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Effect of gelatin mixtures as injected solution on loin ham (#195)

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Introduction

Injection and tumbling is a widely used approach to improve the quality properties of meat products; the injected solution is uniformly dispersed into muscles for the effective extractability and solubility of myofibrillar proteins. As a major ingredient in injected solutions, salt increases the solubility of myofibrillar proteins and ionic strength of myofibrils. However, to meet consumer demand, ingredients derived from natural sources, such as collagen, kiwi, fig, pear, and ginger, have been used to improve the quality properties of marinated meat.

Gelatin is widely used for the preparation of meat products owing to its functionality, including its effects on texture, water-binding ability, adhesion, and cohesion. Previous studies have shown that gelatin mixtures with other functional ingredients improve the water holding capacity (WHC) in cured ham, reduced fat sausage, and chicken nuggets. However, to our knowledge, studies of the effects of commercial gelatin mixtures composed of collagen, carrageenan, isolated soy protein, whey protein, and other components on injected/tumbled meat are lacking. In this study, we compare the functional effects of various commercial gelatin mixtures on physicochemical properties.

Methods

Preparation of loin samples with injected solution

Fresh pork loins were purchased from a local market (Seoul, Korea). Three commercial collagen mixtures (A, 20% pork gelatin, 30% isolated soy protein, 30% konjac, and 12% carrageenan, and 8% guar gum; B, 20% pork gelatin, 30% l-lysine monohydrochloride, 20% maltodextrin, 20% whey protein, 5% inulin, and 5% tapioca starch; C, 40% pork gelatin, 30% l-lysine monohydrochloride, 20% whey protein, 8% maltodextrin, and 2% tapioca starch) were purchased from different companies. The composition (w/w) of the injected solution was 93.6% water and 6.4% nitrite pickled salt (salt: nitrite = 99.4:0.6) for the control. For treatment groups, each commercial collagen mixture (A, B, or C) was dissolved in the injected solution. The solution was injected into each pork loin at a ratio of meat: solution of 10:2 (w/w) using an injector. The injected pork were placed in plastic bags and intermittently tumbled for 90 min (45 min on, 15 min off) at 1 ± 1°C in a tumbler (MKR150; RÜHLE GmbH). After tumbling, samples was dried at 60 ± 1°C for 30, smoked at 65 ± 1°C for 30 min, and cooked at 80 ± 1°C for 30 min to reach an internal temperature of 72°C.

pH values

The pH values were measured in a homogenate prepared with 4 g of meat sample and distilled water (16 mL) using a pH meter.

Water holding capacity (WHC)

The WHC of each sample was measured following the methods of Grau and Hamm, with modifications. In brief, 300 mg of sample was placed on Whatman No. 2 filter paper and then pressed for 3 min with constant pressure using a binate plexiglass plate. Outer and inner sections were measured using a planimeter to evaluate exuded moisture and meat, respectively. The ratio between the inner and outer section was defined as the WHC (%).

Cooking yield

Cooking yield was determined for individual samples by calculating the weight before and after cooking as follows:

Cooking yield (%) = [weight of cooked meat sample (g)/weight of raw meat sample (g)] × 100

Instrumental color

The colors of raw and cooked meat samples were determined using a colorimeter. Lightness (CIE L^* value), redness (CIE a^* value), and yellowness (CIE b^* value) values were recorded.

Shear force measurement

For the Shear force values of the cooked samples were determined using a Warner–Bratzler attachment on a texture analyzer. Test speeds were set to 2 mm/s. Data were collected and the shear force values (kg) were used to obtain the maximum force required to shear each sample.

Statistical analysis

The data were analyzed using one-way analysis of variance (ANOVA) and Duncan's multiple range test implemented in SAS.

Results

The gelatin mixtures led to significant increases in water holding capacity, cooking yield, and instrumental tenderness, regardless of the type of gelatin mixture. In particular, meat samples containing collagen mixture-C showed the highest ($p<0.05$) water holding capacity and tenderness among all groups. Furthermore, gelatin mixture-B induced increases ($p<0.05$) in pH values in samples. The *a** values of samples with gelatin mixtures were lower $p<0.05$) than those of samples without gelatin mixtures. These results indicated that gelatin mixture-C could be used in injection brine to enhance the quality characteristics of meat products, particularly the water holding capacity and tenderness.

Conclusion

Notes

In this study, we compared the functional effects of three commercial gelatin mixtures on quality characteristics, including the proximate composition, pH, cooking yield, WHC, cooking loss, shear force and color, of injected/tumbled loin ham. Our results indicated that gelatin mixture-C and collagen mixture-A injected in brine could be used to improve quality characteristics and lipid oxidative stability, respectively. Further studies should evaluate the protein retardation effect of each commercial gelatin mixture.

Traits	Control1)	Type o
		A1)
pH	5.79 ± 0.01^{by}	5.70 ± 0.02^{by}
Water holding capacity (%)	31.09 ± 1.35^{c}	52.73 ± 3.52^{b}
Cooking yield (%)	75.52 ± 0.92^{a}	78.70 ± 0.52^{b}

Table 1. The pH values and water holding capacity, and cooking yield of pork loin injected with vari

All values are mean ± standard error of four replicates. [a-c]Values with different superscript letters within the same row differ significantly ($p<0.05$). [x,y]Values with different superscript letters within the same column differ significantly ($p<0.05$). [1)]Control, samples injected with no gelatin mixture; A, samples injected with commercial gelatin mixture A; B, samples injected with commercial gelatin mixture B; C, samples injected with commercial gelatin mixture

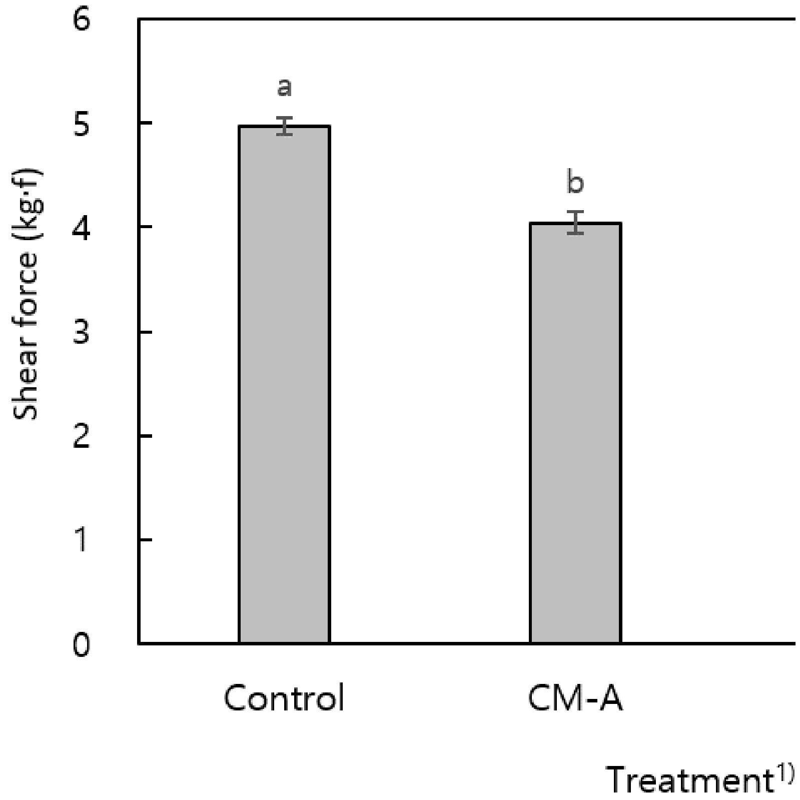

Fig. 1. Shear fore of pork loin injected with various gelatin mixtures. Bars indicate standard error. [a-c]Values with different letters on the bar are significantly different ($p<0.05$). [1)]Control, samples injected with no gelatin mixture; A, samples injected with commercial gelatin mixture A; B, samples injected with commercial gelatin mixture B; C, samples injected with commercial gelatin mixture C.

Notes

Traits	Control	Type of
		A
CIE L*	47.05±0.77^{by}	47.47±0.78^{bx}
CIE a*	17.45±0.37^{ax}	15.71±0.38^{bx}
CIE b*	36.55±0.30^{ax}	35.60±0.28^{ax}

Table 2. Instrumental color profile of pork loin injected with various gelatin mixtures

All values are mean ± standard error of four replicates.

^{a,b}Values with different superscript letters within the same row differ significantly ($p<0.05$).

^{x,y}Values with different superscript letters within the same column differ significantly ($p<0.05$). [1)]Control, samples injected with no gelatin mixture; A, samples injected with commercial gelatin mixture A; B, samples injected with commercial gelatin mixture B; C, samples injected with commercial gelatin mixture C.

Notes