ATTEMPT TO DRAW A MAP CORRESPONDING TO CHANGES IN THE TASTE OF BEEF DURING CONDITIONING AS EVALUATED BY THE USE OF TASTE SENSORS

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Introduction

It is now generally recognized that beef flavor is improved by aging. Bruce et al. (2005) reported that the flavor of beef has become one of the most significant factors in consumer decision-making processes. Sour, sweet, bitter, salty, and umami (delicious taste) are the five basic taste perceptions. The objective sensory evaluation of the taste of meat is important, but it is made difficult by the many conditions that affect taste. Currently, taste sensor technology imitating the human tongue is steadily improving. Taste Sensing System SA402B, equipped with taste sensors, has been developed by a Japanese company.

Okayama et al. (2006) presented data on the use of taste and odor sensors to evaluate the flavor of beef during conditioning at this congress in Dublin last year. The results obtained using taste sensors for beef conditioned for 7, 14, 21, and 28 days indicated that sustainable umami intensity was increased by conditioning of beef. It may be possible to use the taste sensors from previous results as useful and powerful support tools for sensory evaluation. The purpose of this investigation was to draw a map of taste corresponding to the changes in some tastes of beef during aging, as assessed by the use of taste sensors, and at the same time to analyze chemical substances in beef and to carry out a sensory evaluation.

Materials and Methods

1. Materials: *Semimembranosus* muscles from Japanese Black Cattle (n = 9) approximately 29 months of age were used. 2. Methods of conditioning: Samples were aged at 2-4℃in a refrigerator for 7, 14, 21, and 28 days after slaughter. 3. Types of sample for sensor measurements: Raw, simmered in water at 75-80℃ for 30 min, and cooked at 160-200℃ for 2.3 min on a hot plate (griddled). Samples were subjected to taste sensor measurements. 4. Sample preparation: For taste sensor measurement, raw, simmered and griddled samples were homogenized in deionized water at 10,000 rpm for 2 min. The homogenate was centrifuged at 10,000 x g for 30 min. The upper layer was filtered through Advantec 5A filter paper. The filtrate was frozen in a deep freezer at -80℃ in preparation for a taste sensor measurement. The sample was thawed in the refrigerator and used for the measurement. 5. Chemical analysis: Glutamic acid (Glu) was measured with the Yamasa L-Glu measurement kit. Peptide content and IMP were determined by the method of Lowry and an HPLC method, respectively, in the usual ways. 6. Sensory evaluation: Taste sensory evaluation was conducted by a paired comparison method. Panelists were our laboratory students. 7. Sensor instrument: Taste Sensory System SA402B (Intelligent Sensor Technology, Inc. Japan) was used as the taste sensor, imitating the human tongue. This system, the first "Equipment carrying out scientific knowledge of taste" in the world, was developed in Japan. This instrument was constructed to detect tastes such as bitterness, sourness, saltiness, astringency, sweetness, and umami using taste sensors, a robot arm, and computer. The detecting sensor part of the equipment consists of eight electrodes composed of lipid/polymer membranes.

Results and Discussion

From the taste sensor assessment of raw beef samples conditioned for 7, 14, 21, and 28 days, bitterness plus a miscellaneous taste was shown to increase remarkably during aging of beef (Figure 1). In the same manner, salty and sustainable umami intensity exhibited gradual increases during conditioning of beef (Figure 1). Figure 1 shows that sourness was decreased by the aging of beef. In general, beef just after slaughter has a sour taste and is not highly palatable. Okumura et al. (2004) concluded, after identifying sourness-suppressing substances in cooked pork loin, that the mechanism of sourness suppression involves a peptide that inhibits the binding of sour taste substances to the membranes to the tongue. It seems that the sourness sensor reacted clearly to produce the decrease of sourness during the aging of beef. The changes in some tastes of simmered beef samples aged for 7, 14, 21, and 28 days are shown in Figure 2. The values for simmered and griddled (data not shown) beef samples measured using taste sensors were lower than those of raw beef samples. At present, the reason for those results is unknown.

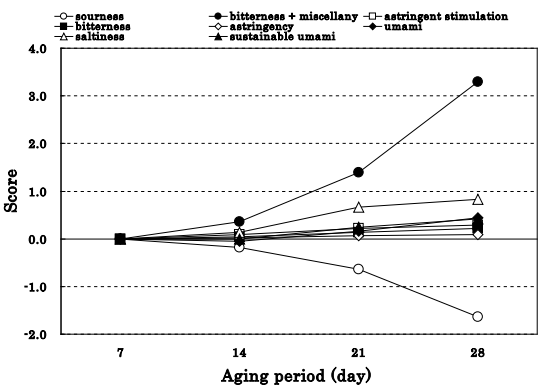

Figure 1. Changes in some tastes of raw beef samples during aging. Values of samples aged 7 days were denoted in zero line.

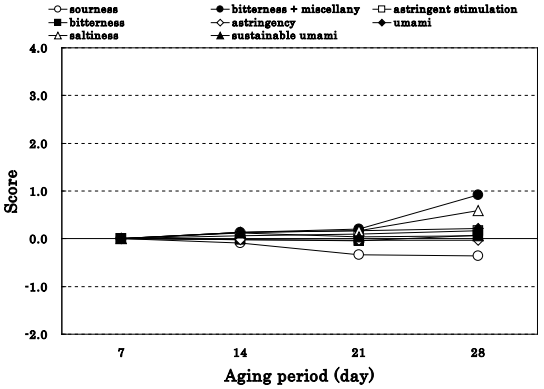

Figure 2. Changes in some tastes of simmered beef samples during aging. Values of samples aged 7 days were denoted in zero line.

From the results of raw beef samples conditioned for 7, 14, 21, and 28 days analyzed with taste sensors, two-dimensional scatter diagrams were drawn to show changes in some tastes. Figure 3 shows a two-dimensional scatter diagram of change in saltiness per umami during aging for 7, 14, 21, and 28 days of raw beef samples. Plots of the 7 day samples were in the lower part and left side area compared with those of 28 days samples in shown in Figure 3. A two-dimensional scatter diagram of change in bitterness plus miscellaneous taste per umami taste is shown in Figure 4. The differences between samples aged 7 days and those aged 28 days are shown in a two-dimensional scatter diagram in Figure 4. Further investigations are needed to ascertain the relationship between the output of taste sensor systems and sensory evaluation using panelists.

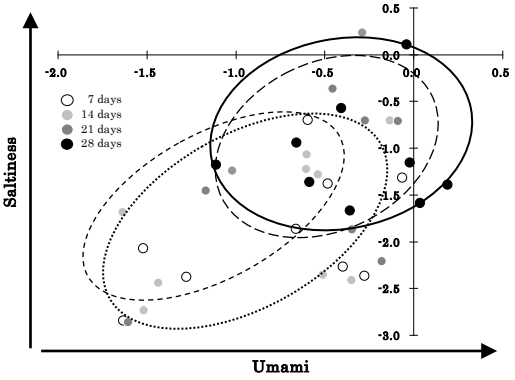

Figure 3. Two-dimensional scatter diagram of change in saltiness per umami of raw samples during aging.

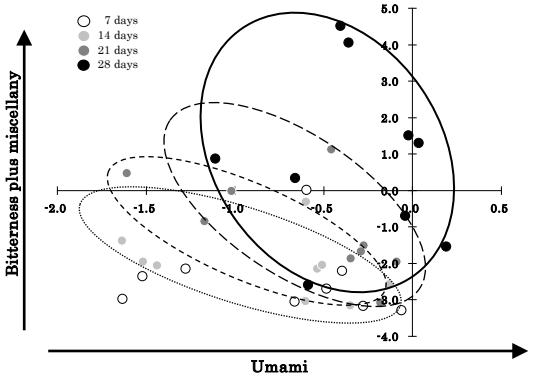

Figure 4. Two-dimensional scatter diagram of change in bitterness plus miscellany saltiness per umami of raw samples during aging.

Conclusions

This study aimed to draw a map of taste corresponding to the changes in some tastes of beef during conditioning, as detected using taste sensors. From the results of raw beef samples aged for 7, 14, 21, and 28 days assessed using the taste sensors, two-dimensional scatter diagrams "the map of taste" were drawn to illustrate the changes in some tastes. The differences in the map of taste between samples aged 7 days and those aged 28 days were illustrated by two-dimensional scatter diagrams of change in bitterness plus miscellaneous taste per umami taste.

References

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