EFFECTS OF DIETARY OF FERMENTED BREWER'S GRAIN DIET ON PORK CHARACTERISTICS IN GROWING-FATTENING PIGS

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***Abstract*—The ovjective of the pesent study was to investigative the effect of dietary of fermented brewer's grain diet on the pork characteristics in growing-fattening pigs. The fermented brewer's grain was mixed with rice bran and by-product, king oyster mushroom and pineapple by-product. Until 78 ± 1 kg live weigh at 130 ± 1 days. The pigs in the control group were fed formula feed, the pigs in the T1 group were fed 20, 40, 60, 80 and 100 % fermented diet substituted formula feed for 1 week interval and the pigs in the T2 group were fed 30, 60 and 100 % fermented diet substituted formula feed for 1 week interval. The live body weight, carcass weight, dressing were singnificantly (P<0.05) higher in the control group than T1 and T2 groups. However, the rate of high grade was higher in the T1 and T2 groups than in the control group. The moisture concenteration in pork was significantly (P<0.05) lower in the T2 group than in the control and T1 groups. The pork cholesterol concentartion, drip loss and cooking loss were significantly (P<0.05) lower in the T1 group than in the control group. The CIE L* (lightless) in meat surface was significantly (P<0.05) higher in the T1 group than in the control group and CIE a* in meat surface was sinificantly decreased in the treatment groups. The collagen concentration was significantly (P<0.05) lower in the T1 group than in the control group. Therefore, although dietary of fermented brewer's grain diet decreased carcass weight, it was changed meat quality parameters.**

***Key words*— Fermented diet, Brewer's grain, pork quality, pigs.**

I. INTRODUCTION

Stock farms including pig farms are developing fermented diets for the productions of high-quality meat, and some diets have already been developed are being applied to stock farming (Kim et al., 2001, 2006a,b; Song, 2001; Park et al., 2003; Song et al., 2001). According to report by Kim et al. (2006b) fermented persimmon shell diet has an increased organic acid concent and the feeding of Berkshires with fermented persimmon shell diets affects the quality fo the carcass and meat such as the chemical components, meat color and water holding capacity of the longissiimus dorsi muscle. It was also reported that fermented diets improve palatability in the sensory evaluation of pork and that up to 3 %, fermented persimmon shell diet dies not cause any detriment to growth performance (Kim et al. 2006b). Previous research shows that fermented diet affect the growth performance of pigs and meat quality. Fermented diets are known to affect the quality of pork, however there has been no reporte about meat quality parameters resulting from feeding pigs with a fermented diet prepared by fermenting dropping brewer's grain.

Therefore, the present study aimed to prepared a fermented diet using berwer's grain and to examine the effects of the fermented on the characteristics of carcass and meat according to the level of fermented brewer's grain.

II. MATERIALS AND METHODS

A. Experimental diet

The fermented brewer's grain diet was made by mixing brewer's grain, rice bran, by-product of king oyster mushroom, pineapple by-product, hulled soybean and corn meal and fermenting this mixture for 1 week (Table 1). The experimental diet in the control group was formula feed (Table 2), T1 group was 20, 40, 60, 80 and 100 % fermented diet substituted formula feed for 1 week interval and T2 group was 30, 60 and 100 % fermented diet substituted formula feed for 1 week interval.

B. Animals

Ninety heads Duroc × (Yorkshire × Landrace) barrow aged approximately 130 days were used in this study. At 78 ±

1 kg body weight the pigs were randomly allocated in the 9 pens with 10 pigs per pen in front-open building with three replicates pens per treatment. Growing diets was given to pigs until 80 ± 1 kg body weight. The control, T1 and T2 diets were added to end of experimental periods. The pigs had *ad libitum* access to water and diets.

C. Carcass traits and chemical composition

The pigs were slaughtered 12 hours from the time of food withdrawal. They were stunned electrically (300 V for 3 second) with a pair of stunning tongs, shackled by the right leg and exsanguinated while hanging.

Carcass weight and back-fat thickness at the 10th rib were measured. For the determination of chemical compositions and meat quality parameters, the longissimus dorsi muscle was cut off and kept at 4 ℃, and then transported to the laboratory.

D. Meat quality parameters

pH was measured using a Hanna HI 9025 (Woonsocket, Rhode Island, USA). Water holding capacity was determined by method by Jauregui et al. (1981). Meat and back-fat color was measured using a Minolta chromameter CR-300 (Minolta, Osaka, Japan).

E. Statistical analyzes

The data were analyzed using the General Linear Model (GLM) procedures of SAS (1999) and significant differences among the means were determined using the Duncan's Multiple Range Test method (Duncan 1955).

III. RESULTS AND DISCUSSION

The live body weight, carcass weight and dressing were significantly ($P<0.05$) higher in the control group than in the treatment groups. On the other hand, the backfat thinkness was significantly ($P<0.05$) lower in the control group than in the treatment groups. The ratio of high grade was higher in the treatment groups than control groups (Table 3).

The concentrations of moisture, crude fat and ash in the pork were significantly ($P<0.05$) higher in the T2 group than in the control group. However, the meat cholesterol concentration was significantly ($P<0.05$) lower in the treatment groups than in the control group (Table 4).

The drip loss and cooking loss were significantly ($P<0.05$) lower in the treatment groups than in the control group. Although meat lightness (CIE L*) was higher in the treatment groups than in the control group, treatment groups was lower redness (CIE a*) compared with control group (Table 5).

Collagen concentration was significantly ($P<0.05$) higher in the T2 group than in the control and T1 groups. Shear force and Hardness were significantly ($P<0.05$) higher in the treatment groups than in the control group (Table 6).

IV. CONCLUSION

As conclusion, although dietary of fermented brewer's grain diet decreased liver body weight, carcass weight and dressing, it was changed the pork quality parameters.

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Table 1. Formula rate of experimental fermented diet

Ingredients	Contain, %
Brewer’s grain	38.00
Rice bran	25.00
By-product King Oyster Mushroom	20.99
Pineapple by-product	8.00
Hulled soybean	4.00
Corn meal	4.00
Synbiotics	0.01
Total	100.00

Table 2. Chemical composition (%) of the formula feed

Ingredients	Growing periods	Fattening periods
Corn	53.00	33.50
Wheat	9.50	30.00
Soybean meal	26.00	12.50
Wheat bran	-	4.00
Rice bran	-	1.00
Rapeseed meal	-	3.00
Palm kernel meal	-	2.00
Cotton seed meal	-	3.00
Limestone	1.24	1.45
Tricalcium phosphate	0.82	0.60
Animal fat	5.10	4.20
Molasses	3.50	4.00
Salt	0.30	0.30
L-lysine HCI	0.20	0.20
DL-mathionine	0.04	-
Vitamin primix[1)]	0.10	0.10
Mineral primix[2)]	0.10	0.10
Phytase	0.10	0.05
Total	100	100
Chemical composition(%)		
ME(kcal/kg)	3,350	3,220
Crude protein	17.50	15.50
Lysine	1.05	0.87
Calcium	0.90	0.92
Total phosphorus	0.50	0.50

[1)] Supplied per kg diets : Vitamin A, 4,000IU; Vitamin D, 3,800IU; Vitamin E, 1,500IU; Vitamin K, 320mg; Vitamin B_{12}, 16mg; Thiamin, 8mg; Ribof lavin, 2mg; Pantothenicacid, 11mg; Niacin, 20mg; Biotin, 0.02mg.
[2)] Supplied per kg diet : Cu, 30mg; Fe, 175mg; Zn, 100mg; Mn, 90mg; I, 0.3mg; Co, 0.5mg; Se, 0.2mg.

Table 3. Effects of dietary fermented diet of brewer's grain on carcass characteristics in growing-fattening pigs

Items	Treatment[1)]		
	C	T1	T2
Live body weight (kg)	129.69 ± 2.60[a]	110.33 ± 1.80[b]	110.22 ± 2.11[b]
Carcass weight (kg)	104.63 ± 1.77[a]	82.44 ± 2.65[b]	83.89 ± 2.26[b]
Dressing (%)	80.69 ± 1.61[a]	74.73 ± 2.34[b]	76.12 ± 2.13[b]
Backfat thickness (mm)	26.63 ± 2.72[a]	18.56 ± 2.70[b]	19.11 ± 2.32[b]
Carcass grade (A:B:C:D, %)	0:13:13:74	9:22:69:0	33:56:0:9

[1)] T1, 20, 40, 60, 80 and 100 % fermented diet substituted formula feed for 1 week interval; T2, 30, 60 and 100 % fermented diet substituted formula feed for 1 week interval.
[a,b] Means values within the same row with different letters are significantly different ($p<0.05$).

Table 4. Effects of dietary fermented diet of brewer's grain on approximate analysis and meat cholesterol content in *longissimus dorsi* of pigs

Items	Treatment[1)]		
	C	T1	T2
Moisture (%)	73.12 ± 0.85[a]	72.86 ± 0.51[a]	72.18 ± 0.66[b]
Crude protein (%)	22.37 ± 0.43	22.19 ± 0.62	21.89 ± 0.43
Crude fat (%)	3.20 ± 0.43[b]	3.62 ± 0.33[ab]	3.91 ± 0.55[a]
Crude ash (%)	1.21 ± 0.11[a]	1.09 ± 0.07[b]	1.07 ± 0.07[b]
Meat cholesterol (mg/100g)	39.43 ± 4.32[a]	26.74 ± 6.64[b]	29.55 ± 4.23[ab]

[1)] T1, 20, 40, 60, 80 and 100 % fermented diet substituted formula feed for 1 week interval; T2, 30, 60 and 100 % fermented diet substituted formula feed for 1 week interval.
[a,b] Means values within the same row with different letters are significantly different ($p<0.05$).

Table 5. Effects of dietary fermented diet of brewer's grain on physico-chemical characteristics in *longissimus dorsi* of pigs

Items	Treatment[1)]		
	C	T1	T2
pH	5.76 ± 0.11	5.75 ± 0.14	5.78 ± 0.09
Drip loss (%)	3.83 ± 1.13[a]	3.45 ± 1.86[b]	3.52 ± 1.56[b]
Cooking loss (%)	31.19 ± 1.19[a]	29.89 ± 0.90[b]	30.68 ± 1.15[ab]
Meat surface			
CIE L^*	55.98 ± 0.78[c]	57.95 ± 5.00[a]	57.10 ± 3.18[ab]
CIE a^*	9.20 ± 1.31[a]	7.95 ± 1.86[b]	8.28 ± 1.30[b]
CIE b^*	4.59 ± 1.72	4.59 ± 1.72	4.70 ± 1.08
Backfat surface			
CIE L^*	84.22 ± 2.10[c]	84.78 ± 2.48[ab]	85.80 ± 1.95[a]
CIE a^*	3.08 ± 0.79	3.25 ± 1.01	3.59 ± 1.25
CIE b^*	3.33 ± 1.25[b]	5.34 ± 0.88[a]	4.86 ± 1.49[a]

[1)] T1, 20, 40, 60, 80 and 100 % fermented diet substituted formula feed for 1 week interval; T2, 30, 60 and 100 % fermented diet substituted formula feed for 1 week interval.
[a,b,c] Means values within the same row with different letters are significantly different ($p<0.05$).

Table 6. Effects of dietary fermented diet of brewer's grain on collagen content, shear force and texture profiles of cooked meat in *longissimus dorsi* of pigs

Items	Treatment[1)]		
	C	T1	T2
Collagen (%)	3.29 ± 0.05[b]	3.13 ± 0.01[b]	3.47 ± 0.25[a]
Warner-Bratzler Shear force (kg/cm^2)	8.16 ± 0.81[b]	8.99 ± 0.86[a]	9.02 ± 0.70[a]
Hardness (kg, f)	1.45 ± 0.34[c]	1.58 ± 0.16[a]	1.50 ± 0.27[b]
Surface hardness (kg, f)	1.44 ± 0.35[c]	1.58 ± 0.15[a]	1.51 ± 0.26[b]
Cohesiveness (ratio)	0.50 ± 0.04	0.51 ± 0.04	0.53 ± 0.03
Springness (ratio)	1.01 ± 0.03	1.00 ± 0.01	1.01 ± 0.02
Gumminess (kg, f)	0.79 ± 0.23	0.81 ± 0.13	0.77 ± 0.19
Chewiness	0.79 ± 0.23	0.81 ± 0.13	0.81 ± 0.17
Adhesiveness (kg, f)	0.50 ± 0.15	0.52 ± 0.15	0.52 ± 0.08

[1)] T1, 20, 40, 60, 80 and 100 % fermented diet substituted formula feed for 1 week interval; T2, 30, 60 and 100 % fermented diet substituted formula feed for 1 week interval.
[a,b,c] Means values within the same row with different letters are significantly different ($p<0.05$).