with 5% beer by-product consisted of the following (% of dietary dry matter): rice bran, 30; maize meal, 20; commercial concentrate, 20; soybean by-product, 14; vegetables, 10; beer by-product, 5; mineral mixture, 1. To produce the diets with 10 or 15%

Table 1: Macronutrient composition of the experimental diets

Macronutrient	Diet (% of beer by-product)		
	5	10	15
Dry matter (g/kg)	780	746	713
Crude protein (g/kg DM)	216	212	208
Crude fat (g/kg DM)	103	106	109
Crude fibre (g/kg DM)	79	86	92
Ash (g/kg DM)	37	38	40

DM = dry matter

beer by-product, part of the concentrate was replaced by beer by-product. Brewers' wheat was obtained from the local factory each week. According to analysis it contained 246 g dry matter/kg product and 301 g crude protein, 126 g crude fat, 168 g crude fibre and 52 g ash/kg dry matter. The commercial concentrate contained 390 g crude protein, 67 g crude fat and 34 g crude fibre/kg dry matter. Feed was provided according to a pre-set schedule. As from the start of the experiment, when the birds were one week old, 15 g dietary dry matter per animal per day was supplied. Feed supply was increased by about 7 g/week so that at the end of the experiment the birds on average received 90 g dry matter per animal per day. Water was supplied *ad libitum*. The diets were made and provided to the broilers by students who were present on the farms each day during the entire experimental period. The students collected and weighed any feed leftovers on a daily basis. Body weights of the broilers were determined at 1, 4, 8 and 12 weeks of age.

Sample collection: For each farm and cage a composite feed sample was analyzed. Dry matter, crude protein, crude fat, crude fibre, ash were measured by the Weende method.

At the age of 9 weeks, six chickens per treatment from each farm were slaughtered. According to the methods of Nguyen (1996), the following slaughter characteristics were assessed: live weight, eviscerated weight, carcass weight, percentage dressing out, percentage abdominal fat, percentage breast meat and percentage drumstick. When the remaining broilers were aged 12 weeks, again six birds per treatment from each farm were used to determine the slaughter characteristics.

Blood samples were collected from the wing vein of the birds and were pooled per treatment per farm. Antibody titres against NCD were determined with the haemaglutination inhibition (HI) test. The antigen used was reconstituted commercial NDV La Sota vaccine (TAD, Cuxhaven, Germany).

Statistical analysis: Cage was considered as experimental unit and farm as repetition. Data were pooled per cage and subjected to Tukey's test to identify differences between treatment means. The level of statistical significance was pre-set at $P < 0.05$.

Results

The macronutrient composition of the diets is shown in Table 1. Mixing more beer by-product into the diet reduced the dry matter content. The diets contained at least 20% of protein. Fat contents of the three diets were similar, but the concentration of crude fibre increased with higher inclusion levels of beer by-product.

For the entire experimental period, mortality was 9, 3 and 7% for the birds fed the diets with 5, 10 and 15% beer by-product, respectively. Group mean body weight increased with increasing inclusion levels of beer by-product (Table 2). Statistically significant treatment differences were seen at weeks 4 and 8. Feed-to-gain ratios were numerically depressed by the feeding of extra beer by-product, but significant differences were observed only for the high versus low inclusion level during the period of 9-12 weeks. The randomly selected animals to be slaughtered at either 9 or 12 weeks of age also showed the pattern of increasing group mean live weights when the intake of beer by-product was increased (Table 3). Carcass weight, dressing out percentage, percentage breast and percentage drumstick at 9 weeks were all increased significantly when the diet contained extra beer by-product. At week 12, no statistically significant differences were observed. When the birds were aged 9 weeks, birds fed the diet with 10% beer by-product had significantly higher titres against NCD than did their counterparts fed the diets containing either 5 or 15% beer by-product (Table 4). However, no diet effects were seen at the ages of 4 and 12 weeks.

Discussion

It is clear that substitution of beer by-product for the commercial diet generally raised body weight, improved feed conversion efficiency and had a positive impact on slaughter characteristics of the broiler chickens when they were aged 9 weeks. This is an important observation for broiler production in the area of Hue City, Central Vietnam because replacement of part of the commercial diet by beer by-product lowers feed costs. The present data also indicate that the feeding of extra beer by-product instead of the commercial diet might diminish mortality and may increase the resistance against NCD. It follows that the use of higher inclusion levels of beer by-product is beneficial for broiler production. A similar conclusion was drawn earlier when brewers' dried grains were compared with palm kernel meal and maize offal (Onifade and Babatunde, 1998).

It is difficult to see why the feeding of beer by-product had various positive effects. Clearly, the composition of the commercial diet and that of beer by-product were

Table 2: Body weight and feed conversion for broiler chickens fed on diets containing different amounts of beer by-product

	Diet (% of beer by-product)			Pooled SEM
	5	10	15	
Body weight (g)				
Week 4	550[a]	555[a]	575[b]	16.8
Week 8	990[a]	1020[b]	1034[c]	22.2
Week 12	1709	1767	1786	34.4
Feed conversion (kg feed/kg weight gain)				
Weeks 1-4	2.18	2.16	2.13	0.034
Weeks 5-8	2.25	2.23	2.22	0.065
Weeks 9-12	2.35[a]	2.32[b]	2.29[c]	0.074

Values refer to pooled data per treatment for each farm so that n=5 for each treatment. Means within rows having different superscript letters differ significantly (P <0.05). SEM = standard error of the mean.

Table 3: Slaughter traits of broiler chickens fed diets containing different levels of beer by-product

Item	Diet (% of beer by-product)				Pooled SEM
	Age (Weeks)	5	10	12	
Live weight (g)	9	1050	1055	1062	27.7
	12	1711	1786	1790	35.4
Eviscerated weight (g)	9	785	792	800	17.7
	12	1386	1390	1400	29.3
Carcass weight (g)	9	635[a]	692[b]	698[c]	25.2
	12	1198	1256	1263	21.5
Dressing out (%)	9	69.1[a]	70.1[b]	70.3[c]	1.17
	12	70.3	70.2	70.3	1.25
Abdominal fat (%)	9	1.9[a]	1.7[b]	1.7[b]	0.04
	12	2.1	2.3	2.5	0.02
Breast (%)	9	22.0[a]	24.2[b]	24.4[c]	1.12
	12	22.1	21.3	22.4	1.34
Drumstick (%)	9	14.8[a]	14.9[b]	15.0[c]	0.97
	12	15.0	15.2	15.1	1.21

Data refer to pooled data per treatment for each farm so that n=5 per treatment. Means in the same row with different superscript letters are significantly different (P < 0.05)

Table 4: Antibody titres against Newcastle disease in broilers fed diets containing different levels of beer by-product

	Diet (% of beer by-product)			Pooled SEM
Age (weeks)	5	10	15	
	HI titre (Log_2)			
4	2.29	2.42	2.31	0.09
9	2.14[a]	2.58[b]	2.33[c]	0.13
12	2.31	2.39	2.28	0.11

Data refer to measurements in blood samples pooled per treatment per farm so that n=5 for each treatment of each farm. Values with different superscript letters are significantly different (P<0.05).

different as to multiple components, but the macronutrient compositions of the experimental diets were similar except that the diets with extra beer by-product contained more crude fibre. It is possible that brewing by-product has growth promoting properties that relate to the presence of viable yeast and/or lactic acid bacteria. In malt, a complex microbial population has been detected, including numerous strains of lactic acid bacteria (Booysena *et al.*, 2002). Possibly, the probiotics in brewing by-product are responsible for its growth enhancing activity. There is evidence that the feeding of probiotics stimulates growth in broiler chickens (Vanbelle *et al.*, 1990).

It is interesting to note that in the birds fed the diet with 10% beer by-product the mortality was lower and the titre against NCD at the age of 9 weeks was higher when

compared with their counterparts fed the diets with either 5 or 15% beer by-product. It is not known whether there is a causal relationship. Furthermore, there was no diet effect on the titre at the age of 4 and 12 weeks. However, it is tempting to speculate that in the birds fed the diet with 10% beer by-product the immunological defense, and thus disease resistance was greatest. This reasoning would imply that there is an optimum inclusion level of beer by-product so that either a lower or higher level would be less favourable. Further research is necessary to prove or disprove our speculations.

Acknowledgement

Linh Q. Nguyen was supported by AGROPOLIS, IDRC, Canada.

References

Booysena, C., L.M. Dicks, I. Meijering and A. Ackermann, 2002. Isolation, identification and changes in the composition of lactic acid bacteria during the malting of two different barley cultivars. Int. J. Food Microbiol., 76: 63-73.

Nguyen, D.H., 1996. Slaughter techniques for the determination of poultry meat quality. J. Agri. Sci. Food Tec., 10: 423-431.

Onifade, A.A. and G.M. Babatunde, 1998. Comparison of the utilization of palm kernel meal, brewers' dried grains and maize offal by broiler chicks. Br. Poult. Sci., 39: 245-250.

Vanbelle, M., E. Teller and M. Focant, 1990. Probiotics in animal nutrition: a review. Arch. Tierernahr, 40: 543-567.

Vetvicka, V., B.P. Thornton and G.D. Ross, 1996. Soluble beta-glucan polysaccharide binding to the lectin site of neutrophil or natural killer cell complement receptor type 3 (CD11b/CD18) generates a primed state of the receptor capable of mediating cytotoxicity of iC3b-opsonized target cells. J. Clin. Invest., 98: 50-61.

Vui, T.Q., 2001. Cross sectional epidemiological survey of antibodies to some avian viruses, with special reference to Newcastle disease virus, in backyard and scavenging chickens in Thua Thien Hue province, Vietnam. M. Sc. thesis, Faculty of Veterinary Medicine, Free University of Berlin, Germany.

Westendorf, M.L. and J.E. Wohlt, 2002. Brewing by-products: their use as animal feeds. Vet. Clin. North Am. Food Anim. Pract., 18: 233-252.