Is goat meat acceptable to Japanese youth? The first goat meat taste survey in Japan

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ABSTRACT

Two sensory evaluations of goat meat were carried out to examine the acceptance of goat meat by Japanese youth. The first test used 172 university students to examine the preference between loin and hind leg of domestic goat. The second test employed 35 university students to rate taste differences between loin and fillet. The sensory analysis between loin and hind leg showed that 'chewiness' in goat meat was highly rated. Also loin meat was relatively highly evaluated in comparison with hind leg meat. Fillet meat obtained slightly higher evaluation in comparison with loin meat. Due to the expense of goat meat at retail outlets in Japan, New Zealand could have an advantage of shipping loin and fillet goat meat to meet the future demand by Japanese youth.

Keywords: goat; meat: sensory test; Japan.

INTRODUCTION

The Japanese goat meat summit meeting has been held annually since 1998 and now gathers more than 2,000 people involved in goat production and consumption from throughout Japan. The 2004 meeting lasted two days and included a symposium about goat management, goat meat preparation and goat nutrition. Ozawa *et al.* (2004) reported that there is a latent demand for goat meat among Japanese households and suggested that sensory testing of goat meat would assist in understanding consumer needs and subsequent expansion of meat sales.

To date, there is only one sensory analysis of goat meat in Japan. Kato (1980) used 19 university students for the sensory evaluation of goat meat. He required each participant to eat pork hind leg meat and goat meat (parts unknown) and asked them to evaluate 'flavour', 'juiciness', 'tenderness' and 'overall perception' on a scale of one to five. The meat component was served anonymously to the participant. He found that goat meat was preferred in every aspect compared with pork leg meat. 'Juiciness' in goat meat was significantly better than in pork. However, there are two major tasks remaining from Kato's work. Firstly, participants were too few to assess the real preference of goat meat. Secondly, because Kato (1980) compared goat meat with pork hind leg meat, he could not conclude as to whether goat meat was acceptable as a meat to the participants.

The objective of this paper was to evaluate the acceptance of goat meat to Japanese youth using sensory tests. Understanding the acceptance of goat meat by Japanese youth will assist New Zealand goat farmers in deciding as to whether there are market opportunities for goat meat in Japan.

MATERIALS AND METHODS

Goat meat preference between loin and hind leg - Experiment 1

One hundred and seventy two students of the Nippon Veterinary and Animal Science University were selected as participants for the sensory experiment. The sensory analysis test was held six times on 11 and 12 November 2003 at a lecture room in the university. Each sensory test took 60 minutes (meat preparation 40 minutes, instructions for participants 5 minutes and test 15 minutes) and was limited to a maximum of 30 participants at a time. All the tests were held from 1 p.m. to 4 p.m.. The meat samples were from two castrated 8 month old Japanese Saanen goats raised at Nagano National Livestock Breeding Centre. They were slaughtered on 7 November 2003 and brought to a local butcher for dressing. Dressing of those carcasses occurred on 9 November 2003 and they were stored in a 5ºC refrigerator for two days aging. Loin and hind leg meat were cut into 10 g portions then wrapped in aluminium cooking foil and evenly placed in an electric oven. Meat was cooked at 180ºC for 30 minutes without adding any flavour to prevent bias. After cooking, the meat was cooled for 5 minutes to room temperature without opening the foil. Loin meat was identified as 'Meat A' to the participants and hind leg meat as 'Meat B' to make them anonymous to the participants. Each participant was asked to taste 'Meat A' first and requested to fill in the evaluation sheet. They rinsed their mouth with mineral water before tasting 'Meat B'. An ordinary lecture room was used as testing room, but all the windows were covered by blackout curtains to prevent natural light, but fluorescent lighting was present. During the test, room condition was maintained to 22ºC with a humidity of 50%. Meat was evaluated for 1) taste, 2) juiciness, 3) chewiness, 4) tenderness and 5) overall evaluation on a scale of minus two (lowest) to plus two (highest). Taste category evaluated the tastiness of the meat. Juiciness evaluated the volume of meat juice when the participants bit the meat. Chewiness evaluated the degree to which teeth bounce from the meat when the participants bit into the meat. Tenderness evaluated condition of the meat and overall evaluation included all previous four categories to give an overall opinion for the meat. Grading '0 (zero)', the middle range of the evaluation -2 to +2 scale represents

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'neutral', while -2 grading represented inferiority in each grading category and +2, superiority.

Gustatory preferences depend on the individual's ethnicity, dietary habits and cultural background. To define the fundamental gustatory preferences of participants, we undertook a questionnaire survey in Experiment 1. Immediately after tasting goat meat the 172 participants were asked their preference of meat as follows:

Question 1: Which meat do you like better, smelly or odourless? Answer 1: I like smelly meat (4.5%). I like odourless meat (95.5%).

Question 2: Which meat do you like better, juicy or dry? Answer 2: I like juicy meat (92.6%). I like dry meat (7.4%).

Question 3: Which meat do you like better, tough or tender? Answer 3: I like tough meat (14.5%). I like tender meat (85.5%).

According to these answers, the meat preference characteristics of the participants are described as they prefer juicy, tender, odourless, meat. Therefore, +2 evaluation in smell means 'odourless'. +2 evaluation in chewiness and tenderness represent "tender". And +2 in juiciness means 'lots of juice'. The zero grading represents 'neutral'. This is based on the personal feeling of each participant if the participant felt the meat had 'average taste'; which is defined as 'neutral'. The comparison between 'inferiority' and 'superiority' represent the gustatory distance from the neutral point.

Chi-squared analyses were used to test for significant differences in the frequency of scores between the meat types.

Goat meat preference between fillet and loin -Experiment 2-

Thirty five students of Nippon Veterinary and Animal Science University were selected to participant in this sensory experiment. The sensory analysis test was on 17 December 2004 at a lecture room in the university. The sensory test took 60 minutes (meat preparation 40 minutes, instructions for participants 5 minutes and test 15 minutes). The test was held from 1 p.m. to 2 p.m.. The meat sample was from castrated 8 month old Japanese Saanen goats raised at Nagano National Livestock Breeding Centre. They were slaughtered on 10 December 2004 and brought to a local butcher for dressing. Dressing of those carcasses occurred on 14 December 2004 and they were stored in a 5ºC refrigerator for two days aging. Fillet and loin meat were cut into 10 g portions then evenly placed in electric oven on a net to drain off extra meat juice. Meat was cooked at 180ºC for 30 minutes without flavouring. After cooking, meat was served immediately to the participants. Fillet meat was identified as 'Meat A' to the participants and loin meat as 'Meat B' to make them anonymous to the participants. Each participant was allowed to taste each meat as they liked and requested to fill in the evaluation sheet. They had to rinse their mouth with mineral water before tasting the second meat. An ordinary lecture room was used as testing room, but all the windows were covered by blackout curtains to prevent natural light, but fluorescent lighting was present. During the test, room condition was maintained to 24ºC with a relative humidity of 20%. Meat was evaluated for 1) smell, 2) taste, 3) juiciness, 4) tenderness and 5) overall evaluation on a scale of -2 (lowest) to +2 (highest). Smell evaluated meat odour. The other characteristics and the grading scores were defined as for the Experiment 1. Chi-squared analyses were employed to test for significant differences in the frequency of scores between the meat types.

RESULTS

Goat meat preference between loin and hind leg

The sensory scores generated by the university students are summarised in Table 1. Loin meat was considered more favourably to hind leg meat for tenderness, chewiness and overall evaluation, but hind leg meat was better for juiciness. Both meats were favourably considered for chewiness.

The average evaluation scores for each meat characteristic are shown in Figure 1. The dotted line in the figure represents the zero scale (neutral) for each of the sensory categories. As Figure1 demonstrates, loin was superior to hind leg meat and better than neutral in all characteristics except for juiciness. Hind leg meat performs below neutral except for chewiness and is inferior to loin, except in juiciness. Meat chewiness is the only characteristic in which both loin and hind leg meat exceed the neutral level.

Goat meat preference between fillet and loin

The sensory scores generated by the university students are summarised in Table 2. Fillet meat was considered more favourable than loin meat for juiciness ($P < 0.01$). Both meats were favourably considered for taste, tenderness and overall evaluation.

The average evaluation scores are shown for each meat characteristic in Figure 2. As shown in Figure 2, fillet meat is superior to loin meat and better than neutral for all characteristics except for smell. Loin meat performs below neutral in juiciness and smell.

DISCUSSION

In sensory studies conducted with untrained or consumer-like panellists, goat meat generally was rated less desirable than other red meats by a total of 100 Texas A & M University students, staff and faculty (Rhee *et al.,* 2003). When oven-baked rib or loin samples were evaluated by five trained sensory panels, goat meat was not markedly different in flavour desirability compared with beef or lamb, but tended to be less desirable in flavour than pork (Smith *et al.,* 1974). Overall satisfaction scores, however, were lower for goat meat than pork, beef, or lamb. In another study, goat meat was rated lower than lamb and mutton in overall desirability by twenty panellists, ten of who were born in the United States of America and ten who were foreign (China, India, Mexico, Taiwan, Saudi Arabia, Venezuela or Vietnam) (Griffith *et al.,* 1992).

TABLE 1: Comparison of sensory traits for loin and hindleg goat meat.

	Total number of examinees		172		Number of	female 96					
	Age of participant		20.7 years			SD 1.2 years					
			Number of respondents								
Parts	**Grades**	**Taste**		**Juiciness**		**Chewiness**		**Tenderness**		**Overall evaluation**	
			%		**%**		**%**		**%**		**%**
Loin	Very good (+2)	13	8	1	1	22	13	19	11	10	6
	Good (+1)	34	20	20	12	66	**38**	52	**30**	46	27
	Neutral (0)	86	**50**	38	22	57	33	52	**30**	72	**42**
	Poor (-1)	35	20	82	**48**	26	15	44	26	39	23
	Very poor (-2)	4	2	31	18	1	1	5	3	5	3
	Average score	0.10		-0.71		0.48		0.21		0.10	
Leg	Very good (+2)	13	8	9	5	31	18	13	8	15	9
	Good (+1)	34	20	35	20	51	**30**	25	15	31	18
	Neutral (0)	66	**38**	55	**32**	35	20	43	25	45	26
	Poor (-1)	48	28	52	30	44	26	55	**32**	64	**37**
	Very poor (-2)	11	6	21	12	11	6	36	21	17	10
	Average score	-0.06		-0.24		0.27		-0.44		-0.22	
Significance		NS		**		**		**		**	

** P < 0.01 for testing difference between loin and leg

TABLE 2: Comparison of sensory traits for fillet and loin goat meat.

	Total number of examinees		35		Number of	female 20					
	Age of participant		20.5 years			SD 1.7 years					
			Number of respondents								
Parts	**Grades**	**Taste**		**Juiciness**		**Smell**		**Tenderness**		**Overall evaluation**	
			%		**%**		**%**		**%**		**%**
Fillet	Very good (+2)	3	9	3	9	2	6	4	11	1	3
	Good (+1)	11	31	10	29	3	9	9	26	14	40
	Neutral (0)	14	**40**	11	**31**	18	**51**	18	**51**	14	**40**
	Poor (-1)	6	17	9	26	8	23	4	11	6	17
	Very poor (-2)	1	3	2	6	4	11	0	0	0	0
	Average score	0.26		0.09		-0.26		0.37		0.29	
Loin	Very good (+2)	3	9	1	3	1	3	4	11	1	3
	Good (+1)	10	29	6	17	6	17	12	34	12	34
	Neutral (0)	14	**40**	12	34	18	**51**	13	**37**	13	37
	Poor (-1)	8	23	14	**40**	10	29	2	6	9	**26**
	Very poor (-2)	0	0	2	6	0	0	4	11	0	0
	Average score	0.23		-0.29		-0.06		0.29		0.14	
Significance		NS		**		NS		NS		NS	

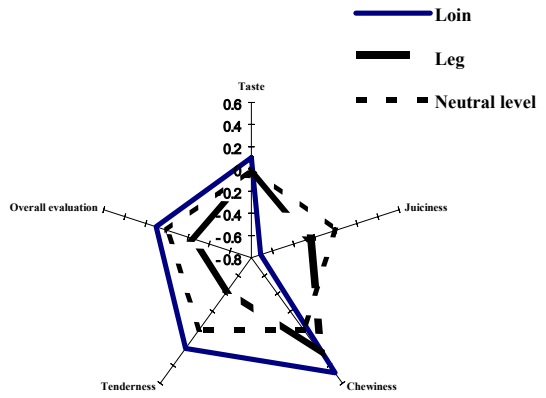
** P < 0.01 for testing difference between loin and leg

In this sensory evaluation with Japanese students, loin meat was considered more desirable compared to hind leg meat except for juiciness. The Japan Meat Information Centre (2002) suggested that loin is more commonly purchased by households than hind leg for both beef and pork because of its superior taste. The chewiness of goat meat obtained favourable evaluation from the participants, while juiciness in loin meat received poor evaluation by the participants. This result may be explained by the method of cooking meat in experiment 1. Meats were wrapped in aluminium cooking foil and heated in the oven. Because loin meat contains more fat and moisture than hind leg meat, a greater amount of meat juice remained inside the foil giving a bad visual affect to the participants for loin meat. For Experiment 2, the test was redesigned based on experiences from Experiment 1 and a net was used to drain off extra meat juice.

The Japan Meat Information Centre (2003) reported that in 582 meat retail shops, beef and pork fillet meats were the most expensive meats. The average retail price of Wagyu (Japanese black beef) fillet was NZ$150.10/kg (10,470.1 Yen/kg) and domestic pork fillet was NZ$33.90/kg (2,353 Yen/kg). Tsuneishi and Nishimura (1989) used a sensory test with 41 participants to determine the preference between fillet (tenderloin), loin (sirloin), thick flank and hind leg in beef. They evaluated for smell, tenderness, juiciness and

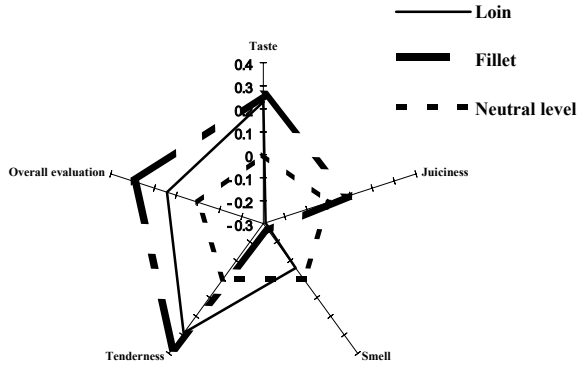
taste. Fillet meat obtained the top preference in tenderness and the lowest preference in smell while loin was the best in taste. Fillet is an expensive meat in Japan because it is only a small proportion of the carcass and it is tender, providing good eating quality. In the present study, fillet meat generally obtained higher preference than loin meat except for smell. This result is very similar to that of Tsuneishi and Nishimura (1989), especially with respect to smell.

FIGURE 1: Grade comparison between loin and leg goat meat.



(Comparison of total points by five grades on a scale of -2 to +2)

FIGURE 2: Grade comparison between fillet and loin goat meat.



(Comparison of total points by five grades on a scale of -2 to +2)

Our previous results (Ozawa *et al.,* 2004) showed that half of Japanese households may purchase goat meat if they had the opportunity. They also suggested that only a small percentage increase in goat meat consumption would require large increases in domestic goat numbers, with a strong likelihood of needing support from tax-free imported goat meat to satisfy the potential demand. The current results of sensory surveys of Japanese youth as future consumers suggest that goat loin and fillet meat are very acceptable.

The average CIF (cost, insurance and freight) goat meat price in year 2000 was NZ$5.50/kg (282 Yen/kg) while Japanese internet retail shop sell domestic female Sanen meat for barbeque at NZ$60/kg (4,167 Yen/kg) (Suzukiya, 2004) or castrated native island goat for soup at NZ$47.52/kg (3,300Yen/kg) (Amamihana, 2004). The price difference between New Zealand imported and Japanese goat meat is obvious. However, the New Zealand goat meat industry still remains in a developing stage compared with other livestock sectors. Batten (2003) stated that "Market supply and development to take advantage of opportunities in North American and European markets are hampered by lack of consistent supply". If New Zealand goat meat can achieve a better price than the average imported CIF price, and provide consistent supply to the Japanese demand, then New Zealand goat meat farmers may have a great opportunity to supply the Japanese market, especially by focusing on loin and fillet meat.

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