5-P61

THE RELATIONSHIPS BETWEEN THE GRADE AND MEAT TRAITS OF JAPANESE BLACK CATTLE (WAGYU) ON THE MARKET IN JAPAN

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BACKGROUND

Beef carcasses in Japan have been divided into five grades (1 to 5) on the basis of quality, and three (A, B and C) on expected dressing percentage. Thus, the carcasses are classified into 15 categories: C1 to A5. Beef marbling score (BMS), level 1 to 12, has a great influence on this quality determination. Generally, beef with higher BMS trade at a higher value, that is, grade A5 beef being the best quality on Japanese market. Beef imported into Japan was liberalized in 1990 using this classification criterion developed in 1988. From that point, the production of beef with higher marbling has been more strongly encouraged than before, because of the need to distinguish domestic beef from imported beef.

OBJECTIVES

Beef quality traits as seen in the market place, appear to have changed in the last decade because of above reasons. The purposes of this study are to clarify the relationships between marbling score and meat quality, and to determine any new trends or characteristics of recent WAGYU meat.

MATERIAL AND METHODS

A total of sixteen *M. longissmus thoracicus* from Japanese Black Cattle (WAGYU) were purchased from meat processing center. These samples were already classified into grade A2, A3, A4 and A5, with four samples in each grade. After 15 days storage at 0 ℃, samples were prepared and moisture, fat, and protein contents were measured according to the method of Williams (1984). Another portion ca.100g was cooked at 80 ℃ (Graafhuis, 1991) and used for determination of toughness as Warner-Braztler Shear force value. The rest of samples were stored at -80 ℃ until the analysis of free amino acids using an amino acid analyzer (JEOL,JLC-300) .

RESULTS AND DISCUSSION

CHEMICAL COMPONENT: The relationships between the beef grade and chemical components (moisture, fat and protein) are shown in Figure 1 with photographs as a reference. It is generally accepted that moisture content of meat is inversely related to fat content, and protein content is relatively constant (Haecker, 1920). This relation was consistently observed for moisture and fat, however the protein of grade A4 and A5 was significantly lower than that of A2 and A3 ($p<0.01$). This means that for the beef grade above A3, which contained ca. 25% fat, would result in a decreasing protein content, in addition to decreasing moisture.

CRITERION OF BMS: The relationships between BMS and fat content are shown in figure 2, and the resulting relationship was described by the equation of $y = 2.6049x + 13.168$ ($R^2=0.79$, $p<0.01$). On the report of (Mitsuhashi, 1993) which used the data before and just after import liberalization of beef in Japan, this relation was presented by $y = 2.439x + 1.6373$ ($R^2=0.86$). The intercept of this new equation was 12.0 point higher, and 0.17 point grater in slope, which means about 11-13% fat content higher in recent beef, even in the case of beef with the same BMS number. These differences showed that the criterion for classification of BMS has been slowly changed. This change would be influenced by the recent production systems to further differentiate domestic beef from imported beef, resulting beef with higher marbling which would have not fitted in with the BMS standard until recently.

TENDERNESS: Tenderness is one of the most important traits on beef quality, and WAGYU is famous for its tenderness. Relationships between the BMS and toughness are shown in figure 3, where there is a statistically significant ($p<0.01$) relationships between BMS SFV and BMS. These relationships suggested the possibility of their being a tenderness estimation from BMS.

AMINO ACIDS CONTENT: Figure 4 shows the amino acid levels in muscles of each grade. Although a pattern of amino acids composition seems to be similar between the grades, increasing the meat grade would tend to decrease the content of each amino acid except Gln, and total free amino acids was also deceased. The levels of Asp, Gly, Ala, Lys and Arg were especially reflected in the protein content showed in Figure 1. The same trend was found in Carnosine. In contrast, Glutamine (Gln) has a positive relationship to the meat grades. In other words, Gln increased as fat content increased. The reasons of this increment of Gln could not be explained in the present study. No marked differences have been reported between breeds in the same beef grade (Sato *et al.*, 1995). Fat content could be one of the main reasons when the differences existed.

CONCLUSIONS

Recent Japanese evaluation criteria for beef seem to have changed in the last decade, resulting for about a 10-20% higher fat content in recent beef, even with the same BMS number. These marked increment of fat content leads to a decreasing protein content, in addition to decreasing moisture content. Higher BMS improved the tenderness, but there is a possibility of a decrease in the amino acid content except for Gln.

PERTIENT LITERATURE

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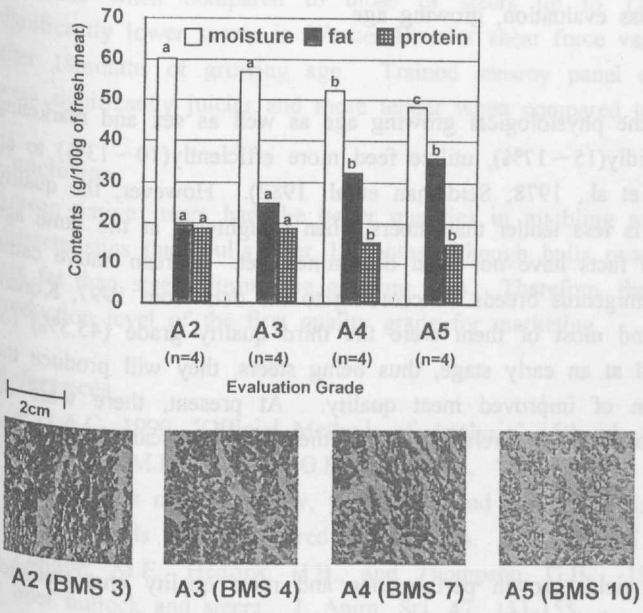


Figure 1
Relationships between the Beef Grade and Chemical Components, and Photographs of each Grade

Different letters (a,b,c) indicate significant differences between grades (p<0.05)

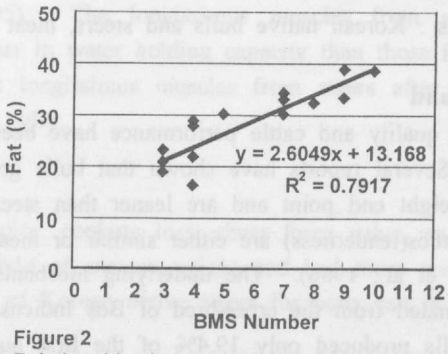


Figure 2
Relationships between BMS Number and Fat Content

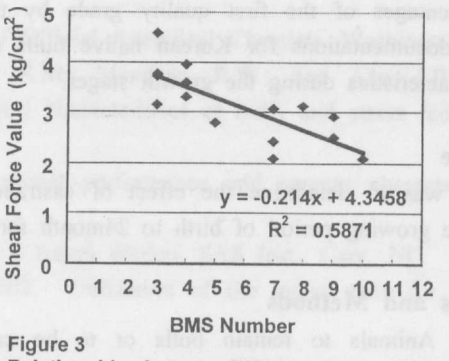
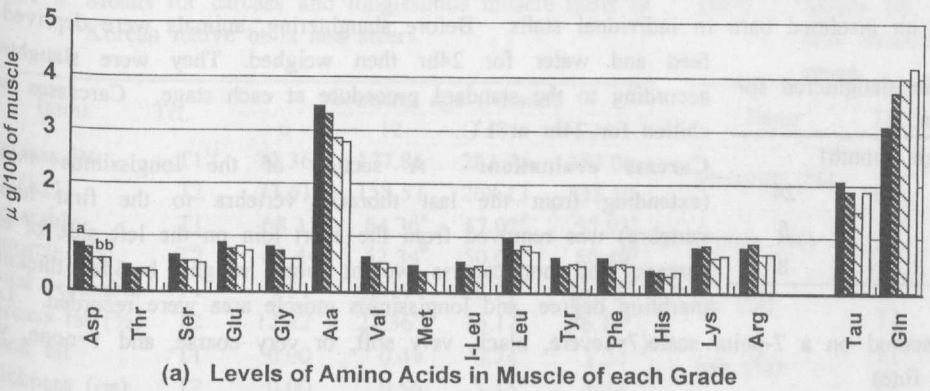


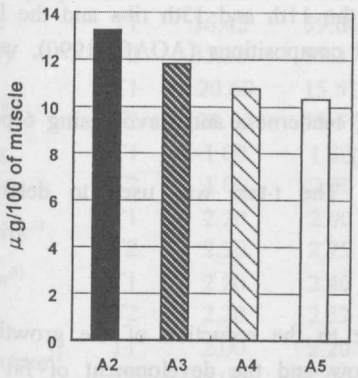
Figure 3
Relationships between BMS Number and Toughness



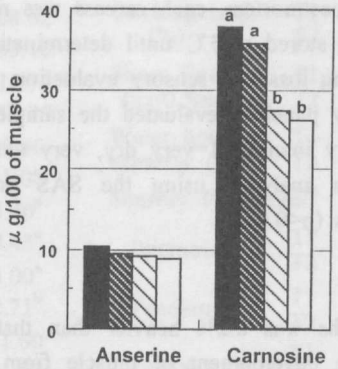
(a) Levels of Amino Acids in Muscle of each Grade

Abbreviations

Asp : Aspartic acid
Thr : Threonine
Ser : Serine
Glu : Glutamic acid
Gly : Glycine
Ala : Alanine
Val : Valine
Met : Methionine
I-Leu : Isoleucine
Leu : Leucine
Tyr : Tyrosine
Phe :Phenylalanine
Lys : Lysine
Arg : Arginine
Tau : Taurine
Gln : Glutamine



(b) Total of Free Amino Acids



(c) Levels of Dipeptide

Free amino acids in this figure are shown in above figure (a) except Tau and Gln.

Figure 4 Relationships between the Beef Grade and the Levels of Amino Acids

Different letters (a,b) indicate significant differences between grades (p<0.05)

A2 A3 A4 A5