

Effect of boiling time on aroma components of Wagyu beef

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Objectives: We previously demonstrated that the characteristic sweet aroma of beef contributes to palatability of Wagyu (Japanese Black cattle) beef (Ref.1). This aroma, named as “Wagyu beef aroma”, is found to be generated by boiling treatment at specific temperature. In Wagyu beef aroma, some volatile compounds of lactones, ketones and aldehydes are shown to be important constituents. The mechanisms of its production are still unknown in detail. In this study, we investigated an effect of boiling time on generation of aroma derived from Wagyu beef.

Materials and Methods: The cuts of Wagyu beef were purchased from retail stores. The *longissimus thoracis* muscle was cut into a cylinder (diameter: 23 mm, height: 10 mm). The meat sample was boiled in 1% NaCl solution at 80°C for the indicated time. The boiled sample was transferred to a sealed plastic tube and stored frozen at -50°C until analysis. The aroma compounds were extracted as follows. The sample was homogenized with chloroform/methanol (2:1, v/v) at 5000 rpm for 3 min. The homogenate was incubated at 35°C for 1 hour and then centrifuged at 1000 g for 5 min. The supernatants were dried in a rotary evaporator at 35°C. The residue was dissolved in hexane and vigorously mixed with methanol. After phase separation, the bottom layer was collected and diluted to 30% methanol with water. The mixture was then mixed with dichloromethane. The collected dichloromethane layer was dried with anhydrous sodium sulfate. The organic layer was concentrated to 200 µL using a Hempel column with a twisted glass plate under atmospheric pressure (ca. 45°C). The volatile compounds were analyzed by GC/MS.

Results and Discussion: In this study, meat sample was boiled for 0.5 min, 1 min or 2 min at 80°C. The raw sample was assigned to 0 min treatment group. The temperature, 80°C, was previously reported as one of optimal conditions for Wagyu beef aroma. The GC/MS analysis indicated that the ratio of peak area of diacetyl was time-dependently increased in Wagyu beef sample (0 min: 3.1, 0.5 min: 3.7, 1 min: 8.5, 2 min: 12.7). Similarly, acetoin was increased with boiling treatment (0 min: 10.2, 0.5 min: 11.5, 1 min: 13.5, 2 min: 19.7). These ketones have been reported as one of characteristic volatile compounds of Wagyu aroma, suggesting boiling condition play an important role in regulating Wagyu beef aroma constituents. One of their precursors, 2,3-butandiol was decreased by boiling treatment, suggesting some oxidative reactions with heat might be involved in diacetyl and acetoin production. In addition, δ-tetradecalactone was increased with boiling time. The δ-lactones are generated by a lactonization of oxidized fatty acids and, its odor is recognized as fatty, sweet and buttery-like. Our results suggest that boiling treatment is necessary to induce an oxidative reaction with fat of Wagyu beef that result in Wagyu beef aroma.

References:

1. Matsuishi *et al.*, *Anim.Sci.J.*72(6):498-504,2001

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