Physico–chemical and Sensory Characteristics of Semi–dried Sausages Containing Different Levels of Kimchi Powder

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Abstract

Effects of the addition of kimchi powder on the physico-chemical and sensory properties of semi-dried sausages were investigated at the following kimchi powder concentrations: control (0%), T1 (1%), T2 (2%), and T3 (3%). pH of the semi-dried sausages containing kimchi powder decreased with the addition of kimchi \((p<0.05)\). Also, the addition of kimchi powder to the sausages significantly decreased the CIE L* and increased the CIE a* and CIE b* values \((p<0.05)\). The T3 treatment resulted in a higher moisture loss than other treatments. TBARS values of the T2 and T3 groups were significantly lower \((p<0.05)\) than that of the control, while T3 had the highest VBN value among treatments at the end of the storage period. Addition of kimchi powder to semi-dried sausages improved the overall sensory properties of the sausages, and increased the softness and tenderness. These results suggest that addition of 2% kimchi powder to semi-dried sausage is helpful to improve the quality of sausages.

Key words : semi-dried sausage, kimchi, dietary fiber, sensory properties, quality characteristics

Introduction

Functional foods can be defined as foods providing health benefits above basic nutrition (Bech-Larsen and Grunert, 2003). Functional attributes of many traditional foods are being discovered, while new food products are being developed with beneficial components (Eim et al., 2008). Producers and processors have responded to consumer demand for foods perceived by many to be more healthy and wholesome than conventionally produced food products (Sebranek and Bacus, 2007). Meat and meat products may also be considered as functional foods to the extent that they contain numerous compounds thought to be functional. The idea of using foods for health purposes rather than for nutrition opens up a whole new field for the meat industry (Calvo et al., 2007; Jimenez-Colmenro et al., 2001). In addition to traditional meat products, the meat industry can explore various new possibilities, including the control of the composition of raw and processed materials via the reformulation of fatty acid profiles or the inclusion of antioxidants, dietary fiber, probiotics, etc. (Kovacs et al., 2007; Mendoza et al., 2001).

Over last few decades, there have been the expansion of knowledge of the influence of diet on health and well-being. The most popular kimchi is baechu kimchi, which is made with Korean baechu cabbage (Cheigh and Park, 1994). Fermented kimchi usually contains high levels of lactic acid bacteria, organic acids, and other nutrients such as vitamins, minerals, dietary fiber, and functional components form during fermentation (Cheigh and Park, 1994; Park, 1995). Thus, kimchi might be called a lactic acid bacteria fermented food as well as a functional food. Kimchi is known to help increase appetite, reduce constipation, maintain proper intestinal flora, and has been reported to have antimutagenic effects, anticarcinogenic effects, anti-aging effects and other health benefits (Hwang and Song, 2000; Kim et al., 1998; Park et al., 1995). The major raw materials of kimchi are vegetable and spices including ginger, garlic, green onion, and paprika which contain antioxidants compounds such as ascorbic acid, carotenoids, flavonoids, phenolic compounds, and tocopherols (Cheigh and Park, 1994; Park, 1995).

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Kimchi, is suitable for meat products, contains 32.50% of dietary fiber on a dry weight basis (Lee et al., 2008b). Various types of kimchi powder have been studied alone or in combination with other ingredients for the formulation of reduced fat meat products (Lee et al., 2008a).

Dietary fiber is desirable not only for their nutritional properties, but also its functional and technological properties in reducing formulation cost, substituting fat and enhancing texture (Akoh, 1998; Fernandez-Gin et al., 2005; Jimenez-Colmenero, 1996). Dietary fiber retains water, increases cooking yields and has a neutral flavor, appropriate for meat products, and has previously been added to meat products to increase the cooking yield because of its water and fat binding properties (Cofrades et al., 2000; thebaudin et al., 1997). The utilization of kimchi powder for meat processing and its potential use as an additive are not well understood.

The aim of this study was to evaluate the influence of kimchi powder levels on the color attributes of semi-dried sausage, and to determine the physico-chemical, sensory properties, and storage stability of meat products with different kimchi powder levels.

**Materials and methods**

**Kimchi powder preparation**

Commercial Baechu (Korean white cabbage) kimchi, the style of central districts in Korea, was purchased from a local market (Chongga kimchi, Daesang FNF, Seoul, Korea). It was prepared as follows (%): Chinese cabbages, cut into half heads, were dipped in 15% (w/v) brine for 4 h. The pieces of cabbage were washed with tap water, drained and then mixed with spices and additives. The recipe of ingredients and additives were 68.1% salted Chinese cabbage, 16% sliced radish, 6% green onion, 2% onion, 1.6% scallion, 1.2% fermented shrimp, 1.2% fermented anchovy sauce, 2% red pepper powder, 1.2% chopped garlic, and 0.6% chopped ginger. At the beginning of fermentation, the averaged pH values of kimchi packaged with PE/Nylon film bags with sealing were pH 5.4, and then gradually decreased to pH 4.3 until approached the optimal sensory condition (Hong and Park, 1999; Park and Lee, 1995) in a period of 15 days at 4±1°C. Fermented kimchi was blended with a cutter (C4 VV, Sirman, Marsango, Italy) and then the blended kimchi was packaged in portions of approximately 300 g per in PE/Nylon film bags and pressed flat. The vacuum-packaged kimchi was immediately frozen at -20±1°C until use. Kimchi was dried in a hot air dryer (Enex-Co-600, Enex, Yongin, Korea) at 60±1°C. For 12 h until kimchi contained <15% final moisture, kimchi was finely ground to a particle size of <0.5 mm (35 mesh) followed by storage in a deep freezer (-70°C) until further use. The chemical compositions of the kimchi powder, determined in triplicates according to the AOAC (1995) method were: 8.02 g/100 g moisture, 13.62 g/100 g protein, 5.88 g/100 g fat, 18.05 g/100 g, and 32.50 g/100 g.

**Processing of semi-dried sausage**

Biceps femoris muscle, Semitendinosus muscle, Semimembranosus muscle from fresh pork (castrated boars; Landrace×Yorkshire×Duroc; approximately 110 kg), weighing 6.8-7.2 kg each, were purchased from a local processor at 48 h postmortem. Pork back fat was also collected. All subcutaneous and intramuscular fat and visible connective tissues were removed from the fresh ham muscles. Lean meat and back fat were ground through an 8 mm plate. Semi-dried sausages were manufactured based on the following formulation; 90% lean pork meat, 10% pork back fat, 1.5% sodium chloride, 0.15% phosphate, and 0.1% monosodium L-glutamate and three batches contained different amounts of kimchi powder in the final meat mixture: 1% (T1), 2% (T2), and 3% (T3). The fourth batch was manufactured without kimchi powder as a control. The addition of sodium chloride controlled as kimchi powder level because kimchi powder had 10% salt content, therefore sodium chloride added 1.5% (control), 1.4% (T1), 1.3% (T2), and 1.2% (T3), respectively. Since kimchi contains 10% salt, the amount of sodium chloride added was adjusted for each formulation so that the final concentration was 1.5%.

The manufacturing process of the semi-dried sausages was as follows. Four batches (2 kg each) were prepared for each formulation. For each batch of sausage, the meat and phosphate were mixed by hand for 3 min and then cured at 4°C for 12 h and then, the cured pork meats were added to kimchi powder, and other ingredients and were emulsified using a silent cutter (Nr-963009, Scharfen, Witten, Germany) for 3 min. After emulsification, the meat batter was stuffed into collagen casings (#240, NIPPI Inc., Tokyo, Japan; approximate 25 mm diameter) using a stuffer (IS-8, Sirman, Marsango, Italy), dried at 55°C for 30 min and smoked at 65°C for 60 min followed by heating at 80°C for 60 min. After cooling with cold water, the semi-dried sausages were anaerobically packed in PE/nylon film bags, stored at 4°C for 6 wk and analyzed for pH, instrumental color, compositional properties, texture profile analysis, sensory evalua-