Physicochemical Traits, Fatty Acid and Free Amino Acid Compositions of Two-way Crossbred Pork Belly

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Abstract

This study was conducted to determine the meat quality characteristics of pork belly from 3 different two-way crossbreeds of Yorkshire × Landrace (YL), Yorkshire × Berkshire (YB), and Yorkshire × Chester White (YC), which were domesticated for Korean consumers. Twenty pigs from each crossbreed (total n=60) were randomly selected when they reached the 110-120 kg range of market weight, slaughtered, and cooled at 0°C for 24 h. The pork bellies on the left side of the cooled carcasses were then sampled and analyzed. The pH of pork bellies was the lowest in YC among the crossbreds. There was no significant difference in fat content by crossbred, but YB bellies had the lowest moisture content (p<0.05). The cooking loss of YB bellies was lower than those of others (p<0.05). The TBARS values in YB was significantly higher than those of the others at 14 d. YL bellies had a higher percentage of stearic acid, oleic acid, and MUFA than the other breeds, while YB and YC had a higher percentage of myristic acid, linoleic acid, linolenic acid, and n-6 fatty acids than the YB (p<0.05). PUFA content and P/S were significantly higher in YC compared with YL. Except for arginine, the concentrations of most free amino acids were higher in YB bellies than in others, (p<0.05). Sensory evaluation scores of bellies were higher for YC than for other breeds (p<0.05).

Key words: crossbred, pork belly, meat quality, fatty acid, free amino acid, sensory

Introduction

Pork quality is a function of multi-factors including breed, feeding scheme, and pre- and post-slaughter managements. However, breed could be attributed as to the most significant single factor related to intramuscular fat, water holding capacity, color and tenderness (Sellier and Monin, 1994). There are numbers of studies have attempted to identify the best premium pig breed in terms of productivity, carcass and eating quality (Newcom et al., 2004). Individual species in pigs have different traits. Berkshire breed had thin muscle fiber and was excellent in water holding capacity (WHC) (Suzuki et al., 2003). Berkshire breed had high contents of amino acids, and lower moisture content, cooking, and drip loss (NPPC, 1995). On the other hand, Yorkshire and Landrace carcasses had a thin subcutaneous fat layer, large hams, and high muscularity (Ruusunen et al., 2012).

Crossbreeding is extensively used to increase the total efficiency of pig production and also to improve the quantity and quality of the meat (Bennet et al., 1983). Crossbred advantage is maximized in an individual born from a three-way cross and is twice as large as in the progeny of a backcross (Langlois and Minvielle, 1989). A few studies investigated the effect of genetic factors on meat quality (Ruusunen et al., 2012; Suzuki et al., 2003). Kim et al. (2006) mentioned that Landrace and Yorkshire × Duroc (LYD) pigs had lower shear force values and higher WHC compared with other breeds. In Korea, commercial pigs are currently three-way crosses with LYD. They are known for more rapid growth rate, bigger litter size, and higher yields than those reported for improved breeds in Korea (Hong et al., 2001).

In recent years, pork bellies are the most demanding and popular cuts in most Korean meat consumers and consequently their retail prices are much higher than other cuts. Although there have been increasing trials to
produce pork species with high meat quality, previous research on comparison between the breed and meat quality has only assessed in the parts of loins. Furthermore, it is not clear whether two-way crossbreeding in swine affects the final meat quality of the three-way crossbreed. It is imperative to select appropriate two-way crossbreeds to produce more competitive three-way crossbreed replacing commercial LYD, in especially highly preferred pork cut bellies. Lipid compositions are known for several muscles within the species (Alasnier et al., 1996; Leseigneur-Meynier and Ganderner, 1991), but little is known about free amino acid composition in the muscles of crossbreeding in pigs. A research should be done using different type of mating system or crossbreds on pork quality parameters such as fatty acid, amino acid and sensory parameter to fulfill consumer’s need in terms of new productive scheme for optimal meat quality.

There is little information on meat quality traits of two-way crossbreds in pork belly known for highly preferred pork cut in Korea. Therefore, the objective of this study was to compare the pork bellies from two-way crossbreds of Yorkshire×Landrace (YL), Yorkshire×Berkshire (YB), and Yorkshire×Chester White (YC) in terms of their physicochemical and sensory characteristics.

**Materials and Methods**

**Animals, sample collection, and preparation for analysis**

A total of 60 gilts (female pig) were evaluated from three different crossbreeding schemes including Yorkshire×Landrace (YL), Yorkshire×Berkshire (YB), and Yorkshire×Chester White (YC), with 20 animals in each scheme. YL, YB, and YC were selected as most potent two-way breed candidate according to the growth and production scores by NongHyun breeding pig improvement center (Yeonggwang, Korea). Thus the pigs were raised and fed under the standardized same feed conditions. Twenty pigs from each crossbred were randomly selected from 110-120 kg range of marketing weight, slaughtered, and cooled at 0°C for 24 h in a chilling room. The parts of bellies on the left side of the cooled carcasses were used to measure meat quality parameters. All samples were placed in vacuum bags and subsequently transported to the laboratory. And they were stored and frozen at -18°C in deep freezer until they were analyzed. All samples were used at the same location on the bellies over the middle portion and excess fat and bone were removed from the belly muscles. Prior to analysis, the samples were thawed overnight at 4°C.

**pH measurement**

The pH of samples was determined with a pH meter (Orion 2 Star, Thermo scientific, Beverly, MA, USA). The pH values of pork belly were measured by blending a 3 g sample with 27 mL distilled water for 60 s in a homogenizer (Polytron PT 10-35 GT, Kinematica AG, Switzerland). The electrode was calibrated with pH 4.01 and 7.00 standard buffers equilibrated at 25°C for the measurements.

**Moisture and fat content**

The samples were trimmed of all external fat prior to analysis. Moisture content was obtained with a slightly modified method of AOAC (2000). The total moisture content of 3 g of samples placed in aluminum moisture dishes were determined from their pre-dry and dry weights (dried in an air oven at 104°C for 24 h) and expressed as the percentage of pre-dry weight and gram water per gram dry weight. The moisture content was determined in triplicate on each sample. Fats were extracted from 5 g of meat with chloroform/methanol (2:1), according to the method described by Folch et al. (1957).

**Drip and cooking loss**

Drip loss and cooking loss were analyzed by the method described by the procedure of Kang et al. (2011). Percentage drip loss was determined by dividing the weight loss during thawing by the frozen weight of each sample. For cooking loss, after the samples were thawed and boned, they were weighed and cooked in an electric grill (HD 6320, Philips Electronics, Netherlands), until they reached a final internal temperature of 72±2°C. Percentage cooking loss was determined by dividing the weight loss during cooking by the pre-cooked weight.

**Instrumental measurement of color**

The surface color value of the pork belly samples were measured by the CIE L*, a* and b* system using a Minolta chromameter (Model CR-410, Minolta Co. Ltd., Japan), with measurements standardized with respect to a white calibration plate (L*=89.2, a*=0.921, b*=0.783) after 30 min blooming at room temperature. Color measurements for each of three replicates, always trying to avoid area with excess fat were taken and the value was recorded.

**Shear force measurement**

Shear force values were analyzed by the method des-