EFFECT OF DIFFERENT DRYING TYPES AND LEVEL OF *KIMCHI* POWDER ON QUALITY CHARACTERISTICS OF BREAFAST SAUSAGE

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Introduction

Kimchi is the traditional fermented vegetable food as one of the most popular side dishes in Korea (Cho *et al*., 1997). If *Kimchi* is dehydrated by various conditions, it could be more convenient and useful. The dietary fiber content of *Kimchi* is about 24.0% on dry basis by freeze drying (Park *et al*., 1996). Dietary fibers are desirable not only for their nutritional properties, but also it can be used in cooked meat products to increase the cooking yield due to their water and fat binding properties and to improve texture properties (Thebaudin *et al*., 1997). Various types of addictives which are soy fiber, (Cofrades *et al*., 2000), citrus fiber (Fernandez-Gins *et al*., 2003), oat fiber (Chang and Carpenter, 1997), and other fibers (Claus and Hunt, 1991) have been incorporated alone or combined with other ingredients for formulation of meat products. *Kimchi* powder has been used to develop new taste-enriched products. Several studies have been conducted to *Kimchi* noodle (Cho and Kang, 2003), seafood bun (Kang *et al*., 2001), and fermented sausage (Lee and Kunz, 2005) through only the addition of various freeze dried *Kimchi* powder. However, very limited studies have been found on the properties of meat products containing different *Kimchi* powder from different drying condition. Therefore, the objective was to evaluate the chemical, physical, and sensory properties of meat batter and breakfast sausage containing hot air dried *Kimchi* powder (HKP) and freeze dried *Kimchi* powder (FKP). All sausages with different levels of *Kimchi* powder (0, 1, and 2%) were also formulated for comparison.

Materials and Methods

Fermented *Baechu Kimchi* dried by a freeze-dryer (PVTFD 20R, Ilshinlab, Yangju, Korea) for 3 days and by a hot air dryer (Enex-Co-600, Enex, Koyang, Korea) at 60°C for 12 h. Dried *Kimchi* was pulverized by a blender (KA-2610, Jworld Tech, Ansan, Korea) in 30 s and screened through a 35 mesh sieve (Testing sieve, Chung Gye Sang Gong Sa, Seoul, Korea). Lean pork meats were initially ground through a 13 mm plate. The pork back fats were also ground through an 8 mm plate. Breakfast sausages were manufactured according to formulation : 50% lean pork meat, 25% pork back fat, 25% water (ice form w/w), 1.5% sodium chloride, 0.15% phosphate, 0.5% sugar, 0.05% onion powder, and 0.05% Monosodium L-Glutamate. Freeze dried *Kimchi* powder (FKP) or hot air dried *Kimchi* powder (HKP) was added at levels of 0% (control), 1% or 2%. These percentages were based on the control formula weight. Each treatment produced approximate 4kg batch breakfast sausage mixtures per trial. For each batch, meat, fat, water, *Kimchi* powders, and other ingredients were emulsified for 9 min and stuffed into collagen casing (approximate diameter of 25 mm). And then, breakfast sausages were heated at 75°C for 30 min. The cooked breakfast sausages were then cooled by cold water. Two replications of the experiment were conducted each at separate times.

Compositional properties and dietary fiber content were determined by using standard AOAC (1995). Dietary fiber content of *Kimchi* powder was determined as described by Prosky (Prosky *et al*., 1998). Water absorption capacity of *Kimchi* powder was determined using a modification of method (AACC, 1995). Color measurements were taken with color meter (Chroma meter CR-200, Minolta, Japan). The pH of sample was determined with a pH meter (Model 340, Mettler-Toledo GmbH, Schwerzenbach, Switzerland). The emulsion stability was measured as described by Bloukas and Honikel (1992). Cooking yield was determined on each treatment by calculating the weight differences before and after cooking at 75±1 °C for 30 min. Textural properties for each sausage was measured at room temperature by a spherical probe (0.25mm diameter), set attached to a Texture Analyzer (TA-XT2*i*, Stable Micro System Ltd., Surrey, U.K.). Sensory evaluations were performed in duplicate on each sausage by ten panelists who had previous sensory panel experience in consuming traditional breakfast sausages. Sausages (10 mm cube) were evaluated using a 10 point horizontal scale. Data were analyzed in a one-way analysis of variance through the analysis of variance (ANOVA) procedure of the SAS statistical package (SAS Institute Inc., USA).

Results and Discussion

Dietary fiber contents of HKP were significantly higher than FKP. Cold water absorption of HKP was higher than FKP ($P<0.05$). Hot water absorption was increased from 311.93 to 362.44 % in FKP and from 326.36 to

409.82 % in HKP (P<0.05). The pH value of breakfast sausages with *Kimchi* powder were lower than the control due to the low pH of *Kimchi* powder. The control was significantly lighter (CIE-L^* value) than treatments containing *Kimchi* powder. CIE-a^* and CIE-b^* value of breakfast sausage with added *Kimchi* powder were higher than control. The highest levels of water and fat separation occurred in the control compared to treatments containing *Kimchi* powder (P<0.05). The cooking yields of the treatments containing *Kimchi* powder were higher than control (P<0.05). The presence of *Kimchi* powder resulted in different fat content and moisture content. Ash content increased when *Kimchi* powder added and percentage of protein content was similar for all treatments (P>0.05). Hardness of treatment groups containing 2% *Kimchi* powder was higher than control. There results indicated that changes in *Kimchi* powder level significantly affected the textural characteristics of the breakfast sausage. Hardness, gumminess, and chewiness increased as fiber content increased. There were no significant differences in cohesiveness characteristics. Shine scores were opposite to those of hue. Hotness, taste, and flavor scores were increased by the increment of the *Kimchi* powder (P<0.05). There were no differences in juiciness and tenderness among the treatments. Overall acceptability scores depended on the dying type and level of *Kimchi* powder.

Conclusions

In summary, breakfast sausage with *Kimchi* powder not only improved a meat quality because of containing dietary fiber, but also addition of *Kimchi* powder affected the improvement of sensory properties. The results point to a potential use of hot air dried *Kimchi* powder by the meat industry better than using a freeze drying which requires a high cost.

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