Comparison of the Chemical Composition, Textural Characteristics, and Sensory Properties of North and South Korean Native Chickens and Commercial Broilers

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Abstract

The objective of this study was to compare the quality characteristics of chicken breast and thigh meat from North Korean native chickens (NKNC), South Korean native chickens (SKNC, woorimotdak), and commercial broilers (CB). NKNC thigh meat had a higher crude protein content than CB. In addition, the breasts of NKNC and CB had higher pH values than that of SKNC, but the cooking loss was higher in NKNC. The surface color of the breast and thigh meat of NKNC was darker and redder than that of SKNC and CB. The total collagen content of the breast and thigh muscles was the highest in NKNC, followed by SKNC and CB. A similar trend occurred with breast meat hardness. The content of arachidonic and docosahexaenoic acids was higher in both the breast and thigh muscles of NKNC than in those of the other groups, while the concentrations of linoleic and linolenic acids were higher only in thigh meat. Sensory evaluation did not show any differences among the three different strains of chicken except for the meat color. Sensory panelists preferred thigh meat from SKNC and CB to that of NKNC due to the strong dark color of the NKNC. Based on these results, NKNC had harder breasts based on texture, as well as a darker surface color and higher composition of long chain polyunsaturated fatty acids than CB. The quality characteristics of SKNC tested in this study were intermediate between NKNC and CB; however, SKNC may have a better chance of acceptance by Korean consumers due to the undesirable color of NKNC.

Key words: North Korean native chicken, South Korean native chicken, commercial broiler, chemical composition, sensory

Introduction

Recently, chicken meat has been considered superior to red meat due to its health benefits, as it contains less fat and has lower cholesterol (Jaturasitha et al., 2008). In addition, chicken meat is relatively lower in price, has easy to handle portions and is not the subject of religious restrictions as far as its consumption is concerned (Jaturasitha et al., 2004). In 1970, the per capita chicken consumption in Korea was estimated to be approximately 1.4 kg, and this value reached 7.5 kg in 2005. A similar trend in chicken production and consumption has also been observed in China and other Asian countries (Han et al., 2009).

This rapidly growing chicken meat industry has been based on only few fast-growing broiler strains produced by commercial breeding companies in intensive fattening systems (Jaturasitha et al., 2008). As a result, native chicken breeds in Korea have become endangered or even extinct because of their poor commercial performance when compared with imported commercial synthetic breeds (Sang et al., 2006). This has led to only a few farms in remote areas of Korea raising native chicken breeds. To prevent the loss of this national resource, the National Institute of Animal Science, Rural Development Administration of Korea has been conducting a Korean native chicken breed restoration program. They have developed a Korean native chicken line (KNC) from the restored breeds known as woorimotdak, which has been used for commercial purposes. This KNC line is characterized by having less fat and higher protein than foreign breeds, which makes it more attractive to domestic consumers who are prepared to pay a premium
price for high quality products (Kong et al., 2006).

Native chicken meat usually has a unique taste and texture that attracts a price 2-3 times higher than that of commercial broilers (Ding et al., 1999). Wattanachant et al. (2004) reported that native chickens generally have slower growth than the commercial broilers, and that this may contribute to differences in the properties of their meats. For example, the muscles of Thai native chickens have a firmer texture than those of commercial broilers, particularly after cooking. This difference in textural characteristics might be related to the differences in total and soluble collagen contents (Wattanachant et al., 2004). However, there is limited information available regarding the quality attributes of North Korean native chickens (NKNC). It has been assumed that NKNC strains raised in isolated environments possess specific characteristics that could be appealing to consumers. Therefore, this study was conducted to compare the chemical composition, textural characteristics, and sensory attributes of breast and thigh meat derived from NKNC, restored South Korean native chickens (SKNC, woorimotdak), and commercial broilers (CB).

**Materials and Methods**

**Samples**

North Korean native chickens (NKNC) were a gift from the North Korean government as part of the peace cooperation program between the South and North Korean governments. The chickens were raised and continuously inbred on a local farm in South Korea. The NKNC is characterized by a variety of feather colors, relatively better flying activity, and aggressive temperament. NKNC aged approximately 180 d were manually slaughtered on the farm, defeathered, and their carcasses were frozen at -20°C until further analysis. The SKNC, which are sold as woorimotdak, have been restored by National Institute of Animal Science, Rural Development Administration, Korea as a part of Korean Native Chicken Breed Restoration Project. SKNC samples were purchased from Elim Farm, Changnyeong, South Korea, which produces and distributes woorimotdak. The South Korean native chickens (Gallus domesticus) used for the present study were aged approximately 100 d. Commercial broilers (Ross strain) aged 32 d were purchased from a local market in Daejeon, Korea. SKNC and CB were slaughtered by commercial slaughterhouses. The frozen chicken carcasses from the three different strains were thawed for 48 h in a refrigerator, after which the breast (pectoralis) and thigh muscles (biceps femoris) were deboned and the visible skin and excessive connective tissues were removed. Five chickens of each origin were used to generate the experimental data.

**Proximate composition**

The proximate composition of the breast and thigh muscles from the NKNC, SKNC, and CB was determined using the methods of the AOAC (1995). Briefly, the moisture content was measured by drying the samples (2 g) at 102°C for 15 h. The crude protein content was measured by the Kjeldahl method (VAP045, Gerhardt Ltd., Idar-Oberstein, Germany). The crude fat content was measured using the Soxhlet extraction system (TT 12/A, Gerhardt Ltd., Idar-Oberstein, Germany). The crude ash content was measured by heating the sample (2 g) in a furnace at 600°C for 6 h.

**pH, cooking loss, and color measurements**

To determine the pH values, 10 g of each sample were mixed with 90 mL of distilled water and homogenized using a homomixer (T25 basic, Ika Co., Staufen, Germany) for 1 min. The mean value from three repeated measurements was determined using a pH meter (750P, Istek Co., Seoul, Korea).

To determine the cooking loss, each sample was cut into 2.5 cm thick slices that were then packaged in polyethylene bags and placed in an 80°C water bath for 30 min. The samples were then removed and cooled at room temperature for 30 min, after which the cooking loss values were calculated based on the difference in the weight of the meat before and after cooking.

The meat color values of each breast and thigh muscle were measured on the surface of the meat samples (4 cm diameter, 1.5 cm thickness) using a colorimeter (Spectrophotometer, CM-3500d, Minolta, Tokyo, Japan). The color L* (lightness), a* (redness), and b* (yellowness) values were obtained using an average value from three repeated measurements taken at different locations on the surface of the meat. Each color value was automatically analyzed by the Spectra Magic Software (Minolta, Tokyo, Japan).

**Fatty acid composition**

To determine the fatty acid composition, lipids were extracted from each breast and thigh sample according to the method described by Folch et al. (1957). Briefly, the meat sample (30 g) was mixed with 150 mL Folch solvent (methanol:chloroform = 1:2). In next, 0.88% KOH