Evaluation of physical properties of beef according to part characteristics

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Introduction: One of the factors that contribute to the deliciousness of meat is considered to be „tenderness," and it has been reported that when meat is labeled for tenderness, consumers are more willing to purchase it even at a premium price. Furthermore, it has been shown that consumers seek „tenderness" in the purchasing stage before eating, and prefer „tenderness" meat even in the actual eating stage. Hence, the producers wanted to objectively quantify the „tenderness" of each beef part in selling the meat, and to measure the „tenderness" of the meat in a non-dismantling manner. Therefore, in this study, the tenderness of beef muscle fibers was quantified using the items of the breaking strength analysis, and the relationship with the texture obtained by sensory inspection was carefully examined, with the aim of quantifying the „tenderness" of beef by muscle part and exploring the factors of that tenderness.

Materials and methods: The sample beef was a crossbred cow, which is a crossbreed of a Wagyu bull and a dairy cow, the most widely distributed domestic cattle in Japan. The same individual was divided into 52 muscles to improve the ambiguity of the muscle parts depending on the place of origin of the cattle and to enable academic evaluation of each muscle part. The physical properties of beef were measured using a rupture strength analyzer. For the measurement of one sample, maximum load (N), total energy (J/m³), elastic modulus (Pa), post-break slope (Pa), break load (N), break deformation (mm), break strain rate (%), break energy (J/m³), and fragility load (N) among other physical property items were obtained. Sensory tests were conducted by four panelists on the roasted beef pieces. Judgments of palatability and physical properties (arranged in order of tenderness) were made using the ranking method.

Results: The physical property item that reflected the sensory evaluation results without exception was the total energy (J/m³). It was surmised that muscle parts with a total energy of 0.75×10^6 (J/m³) or less were „tenderness" even after grilling, while muscle parts with a total energy of 0.98×10^6 (J/m³) or more were „tough". Among the multiple physical property items, the item that reflected the sensory evaluation results without exception was the total energy (J/m³). Muscle parts that could be inferred to be „tenderness" when they were baked with a total energy of 0.75×10^6 (J/m³) or less included the semispinalis dorsi (4th thoracic vertebra) (0.47×10^6 J/m³), semispinalis dorsi (7th thoracic vertebra) (0.48×10^6 J/m³), and obliquus internus abdominis (0.58×10^6 J/m³). On the other hand, the „tough" muscle parts with a total energy of more than 0.98×10^6 (J/m³) were the semimembranosus (1.71×10^6 J/m³), longissimus capitis et atlantis (1.74×10^6 J/m³), and biceps femoris (13 from the side of the body) (1.96×10^6 J/m³).

Conclusions: It was surmised in this study that there was a nearly four-fold difference in the „tenderness" of muscle parts in cattle.

Literature:

S. D. Shackelford, T. L. Wheeler, M. K. Meade, J. O. Reagan, B. L. Byrnes, and M. Koohmaraie (2001). Consumer impressions of Tender Select beef. Journal of Animal Science, 79(10), 2605-14