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STUDY ON THE HEAT RESISTANCE OF RED PIGMENTS IN AIGAMO DUCK MEAT

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I. INTRODUCTION

It is widely known that meat color is not only an indicator of freshness in raw meat, but also an indicator of the degree of being heated. In addition, the color of meat reflects the ratio of the major heme proteins, myoglobin (Mb) and hemoglobin (Hb), and their derivatives (especially oxy- and met-forms), and it is generally believed that myoglobin has a large influence [1]. The color of Aigamo duck meat soup prepared by heating at 60°C for taste testing [2] was significantly redder than the color of beef soup. To clarify the cause of this high heat resistance of Aigamo duck meat, we measured the color difference of the homogenate supernatants of each meat homogenate heated at 60-80° C. Furthermore, we purified the red pigments from each meat and investigated the heat resistance of the red component (the degree to which the red color is maintained when heated).

II. MATERIALS AND METHODS

The Aigamo duck and beef meats were purchased from a local market. The minced meats were homogenized with the equal weight of 0.5% NaCl and the obtained homogenate were divided to two for using as follows: Experiment 1: Fifteen gram of homogenates were heated at 60-80° C for 30 min and then centrifuged at 5.500x *g* for 20 min. The color of the obtained supernatants was compared visually between Aigamo and beef samples, and then the color difference was measured with the instrument (Nippon Denshoku Kogyo Co., Ltd. ZE-2000). Experiment 2: The homogenates were centrifuged at 5,500X *g* for 20 min. Fifteen mL of the obtained supernatants were heated and used for visual and instrumental measurement as Experiment 1. The major red pigments were purified from each meat extract at pH 7.2 with chromatography using CM-Sephadex C-50 and Sephadex G-75 columns (Merck , Germany). Species of the purified pigments were identified with Western blotting using rabbit anti-Mb antibody (PGI Proteintech Group,Inc., USA) and rabbit anti-Hb ALPAH antibody (PGI Proteintech Group,Inc., USA) . The purified pigments were reduced with 0.5% ascorbic acid at room temperature for 30 min and then dialyzed to remove residual ascorbic acid. Five mL of the reduced samples were heated at 60-70°C for 10 minutes, and centrifuged at 5,500 x *g* for 20 min. The color difference of the obtained supernatant was measured.

III. RESULTS AND DISCUSSION

In Experiment 1, comparing the supernatants of heated homogenates from both meats by visual inspection, the beef sample turned brown from 60℃, and as the temperature increased, the brown color faded and became transparent above 70℃, while the Aigamo sample was red at 60℃, and as the temperature increased, the color faded but still seemed to maintain the red color. In Experiment 2, the changes in color of Aigamo and beef samples heated at 60-80° C were similar with the Experiment 1. In addition, the redness degree, a*/b* [3] of Aigamo sample, obtained by color difference measurement was significantly higher than that of beef sample at 60℃ or higher, suggesting high heat resistance of red pigments of Aigamo meat (Figure 1). The main red pigments purified from both meats were subjected to SDS-PAGE and the pigment species were examined by Western blotting, suggesting that the Aigamo meat pigment was Hb and the beef pigment was Mb (data not shown). When both purified products were heated at 60-70℃, there was no difference in a*/b* at each temperature between the two, as shown in Figure 2. It was considered that there was no difference in heat resistance between the two. Therefore, it was suggested that some components removed by purification were responsible for the high heat resistance of the red pigment of Aigamo meat in the homogenate.

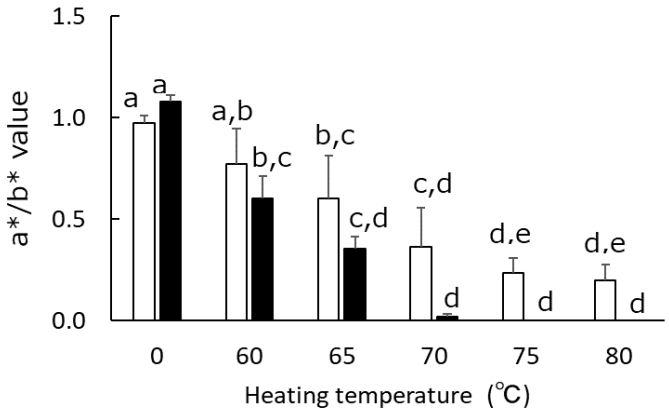


Figure 1. The value of a*/b* of supernatant obtained from the homogenate supernatant heated at 60-80°C.

Open bar shows Aigamo sample and closed bar shows beef sample. Means with different letters (a, b, c, d, e) indicate significant difference between samples (P<0.05).

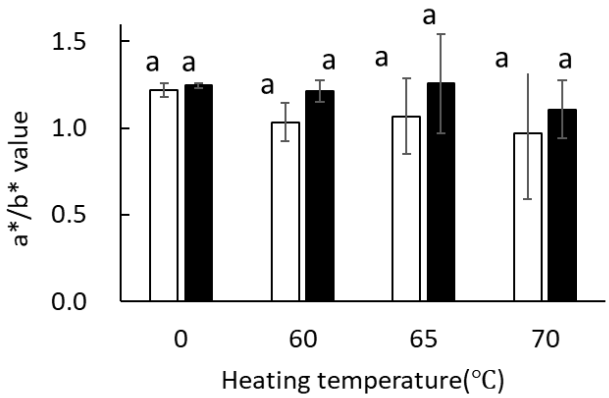


Figure 2. The value of a*/b* of supernatant of purified red pigments heated at 60-70°C.

Open bar shows Aigamo sample (Hb) and closed bar shows beef sample (Mb). Means with different letters indicate significant difference between samples (P<0.05).

IV. CONCLUSION

The red components of the homogenate supernatant of Aigamo meat were shown to have higher heat resistance than those of beef. The main red pigments of Aigamo meat and beef were Hb and Mb, respectively. There was no difference in heat resistance between the two, suggesting that the high heat resistance of the red pigment of Aigamo meat was caused by some components removed by purification.

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