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# **Identifying Consumer Characteristics Associated With Japanese Preferences Towards Milk Products**

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- Develop and maintain comprehensive databases relating to commodity promotion research and evaluation.
- Facilitate the coordination of multi-commodity and multi-country research and evaluation efforts.
- Enhance both public and private policy maker's understanding of the economics of commodity promotion programs.
- Facilitate the development of new theory and research methodology.

## Identifying Consumer Characteristics Associated With Japanese Preferences Towards Milk Products

*Yasuhito Watanabe, Nobuhiro Suzuki,  
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Consumption of dairy products in Japan is low compared to that of the United States and European countries. For example, a 1995 survey conducted by the National Milk Promotion Association of Japan (NMPAJ) indicated that daily per capita (consumers aged 20 years or older) fluid milk consumption was 143 ml in Japan, 251 ml in France, 267 ml in Germany, 323 ml in Denmark, 331 ml in the U.S., 412 ml in New Zealand, and 418 ml in England (NMPAJ 1996). These patterns suggest great potential for increasing consumption of dairy products in Japan relative to the potential in many other industrialized countries.

The Japanese dairy industry is committed to increasing dairy product consumption. For example, the industry currently invests about \$100 million (U.S.) per year in generic dairy promotion activities. The Japanese dairy industry also spends money on branded promotion, but data are not available on the level of those expenditures. In addition, the U.S. dairy industry is committed to increasing demand for dairy products within Japan, as well as other Pacific Rim countries, because of the tremendous market potential. Given the commitment by the Japanese and United States dairy industries to increasing dairy consumption in Japan, it is important to investigate characteristics that are associated with consumers' preferences towards milk products. A better understanding of socioeconomic, attitudinal, and demographic characteristics associated with dairy preferences is key to devising promotion and advertising strategies for milk and dairy products.

The purpose of this paper is to identify key characteristics of consumers that are associated with alternative preferences towards milk products in Japan. Specifically, this paper examines whether there are certain demographic, attitudinal, and socioeconomic factors associated with consumers' degree of preferences for milk products. The analysis is based on data from the Japanese consumer survey conducted by the NMPAJ. A technique

known as Quantification Theory Type III (QTTIII) is used to quantify consumers preferences for milk and other beverages. Cluster analysis is then used to identify key demographic, attitudinal, and socioeconomic characteristics associated with alternative degrees of preferences for milk products.

### Data and Method

The data used in this study come from interviews conducted by the NMPAJ of Japanese consumers (aged 13 years and older) in 1995 (NMPAJ 1995). In total, 4,668 individuals participated in the survey. This study uses the responses of four key questions to conduct the quantification analysis. These questions are:

1. What are your favorite beverages?
2. How frequently do you drink milk?
3. How much milk do you drink each day?
4. How frequently do you consume cheese and yogurt?

Questions 2 and 3 are similar, but both were necessary since some consumers drink only a little milk at a time but on a very frequent basis, while other drink a lot of milk at a time but not frequently. Each of these four questions had several categories for answers. Question 1 listed 13 possible responses in terms of favorite beverages, Question 2 had seven categories of frequency, Question 3 had eight different amounts of milk consumed, and Question 4 had six frequency levels each for cheese and yogurt. The consumers' responses to these questions form the basis of the analysis conducted on preferences towards milk beverages and dairy products.

QTTIII is a method for measuring sample similarity and characteristics. This method makes new quantitative indicators from original qualitative factors, and is similar to principal component analysis. The difference is that QTTIII deals with categorical or qualitative data while the principal component analysis deals with quantitative data.

Using the QTTIII technique creates a new quantitative indicator to summarize respondents' characteristics revealed by their response to some question.

For example, suppose that a question has  $k$  possible categories for response. Characteristics of respondent  $i$  can be explained by  $k$  categorical answers. The following linear relationship is assumed by this technique:

$$(1) \quad y_i = a_1x_{i1} + a_2x_{i2} + \dots + a_kx_{ik} = \sum_{j=1}^k a_jx_{ij}$$

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where  $y_i$  represents the summarized characteristics of respondent  $i$  and is called the "sample score,"  $x_{ij}$  represents the response of respondent  $i$  to category  $j$ , which is one when respondent  $i$  is positive to category  $j$  and zero otherwise,  $a_j$  is the weight for category  $j$  and is called the "category score."

The value for  $a_j$  is determined as the value satisfying the condition that the correlation coefficient ( $r$ ) between  $y_i$  and  $a_j$  is maximized. Mathematically, this is expressed as:

$$(2) \quad \text{Max: } r = \text{cov}(a_j, y_i) / [\text{var}(a_j) \text{var}(y_i)]^{1/2},$$

where:

$$\begin{aligned} \text{cov}(a_j, y_i) &= \sum_{i=1}^n \sum_{j=1}^k (a_j - \bar{a})(y_i - \bar{y}) / \sum_{i=1}^n \sum_{j=1}^k x_{ij}, \\ \text{var}(a_j) &= \sum_{i=1}^n \sum_{j=1}^k x_{ij} (a_j - \bar{a})^2 / \sum_{i=1}^n \sum_{j=1}^k x_{ij}, \\ \text{var}(y_i) &= \sum_{i=1}^n \sum_{j=1}^k x_{ij} (y_i - \bar{y})^2 / \sum_{i=1}^n \sum_{j=1}^k x_{ij}, \text{ and} \\ \bar{a} \text{ and } \bar{y} &= \text{average values for } a_j \text{ and } y_i. \end{aligned}$$

The first order necessary conditions for this maximization problem are:

$$\begin{aligned} \partial r / \partial a_j &= 0, \text{ and} \\ \partial r / \partial y_i &= 0. \end{aligned}$$

Values for  $a_j$  are determined by solving the two first order necessary conditions.

This method was used to determine the degree of consumer preferences for dairy products and procedurally, involved the following steps. First, for each respondent a degree of preference indicator for milk beverages versus other beverages was created by QTTIII and the first question, "What are your favorite beverages?" Next, using Questions 2 and 3 (frequency and amount of milk consumption), an indicator for degree of preference for white milk was created. Next, using Question 4 (frequency of cheese and yogurt consumption), an indicator for degree of preferences towards cheese and yogurt was created. Finally, the three quantitative indicators were used to classify the respondents into seven segments regarding degree of preference to dairy products using cluster analysis.

## Results

### Indicator I: Degree of Preference for Milk Beverages versus Soda Drinks

The first question concerning one's favorite beverages included 13 possible responses. Respondents were allowed to check more than one category and consequently, the aggregate results for all categories was

greater than 100 percent. Table 1 presents the 13 beverages and the percentage of respondents indicating it as one of their "favorite beverages." White milk (67 percent) and green tea (66.3 percent) were the most popular beverages of the respondents in this survey followed by coffee (59.2 percent). On the other end of the spectrum, mineral water (11.0 percent), yogurt beverages (13.0 percent), and sports beverages (16.5 percent) were the least popular beverages in the sample of Japanese consumers. Unlike the United States, soda drinks (19.3 percent) were among the least popular beverages.

Using the responses to Question 1 and QTTIII, a set of values for the  $a_j$ 's were estimated as:

$$\begin{aligned} (2) \quad y_i &= 0.0179x_{i1} + 0.0141x_{i2} + 0.0032x_{i3} + 0.0031x_{i4} \\ &+ 0.0031x_{i5} + 0.0024x_{i6} + 0.0009x_{i7} + 0.0009x_{i8} + \\ &0.0003x_{i9} - 0.0036x_{i10} - 0.0089x_{i11} - 0.0110x_{i12} - \\ &0.0172x_{i13}, \\ r &= 0.4533. \end{aligned}$$

In equation (2), the subscripts for the  $x$  variables refer to the 13 categories from Question 1 (see Table 1). In equation (2), the largest estimated parameter values are for yogurt drinks (category 1) and acidophilus milk beverages (category 2), while the lowest parameter values are for soda (category 12) and alcoholic drinks (category 13). This indicates that respondents who like yogurt and acidophilus milk drinks (hereafter referred to as milk beverages) tended to dislike soda and alcoholic drinks. This also indicates that respondents who liked milk beverages received the highest sample scores, while respondents who liked soda and alcoholic beverages received the lowest sample scores. Therefore, equation (2) can be regarded as an indicator for degree of preference of milk beverages versus soda and alcoholic drinks (Indicator I). That is, the higher the sample score via equation (2), the greater the preference for milk beverage over sodas and alcoholic beverages by the consumer.

Unlike the United States, Japanese per capita milk consumption is greatest in summer indicating that milk demand increased as temperatures rose. This suggests that milk consumption is similar to soda consumption. However, most previous econometric analyses of fluid milk demand have not found any significant substitutability between milk and soda. This lack of significance found in previous econometric studies may be due to data limitation on prices of soda, and/or econometric problems such as multicollinearity. In any event, the results of equation (2) were interesting since they indicated that milk and soda are indeed substitutes in Japan.

**Table 1. Distribution of consumer's "favorite beverages".**

Beverage	Percent indicating "favorite beverage"
1. yogurt drinks	13.0%
2. acidophilus milk beverages	20.2%
3. white milk	67.0%
4. tea	24.4%
5. mineral water	11.0%
6. green tea	66.3%
7. milk beverages (or colored milk) such as chocolate milk	17.9%
8. Chinese tea	34.2%
9. fruit juices	26.0%
10. coffee	59.2%
11. sport drinks	16.5%
12. alcoholic drinks such as beer	33.4%
13. soda drinks	19.3%

**Table 2. Frequency and amount of milk consumption per day.**

Item	Percent
<i>Frequency of milk consumption:</i>	
1. everyday	48.4%
2. five to six days a week	7.5%
3. three to four days a week	12.9%
4. one to two days a week	9.9%
5. two to three times a month	6.6%
6. less than two times a month	4.7%
7. never	9.9%
<i>Amount consumed per day:</i>	
8. one half cup	8.4%
9. one cup	40.6%
10. two cups	26.6%
11. three cups	8.0%
12. four cups	2.1%
13. five cups	1.4%
14. six cups or more	0.9%
15. none	11.7%

It is useful to examine the average sample scores among respondents categorized by various factors including demographic, attitudinal, and socioeconomic characteristics. The highest scores were obtained by respondents in the age group of 65 years old and older (0.002), housewives (0.001), respondents who were unemployed (0.001), and women (0.001). These groups would prefer milk beverages over soda and alcoholic beverages. The lowest scores were obtained by men (-0.001), respondents in the age group of 35 to 39 years

old (-0.001), respondents who were unaware of osteoporosis (-0.001), and respondents with management positions (-0.001). These scores suggest that men, middle aged people, and individuals with no calcium concerns prefer soda and alcoholic beverages to milk beverages.

Indicator II: Degree of Preference for White Milk

Questions 2 and 3 determined the frequency and amount of milk consumed by Japanese consumers. Table

2 presents the percentage distribution on frequency and amount of milk consumption for the respondents. Slightly less than one-half of the respondents consumed milk every day, while almost 10 percent never consumed milk. About 41 percent of the respondents consumed one cup of milk each day, with another 27 percent consuming two cups per day.

Using the responses to Questions 2 and 3 and QTIII, an indicator for degree of preference for white milk (Indicator II) was created as:

$$(3) \quad y_i = 0.0041x_{i1} + 0.0040x_{i2} + 0.0039x_{i3} + 0.0037x_{i4} + 0.0036x_{i5} - 0.0097x_{i6} - 0.0301x_{i7} + 0.0024x_{i8} + 0.0036x_{i9} + 0.0042x_{i10} + 0.0043x_{i11} + 0.0043x_{i12} + 0.0043x_{i13} + 0.0044x_{i14} - 0.0284x_{i15},$$

$$r = 0.9864,$$

where subscripts on the x variable refer to the category number for Questions 2 and 3 (see Table 2). Not surprisingly, equation (3) indicates that the highest scores in Indicator II were for people who drank a lot of milk on a frequent basis.

It is useful to understand what segments of the population have high preferences towards white milk. Therefore, we segmented the population by various demographic and socioeconomic factors to determine if there were differences in milk preferences among groups. The results indicated that the highest scores were obtained by respondents in the age group of 13 to 15 years old (0.003), students (0.002), families with five persons (0.001), and families with three generations (0.001). On the other hand, the lowest scores were obtained by people in the age group of 70 years and older (-0.003), people without jobs (-0.002), single people (-0.002), and people who were not aware of osteoporosis (-0.002). These scores suggest that younger people, respondents with larger families, and people with calcium concerns drank more milk more often than other segments of society.

#### Indicator III: Degree of Preference for Cheese and Yogurt

Table 3 presents the responses to Question 4 concerning the frequency of cheese and yogurt consumption. More people in the survey consumed milk than either cheese or yogurt. For example, over 18 percent never consumed cheese while almost 20 percent never consumed yogurt. This compares to less than 10 percent of the respondents who indicated never consuming milk.

Using the responses to Question 4 and QTIII, an indicator for degree of preference for cheese and yogurt (Indicator III) was created as:

$$(4) \quad y_i = 0.0082x_{i1} + 0.0146x_{i2} + 0.0106x_{i3} + 0.0017x_{i4} - 0.0076x_{i5} - 0.0157x_{i6} + 0.0100x_{i7} + 0.0121x_{i8} + 0.0069x_{i9} - 0.0002x_{i10} - 0.0092x_{i11} - 0.0154x_{i12},$$

$$r = 0.8491,$$

where subscripts on the x variable indicated the above answer categories. Equation (4) indicates that higher scores in Indicator III were obtained by people who ate more cheese and yogurt.

Characteristics of Indicator III were examined by comparing average sample scores among respondents categorized by other questions including demographic and socioeconomic factors. Higher scores were obtained by respondents who drank five cups of milk each day (0.805), people in the age group of 13 to 29 years old (0.003), students (0.003), women (0.001), and housewives (0.001).

Lower scores were obtained by people who never drink milk (-0.006), people with no jobs (-0.003), respondents 70 years old or older (-0.003), single persons (-0.002), people who were unaware of osteoporosis (-0.002), and men (-0.001). These results indicated that people who do not drink milk, older people, single people, people with no calcium concerns, and men were less inclined to consume cheese and yogurt.

#### Classifying Consumer Groups by the Three Indicators

Using the above three indicators, respondents were classified into seven groups based on preference to milk and dairy products using cluster analysis. The seven groups included:

- G1. strongly pro-white milk, milk beverages, and dairy products group (24.7 percent)
- G2. pro-white milk and milk beverages group (29.2 percent)
- G3. pro-white milk group (16.6 percent)
- G4. pro-white milk and soda drinks group (18.1 percent)
- G5. anti-white milk group (3.1 percent)
- G6. anti-white milk and dairy products group (3.8 percent)
- G7. anti-white milk, milk beverages, and dairy products group (4.7 percent),

**Table 3. Frequency of cheese and yogurt consumption.**

Consumption level	Percent
<i>Cheese:</i>	
1. four times or more a week	5.8%
2. two or three times a week	12.3%
3. once a week	17.3%
4. two to three times a month	23.9%
5. less than two times a month	21.3%
6. never	18.4%
<i>Yogurt:</i>	
7. four times or more a week	13.2%
8. two or three times a week	17.2%
9. once a week	16.4%
10. two to three times a month	16.0%
11. less than two times a month	16.3%
12. never	19.5%

where "milk beverages" means yogurt drinks and acidophilus milk, and "dairy products" means cheese and yogurt in this case. Figures in parentheses are percent of respondents who belong to the group.

G1 was the group which had the highest average sample scores for Indicators I to III (0.002, 0.004, and 0.01, respectively) of all groups (Table 4). The opposite extreme was group G7 which had the lowest average sample scores for the Indicators I and II (-0.006 and -0.03, respectively) and a relatively low score for Indicator III (-0.001). In the analysis below, differences in demographic and socioeconomic factors between groups G1 and G7 are compared since these two groups represent the two extremes regarding milk and dairy product preferences. Socioeconomic, demographic, and attitudinal differences between the two extreme groups may be useful in devising promotion strategies for milk and dairy products.

One of the most striking differences was the percentage of women between groups. Group G1 respondents had the highest percentages of women (67.3 percent) of all groups, while Group G7 had the lowest (30.5 percent). It is clear from this result that Japanese women have much stronger preferences for milk products than men. These results are different from milk consumption patterns in other developed countries. For instance, according to an international comparative survey conducted by the NMPAJ, per capita daily milk consumption by men and women, respectively, were 467 ml and 371 ml in England, 447 ml and 379 ml in New Zealand, 351 ml and 312 ml in the United States, 351 ml and 296 ml in Denmark, and 134 ml and 151 ml in Japan (NMPAJ 1996). A similar result held for percentage of

housewives among the two groups. The proportion of housewives in Group 1 (27.7 percent) was almost three times larger than Group G7 (10.2 percent). This is interesting information since it suggests that Japanese housewives are more likely to prefer milk products. The fact that women and housewives comprise a large percentage of Group G1 could be used in devising promotional campaigns for milk and dairy products.

Another important difference between the two groups has to do with breakfast habits. Group 1 had the highest percentage of all respondents indicating they ate breakfast every day (86.3 percent), while Group G7 had the lowest percentage (64.7 percent). This suggests that people with strong preferences for milk tended to be more likely to eat breakfast than those who did not prefer milk. This result may be due to the fact that people consume more milk at breakfast than at any other meal during the day. For example, the international comparative survey by the NMPAJ survey found that the percentage of respondents who drank milk at breakfast was 84 percent in England, 81 percent in New Zealand, 78 percent in the U.S., and 53 percent in Japan. On the other hand, the percentage of respondents who drank milk at dinner was 50 percent in England, 49 percent in New Zealand, 49 percent in the U.S., and 9 percent in Japan. Because breakfast is the time when most people drink milk, convincing people to eat breakfast everyday is an important factor to increase milk consumption.

The results of the analysis also shows a positive association between health concerns and preferences for milk products. For example, 53.3 percent of Group G1 housewives indicated that the first priority when

**Table 4. Average Sample Scores of the Seven Consumer Groups for the Three Indicators**

Groups	Indicator I	Indicator II	Indicator III
G1	0.00184	0.00391	0.01033
G2	0.00125	0.00371	0.00057
G3	0.00071	0.00355	-0.01125
G4	-0.00478	0.00339	-0.00128
G5	0.00144	-0.02718	0.00301
G6	0.00085	-0.02775	-0.01227
G7	-0.00562	-0.02783	-0.00611

choosing dinner menus was nutrition compared with 34.9 percent of housewives in Group G7. In addition, over 44 percent of housewives in Group G1 liked to read publications on nutrition compared with 23.1 percent of housewives in Group G7. Over 60 percent of Group G1 respondents indicated drinking milk for nutritional reasons, while only 33.3 percent of Group G7 claimed this as a reason for consuming milk. Finally, 93.8 percent of respondents in Group G1 were aware of osteoporosis, which was the highest of any group, while 86.1 percent of Group G7 respondents were aware of osteoporosis, which was the lowest of any group. These results imply that stronger health concerns increase demand for milk and milk-related products, and housewives' knowledge and attitudes are especially important because they control food for family members. Alternatively, lower health concerns are correlated with lower demand for milk and milk-related products. The Japanese clearly view milk and dairy products as healthy and nutritious food.

### Summary

The purpose of this paper was to determine key characteristics of consumers associated with preferences towards milk products in Japan. The analysis was based on data from a Japanese consumer survey conducted by the NMPAJ, and a technique known as Quantification Theory Type III was used to quantify consumers' preferences for milk and other beverages. Cluster analysis was then used to identify key demographic and socioeconomic characteristics associated with alternative degrees of preference for milk products.

Previous econometric analyses of fluid milk demand have not found any significant substitutability between milk and soda. This lack of significance found in previous econometric studies may be due to data limitation on prices of soda and/or statistical problems such as multicollinearity. Using QTTIII, this study found that milk and soda were indeed substitutes in Japan. QTTIII was used to compute sample scores based on preferences for milk beverages relative to sodas and alcoholic beverages. The results indicated that men, middle age people, and people with no calcium concerns prefer soda and alcoholic beverages to milk beverages.

Next, the respondents were segmented by various demographic and socioeconomic factors to determine if there were differences in white milk preferences among groups. The results indicated that younger people, larger families, and people with calcium concerns drank more milk more often than any other segment of society. A similar analysis was conducted of respondents' preferences for cheese and yogurt. The results indicated that people who did not drink milk, older people, people with no calcium concerns, and men were less inclined to consume cheese and yogurt.

Finally, we classified respondents based on preference to all milk and dairy products. The results indicated that stronger health concerns increased demand for milk and dairy products. Housewives' knowledge and attitude on health and nutrition were especially important because housewives control food for family members in Japan. This analysis also showed that Japanese men had



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lower consumption of milk products than women, which was opposite of the pattern found in most high-level milk consuming countries. Regarding health concerns, this analysis showed that skipping breakfast every day contributed to decreases in demand for milk and dairy products. Eating breakfast is one key factor to dairy promotion because breakfast is the best opportunity to drink milk of any other meal during the day.

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