51st International Congress of Meat Science and Technology
August 7-12, 2005 – Baltimore, Maryland USA

EFFECT OF DIETARY ENERGY LEVELS ON THE MEAT QUALITY OF KOREAN NATIVE BLACK PIGS

Kang, S.M.[1*], Kang, C.G.[1], Kim, Y.S.[2], Lohakare, J.D.[3], Chae, B.J.[3], and Lee, S.K.[1]

[1]Dept. of Food Science and Technology in Animal Resources, [2]Institute of Animal Resources, [3]Division of Animal Resource Science, Kangwon National University, Chunchon, 200-701, South Korea

Key Words: Korean native black pig, intramuscular fat, drip loss, color, TBARS, sensory evaluation

Introduction

Recently in Korea, importance is given to native breeds of livestock under the preservation of its gene resources and the consumer's demand for good taste and quality of meat products. Hence the number of native livestock-breeding farmers that bred native livestock is gradually increasing. Korean native black pig (KNP) has been originated from small, middle, and large species of black pig that had originally inhabited in Manturia almost 2,000 years ago and has been settled in the Korean Peninsula. KNP has ability to adapt easily to the climatic variations, and have better resistance to diseases (RDA 2001). Muscle color of KNP is redder than that of Landrace and back fat color is also lighter than Landrace (Jin et al. 2001a). Even sensory quality of raw and cooked meat is higher in KNP than to Landrace (Jin et al. 2001b). Glutamate and essential amino acid content in pork from KNP is greater as compared with Landrace (Park et al. 2005). But breeding system and nutrient requirements suited to inherent characteristics of KNP is not still clearly established and KNP is supplied with diet fed to modern-genotype pig, thereby KNP does not bring an economical value for productivity and meat quality.

Objectives

The objective of this experiment was to determine the effect of dietary energy level on the meat quality of Korean native black pigs.

Methodology

Animals, diets and sample

Fifty-four KNPs with a live weight of 25 kg were allotted to three dietary treatments (9 gilts and 9 barrows per treatment). The treatments included three levels (high, medium, and low) of metabolizable energy (ME) at the growing stage (25-45 kg) comprising high (3265 kcal/kg), medium (3165 kcal/kg) and low (3065 kcal/kg) energy and during finishing stage (45-65 kg) the energy levels were high = 3065 kcal/kg, medium = 2965 kcal/kg, and low = 2865 kcal/kg. Three gilts and three barrows in each treatment were slaughtered at a live weight of 65 kg. The Longissimus muscles were utilized for the meat quality measurement. Following cut into 3 cm, samples were individually packaged in low-density polyethylene zipper bags (LDPE, Clean zipper bag, Cleanwrap Co., LTD, South Korea) and placed in dark room at 4 for 9 days.

Analytical methods

The IMF (intramuscular fat) content was analyzed according to AOAC (1995). The drip loss was determined according to Honikel (1998) and expressed as percentage of the initial weight. Color of the sample surface was measured by a Minolta Chroma meter (CR-301, Minolta Co., Japan), which recorded the lightness (L*), redness (a*), and yellowness (b*). The TBARS (2-thiobarbituric acid reactive substances) value was determined as described by Sinnhuber and Yu (1977) and reported as mg malonaldehyde (MA)/kg meat. Sensory analyses of raw and cooked meat were performed by trained ten-member laboratory panel. They rated muscle color, back fat color, marbling score, and overall liking of raw meat, taste, flavor, texture, juiciness, and overall liking of cooked meat using 9-point hedonic scales (1 = extremely unlike; 5 = normally like; 9 = extremely like). Data was analyzed using the General Linear Model procedure of SAS (1999) program. Differences among means at the 5% level were determined by the Duncan's multiple range tests.

Results & Discussion

The IMF (Fig. 1) was higher ($P < 0.05$) in barrows fed high-energy diets than that fed low energy diets and also in gilts fed medium energy levels. But IMF content remained comparable to barrows fed medium energy diets. Increasing the dietary energy levels decreased the drip loss (Fig. 2) but it was not affected by sex. It was significantly higher ($P < 0.05$) in high energy fed animals as compared with other treatments and increased linearly with increasing the refrigerated storage in all treatments. The lightness (L*) of the muscle surface (Fig. 3) decreased by increasing the dietary energy level and was lowest ($P < 0.05$) in high energy group than to other treatments at all measurements after storage. The redness (a*) (Fig. 4) increased as dietary energy level increased and was also higher in the barrows fed medium energy diets as compared with other treatments but it get decreased ($P < 0.05$) during refrigerated storage in all treatments. In addition, the lightness (L*) and redness (a*) in medium energy group were affected by sex, since the lightness (L*) was lower and the redness was higher in barrow than in gilt ($P < 0.05$). The yellowness (b*) (Fig. 5) was lower ($P < 0.05$) in the gilt fed low energy diets than to other treatments. The TBARS value (Fig. 6) was more in high and medium energy fed animals as compared with low energy from 6 d onwards ($P < 0.05$) and increased in all treatments during refrigerated storage ($P < 0.05$). Muscle color, back fat color, marbling score, and overall liking of raw meat and taste, flavor, texture, juiciness, and overall liking of cooked meat (Table 1) were higher ($P < 0.05$) in high and medium energy treatments than to low energy.

Conclusions

As dietary energy level of Korean native black pig increased, the intramuscular fat content, redness (a*), lipid oxidation, and sensory evaluation of the meat increased but the drip loss and lightness (L*) decreased.

References

AOAC. 1995. Official methods of analysis, 16th ed., Association of Official Analytical Chemists, Washington, DC, USA.

Honikel, K.O. 1998. Reference methods for the assessment of physical characteristics of meat. Meat Sci. 49:447–457.

Jin, S.K., Kim, C.W., Song, Y.M., Jang, W.H., Kim, Y.B., Yeo, J.S., Kim, J.W., and Kang, K.H. 2001a. Physicochemical characteristics of longissimus muscle between the Korean native pig and Landrace. Korean J. Food Sci. Ani. Resour. 21:142–148.

Jin, S.K., Kim, C.W., Song, Y.M., Kwon, E.J., Hwang, S.S., Jang, W.H., Park, Y.A., Cho, K.K., and Lee, J.I. 2001b. Comparison of sensory evaluation, fatty acid and amino acid composition of *longissimus* muscle between the Korean native pig and Landrace. Korean J. Food Sci. Ain. Resour. 21:183–191.

Park, J.C., Kim, Y.H., Jung, H.J., Park, B.Y., Lee, J.I., and Moon, H.K. 2005. Comparison of meat quality and physicohemical characteristics of pork between Korean native black pigs (KNBP) and Landrace by market weight. J. Anim. & Technol. 47:91–98.

RDA. 2001. Korean native black pig (standard farming textbook-121). Rural Development Administration, South Korea.

SAS. 1999. SAS User's Guide. SAS Institute, Inc., Cary, NC, USA.

Sinnhuber, R.O. and Yu, T.C. 1977. The 2-thiobarbituric acid reaction, an objective measure of the oxidative deterioration occurring in fats and oils. J. Jap. Soc. Fish. Sci. 26:259–267.

Tables and Figures

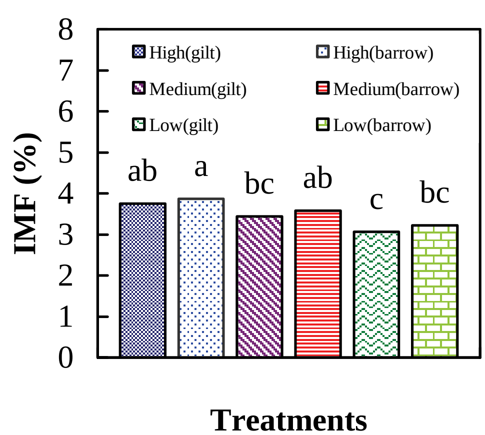

Fig. 1: Effect of dietary energy level on the IMF of Korean native black pig.

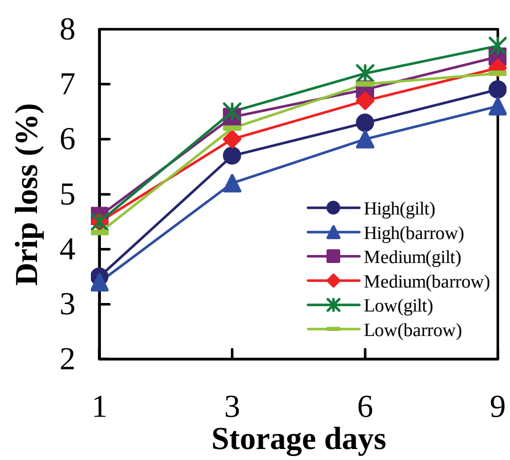

Fig. 2: Effect of dietary energy level on the drip loss in pork of Korean native black pig during refrigerated storage.

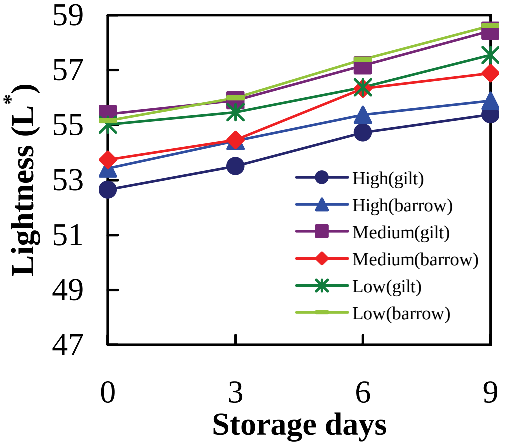

Fig. 3: Effect of dietary energy level on the muscle lightness of Korean native black pig during refrigerated storage.

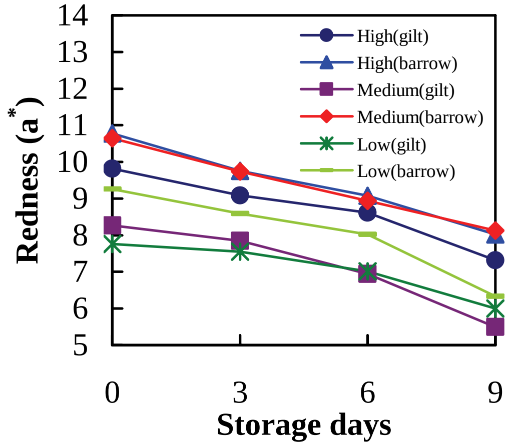

Fig. 4: Effect of dietary energy level on the muscle redness of Korean native black pig during refrigerated storage.

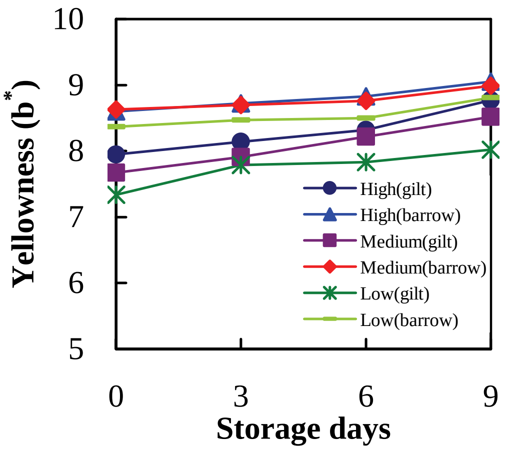

Fig. 5: Effect of dietary energy level on the muscle yellowness of Korean native black pig during refrigerated storage.

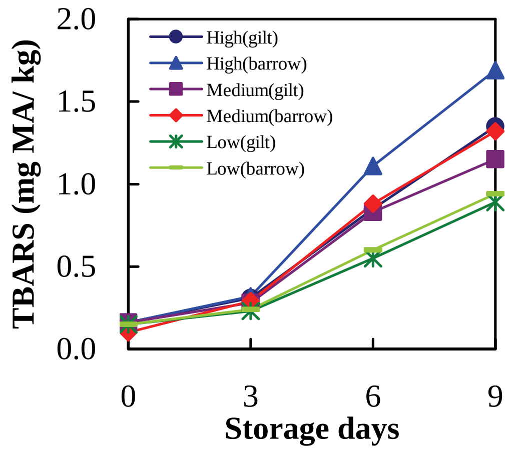

Fig. 6: Effect of dietary energy level on the TBARS value of Korean native black pig during refrigerated storage.

Table 1: Effect of dietary energy level on the sensory evaluation of raw and cooked pork from Korean native black pig.

Sensory evaluation*	Dietary energy level					
	High		Medium		Low	
	Gilt	Barrow	Gilt	Barrow	Gilt	Barrow
Raw meat						
Muscle color	7.22^{AB}	7.44^{A}	6.56^{AB}	6.78^{B}	5.56^{C}	5.75^{C}
Back fat color	7.11^{A}	7.22^{A}	6.44^{A}	6.44^{A}	5.22^{C}	5.25^{C}
Marbling score	7.22^{A}	7.33^{A}	6.67^{A}	6.78^{A}	5.33^{B}	5.50^{B}
Overall liking	7.11^{AB}	7.44^{A}	6.33^{AB}	6.56^{B}	5.56^{C}	5.63^{C}
Cooked meat						
Taste	7.00^{A}	7.13^{A}	6.63^{A}	6.75^{A}	5.38^{B}	5.63^{B}
Flavor	6.88^{A}	7.00^{A}	6.50^{AB}	6.50^{AB}	5.63^{B}	5.50^{B}
Texture	7.13^{A}	7.25^{A}	6.50^{A}	6.88^{A}	5.50^{B}	5.38^{B}
Juiciness	6.88^{AB}	7.13^{A}	6.63^{AB}	6.75^{AB}	5.63^{B}	5.88^{AB}
Overall liking	7.00^{A}	7.25^{A}	6.75^{A}	6.88^{A}	5.38^{B}	5.50^{B}

^{ABC}Means in the same rows with different superscripts are significantly ($P < 0.05$).

*9-point hedonic scale (1=Extremely unlike, 5=normally like, 9=extremely like).