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Effect of Fatty Acids Profiles on Sensory Characteristics of Korean and Australian Consumer Groups

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Introduction

Fatty acid composition of ruminant meats can influence the flavor in the eating satisfaction of consumer in different countries. The amount and proportions of fatty acids in the main lipid fraction of the muscle such as neutral lipid and phospholipids differ, and variations in the proportions of fatty acids within these components explain some of the quality differences between muscles in shelf life and flavor (Wood *et al.*, 2004). In addition, sensory quality of beef can be affected by internal and external factors which vary between countries. This study presents the results of a large collaborative project between Australia and Korea. The consumers evaluated the beef cooked by traditionally grilled steaks and thin-sliced/roasted beef in two countries. The objective of this study was to investigate the relationship between sensory qualities and fatty acid composition with the response of different consumer group.

Materials and Methods

1. Animals, Sample Preparation and Sensory Evaluation

A total of 18 Korean Hanwoo steers (~ 24 months of age; 150 days on a high concentrate ration before slaughter; 313~409kg carcass weight) and 18 Australian Angus steers (~ 24 months of age; 150 days on a high concentrate ration before slaughter; 342~423kg carcass weight) were slaughtered in Korea at the NLRI and Australia at Bunbury WA, respectively. The cattle were slaughtered on the following day. At both slaughter locations, carcasses were deboned, and *longissimu dorsi*, *semimembranosus*, and *triceps brachi* muscles were removed and vacuum-packed on the following day, and aged for 7 days at a 1℃ chiller. Samples prepared in Australia were transported to Korea (NLRI, Suwon) in frozen state,

Table 1. Means of sensory characteristics (tenderness, juiciness, like-flavor, overall likeness) clustered for all consumers by Ward method and ANOVA results of comparing cluster means of fatty acids

Consumer	Korean consumer						Australian consumer		
Breed	Angus			Hanwoo			Angus		
Cluster	1	2	3	1	2	3	1	2	3
Tenderness[c***]	75.22[b]	62.75	47.21	75.20	61.60	43.85	73.57	61.17	46.09
	(5.93)	(5.88)	(7.80)	(5.84)	(5.21)	(8.76)	(5.44)	(5.20)	(8.59)
Juiciness[c***]	69.95	59.64	54.66	69.59	62.24	54.24	72.56	62.68	50.54
	(7.37)	(6.04)	(6.69)	(5.18)	(8.11)	(7.41)	(5.38)	(6.16)	(8.86)
Like-flavor[c***]	67.92	61.89	56.31	65.81	60.75	55.14	71.02	61.92	53.32
	(6.49)	(4.38)	(6.24)	(4.64)	(4.06)	(5.56)	(6.12)	(3.24)	(5.94)
Overall	71.59	62.63	50.99	71.77	61.47	48.96	73.01	62.14	49.77
likenessc***	(5.16)	(3.91)	(5.89)	(4.21)	(4.03)	(7.08)	(4.93)	(3.57)	(7.05)
Fatty Acids	F-ratio[d]			F-ratio[d]			F-ratio[d]		
C14:0	0.66			7.02**	(1 2) (3)		1.15		
C16:0	6.33**	(1 2) (3)		6.40**	(1) (2 3)		2.99		
C16:1(n7)	3.79*	(1) (2 3)		4.11*	(1) (2 3)		2.76		
C18:0	5.21*	(1 2) (3)		8.36***	(1) (2 3)		2.69		
C18:1(n9)	2.75			0.24			1.03		
C18:1(n7)	0.13			0.96			0.28		
C18:2(n6)	4.05*	(1) (2 3)		10.08***	(1) (2 3)		1.35		
C18:3(n6)	1.01			1.12			0.36		
C18:3(n3)	4.82*	(1) (2 3)		7.49***	(1 2) (3)		1.85		
C20:1(n9)	2.06			2.41			0.32		
C20:2(n6)	1.13			2.75			0.76		
C20:3(n6)	9.38***	(1) (2 3)		11.36***	(1 2) (3)		2.62		
C20:4(n6)	11.79***	(1) (2 3)		14.86***	(1 2) (3)		3.74*	(1) (2 3)	
C20:5(n3)	12.06***	(1) (2 3)		0.10			4.77**	(1) (2 3)	
C22:4(n6)	6.25**	(1) (2 3)		7.59***	(1 2) (3)		0.42		
C22:5(n3)	11.70***	(1) (2 3)		3.75*	(1 2) (3)		4.66*	(1) (2 3)	
SFA[a]	7.16***	(1 2) (3)		10.20***	(1) (2 3)		2.85		
MUFA[a]	3.91*	(1 2) (3)		1.51			1.88		
PUFA[a]	9.08***	(1) (2 3)		12.62***	(1) (2 3)		2.63		
n3	12.31***	(1) (2 3)		6.96**	(1 2) (3)		4.66*	(1) (2 3)	
n6	7.53***	(1) (2 3)		12.58***	(1 2) (3)		2.15		

[a] SFA, saturated fatty acids; MUFA, monounsaturated fatty acids; PUFA, Polyunsaturated fatty acids

[b] Means (standard deviation)

[c] 0: very tough, very dry, dislike extremely; 100: very tender, very juicy, like extremely.

[d] F-ratio ; F-ratio statistic for one way ANOVA.

P-value with * : * if $P < 0.05$, ** if $P < 0.01$.

(ab) means that cluster a and cluster b can be combined into the same group.

and kept at −20℃ until use. Australian beef were prepared in the same manner and sensory testing was performed with the same methodology in Australia. The sensory testing was performed with the methods described by Gee *et al.* (1998, 2002). A total of 432 samples (216 Hanwoo beef and 216 Australian beef) were evaluated by Korean consumers in Korea and a total of 216 samples (216 Australian beef) were evaluated by Australian consumers in Australia. Consumers were asked to score the samples for tenderness, juiciness, flavor, and overall liking.

2. Fatty Acid Analysis

Total lipids of beef samples were extracted by using chloroform−methanol (2:1, v/v) according to the procedure of Folch *et al.* (1957). An aliquot of total lipid extract was methylated as described by Morrison and Smith (1964).

3. Statistical Analysis

For cluster analysis, 4 sensory characteristics were considered as grouping variables. Firstly, a hierarchical cluster analysis using Ward method was undertaken with the SAS CLUSTER procedure (SAS, 1996). All the consumers were classified into 3 clusters, and the cluster profiles of the sensory characteristics were reported for the comparison of the 3 clusters. After clustering the consumers in the Korean Angus group, data were collected in each cluster, and the same procedure was done for both the Korean Hanwoo and Australian Angus groups.

Results and Discussion

The clusters consisted of descending order of sensory mean scores, such that cluster 1 had high scores for four factors, while cluster 3 had lowest mean scores for tenderness, juiciness, like−flavor, and overall likeness, respectively. Several fatty acids such as C20:4n6, C20:5n3, and C22:5n3 significantly affected the preference clusters of both consumers (Table 1). There was a significant difference in fatty acids for each group of cluster depending on beef origin; for example, C14:0 had significant effect on the cluster grouping when Korean consumers evaluated Hanwoo beef, while C20:5n3 showed significant effect on the cluster grouping when they evaluated Australian angus beef. Total contents of SFA, MUFA, and PUFA were significantly different among the preference clusters of Korean group, while these were not significantly different for Australian group. Korean consumers had significant differences in the clusters for the contents of total n−6 and n−3 PUFA, while Australian consumers had significant differences in clusters for the contents of total n−3 PUFA. There was a significantly different relationship between fatty acids and the palatability of beef based on the perception of Korean and Australian

consumer groups. Although variations in the absolute concentration and in the relative proportions of different fatty acids would affect the flavor profile, the cluster analysis showed that the effect of fatty acids on the preference was different depending on the consumer groups. Therefore, the culture-based perception and preference of taste panelists for meat seemed to depend on their previous experience and eating habit.

Conclusions

There was a significantly different relationship between fatty acids and the palatability of beef based on the perception of Korean and Australian consumer groups. The Korean consumers' palatability evaluation showed more significant relationship with fatty acid composition of beef than that of the Australian consumers.

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