

Dynamics of dominant sensations of Wagyu beef assessed by temporal dominance of sensations

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I. INTRODUCTION

Japanese Black cattle which is known as “Wagyu,” are characterized by a large amount of intramuscular fat. Also, Wagyu beef has a unique texture, taste, and aroma, and they affect to consumer preference. These characteristics have been evaluated by traditional descriptive sensory methods, however, these sensory methods cannot evaluate the “relative contribution” and “dynamics of perception” of characteristics because sensory characteristics are evaluated by independently, at a single time point. To solve the above problem, we focused on the “temporal dominance of sensations (TDS)”. TDS is a dynamic sensory method that captures the “dominant sensation” throughout food consumption, and it is possible to calculate the relative contribution of various sensory characteristics by “dominance rate” over time [1]. Thus, TDS is expected as a useful method to evaluate complex sensory characteristics of Wagyu beef; however, Wagyu beef has never been studied by using of TDS. The objective of this study was to assess the relative contributions of sensory characteristics and dynamic sensory perception of Wagyu beef. For this purpose, Japanese Black cattle from 24 and 28 months of age were obtained, and they were assessed by using of TDS.

II. MATERIALS AND METHODS

Sirloin was obtained from the Japanese Black cattle from 24 and 28 months of age. In each group, sample was prepared from three cattle carcasses and vacuum packed, and stored at $-30\text{ }^{\circ}\text{C}$. The samples were thawed in a refrigerator for one day and formed into 4 mm thick disks (4 cm diameter). The meat disks were cooked on an electric griddle set at $180\text{ }^{\circ}\text{C}$ for 30 s for each side. Samples were placed in polypropylene cups covered with a polyethylene terephthalate lid and kept warm in warm cabinet set at $70\text{ }^{\circ}\text{C}$ until just before the TDS assessment.

Sixteen (5 males and 11 females) trained sensory panelists were recruited for TDS. Sensory attributes were developed by preliminary sensory sessions, and the following 12 sensory attributes were presented in each TDS session: “tender and/or soft”, “tough and/or hard”, “juicy”, “dry”, “fat melting”, “smooth”, “umami”, “sweet”, “fat taste”, “sweet odors”, “butter odors”, and “oily odors”. The TDS computerized system designated by MagicSense (Taste Technology LLC., Tokyo, Japan) showed the entire list of characteristics on a computer screen to panelist. For the TDS test, panelists were instructed to click on the “START” button as soon as they put the sample in their mouth. They could then successively select the characteristics that most triggered their attention from the provided list. Clicking on one characteristic at a time, they could change it as many times as they wanted whenever a new sensation became dominant and they were free to choose a characteristic several times. The TDS test lasted for 60 s, and data were recorded every 0.2 s. When no sensation was perceived as dominant, panelists were instructed to click on the “ABSENCE” button. The TDS session was conducted three times with muscles from different carcasses used in each session, and a total of 46 runs were conducted for each beef sample because one panelist was absent from second and third session. A Latin square design was used to avoid the effects of serving order.

Collected data was analyzed by following process described by Pineau et al. (2009) [1]: 1) For each time point and each characteristic, “Dominance rate”, which is the rate of runs for assessed as dominant, was calculated. 2) The “chance level” is the dominance rate that a characteristic can obtain by chance considering

all of the characteristics evaluated. Its value is equal to $1/p$, p being the number of sensory items. 3) The “significant level” was calculated from the confidence interval of a binomial proportion based on a normal approximation taking into account the chance level and the 46 evaluations performed, which resulted in 0.15. 4) In order to compare between two age groups, the difference of the dominance rates of each characteristic was computed in each time point, and limit of significance for these difference is obtained using the usual test to compare two binomial proportions in each time point.

III. RESULTS AND DISCUSSION

Dominance rates of “tender and/or soft”, “juicy”, “dry”, “fat melting”, “umami”, and “fat taste” were exceeded the significant level in Wagyu beef from both 24 and 28 months of age (Figure 1). Also, the dominant sensory characteristics were almost same in each session. Taken the results for the Wagyu beef from 24 and 28 months of age together, and dynamic perceptions of Wagyu beef sensory characteristics were roughly depicted as follow: “tender and/or soft” was dominant in almost 0 to 10 s; “juicy” was dominant in almost 5 to 15 s; “fat melting” was dominant in almost 5 s to 25 s; “umami” was dominant in almost 15 s to 30 s; “fat taste” was dominant in almost 10 s to 40 s; and “dry” was dominant in almost 25 to 50 s. (Figure 1).

The dominance rates of “dry” was significantly different between the 24 months of age and 28 months of age in 35 to 50 s (data is not shown), and this seemingly induced by the difference of water-holding capacity. Also, “tender and/or soft,” “tough and/or hard,” “fat taste,” “fat melting,” “sweet,” “umami,” “butter odor,” and “oily odor” was significantly different between the Wagyu beef from 24 months of age and 28 months of age in some short time point (data is not shown).

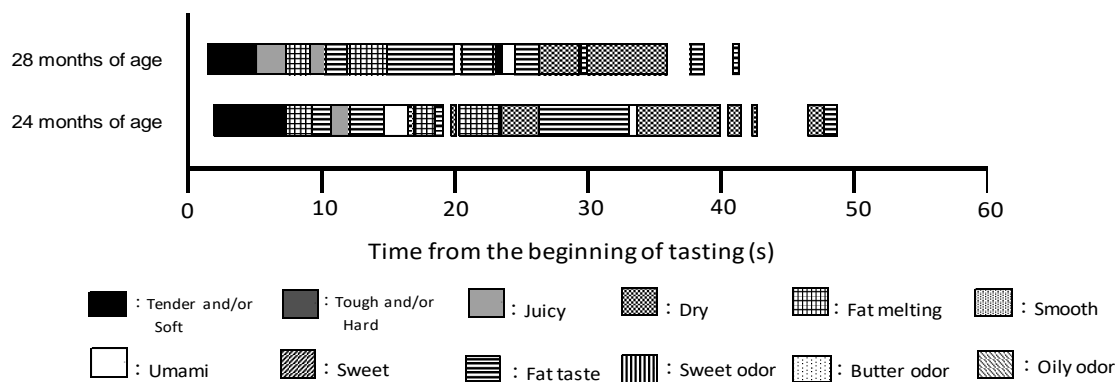


Figure 1. Dynamics of dominant sensations of Wagyu beef. If the several characteristics became dominant, the characteristics which had the highest dominance rate was shown in each time point. The blank indicated that all traits were not dominant.

IV. CONCLUSION

The TDS indicated the dominant sensations of the Wagyu beef. In addition, dynamics of sensory perception of Wagyu beef was revealed. Moreover, the difference of perception between the Wagyu beef that obtained from different age, was also indicated by using of TDS. Accordingly, the TDS method revealed new information which makes it easy to understand the complex Wagyu beef sensory characteristics.

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