

CORRELATION BETWEEN BEEF GRADING AND SENSORY ATTRIBUTES

Kazumi Asaka, Kazuhisa Honda, Masahiro Numata, Toyoo Nakamura, Michiyo Okita*, Sizuko Yamaguchi* and Hiroyasu Nakai**

Central Research Institute, Itoham Food Inc., Ibaraki, 302-0104, Japan

*Department of Applied Bio Science, Tokyo University of Agriculture, Tokyo, 156-8502, Japan

**Tohoku National Agricultural Experiment Station, Iwate, 020-0198, Japan

Keywords: beef, sensory attributes, grade

Background

The Japanese Black beef is specific to Japan, and being fine-grained, its sensory characteristics such as flavor and texture are evaluated as excellent. There was some concern that import liberalization and the decline of beef prices could influence the total consumption of domestic beef. However, the Japanese Black beef was not influenced by these factors, and it is possible to consider the advantage that the high quality of the Japanese Black beef was able to beat the competition. Among a great number of studies on meat, there are unexpectedly few studies about how the palatability or acceptability of beef should be evaluated. We determined sensory attributes that influence on the palatability of beef by sensory analysis and found what are the decisive evaluation items using different kinds of beefs such as Japanese Black beef and imported beef.

Objectives

Grading is the quality evaluation which is generally implemented in the trading of meat. The dressing percentage is A(good), B and C for beef in 3 steps. It denotes the red meat rate accounted for in a dressed carcass. It is calculated from the weight, fat thickness, muscle area, etc. On the other hand, the meat quality is evaluated from 5(good) -1, estimated from the marbling in the loin section, glossy, firm, texture, and the color quality of the fat. For example, it is common that the best meat traded at a high price is rated A5, where there is much meat with some fine marbling. However, there were no studies which compared both the palatability or acceptability perceived by consumer and quality of meat with the evaluation that was done by the inspector in the carnivorous market.

Therefore, we investigated the correlation between the different graded beef and the sensory attributes.

Methods

The sensory profile descriptors were collected in advance using different beef samples (Japanese Black beef, Holstein, and imported beef) which were collected at department stores, butchers and supermarkets by the testing panelists. To evaluate steak and soup samples, each panelist referred to the list of evaluation terminology, consisting of selected items which seems to be important. Samples for the sensory evaluation, specified as part of the *longissimus dorsi*, had ingredients extracted at a constant temperature of 90°C for 90 min for the soup. Part of the samples were cooked steaks using a hot plate that reached an internal temperature of 70°C. The sample gradings were as follows: Holstein was B3(control, evaluated 0), Japanese Black beef was A4-5, imported beef was unknown, but it was the grass feed beef with little fat. A statistical analysis was carried out using EXCEL and JUSE-MA/V.4.0. Ten super panelists of Itoham Food Inc, and 8 trained students at Tokyo University of Agriculture evaluated 27(for steaks) or 23(for soups) sensory attributes on a 7-point scales from -3 to +3 as compared with control.

Results and discussion

The sample mean values for each attribute were subjected to the principal component analysis (PCA) of the correlation matrix. In the case of steaks, 81.4% of the total variance was explained by the first principal component. The factor loading showed high positive values for desirable attributes, such as beefy, amplitude, tender, etc., but high negative values for undesirable ones, such as animal and offensive. In the plot spanned by the first two PC scores, Japanese Black beef samples were distinguished from imported beef samples along the first component axis in both panelist groups. The Japanese Black beef samples had the highest desirable scores compared to the others.

As for soups, 74.6% of the total variation was explained by the first two components, of which 56.4% was the first component. As in the case of steaks, the first component was related to desirable attributes such as beefy, amplitude, etc., while the second component was related to undesirable flavor and taste. The Japanese Black beef samples were also distinguished from the imported beef samples and perceived as desirable.

Conclusions

Correlations of most of the sensory attributes were high for the desirability of the beef which is beefy, amplitude, tender and umami. That is, the beef that was rated beefy, amplitude, tender, etc., was the one which gave desirable attributes at the same time. It was clear that the Japanese Black beef samples were distinguished from imported beef ones as well as Holstein ones using these evaluation items in the case of both steaks and soups by the principal component analysis.

Pertinent literature

- 1)Irie, M., Journal of the Japanese Society for Cold Preservation of Food, 22, 103, 1996.
- 2)Ozutumi, K. et al, J. Anim. Sci. , 59, 590, 1988.
- 3)Nakai, H. et al, 38th ICoMST, 947, 1992.

Data in the form of tables, charts and figures

Table 1 First two principal axis loading factors.

Attribute	soup samples		steak samples		
	Component 1	Component 2	Component 1	Component 2	
Smell	Strength/intensity	-0.228	0.509	0.591	0.551
	Beefy	0.790	0.135	0.944	-0.008
	Animal	-0.655	0.547	-0.832	0.196
	Objectionable	-0.729	0.346	-0.882	0.029
	Overall	0.908	0.022	0.967	0.089
Flavor in mouth	Beefy	0.911	0.149	0.988	0.015
	Animal	-0.655	0.696	-0.827	0.310
	Objectionable	-0.459	0.629	-0.881	0.143
	Amplitude	0.904	0.226	0.980	-0.026
	Overall	0.961	0.144	0.992	-0.018
Texture	Tenderness			0.926	0.022
	Elasticity			0.811	-0.368
	Juiciness			0.979	0.093
	Overall			0.961	0.028
Taste	Strength/intensity	0.071	0.916	0.933	0.119
	Umami	0.855	0.421	0.987	-0.004
	Sweet	0.838	0.158	0.961	0.043
	Acid	-0.405	0.431	-0.843	-0.281
	Salty	-0.501	0.635	-0.012	0.882
	Bitter	-0.614	0.191	-0.844	0.285
	Objectionable	-0.486	0.525	-0.734	-0.001
	Fatty	0.899	-0.087	0.983	0.049
	Body	0.853	0.438	0.985	0.061
	Round	0.958	-0.02	0.986	0.031
	Affertaste	0.835	0.457	0.981	-0.049
	Overall	0.881	0.362	0.991	0.059
	Overall acceptance	0.946	0.209	0.988	0.072

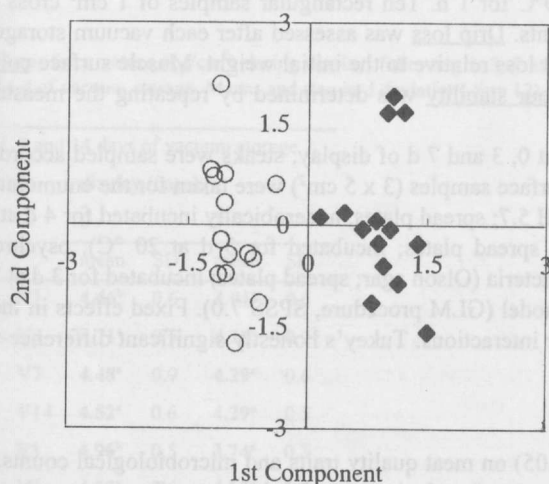


Figure 1 Plot of the steak samples in the plane spanned by the two first principal components.

◆ = the Japanese Black beef samples.
○ = the imported beef samples.

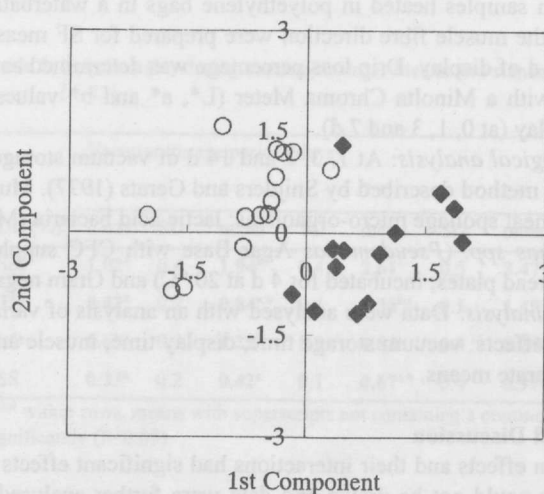


Figure 2 Plot of the soup samples in the plane spanned by the two first principal components.

◆ = the Japanese Black beef samples.
○ = the imported beef samples.