ULTRASOUND-INDUCED MODIFICATIONS OF BEEF FLAVOR CHARACTERISTICS DURING POSTMORTEM AGING

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I. INTRODUCTION

The postmortem aging of beef leads to the accumulation of small molecules, such as free amino acids, small peptides, fatty acids, reducing sugars, and nucleotides, thereby enhancing the flavor characteristic of beef [1]. However, achieving the desired flavor and palatability of beef requires a prolonged aging period, which poses a significant expense for industrial production. Thus, it has significance to achieve an innovative way to shorten beef aging and remain or even improve beef flavor. Ultrasound, as a non-destructive, efficient, and environmentally friendly emerging technology, has been employed in the research of meat processing [2-3]. This work was designed first to explore the impact of ultrasound on beef flavor characteristics during postmortem aging.

II. MATERIALS AND METHODS

2.1 Sample collection

Four Simmental cattle with an average weight of 520 kg were selected and slaughtered. After carcasses were halved and placed in cold storage at 4 °C for 24 h, the *longissimus thoracis* muscle (pH ranging from 5.55 to 5.65) was extracted and collected. The samples were then promptly transported back to the laboratory within 6 h under controlled temperature conditions of 0-4 °C after vacuum packaging. At 48 h postmortem, each muscle was sliced into six 2.54 cm thick steaks and then individually vacuum-packed. Subsequently, all steaks were randomly allocated into two groups (n = 4): ultrasound (US) and control (CK) groups. The steaks in the US group were submerged in a water-filled (water bath at 0-4 °C) ultrasonic pot (Jining Tianhua Ultrasonic Electronic Instrument Co., Ltd., China) and sonicated for 40 min (20 min on each side, with a 5 min break at 20 min intervals), utilizing an ultrasonic power of 500 W at a frequency of 20 kHz. The steaks in the CK group underwent no sonication. After US treatment, all steaks were transferred to a cold room at 4 °C and aged for 0, 7, and 12 d for further analysis.

2.2 Gas chromatography-mass spectrometry (GC-MS) analysis

The method of Zou et al [2] was used for GC-MS analysis to identify volatile flavor compounds in various beef sample groups.

2.3 Statistical analysis

All data were analyzed by SPSS 20.0 software (Chicago, IL, USA), and the significant differences (p < 0.05) were determined by Duncan's multiple-range test in a one-way analysis of variance.

III. RESULTS AND DISCUSSION

A total of 69 volatile flavor compounds were identified in six groups, with 61 and 58 compounds being identified in US and CK groups, including 15 alcohols, 21 aldehydes, 4 ketones, 2 esters, 1 furan, 17 hydrocarbons, 4 acids, and 5 nitrogen-containing compounds (Figure 1). The relative content and type of volatile flavor compounds were significantly altered after US treatment (p < 0.05). Compared with the CK group, the relative content of the total volatile compound in the US group increased by 266.62%, 30.32%, and 18.02% at 0, 7, and 12 d of aging, respectively.



Volatile flavor compound species

Figure 1. Volatile flavor compound of beef samples at different ultrasonic powers and postmortem aging time points. US: ultrasound group; CK, control group.

IV. CONCLUSION

In summary, this study shows that ultrasonic treatment increased the content and type of volatile compounds and improved the flavor characteristics of beef during postmortem aging. Thus, ultrasound technology can be regarded as an effective method for enhancing the beef flavor profile during postmortem aging.

ACKNOWLEDGEMENTS

This work was supported by the National Natural Science Foundation of China (32372358) and the earmarked fund for China Agriculture Research System (CARS-35).

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