Sensory Factors Contributing to the Identification of the Animal Species of Meat

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ABSTRACT: The aim of the present study was to clarify by means of sensory tests whether taste, aroma, or texture is the dominant contributor to people's ability to identify the animal species of meat. The meat samples used were loins of beef, pork, and lamb; chicken thigh; and aigamo (crossbreed of domestic duck and wild duck) breast. Panelists (32 to 35 persons) wearing eye masks ate cooked pieces, patties, and heated soups prepared from the meats of these 5 species with and without pinching their noses to regulate the aroma sensation, attempted to identify the species, and gave reasons for their identifications. In the test involving meat pieces and pinched noses, the percentage of panelists identifying chicken correctly was the highest, at 72%, whereas the percentages of correct identification for all other animal species were less than 50%; however, values were higher for each species in tests without nose pinching. In the tests of meat patties involving pinched noses, the percentage of correct identification for each animal species was slightly lower in comparison with the tests of meat pieces; however, the values were higher in tests without pinched noses. In the tests of soups using pinched noses, the percentage of correct identification for each animal species was lower than 30%; however, the values were higher in tests without pinched noses. These results led us to the conclusion that aroma is the most important contributor to the identification of the animal species of meat, and texture is the 2nd most important contributor. The contribution of taste appears much smaller than that of aroma and texture.

Keywords: animal species of meat, sensory factors, meat taste, meat aroma, meat texture

Introduction

The sensory factors of taste, aroma, and texture contribute to the palatability of meat. Because taste and aroma (retronasal aroma [Roberts and Acree 1995]) are perceived simultaneously when meat is chewed, this complex sensation is usually called a flavor. Thus, the relative contributions of taste and aroma to the palatability of meat are often unclear. However, in a previous paper, we found that aroma rather than taste was the key factor in the palatability of Japanese Wagyu beef, as indicated by sensory evaluation in which panelists either did or did not pinch their noses to regulate the aroma sensation (Matsuishi and others 2001). People eat various animal species of meat, including beef, pork, chicken, lamb, and aigamo (crossbreed of domestic duck and wild duck). However, the extent to which the 3 factors of taste, aroma, and texture enable people to identify the animal species of meat is uncertain. Therefore, the aim of this work was to clarify which of these 3 factors is the dominant contributor to the identification of animal species during consumption of various meats.

Materials and Methods

Materials

Loins of beef, pork, and lamb, chicken thigh, and aigamo breast were purchased from retail shops. The beef samples were lean meat imported from the U.S.A. The pork samples were domestic products from crossbreed pigs. Lamb was imported from Australia. The chicken samples were domestic broiler meat. The country of production of the aigamo was unknown. Aigamo was obtained in a frozen state and used after thawing in tap water. The other meats were purchased refrigerated.

Sample preparation for sensory animal species identification tests

Adipose and connective tissues were removed from all samples; only lean meat was used. Pieces of meat (approximately 2 × 2 × 0.3 cm) of each species were heated in a 1% NaCl solution at 80 °C for 3 min. A meat block of each animal species was minced, and meat patties (approximately 3 cm dia and 0.5 cm thick) were prepared from the minced meat. The meat patties were heated in a 1% NaCl solution at 80 °C for 3 min. A 100-g sample of minced meat of each animal species was heated with 100 mL of a 0.5% NaCl solution in a boiling water bath for 30 min. Then, the heated mixture was filtered with gauze and filter paper after cooling to remove suspended materials (including fats) and used as a heated soup. The soup was incubated at 40 °C, and portions of about 5 mL were used for the species identification test.

Sensory animal species identification test

Animal species identification tests were performed with meat pieces, meat patties, and heated soups prepared from each species. In the 1st test, panelists who wore eye masks and pinched their noses ate 5 samples (beef, pork, chicken, lamb, and aigamo) provided in random order, attempted to identify the species, and answered questions about the reasons for their identifications. In a later test, panelists followed the same procedure but did not pinch their noses. The aim of the tests with and without pinched noses was to observe the difference between subjects' responses without and with the aroma sensation. Panelists were required to select a species identification for each sample even if they could not describe the

Table 1—Percentages of correct identification of animal species and reasons for identification in a test of meat pieces[a]

Species	Test with pinched noses					Test without pinched noses					
	Correct identification		Reason[b]			Correct identification		Reason[b]			
	Number	Percentage	Taste	Texture	Other[c]	Number	Percentage	Taste	Aroma	Texture	Other[c]
Beef	14	44	2	7	5	22	69	2	18	6	3
Pork	12	38	2	9	2	16	50	0	8	1	6
Chicken	23	72	5	23	0	27	84	8	14	13	1
Lamb	15	47	3	4	8	21	66	0	20	0	1
Aigamo	14	44	3	11	2	22	69	4	21	3	1

[a]Four experiments were performed. In each experiment, different lots of market meats were used for all animal species. Eight, 8, 9, and 7 panelists participated in the 1st, 2nd, 3rd, and 4th experiments, respectively (32 panelists in total).
[b]The number of panelists who identified animal species correctly and indicated each reason described in the table. Panelists were allowed to give more than 1 reason.
[c]"No reason" was included in this count.

Table 2—Percentages of correct identification of animal species and reasons for identification in the test of meat patties[a]

Species	Test with pinched noses					Test without pinched noses					
	Correct identification		Reason[b]			Correct identification		Reason[b]			
	Number	Percentage	Taste	Texture	Other[c]	Number	Percentage	Taste	Aroma	Texture	Other[c]
Beef	12	36	2	7	3	21	64	4	15	3	0
Pork	12	36	3	4	6	20	61	4	7	1	7
Chicken	20	61	11	14	0	24	73	3	18	10	0
Lamb	11	33	2	3	5	22	67	1	21	0	0
Aigamo	10	30	4	5	3	17	52	1	16	2	1

[a]Four experiments were performed, as in the case of meat pieces in Table 1. Seven, 10, 8, and 8 panelists participated in the 1st, 2nd, 3rd, and 4th experiments, respectively (33 panelists in total).
[b]The same as in Table 1.
[c]The same as in Table 1.

reason for the identification. Panelists were undergraduate students (age 20 to 23) and 2 staff members (age 39 and 59) affiliated with the laboratory of food chemistry at Nippon Veterinary and Animal Science Univ. in Tokyo. All panelists had experience eating the types of meat included in the study, and none had received special training in species identification of meat.

Results and Discussion

Sensory identification of meat pieces from various species

Table 1 shows the number and percentage of panelists correctly identifying each species of meat pieces and the sensory traits that they gave as the reasons for the identifications. In the test that involved pinched noses, the percentage of panelists identifying chicken correctly was the highest, at 72%, but the percentages for all other species were lower than 50%. Many panelists indicated texture rather than taste as the reason for the correct identification of chicken. This is likely due to its uniquely elastic, tender texture.

This result seems to indicate that there is not as much difference in texture among the other types of meat tested as between chicken and those meats. Thus, the texture of aigamo may be similar to that of mammalian meats even though aigamo is poultry.

In the cases of beef and lamb, traits other than taste and texture were relatively frequently mentioned (5 and 8 times, respectively) as reasons for identification. This might indicate that both meats were identified by passive rather than active types of evidence, whereas pork, chicken, and aigamo were identified by active evidence, and, moreover, that the texture of beef and lamb was similar.

In the test where panelists did not pinch noses, the percentage identifying each animal species correctly was higher than that in the test where noses were pinched. Aroma was the most frequently cited reason for the correct identification of each animal species.

Pork was correctly identified least often, and aroma was less frequently given as the reason for identification, while "other" as the reason for identification was given more often than for the other species. These results seem to indicate that because pork did not have a strong, characteristic aroma, it was identified by passive evidence, whereas the other meats were identified by active evidence of their characteristic aromas.

Many panelists indicated taste and texture as reasons for the identification of chicken but few indicated such traits for other species. It is assumed that chicken presents no characteristic chicken taste from the results on soup described below. Therefore, it appears that the characteristic texture of chicken modifies the taste sensation from the meaty taste common to all animal meats.

Sensory identification of meat patties from various animal species

Table 2 shows the results for patties in which muscle structures were partially destroyed. In the test involving pinched noses, the percentage of panelists identifying chicken correctly was the highest, at 61%, and percentages for all other animal species were lower than 40%. Many panelists indicated texture rather than taste as the reason for the correct identification of chicken. This is likely due to the elasticity of its texture, which resembles that of a fish gel product (kamaboko). In all animal species, the percentages of panelists identifying the species correctly decreased slightly in comparison with the percentage for meat pieces, indicating that identification had become more difficult because of the destruction of texture.

In the case of chicken, taste was given as the reason for identification 11 times, a much higher number than for the other meats. This seems to be due to the fact that the characteristic texture of chicken still modifies the taste sensation from the meaty taste common to all animal meats, even if the muscle structure is partially destroyed by mincing.

Table 3—Percentages of correct identification of animal species and reasons for identification in the test of heated soups[a]

Species	Test with pinched noses				Test without pinched noses				
	Correct identification		Reason[b]		Correct identification		Reason[b]		
	Number	Percentage	Taste	Other[c]	Number	Percentage	Taste	Aroma	Other[c]
Beef	5	14	4	1	10	29	4	4	2
Pork	6	17	5	1	10	29	3	7	2
Chicken	9	26	7	2	15	43	6	6	2
Lamb	5	14	2	3	23	66	2	22	1
Aigamo	7	20	5	2	12	34	3	8	2

[a]Four experiments were performed, as in the case of meat pieces in Table 1. Eight, 10, 10, and 7 panelists participated in the 1st, 2nd, 3rd, and 4th experiments, respectively (35 panelists in total).
[b]The same as in Table 1.
[c]The same as in Table 1.

The percentage of panelists without pinched noses that correctly identified each animal species was higher than that of panelists with pinched noses. The largest number of panelists indicated aroma as the reason for the correct identification of each animal species. Both tests without pinched noses shown in Table 1 and 2 indicated that for all animal species, percentages of correct identification of meat patties were roughly similar to those of meat pieces. This result would indicate that panelists are able to identify animal species correctly by aroma, even if muscle structures are partially destroyed.

In the case of pork, aroma was least frequently cited as the reason for identification, and "other" reasons showed the highest count. Because this trend is exactly the same as for meat pieces, the explanation is assumed to be the same as described above for meat pieces.

In the case of chicken, the number of participants citing aroma as the reason for the correct identification was higher and that of taste was markedly lower as compared with the test with pinched noses. This result seems to indicate that the aroma sensation is more characteristic of the species than the taste sensation from chicken patties.

Sensory identification of heated soups from various animal species

Table 3 shows the results in tests involving heated soups, which had no muscle structure. In the test with pinched noses, percentages of correct identification for all animal species were lower than 30%; these are markedly lower values than those in the cases of meat pieces and patties. This indicates that it is quite difficult for panelists to identify animal species by taste alone. In other words, this result demonstrates that the tastes of the soups from various animal species are almost indistinguishable. Nishimura and others (1988) reported that the pattern of free amino acids in soups was almost the same among beef, pork, and chicken. Therefore, it was suggested that the meaty taste of soups is determined by the pattern of the free amino acids, the high similarity of which makes the identification of animal species difficult.

The percentage of panelists without pinched noses identifying each animal species correctly was higher than that of panelists with pinched noses. In the case of lamb, the percentage of correct identification was notably high at 66%, indicating that the mutton aroma of the heated soup helped the identification.

For the other 4 meats, the percentages of correct identification were much lower than those obtained from meat pieces and patties. As it is suggested that the texture is similar among beef, pork, and aigamo as described above, the identification of beef, pork, and aigamo seems to be mainly dependent on the aroma. However, the aromas of the soups could not elevate the percentage of correct identification as much as those of meat pieces and patties. This result appeared to indicate that at least some of the aroma compounds characteristic of each animal species were removed with the fat fraction discarded when the soups were prepared in this experiment.

Conclusions

The results obtained from the present study, in which sensory tests were conducted to identify animal species of meat pieces, patties, and soups prepared from beef, pork, chicken, lamb, and aigamo, support the hypothesis that aroma is the most important contributor to the identification of animal species of meat, and texture is the 2nd most important. The contribution of taste is much smaller than that of aroma and texture.

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