Development of a method to estimate the taste of Japanese Black beef based on chemical compositions

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Introduction

Over the past three decades, Japanese black cattle have been genetically improved on beef marbling score (BMS)（Fig. 1).
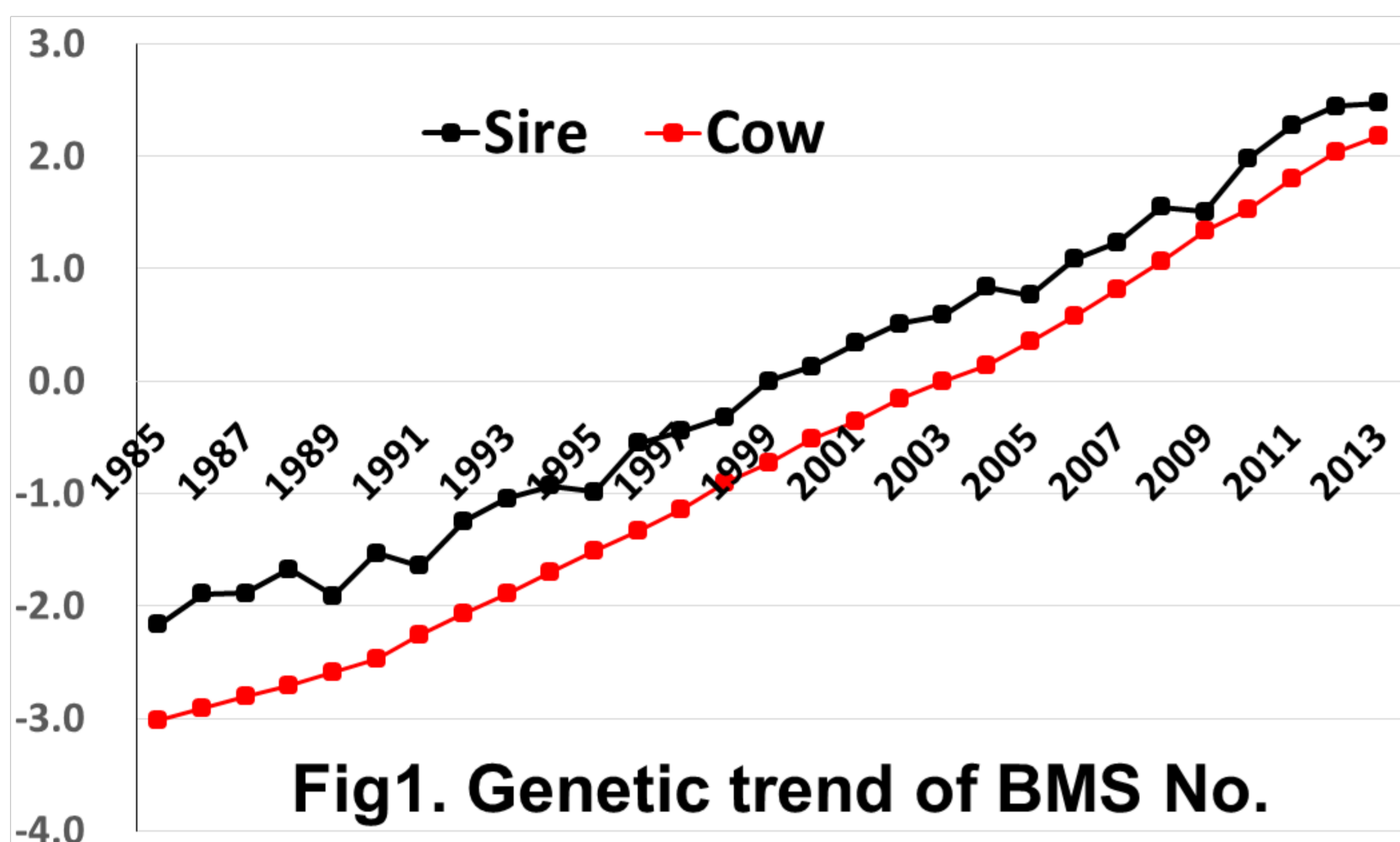
About 70 % of slaughtered beef were graded 4~5. However, in recent years, new indicators fort beef taste have been considered. In this study, we developed a method to estimate the taste of Japanese Black beef based on its chemical compositions by combining the data of the sensory panel test and the chemical compositions.
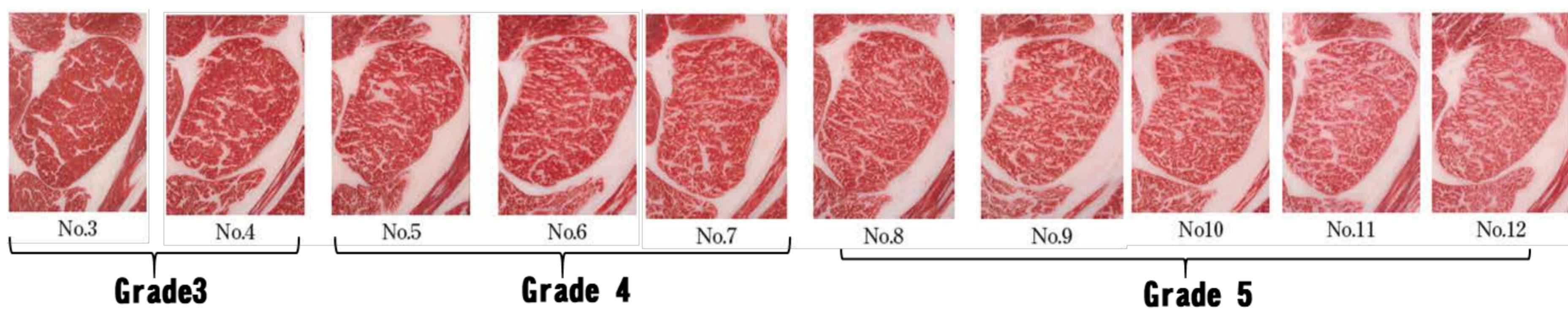

Fig1. Genetic trend of BMS No.

Fig 2. Beef marbling score (BMS No.) for each beef quality grade.

Materials and methods

➢ **Meat samples**

Thirty-five sirloin Japanese black heifers beef graded 4 or 5 by the Japanese Meat Grading Association.

	Brand beef						
	Sendai beef	Yonezawa beef	Maesawa beef	Kobe beef	Hida beef	Ishigaki beef-a	Ishigaki beef-b
Number	5	5	5	5	5	5	5
Age (Month)	37.3	29.1	31.7	30.2	33.8	36.2	40.2
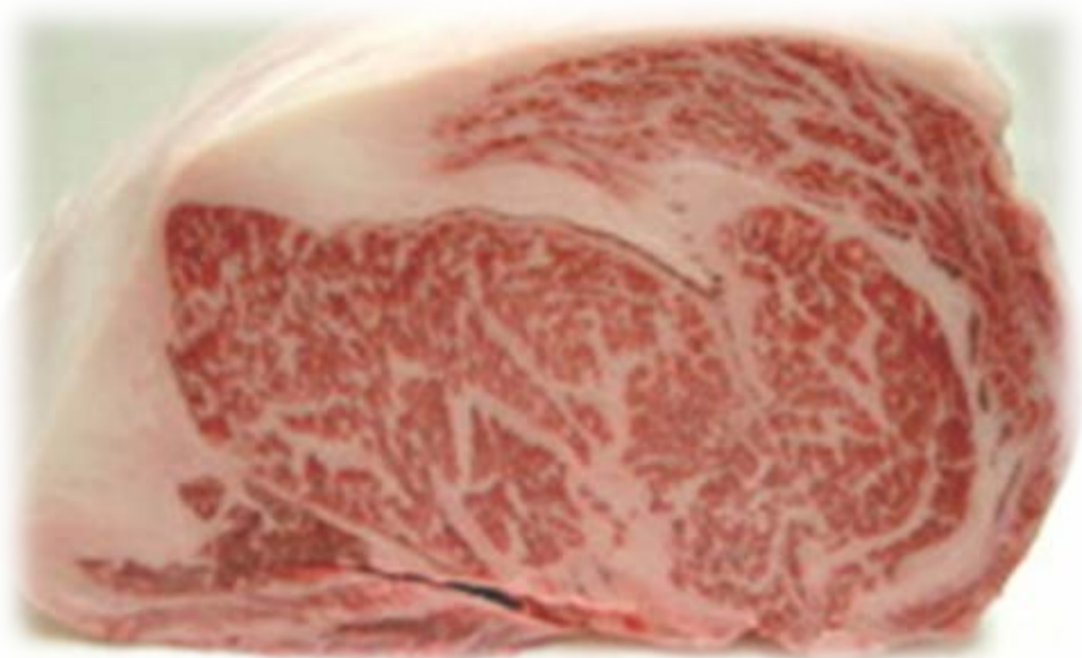
Sirloin beef was used for the sensory panel test and chemical compositions analysis.

➢ **Sensory test**

The sensory test : 9 trained female university students. **Ten items for the panel test:** "tenderness on the first bite," "tenderness while chewing," "fiber feeling," "juiciness," "total texture," "sweet scent," "off flavor," "strength of the aroma," Inosinic acid-derived umami", glutamic acid-derived umami", "umami intensity" and "overall evaluation". Judged by 8 point scale.
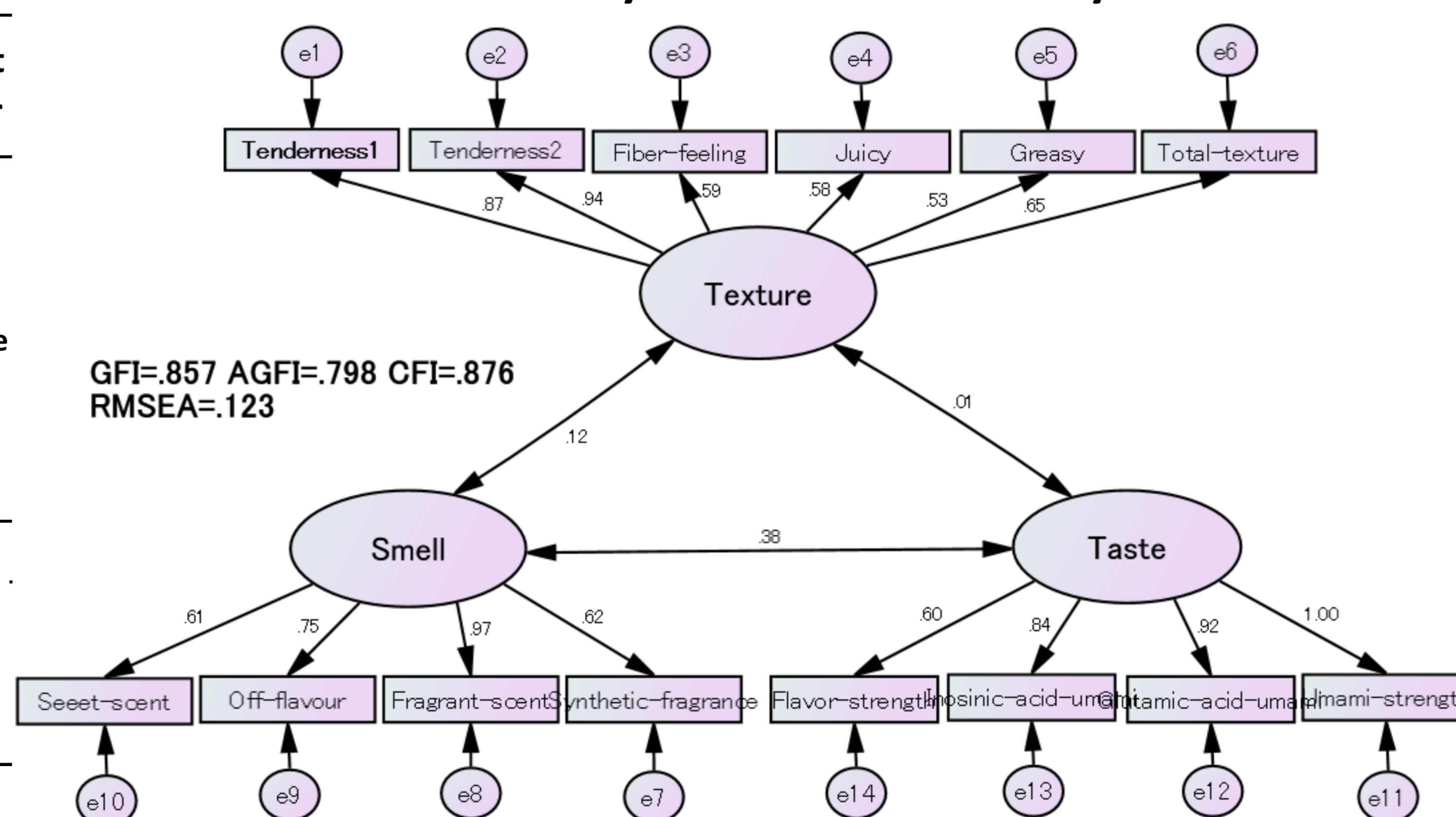

➢ **Chemical analysis**

Approximately 200 mg of meat sample was weighed and homogenized in 1.5 mL of distilled water. After pre-processing, 39 chemical compositions (amino acids, inosinic acid (IMP), inosine (HxR), and hypoxanthine (Hx) , monosaccharides , glucose, fructose, mannose, inositol, and ribose, muscle glycogen and fatty acids) concentration were measured using HPLC and GC.

➢ **Statistical Analysis**

Latent factors were identified and scored by factor analysis and covariance structure analysis of sensory panel data. PLS analysis was performed, with latent factors as dependent variables and chemical components as independent variables. SAS program was used for analysis.

Results

Factor analysis results for sensory test

	Rotated Factor Pattern (StandardizedRegressionCoefficients)			Latent factor
	Factor1	Factor2	Factor3	
Tenderness1	0.930	-0.001	-0.121	Texture
Tenderness2	0.836	-0.005	-0.106	
Total texture	0.656	0.082	0.186	
Juicy	0.623	0.005	0.100	
Fiber feeling	0.585	0.017	0.092	
Greasy	0.575	-0.120	0.008	
Umami strength	-0.016	1.019	-0.049	Taste
Glutamic acid umami	-0.016	0.910	0.007	
Inosinic acid umami	-0.016	0.824	0.010	
Flavor strength	0.010	0.467	0.393	
Synthetic fragrance	-0.020	-0.042	0.987	Smell
Off flavour	0.027	-0.105	0.762	
Overall evaluation	0.093	0.285	0.510	
Fragrant scent	-0.012	0.222	0.508	

Covariance Structure Analysis results for sensory test

GFI=.857 AGFI=.798 CFI=.876
RMSEA=.123

Taste=6.288+0.003IMF-2.899INOS+1.103IMP+0.201HxR+0.081ATPR-0.381Kvalue+0.028(Car+Tau)

PLS analysis results for "Taste"

Parameter Estimates	
Intercept	6.288
IMF	-0.003
Inositol	-2.899
Inosinic acid	0.103
Inosine	0.201
NARS	0.081
K value	-0.381
Car+Tau	0.028

*NARS:
Nucleic acid related substances

Conclusion

"Taste" could be estimated using seven chemical compositions (fat content, inositol, inosinic acid, inosine, nucleic acid content, K value, and carnosine + taurine). Currently, in order to improve the accuracy of the estimation formulas for beef texture, taste and aroma, we plan to increase the number of beef samples.