Received: 24 January 2022 | Revised: 18 February 2022 | Accepted: 24 February 2022

DOI: 10.1111/asj.13705

REVIEW ARTICLE

Animal Science Journal WILEY

Diversity of Japanese consumers' requirements, sensory perceptions, and eating preferences for meat

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Funding information
Ministry of Agriculture, Forestry and Fisheries, Grant/Award Numbers: 2001, 27005B, 25064C; Japan Society for the Promotion of Science, Grant/Award Numbers: 21K02144, 23700898, 21700746

Abstract

Japanese consumers are generally characterized as preferring high marbling in beef and pork and choosing domestic products. However, the Japanese food market is not homogenous. Understanding the diversity of Japanese consumers will provide benefits for the optimization of meat production and distribution in Japan. This article focuses on three factors affecting purchasing decisions and eating satisfaction, namely, requirements, sensory perception, and eating preferences, in order to understand the diversity of Japanese consumers in a simplified manner. Diversity was observed in Japanese consumers in all three of these factors (requirements, perception, and preference) using a questionnaire survey, sensory and biological procedures, and an eating preference test. These diversities are due to not only sociodemographic characteristics but also biological and physiological factors, background culture, and individual attitudes and criteria. Although consumer variation based on sociodemographic characteristics is of course important, it is equally important to understand diversity by focusing on the individual differences among consumers.

KEYWORDS
consumer, diversity, Japan, meat, preference

1 | INTRODUCTION

Understanding what consumers require for meat, how they perceive it, and how they prefer it is essential to optimize meat quality and production and to maximize profits by meat producers and distributers. In Japan, household meat consumption was nearly constant or marginally increasing between 2016 and 2019, according to government statistics (Agriculture and Livestock Industries Corporation, 2022). However, meat consumption in 2020 notably increased by approximately 10% compared with 2019, partly due to the covid-19 outbreak, suggesting that the demand for meat in households has become strong again (Figure 1). Improvement in meat quality based on the requirements and preferences of Japanese consumers will stimulate further demand and consumption for meat.

Japanese consumers' overall meat requirements and preferences have been well surveyed and reported. Japanese consumers consider marbling to be important in judging the quality of beef (Koizumi et al., 1986). This is supported by the emphasis on intramuscular fat in the longissimus muscle in Japanese carcass grading (Motoyama et al., 2016). Polkinghorne et al. (2011) reported that in Japanese consumers, tenderness, juiciness, and flavor are important for sensory scoring of beef. Juiciness, in particular, was more important in beef for Japanese than for Australian consumers (Polkinghorne et al., 2013). Flavor is also identified as an important characteristic for eating

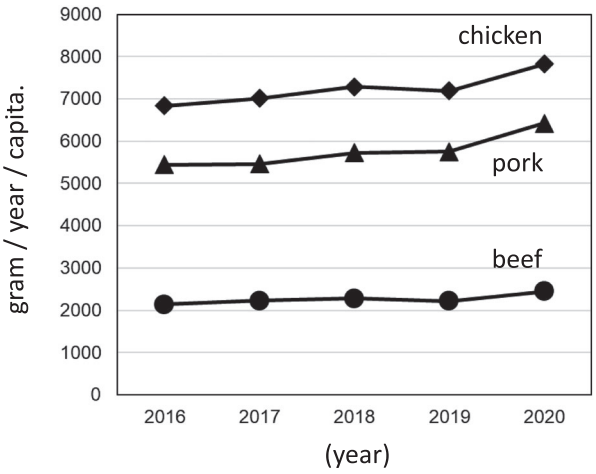

FIGURE 1 Changes in beef, pork, and chicken consumption in Japan between 2016 and 2020. Values are gram per capita in each year

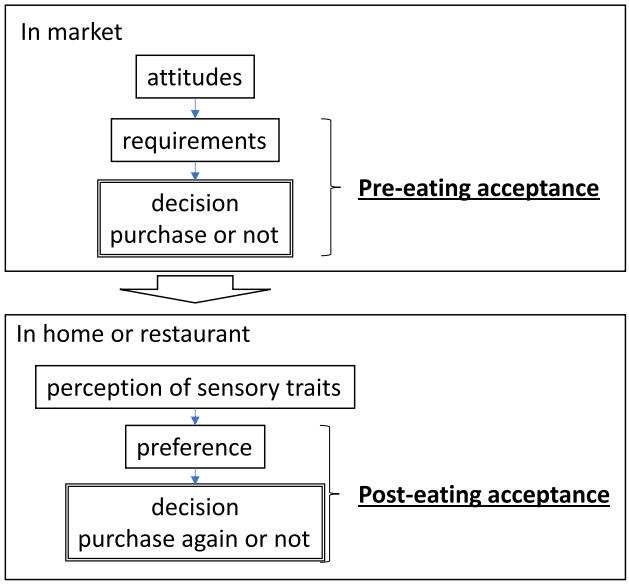

FIGURE 2 Model of the pre- and post-eating acceptance of meat in consumers

preference of beef in Japan (Saito et al., 2011). Japanese consumers are concerned about the origin of beef, particularly preferring domestically produced beef (Seghaian & Reed, 2004; Tonsor et al., 2009). For pork, a cross-cultural study indicated that Japanese consumers prefer marbling and no drip compared with consumers in other countries (Ngapo et al., 2007). A consumer preference test with 318 Japanese consumers supported this preference for marbling of pork (Kohira et al., 2021). Japanese consumers also consider the origin of pork meat when making purchasing decisions more than do consumers in China and South Korea (Oh & See, 2012). Wang et al. (2019) also reported that Japanese consumers have a preference for domestic pork as compared with Chinese consumers. When choosing processed pork, Japanese consumers are wary of food additives and preservatives and prefer low-fat products (Sapp & Knipe, 1990). These findings are useful for understanding overall tendencies in the requirements and preferences for muscle foods in Japanese consumers.

On the other hand, it is known that the Japanese food market is not homogenous. Rothacher (1989) reported that generational, social, and regional differences are observed in Japanese dietary habits. For example, regional differences in consumption of milk (Stroppiana et al., 1998), beef and pork (Riethmuller & Stroppiana, 1996), and seafood (Kusanagi et al., 2018; Wessels & Wilen, 1994) have been reported. Sociodemographic characteristics also affect food consumption in Japan (Kobayashi et al., 2015). To optimize meat production and distribution in order to improve meat consumption and consumer satisfaction, it is useful to understand the diversity of Japanese consumers in their attitudes toward meat.

Furthermore, it is convenient to divide the acceptance of meat by consumers into two phases, pre-eating acceptance and post-eating acceptance (Figure 2). In the first phase, pre-eating acceptance, consumers decide whether they will purchase certain meat according to their requirements, based on their attitudes toward meat and sociodemographic characteristics. After purchasing the meat, they eat it and perceive its sensory characteristics, such as taste, flavor, and texture, and decide whether they like it. Depending on whether or not they like the meat, consumers will decide whether to purchase it again. This is the second phase, post-eating acceptance. To improve the consumption of meat, we should understand and satisfy both pre- and post-eating acceptance in Japanese consumers.

Therefore, this article presents a diversity of factors, that is, attitudes and requirements, sensory perception, and eating preferences, which affect pre- and post-eating acceptance of meat in Japanese consumers. Font-i-Furnols and Guerrero (2014) categorized factors affecting consumer behavior toward meat into psychological, sensory, and marketing factors. This article focuses on the first two factors mentioned above, psychological and sensory factors.

2 | FACTORS AFFECTING CONSUMER DIVERSITY

2.1 | Attitudes and requirements

Meat purchasing decisions are influenced indirectly by attitudes and directly by the requirements of consumers. The diversity of these attitudes and requirements has been investigated by combinations of questionnaire studies and segmentation. Consumer segmentation into homogenous groups according to their requirements and attitudes is useful to understand individual differences and to develop novel products (Meullent et al., 2007). Sasaki and Mitsumoto (2004) performed a questionnaire study on requirements for beef with 532 Japanese consumers. In that study, a total of 20 questions regarding sensory properties, appearance, safety and freshness, production origin, price, and other properties were prepared. According to the answers, the

participants were divided into four groups: "specific quality oriented," "Wagyu oriented," "safety and freshness oriented," and "overall high quality oriented." Gender and age characteristics were different between these four groups; in the "safety and freshness oriented" group, the ratio of respondents in their 20s was high. Sasaki et al. (2006) also carried out a questionnaire survey using conjoint analysis and visual beef images with 247 Japanese consumers. This study used eight beef profiles constructed with orthogonal array using the four attributes of marbling (two levels), meat color (two levels), price (three levels), and "tenderness" guarantee labeling (two levels). Based on the results, these consumers were divided into four groups using cluster analysis: "leanness and high price oriented," "marbling and labeling oriented," "middle price, labeling, and marbling oriented," and "low price and labeling oriented." It is noteworthy that although most Japanese are thought to prefer beef with high marbling, a group of consumers was found to highly value beef with low marbling. Furthermore, this survey also indicated that the "low price and labeling oriented" group had a higher ratio of younger consumers, and visual properties such as marbling did not affect the beef choice in this group. Both of these two surveys found that younger consumers, for example, those in their 20s, differed from other age groups in their requirements for beef.

Consumer segmentation using a questionnaire regarding pork was also carried out with 277 Japanese respondents (Sasaki et al., 2009). This study used eight profiles of pork, which were designed by orthogonal array using the following four attributes: marbling (two levels), fat color (two levels), "rice fed pork" labeling (two levels), and price (three levels). Consumers were classified into four groups by cluster analysis, which were characterized as "high-marbling oriented," "low-marbling oriented," "rice-fed oriented," and "low price oriented." The importance of price was the highest among the four attributes used in the pork profile preparation in all four consumer groups. However, sociodemographic characteristics did not differ between the consumer groups.

A questionnaire study regarding "Ecofeed," a trademark of food waste or food coproduct animal feed certified by the Japanese government, was also carried out with a total of 1500 Japanese participants (Sasaki et al., 2011). Respondents were classified into four categories according to their impression of "Ecofeed" pork. A comparison between consumer segments indicated that a positive impression for "Ecofeed pork" is related with high levels of knowledge of pork farming procedures, although sociodemographic traits were not different between the four consumer groups.

Animal welfare has become an important factor in consumers' meat choices. Sonoda et al. (2018) evaluated how animal welfare and environmentally friendly production affected consumer values for beef in 846 Japanese consumers. They divided respondents into five segments: label conscious (11.0%), domestic beef preference (31.6%), price conscious (21.4%), animal welfare preferring (23.1%), and not interested in production procedures (12.9%).

The results presented above suggest that it is more appropriate to first classify consumers according to their requirements and/or attitudes rather than focusing on their sociodemographic characteristics, such as age and gender.

Regional differences in meat consumption are well known in Japan. Dinku and Matsuda (2017) carried out an econometric analysis of national survey data on expenditure, and their findings supported the general knowledge in the following: Pork is popular in the eastern region of Japan, whereas beef and chicken are popular in the western region of Japan. A questionnaire survey regarding attitudes, knowledge, and degree of quality required for pork in eastern and western Japan was also carried out (Sasaki et al., 2022). This survey indicated a stronger preference for pork dishes in eastern Japanese consumers than in western Japanese consumers, whereas knowledge was higher and requirements were stronger in western Japanese consumers than in eastern consumers. For optimizing the marketing and distribution of meat, further surveys should also be conducted to accumulate insights regarding regional diversity of meat requirements within Japan.

2.2 | Perception of sensory traits

As shown in Figure 2, perception of sensory traits of meat, such as taste, flavor, and texture, is important in judging whether or not the meat will be preferred by consumers. These sensory traits generally can be measured objectively using instrumental techniques and/or sensory evaluation by a trained panel. On the other hand, each consumer perceives sensory traits of meat using his or her own criteria, and there are some biological and cultural factors that influence these criteria.

Boar taint is a typical trait that is perceived differently among individuals. Androstenone has been well known as an important substance affecting boar taint, one of the important malodor characteristics of pork meat. Various reports have indicated that consumers can be categorized as androstenone sensitive or nonsensitive (Font-i-Furnols, 2012). Japanese consumer acceptance of boar meat was lower than that of castrated pork meat, in an assessment by 80 participants (Hennessy, 2006); therefore, it is strongly suggested that Japanese consumers also do not like boar taint. On the other hand, Tokunaga et al. (2005) reported that the range of androstenone sensitivity was from 0.1 to 100,000 ppb in males and from 0.1 to 1000 ppb in females in Japanese subjects. Human odorant receptor OR7D4 is known to be selectively activated by androstenone. Genetic polymorphisms of OR7D4 produce individual differences in sensitivity and description of the odor (Keller et al., 2007). Such genetic diversity may be related to individual differences in androstenone sensitivity in the Japanese populations as mentioned above.

Umami is an important taste characteristic of beef and pork (Nishimura, 1998) and chicken meat (Fujimura et al., 1995), due to free amino acids, particularly glutamic acid. The perception of umami is also differentiated between individuals due to genetic and physiological factors. TAS1R1/TAS1R3, an umami taste receptor, also has genetic variants. Shigemura et al. (2009) showed that some single nucleotide polymorphisms in this taste receptor affected the

recognition threshold of monosodium glutamate in 254 Japanese subjects. Furthermore, eating behavior also affects umami perception. Noel et al. (2018) reported that prolonged exposure to monosodium glutamate decreased umami taste perception in a total of 66 participants. Moreover, other taste traits, such as bitterness, were differently perceived between testing times. In a panel screening test, the gustatory detection rate of bitterness in a discrimination test of five basic tastes was different between testing periods of 11:00 a.m., 1:15 p.m., and 3:00 p.m. in untrained Japanese subjects (Sasaki et al., 2012). These findings suggest that both genetic and physiological factors provide diversity of sensory perception of meat in Japanese consumers.

Variation in sensory perception between consumers is also affected by cultural factors, particularly language. Tenderness is a very important sensory characteristic of meat. In Japanese, "*yawaraka-i*" (adjective) and "*yawaraka-sa*" (noun) mean tender and tenderness, respectively. However, the Japanese word "*yawaraka-i*" and "*yawaraka-sa*" also include the meanings of soft and softness, respectively. Tenderness and softness are terms with different definitions in sensory analysis in English. In ISO 5492:2008, "tender" is defined as a low level of chewiness, which is "the amount of work required to masticate a solid product into a state ready for swallowing." "Soft" is defined as a low level of hardness, which is "the force required to achieve a given deformation, penetration, or breakage of a product" (International Organization of Standardization, 2008). Also, in beef, tenderness and softness can be distinguished from each other by trained panel personnel (Sasaki et al., 2010). Therefore, it is necessary to understand exactly how Japanese consumers perceive "*yawaraka-sa*," that is, whether they perceive it more as tenderness or softness. A consumer sensory survey of beef longissimus muscle with Japanese subjects indicated that Japanese consumers were divided by "*yawaraka-sa*" perception into two groups: One group perceived "*yasaraka-sa*" as tenderness, and the other group perceived "*yawaraka-sa*" as softness (Sasaki et al., 2014). The two groups accounted for about the same percentage of the total subjects. This survey also showed that requirements with regard to "pleasure of chewing" of beef were different between the two groups, according to a questionnaire study of the participants. In other words, the degree of requirement to "pleasure of chewing" in consumer depends on what kind of texture he or she perceives beef to be "*yawaraka-i*." These findings suggest that cultural factors, particularly interpreting the meaning of sensory descriptors, and attitudes affect the reported differences in sensory perception between individuals. Language problems that lead to differences in sensory perception have also been pointed out for the *umami* taste (O'Mahony & Ishii, 1986) assessed in a cross-cultural study. Such limitations of consumer language regarding perception of sensory traits of meat have been well discussed by Muñoz (1998).

Each consumer judges the sensory traits of meat with their own criteria arising from biological and cultural factors, as described above, because consumers are neither selected nor trained like the people on a trained sensory panel. For the utilization of sensory traits objectively assessed by a trained panel in quality improvement and the marketing of meat, the focus should be on how each consumer perceives and judges the sensory traits of meat as a result of biological variations and cultural differences between individuals, in particular the limitations of language.

Recently, nine genetic loci associated with dietary habits, such as consumption of alcohol, beverages and foods, in Japanese individuals were identified by a genome-wide association (GWAS) study using 58,610–165,084 subjects (Matoba et al., 2020). Although this survey did not show genetic loci associated with meat consumption unfortunately, such large-scale genetic studies including GWAS are expected to provide novel findings regarding diversification of sensory perception of meat in Japanese consumers.

2.3 | Eating preference

Variations within a country and differences between countries in consumer meat preferences have been well investigated. For example, European consumers were classified into several groups based on their acceptance of boar taint of pork meat (Panella-Riera et al., 2016). Variations in consumer preference were also observed for grass-fed beef in European consumers (Realini et al., 2013) and beef steaks cooked with different doneness in US consumers (Schmidt et al., 2010), and for fermented lamb sausages (Helgesen et al., 1997), dry-cured ham (Pham et al., 2008), and chunked and boneless cured ham (Wilbourn et al., 2007).

Among Japanese consumers, recent reports have indicated variations in meat preferences. Sociodemographic traits such as gender also affect the eating palatability of beef in Japanese consumers (Asa et al., 2016), whereas variations in meat preference due to individual factors other than sociodemographic characteristics have been observed, as described below. A sensory test for comparison between two pork samples with different fat melting points was carried out using untrained Japanese subjects (Sasaki et al., 2007). The participants discriminated the differences in the melting properties of fat, but they were divided into two groups according to their preference for fat texture. One group preferred pork fat texture that was easier to melt, and the other group preferred pork fat that was harder to melt. Sasaki et al. (2017) also conducted a consumer survey for beef preferences in 307 general Japanese consumers and eight kinds of beef: three kinds of Wagyu beef, one of domestic Holstein beef, and two of lean imported beef. According to consumer classification using hedonic scores, four consumer segments were identified: "gradual high-fat likers," "moderate-fat and distinctive taste likers," "Wagyu likers," and "distinctive texture likers" (Figure 3). Notably, 16.9% of the consumers were identified as "moderate-fat and distinctive taste likers"; in other words, this group preferred domestic Holstein beef, whereas the major beef preference in Japan is high-marbled beef, presented in this survey as "gradual high-fat likers" and "Wagyu likers." In addition, consumers' requirements and attitudes assessed in a questionnaire study were different between groups. The preference for moderate-fat beef in particular was related to attitudes toward beef marbling. Hayashi et al. (2018) carried out a consumer preference

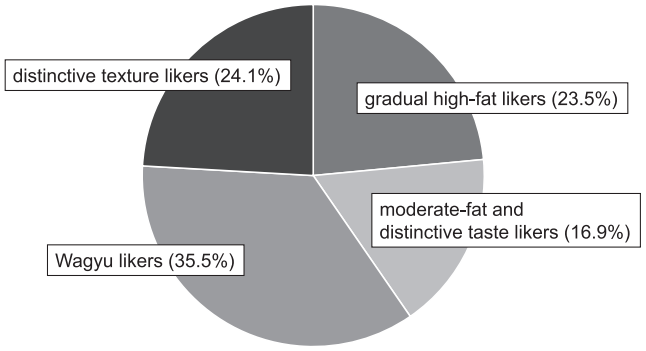

FIGURE 3 Japanese consumer classification and characterization of each segment according to eating preference of beef ($n = 307$), investigated in Sasaki et al. (2017). Values are percentages of consumers in each consumer segment

test with 87 untrained consumers and Wagyu beef classified into 3, 4, and 5 grades according to Japan Beef Carcass Grading Standards. According to the liking scores, consumers were classified into three groups: a "group that likes all samples" (47.1%), a "group that prefers low-fat beef" (31.0%), and a "group that prefers high-fat beef" (21.9%).

These findings suggest that eating preferences for meat are diverse in Japanese consumers and that consumer segmentation using hedonic scores as judged by the respective consumers themselves, not using the sociodemographic characteristics of consumers, is a powerful tool to understand the variety of eating preferences. Further investigations to clarify the variety of eating preferences among Japanese consumers should be carried out to optimize the sensory traits of meat.

3 | CONCLUSION

In this article, the diversity of requirements and attitudes, sensory perceptions, and eating preferences among Japanese consumers was examined. Consumer segmentation using questionnaire scores, perceptions, and hedonic ratings was found to be useful for looking at the diversity of the overall market, whereas traditional works have focused on differences by sociodemographic characteristics, such as age and gender. Although consumer variation based on sociodemographic characteristics is of course important, it is equally important to understand diversity by focusing on the individual differences of consumers.

The findings presented above will be useful in optimizing the production and marketing of meat and meat products in Japan. However, the relationships between attitudes, requirements, perception, and eating preferences have not yet been clarified. As shown in Figure 2, attitudes and requirements influence meat purchasing decisions. Sensory perception affects eating preference. As shown above, attitudes also affect eating preference in individuals. Finally, eating preference influences decisions on whether or not the consumer will repurchase the same product. Therefore, in order to produce and distribute meat that will be chosen continuously by a specific consumer segment, factors affecting both purchasing and repurchasing should be understood. Grunert (2006) also pointed out that fragmentation and diversification is likely to be a future trend regarding meat consumption. Optimizing meat production and marketing to satisfy individual requirements and preferences by using such information regarding consumer diversity will contribute to the development of the meat market in Japan.

ACKNOWLEDGMENTS

I am grateful for the valuable support and fruitful discussions provided by Dr. Ikuyo Nakajima, Dr. Michiyo Motoyama, Dr. Genya Watanabe, Dr. Koichi Chikuni, Ms. Yumiko Endo, Ms. Yuko Kurosawa, and the late Dr. Mitsuru Mitsumoto (Institute of Livestock and Grassland Science, NARO). The author's research program was supported in part by the Japan Society for the Promotion of Science (JSPS KAKENHI 21700746, 23700898, and 21K02144); a grant from the Science and Technology Research Promotion Program for Agriculture, Forestry, Fisheries and Food Industry (25064C and 27005B) of the Ministry of Agriculture, Forestry and Fisheries (MAFF); Integrated Research for Developing Japanese Style Forage Feeding System to Increase Forage Self-sufficiency Ratio of MAFF; Bio Recycle Research Project of MAFF; and Research and Development Projects for Application in Promoting New Policy of Agriculture Forestry and Fisheries (2001) of MAFF.

CONFLICT OF INTEREST

The author declares no conflicts of interest for this article.

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How to cite this article: Sasaki, K. (2022). Diversity of Japanese consumers' requirements, sensory perceptions, and eating preferences for meat. *Animal Science Journal*, *93*(1), e13705. https://doi.org/10.1111/asj.13705