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Effects of adding FFAs on beef taste-traits analyzed by electronic taste sensing system and sensory evaluation
(#594)

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Introduction:
Japanese Black Wagyu beef is popular in Japan and recently becomes recognized as "Wagyu" around the world due to its deliciousness affected by intramuscular fat. Although changes in the amounts and composition of fatty acids are considered to contribute to beef aroma (Westerling et al., 1979), effects of those changes on beef taste-traits remain poorly understood. Sensory evaluation by human panels is a well-known method to objectively analyze beef taste-traits. On the other hand, an electronic taste sensing system has been recently developed as a method to evaluate taste-traits of meat and meat products (Sasaki et al., 2005; Nodake et al., 2013). This study investigated effects of adding free fatty acids (FFAs) on taste-traits of beef broth using both methods.

Methods:
Beef samples: Beef samples taken from *longissimus thoracis* muscle of carcass of Japanese Black Wagyu and Holstein cattle were purchased and stored at 4°C. At 7-, 14-, and 21-days postmortem, parts of rib eye including intramuscular fat tissues were used to prepare beef broth samples.

Preparation of beef broth: Beef broth samples were prepared by the method (Sasaki et al., 2005) mainly focused on fat removing by boiling and low-temperature solidification. Palmitic acid (C16:0), stearic acid (C18:0), oleic acid (C18:1) and those mixture were added to both broth samples at 7-days postmortem, respectively, and provided for taste-trait analysis.

Measurements of the amounts of FFA: The amounts of FFA in beef broth were measured by the method of Shimizu et al. (1980).

Taste-trait analysis

by an electronic taste sensing system: An electronic taste sensing system SA402B (INSENT Co., Ltd, Kanagawa, Japan) was equipped with six sensors (Toko, 1996).

by sensory evaluation: Each taste intensity of broth samples compared to control samples was evaluated by seven trained panelists (students of Kobe University) using a seven-point hedonic scale.

Statistical analysis: The amounts of FFA were compared by a one-way analysis of variance (ANOVA) with post hoc analysis using Tukey's HSD test among aging time and by Student's t-test between two bovine breeds.

Results:
As shown in Figure 1, the amounts of FFA in both Japanese Black Wagyu and Holstein beef broth increased during postmortem aging. In Japanese Black Wagyu beef, there was a significant difference between 7- and 21-days postmortem ($P < 0.05$), indicating that postmortem aging caused obvious effect on increased amounts of FFA.

Figure 2 shows taste-traits of Japanese Black Wagyu beef analyzed by an electronic taste sensing system and sensory evaluation. Broth sample at 7-days postmortem was used as control. *Acid bitterness* and *astringency* were not evaluated in sensory evaluation and shown as "NA". In the results of the system, *sourness* and *sweetness* increased whereas *astringency*, *umami* and *saltiness* decreased in adding FFAs (Figure 2A). In sensory evaluation, *sourness* and *umami* increased (Figure 2B). On the other hand, the results of Holstein beef were almost similar with those of Japanese Black Wagyu beef (Figure 3). Increased values of *sweetness* in Holstein beef analyzed by two methods coincided, considering probably relate to adding of FFAs. Moreover, *richness* seemed to be increased by FFA adding in sensory evaluation (Figure 3B).

Conclusion:
Adding of FFA mixture contributed to increased values of *sweetness* in beef broth, especially in Holstein beef, which was considerably affected by FFA adding due to lower content of intramuscular FFAs. Therefore, deliciousness of Japanese Black Wagyu beef is suggested to relate to increased amounts of FFA from higher content of intramuscular fat.

Notes

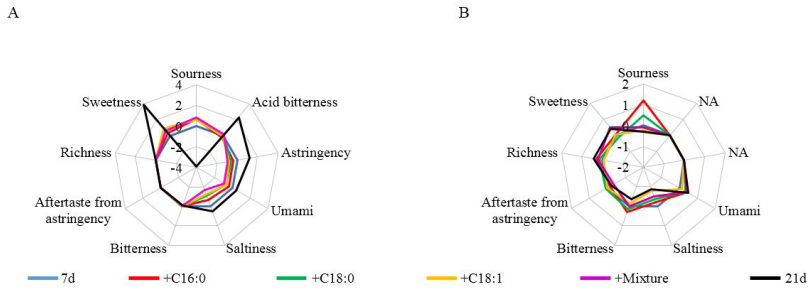

Figure 3.
Effects of adding FFAs on taste-traits of Holstein beef broth analyzed by an electronic taste sensing system and sensory evaluation A, electronic taste sensing system (n=4); B, sensory evaluation (n=2).

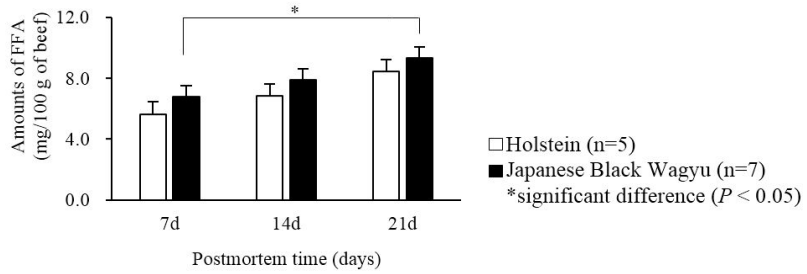

Figure 1. Effects of postmortem aging on the amounts of FFA in Japanese Black Wagyu and Holstein beef

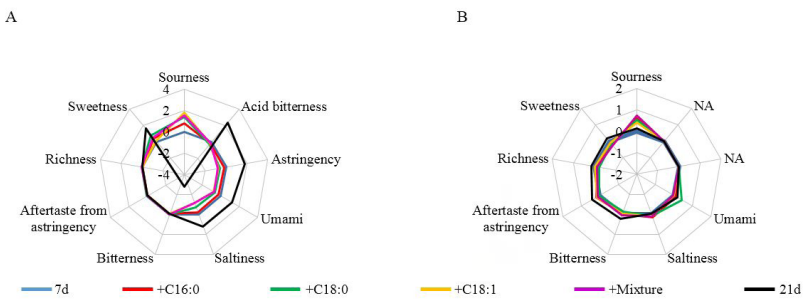

Figure 2. Effects of adding FFAs on taste-traits of Japanese Black Wagyu beef broth analyzed by an electronic taste sensing system and sensory evaluation A, electronic taste sensing system (n=4); B, sensory evaluation (n=4).

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