Milk consumption patterns and perceptions in Korean adolescents, adults, and the elderly

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ABSTRACT

Milk intake has steadily declined over the past decade; milk consumption patterns and perceptions in Korean adolescents, adults, and the elderly (n = 918) were therefore investigated. Demographic characteristics and milk consumption patterns and attitudes were recorded. An importance-performance analysis was firstly applied to identify marketing priorities of milk across age groups. The main reasons for consuming milk by age groups were 'height growth' (30.7%) for adolescents, 'as a meal substitute' (34.8%) and 'bone health' (25.7%) for adults, and 'bone health' (59.6%) for the elderly. The most important criterion for milk selection across all age groups was 'brand or manufacturer'. Adults rated price as the only 'highly important and not satisfactory' variable. Common 'highly important and satisfactory' variables across participants were 'hygiene', 'nutrition', and 'health'. These results can be used as basic data to improve nutritional status via milk intake; a well-designed large study is necessary to confirm our findings.

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1. Introduction

Milk consumption has plunged over the last 20 years in developed countries, including the United States and Canada (Statistics Canada, 2017; USDA, 2017). Adults in developed countries typically consume more milk than those in developing countries (Petherick, 2016), and adolescents and young adults tend to consume less milk than older adults because they replace milk with sweetened beverages or fruit juice (Petherick, 2016; Singh et al., 2015).

Although dairy products are not part of the traditional Korean diet, milk and dairy consumption in South Korea has increased since 1960 due to the growth of the milk and dairy industry, the westernisation of dietary habits, and nutrition education for nutrition balance. However, similar to western countries, including the US and Europe, milk consumption per capita has steadily declined over the past decade from its peak at 31.5 kg in 1997 to 26.6 kg in 2015 (MAFRA, 2016).

'The lipid hypothesis' led most dietary guidelines to recommend low fat or non-fat milk consumption because milk also contains considerable saturated fatty acid that is associated with increased risk of chronic diseases such as cardiovascular disease (CVD) (Lordan, Tsoupras, Mitra, & Zabetakis, 2018). However, recent meta-analyses and reviews have reported that milk is not associated with all-cause mortality (Soedamah-Muthu et al., 2011), cardiovascular disease (Drouin-Chartier et al., 2016; Lordan et al., 2018), or certain types of cancer (Larsson, Bergkvist, Rutegard, Giovannucci, & Wolk, 2006). Rather, milk and dairy products may prevent chronic diseases such as CVD (Alexander et al., 2016), stroke (Hu, Huang, Wang, Zhang, & Qu, 2014), type 2 diabetes mellitus (Aune, Norat, Romundstad, & Vatten, 2013; Diaz-Lopez et al., 2016), metabolic syndrome (Shin, Yoon, Lee, Kim, & Oh, 2013), obesity (Lee, Cho, Lee, Kim, & Cho, 2014), osteoporosis (Caroli, Poli, Ricotta, Banfi, & Cocchi, 2011; Mangano, Noel, Sahni, & Tucker, 2019) and certain types of cancer (Cho et al., 2004; Larsson et al., 2006).

Despite the debate, milk is recommended for balanced nutrition and child growth since milk contains essential nutrients, including calcium. Thus, growing adolescents have been strongly recommended to drink milk instead of consuming sweetened beverages

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to supplement their calcium intake, which remains low in South Korea despite governmental efforts (Kweon, 2013; Lee, 2012).

Therefore, we examined the preferences and perceptions of consumers on milk to promote milk intake in Korea.

2. Methods

2.1. Participants

Participants were recruited from Seoul and Gyeonggi Province through visits to middle and high schools, companies, and community senior centres, as well as flyers and poster advertisements. They were then stratified based on a composition ratio of the estimated population in the Korean National Statistical Office in 2015 (KOSIS, 2015) as follows: 79 (41 males, 38 females) aged 12–17 years, 54 (28 males, 26 females) aged 18–21 years, 110 (61 males, 49 females) aged 22–29 years, 331 (166 males, 165 females) aged 30–49 years, 212 (108 males, 104 females) aged 50–64 years, 76 (34 males, 42 females) aged 65–74 years, and 56 (20 males, 36 females) aged ≥ 75 years. The groups were re-categorised into three age groups based on the classification of the Korean nutritional standard (KDRIs; Korean Nutrition Society, 2010) as follows: adolescents (12–18 years), adults (19–64 years), and elderly (≥65 years). The final analysis included 918 participants (89 adolescents, 697 adults, and 132 elderly) (Fig. 1). The study was approved by the Ethics Committee of Eulji University (IRB number; EUIRB2015-18).

2.2. Questionnaire

A questionnaire was developed by our research team to investigate milk consumption patterns and perceptions regarding milk quality. It was then revised and supplemented based on focus group interviews and references (Kim, 2007; Kim & Kim, 2012; Yoon et al., 2009). The questionnaire consisted of 14 questions that took about 15–20 min to complete. The 14 items largely included the milk intake, the consumption pattern, health efficacy awareness of milk, consumed beverages instead of milk, and the overall perception of milk quality. The questionnaire was self-reported by the participants under the guidance of nutrition experts.

Milk consumption was considered as 'more than once a month', which is the starting point for the frequency of intake in the validated KNHANES food frequency questionnaire (Kim et al., 2014). When asked about milk intake, the term "milk" included all kinds of cow milk, regardless of fat contents or flavour, because Koreans noticeably drink more white fluid milk (white milk) than flavoured milk. In fact, a previous study reported that white milk and flavoured milk consumption were 1,356,300 tons and 280,700 tons, respectively, using Korean food supply data (Kim, 2016). In addition, based on our analysis of the 2016 Korea National Health and Nutrition Survey data, adolescents drank 74.3 g of white milk and 16.3 g of flavoured milk, adults drank 48.51 g of white milk and 6.3 g of flavoured milk, and seniors drank 31.6 g of white milk and 0.8 g of flavoured milk.

Of the 918 participants, 48 did not respond on the items of perceived health benefits and 5 did not respond on the items of overall importance and performance of milk attributes. Only participants who had consumed milk (more than once a month, n = 799) answered the items regarding milk consumption patterns, including the location of intake, the time of day consumed, foods consumed with milk, reasons for drinking milk, and the selection criteria for milk purchase (Fig. 1). Corresponding examples were provided to help them report.

A five-point Likert scale (strongly disagree, disagree, neutral, agree, and strongly agree) was used to assess participants' perception on the degree of milk's contribution to overall health, disease prevention, bone health, growth, muscle strengthening, immunity, prevention of obesity, allergy, heart disease, and cancer.

Participants who had not consumed milk (n = 119) were asked about their most preferred drink (Fig. 1). The data obtained from adults were presented using a graph whereas the data obtained from adolescents and the elderly were not presented because the sample size was too small.

To assess the overall perception of milk quality, we used a five-point Likert scale to quantify the importance of the following factors: hygiene, taste, colour, smell, nutritional value, calories, fat
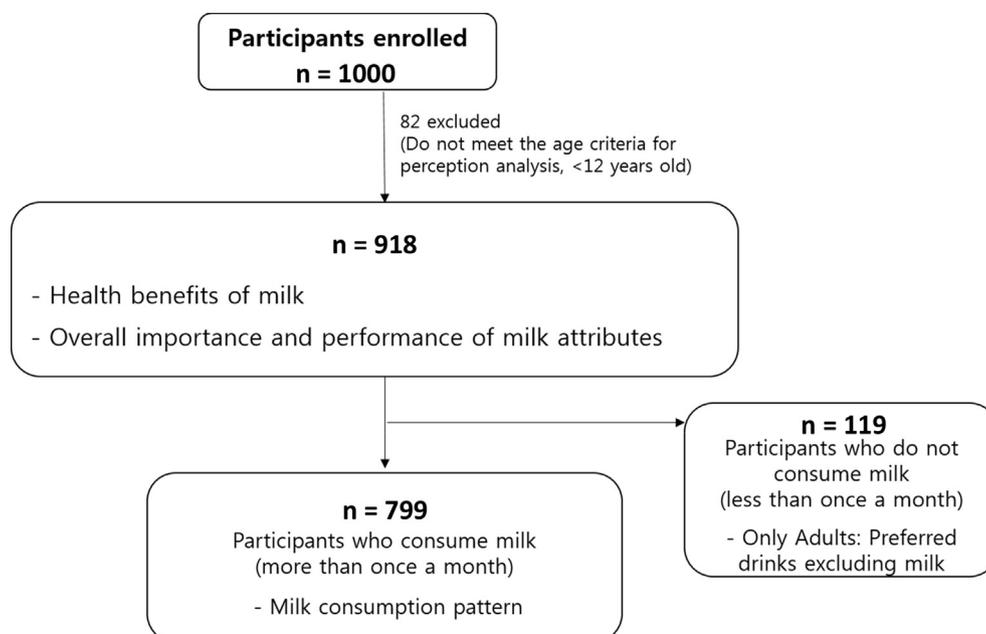

Fig. 1. Study population flowchart diagram.

content, health, price, and convenience. Milk hygiene refers to whether it has been treated hygienically during milk production, distribution, and consumption. An importance-performance analysis (IPA) was used to detect graphically the relative importance and achievement of milk attributes (Fig. 3). IPAs have commonly been used as a tool to measure customer perception of the importance and performance of goods or services (Kim, Lee, & Ko, 2013; Tzeng & Chang, 2011).

In this IPA model, performance means customers' satisfaction. The two-dimensional IPA model consists of four quadrants with milk performance in terms of consumer satisfaction on the x-axis and importance of milk on the y-axis (Wong, Hideki, & George, 2011). Each quadrant in an IPA model is determined based on the average of importance and performance scores. An IPA chart was drawn according to the age groups; adolescents, adults, and the elderly. Findings from the importance and performance of milk evaluation were presented as follows: The upper left corner, quadrant I, had a high importance score but a low performance score; the upper right corner, quadrant II, had high importance and performance scores; the lower left corner, quadrant III, had low importance and performance scores; the bottom right corner, quadrant IV, had a low importance score but a high performance score.

2.3. Statistical analyses

All statistical analyses were performed using SPSS Version 20 (IBM Corp., Armonk, NY, USA) statistical software. To examine milk consumption patterns across age groups, the mean and standard deviation were derived using a one-way analysis of variance (ANOVA) for continuous variables. Frequency analyses and chi-squared tests or Fisher's exact tests were used for categorical variables. To evaluate the overall importance and performance of milk and the perception of milk's contribution to health and disease prevention, each item was scored on a five-point Likert scale (1, strongly disagree; 2, disagree; 3, neutral; 4, agree; and 5, strongly agree), and analysed for mean and standard deviation. The p-values were calculated from ANOVA, or Welch's ANOVA for data without equal distribution. Bonferroni's method or Dunnett's T3 was used for post-hoc analysis ($p < 0.05$).

3. Results

3.1. General characteristics of participants

Table 1 shows the distribution of sex, education levels, and the milk consumption and mean and standard deviations of anthropometric assessments across the age groups. Among adolescents, 53.9% were males and 46.1% were females. Of the adults, 51.1% were males and 48.9% were females. In the elderly, 40.9% were males and 59.1% were females. The distribution of education levels among adults revealed that 60.2% were associate or bachelor's degree, followed by 25.9% who were less than high school graduates and 12.4% who were master's degree or higher. The distribution of education levels in the elderly cohort was as follows: less than high school completion (42.7%), less than elementary school completion (30.5%), associate or bachelor's degree (19.8%), and master's degree or higher (6.9%). The rate of not consuming milk (less than once a month) was 15.7% for adolescents, 12.1% for adults, and 15.9% for elderly individuals.

3.2. Milk consumption patterns

Table 2 shows the pattern of milk consumption across the age groups and all related items were answered from participants who consume milk (more than once a month). The most common place
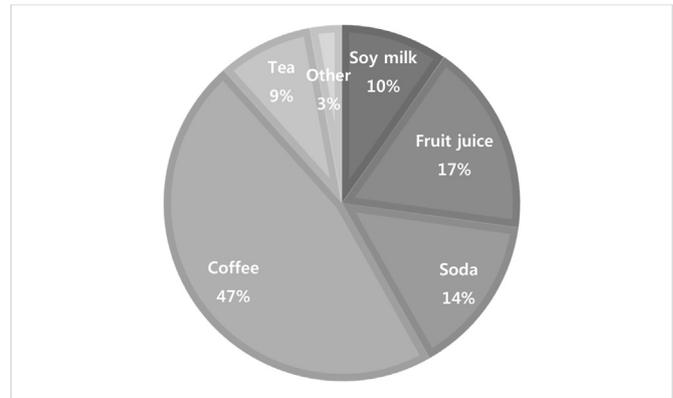

Fig. 2. Preferred drinks, excluding milk, in adults (%).

to consume milk was home; 91.3% of adolescents, 76.8% of adults, and 95.8% of elderly participants drank milk at home. Only 5.8% of the adolescents reported school as a place to consume milk.

The most frequent time for milk consumption was in the morning, except in adolescents, who reported the highest milk intake occurred 'between lunch and dinner' (30.4%), followed by breakfast (27.5%).

Most participants reported consuming milk alone, rather than with a food item. This trend was positively correlated with age: 43.5% of adolescents, 61.0% of adults, and 79.6% of the elderly reporting consuming milk alone. Twenty six percent of adolescents reported consuming milk with cereal, Sunsik (a special grain mix of seven kinds of grains and eaten with water or milk), or bread and cookies.

Most adolescents drank milk 'for height growth' (30.7%), followed by 'other reasons' (25.3%), 'as a snack' (21.3%), or 'as a meal substitute' (17.3%). Adults drank milk 'as a substitute for meals' (34.8%), 'for bone health' (25.7%), or 'as a snack' (19.9%). Elderly individuals drank milk 'for bone health' (59.6%), 'as a snack' (14.4%), or because it is 'rich in nutrients' (14.4%).

The most important criterion for milk selection during purchase was 'brand or manufacturer' for all participants. Secondary reasons included 'expiration date' (22.2%) for adolescents and 'composition' for adults and the elderly (18.4% and 18.6%, respectively).

3.3. Awareness of the health impacts of milk

The perception scores on beneficial health effects of milk are shown in Table 3. The score for 'milk contributes to bone health' was 4.16 for the elderly, 3.96 for adults, and 3.84 for adolescents. 'Milk is good for teeth' was 3.85 for the elderly and 3.59 for adults. The score for 'milk contributes to height growth' was 3.57 for teenagers.

The scores related to milk's contribution toward 'muscle strengthening', 'immunity', 'prevention of heart disease', and 'prevention of cancer' were high for the elderly. The scores for 'milk could be beneficial for obesity prevention' and 'prevention of allergies' were similar in age groups.

3.4. Preferred drinks other than milk

The adults who did not consume milk responded for their most favourite drinks (Fig. 2). Coffee was the most preferred drink (47%), followed by fruit juice (17%), carbonated drinks (14%), soy milk (10%), and tea (9%).
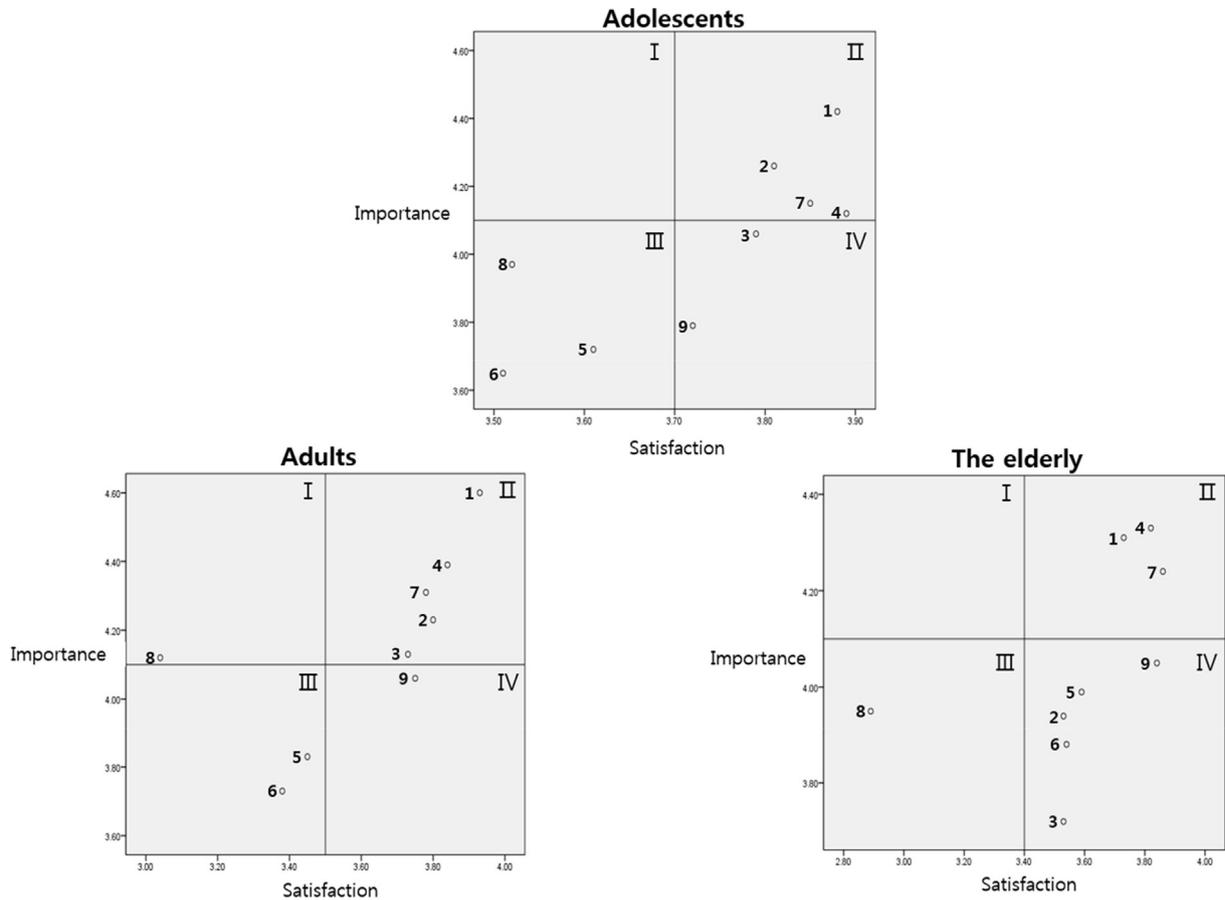
Fig. 3. Importance-performance analysis (IPA) chart for milk in three age groups: quadrant I, high importance/low performance; quadrant II, high importance/high performance; quadrant III, low importance/low performance; quadrant IV, low importance/high performance. Key is: 1, hygiene; 2, taste; 3, colour/smell; 4, nutrition; 5, calories; 6, fat content; 7, health; 8, price; 9, convenience.

3.5. Perception of milk quality: importance and performance

The overall importance and performance (satisfaction) scores for milk across the three age groups are shown in Table 4. The importance score regarding hygienic production and distribution of milk was high in adults ($p < 0.001$) and the performance score of the 'hygiene' was also high for adults ($p < 0.040$). Adolescents and adults scored the importance for milk 'taste' high ($p < 0.001$), but the performance scores of milk 'taste' differed between adults and the elderly ($p = 0.001$). The importance score for milk 'colour/smell' was low for the elderly rather than other groups ($p = 0.023$).

The importance scores for the 'nutritional value' of milk were significantly high for adults ($p < 0.05$), but the performance scores were similar between all age groups ($p = 0.832$). Similar trend was

Table 1
General characteristics of participants according to age groups (n = 918).[a]

Variables	Adolescents	Adults	Elderly	*p*-value
Sex				
Male	48 (53.9)	356 (51.1)	54 (40.9)	0.073
Female	41 (46.1)	341 (48.9)	78 (59.1)	
Education				
Less than elementary school completion	5 (5.7)	6 (0.9)	40 (30.5)	<0.001
Less than high school completion	79 (89.8)	180 (25.9)	56 (42.7)	
Associate or bachelor's degree	4 (4.5)	419 (60.2)	26 (19.8)	
Master's degree or higher	0 (0.0)	86 (12.4)	9 (6.9)	
Other	0 (0.0)	5 (0.7)	0 (0.0)	
Anthropometric variables				
BMI (kg m^{-2})	19.4 ± 3.3[3)]	23.2 ± 3.3	23.1 ± 2.7	<0.001
Milk consumption				
Yes (more than once a month)	75 (84.3)	613 (87.9)	111 (84.1)	0.363
No (less than once a month)	14 (15.7)	84 (12.1)	21 (15.9)	

[a] Values in a column are the number with percentages in parentheses. Education represents the school enrolled at present (aged <19) for adolescents. Fisher's exact test was performed for education levels. BMI values are the mean ± SD. For p-values: categorical variables: χ^2 test, Fisher's exact test (in more than 20% cases when expected frequencies in a cell are less than 5); continuous variables: ANOVA.

Table 2
Milk consumption patterns according to age groups among only participants who consumed milk (n = 799).[a]

Milk consumption pattern	Adolescents	Adults	Elderly	p-value
Top ranked place for milk consumption				
Home	63 (91.3)	440 (76.8)	91 (95.8)	<0.001[§]
School	4 (5.8)	26 (4.5)	0 (0)	
Work place	0 (0.0)	73 (12.7)	0 (0)	
Others	2 (2.9)	34 (6.0)	4 (4.2)	
Top ranked time of milk consumption				
Breakfast	19 (27.5)	290 (51.0)	53 (54.6)	<0.001
Lunch	8 (11.6)	37 (6.5)	11 (11.3)	
Dinner	13 (18.8)	89 (15.6)	6 (6.2)	
Between breakfast and lunch	2 (2.9)	59 (10.4)	12 (12.4)	
Between lunch and dinner	21 (30.4)	58 (10.2)	12 (12.4)	
Night after dinner	6 (8.7)	36 (6.3)	3 (3.1)	
Top ranked food consumed with milk				
Only milk	30 (43.5)	350 (61.0)	78 (79.6)	<0.001
With cereal and sunsik	18 (26.1)	75 (13.1)	4 (4.1)	
With bread and cookies	18 (26.1)	89 (15.5)	10 (10.2)	
Others	3 (4.3)	60 (10.5)	6 (6.1)	
Top ranked reasons for milk consumption				
For height growth	23 (30.7)	5 (0.8)	2 (1.9)	<0.001
For bone health	3 (4.0)	156 (25.7)	62 (59.6)	
As a meal substitute (for convenience)	13 (17.3)	211 (34.8)	7 (6.7)	
As a snack	16 (21.3)	121 (19.9)	15 (14.4)	
Rich in nutrients	1 (1.3)	46 (7.6)	15 (14.4)	
Others (tasty, gut health, etc.)	19 (25.3)	68 (11.2)	3 (2.9)	
Top ranked milk selection criteria				
Price (cheap, expensive)	13 (18.1)	98 (16.1)	14 (12.4)	0.018
Brand or manufacturer	27 (37.5)	284 (46.6)	54 (47.8)	
Composition (low fat, lacto, calcium enriched, etc.)	5 (6.9)	112 (18.4)	21 (18.6)	
Convenience	5 (6.9)	33 (5.4)	6 (5.3)	
Expiration date	16 (22.2)	62 (10.2)	11 (9.7)	
Others	6 (8.3)	20 (3.3)	7 (6.2)	

[a] Consumption more than once a month was considered milk consumption (Sunsik is a special grain mix made up of seven kinds of grains, i.e., brown rice, glutinous rice, barley, black bean, black sesame, perilla, and yulmu, and is eaten with water or milk. Values in a column are the number with percentages in parentheses. For p-values: categorical variables: χ^2 test, [§]Fisher's exact test (in more than 20% cases when expected frequencies in a cell are less than 5).

Table 3
Perceived health benefits of milk according to age groups in participants (n = 870).[a]

Health benefits	Adolescents (n = 82)	Adults (n = 664)	Elderly (n = 124)	p-value
Bone health[*]	3.84 (0.92)[a]	3.96 (0.87)[a]	4.16 (0.68)[b]	0.017
Dental health	3.63 (0.93)[ab]	3.59 (0.92)[a]	3.85 (0.80)[b]	0.012
Height growth	3.57 (1.05)[a]	3.92 (0.99)[b]	3.94 (0.84)[b]	0.017
Prevention of obesity[*]	3.15 (1.06)[a]	2.93 (0.96)[a]	3.16 (0.91)[a]	0.035
Muscle strengthening	3.39 (0.97)[ab]	3.26 (1.03)[a]	3.68 (0.86)[b]	<0.001
Prevention of allergies[*]	2.94 (1.06)[a]	2.80 (1.08)[a]	2.75 (1.05)[a]	0.484
Immunity	3.29 (1.00)[a]	3.30 (1.05)[a]	3.82 (0.88)[b]	<0.001
Prevention of heart disease[*]	2.99 (1.12)[ab]	2.69 (1.03)[a]	3.39 (0.97)[b]	<0.001
Prevention of cancer[*]	2.85 (1.24)[ab]	2.59 (1.11)[a]	3.23 (0.92)[b]	<0.001

[a] Of the 918 participants, 48 did not respond. A five-point Likert scale used (1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree). Values are the mean with standard deviation given in parentheses; superscript letters indicate means difference within a column (Bonferroni's Method was applied in items indicated with an asterisk, Dunnett's T3 was used in the rest). For p-values, ANOVA was applied to calculate mean difference across age groups. Welch's ANOVA was also used when the groups had unequal variances.

shown in the importance and performance scores of 'caloric value', 'fat content', or 'health' between age groups.

The importance score was similar for the 'price' of milk in age groups, while the performance score was significantly low for adults and the elderly ($p < 0.001$).

3.6. IPA of milk

The priority of marketing using IPA is shown in Fig. 3. Quadrant I, where critical care was needed to improve the performance of milk, was dominated by 'price' among adults. Quadrant II, where continuous maintenance was required, included the following:

'hygiene', 'taste', 'nutrition', and 'health' among teenagers; 'hygiene', 'taste', 'colour/smell', 'nutrition', and 'health' among adults; and 'hygiene', 'nutrition', and 'health' among the elderly. These results indicate that 'hygiene', 'nutrition', and 'health' of milk were highly important yet satisfactory across all age groups. The factors noted in quadrant III, where the management of milk could be reduced, were 'calorie', 'fat content', and 'price' among adolescents; 'calorie' and 'fat content' for adults; and 'price' for the elderly. Factors located in quadrant IV were 'colour/smell' and 'convenience' for adolescents; 'convenience' for adults; and 'taste', 'colour/smell', 'calorie', 'fat content', and 'convenience' for the elderly.

Table 4
Overall importance and performance of milk attributes according to age groups in participants (n = 913).[a]

Milk attributes		Adolescents (n = 89)	Adults (n = 692)	Elderly (n = 132)	p-value
Hygiene	Importance	4.42 (0.82)[1)ab3)]	4.60 (0.65)[a]	4.31 (0.71)[b]	<0.001
	Performance[*]	3.88 (0.90)[ab]	3.93 (0.84)[a]	3.73 (0.74)[b]	0.040
Taste	Importance[*]	4.26 (0.82)[a]	4.23 (0.77)[a]	3.94 (0.84)[b]	<0.001
	Performance	3.81 (1.08)[ab]	3.80 (0.85)[a]	3.53 (0.71)[b]	0.001
Color/smell	Importance[*]	4.06 (0.91)[a]	4.13 (0.89)[a]	3.72 (0.99)[b]	<0.001
	Performance[*]	3.79 (1.01)[ab]	3.73 (0.94)[a]	3.53 (0.77)[b]	0.023
Nutritional value	Importance	4.12 (0.95)[a]	4.39 (0.76)[b]	4.33 (0.67)[ab]	0.030
	Performance[*]	3.89 (0.89)[a]	3.84 (0.85)[a]	3.82 (0.74)[a]	0.832
Caloric value	Importance	3.72 (1.01)[a]	3.83 (1.03)[a]	3.99 (0.83)[a]	0.066
	Performance	3.61 (0.89)[a]	3.45 (1.02)[a]	3.59 (0.74)[a]	0.080
Fat content	Importance	3.65 (0.97)[a]	3.73 (1.04)[a]	3.88 (0.96)[a]	0.172
	Performance[*]	3.51 (0.83)[a]	3.38 (1.51)[a]	3.54 (0.79)[a]	0.383
Health	Importance	4.15 (1.01)[a]	4.31 (0.80)[a]	4.24 (0.68)[a]	0.222
	Performance	3.85 (0.95)[a]	3.78 (0.92)[a]	3.86 (0.76)[a]	0.506
Price	Importance	3.97 (1.04)[a]	4.12 (0.92)[a]	3.95 (0.86)[a]	0.089
	Performance[*]	3.52 (0.98)[a]	3.04 (1.10)[b]	2.89 (0.94)[b]	<0.001
Convenience	Importance	3.79 (1.03)[a]	4.06 (0.88)[b]	4.05 (0.73)[ab]	0.055
	Performance	3.72 (0.97)[a]	3.75 (0.91)[a]	3.84 (0.80)[a]	0.461

[a] Of the 918 participants, 5 did not respond. A five-point Likert scale used (1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree). Values are the mean with standard deviation given in parentheses; superscript letters indicate means difference within a column (Bonferroni's Method was applied in items indicated with an asterisk, Dunnett's T3 was used in the rest). For p-values, ANOVA was applied to calculate mean difference across age groups. Welch's ANOVA was also used when the groups had unequal variances.

4. Discussion

The most common place to consume milk in the three age groups was at home. The main reasons for consuming milk by age groups were 'height growth' (30.7%) for adolescents, 'as a meal substitute' (34.8%) and 'bone health' (25.7%) for adults, and 'bone health' (59.6%) for the elderly. The most important criterion for milk selection across all age groups was 'brand or manufacturer'. Adults rated price as the only 'highly important and not satisfactory' variable. Common 'highly important and satisfactory' variables across participants were 'hygiene', 'nutrition', and 'health'.

Mean intake of milk and milk products from 2016 the Korea National Health and Nutrition Examination Survey (KHIDI, 2016) was 101.62 g in a day, which is mostly milk. Especially, the average milk intake of adolescents, 90.6 g day^{-1} (KHIDI, 2016), is much lower than that of Korean Dietary Guideline recommendation for the adolescents. Korean Dietary guideline recommends more than 2 glasses (approximately 400 mL) of milk per day for adolescents (Park et al., 2012). According to the Korea National Health and Nutrition Examination Survey (KNHANES), adolescents and elderly had very low calcium intake compared with the recommended amounts (KCDC, 2016).

The elderly mainly consumed milk because of 'bone health', whereas adults consumed milk 'as a meal replacement', followed by 'bone health' and 'as a snack'. On the other hand, adolescents were more likely to drink milk for 'height growth' and 'as a snack'. Similar patterns occurred in a Canadian study, where adolescents perceived that children and the elderly needed calcium for bone health but reported that their own age group did not need to do so (Marcinow, Randall Simpson, Whiting, Jung, & Buchholz, 2017). A previous Korean study reported that only 19.5% of middle school students and 16.5% of high school students consume milk for their bone and teeth health (Yoon & Lee, 2005). The percentage of high school students consuming more than one cup of milk a day, including flavoured milk, was 36.2% (Yoon & Lee, 2005). Another Korean study found that only 37.4% of middle school students consume milk (Nam, Kim, & Park, 2011). According to these studies, the milk intake of adolescents is insufficient, as they do not recognise that milk is beneficial for bone health. It has also been shown that milk intake of middle and high school students varies depending on their nutrition education, which suggests the need for increased, targeted nutrition education for adolescents (Kim, 2010).

Despite the controversy over the health benefits of milk, consumers perceived milk to contribute to bone health; in particular, the perception score was high in the elderly. Furthermore, all participants responded 'milk is good for teeth and height growth' with higher scores. An Australian study reported that participants rated milk as 'important for children', followed by 'important for strong teeth' and 'important for strong bones' (Bus & Worsley, 2003). A Canadian study also indicated that participants of focus groups perceived that 'milk gives you healthy bones' (Jung et al., 2015). Consumer perceptions of the health benefits of milk are positive in Korea and other countries, so it would be good to make efforts to strengthen positive perceptions for adequate milk intake.

A preliminary study (Kim & Kim, 2012) indicated that factors affecting milk quality included hygiene, taste, colour/smell, nutrition, calories, fat content, health, price, and convenience. The perceived importance and satisfaction of each attribute were investigated for different ages. For adolescents and adults, hygiene was the most important attribute of milk, followed by taste, colour/smell, and nutrition. The elderly ranked nutritional value and convenience as the most important factors of milk quality. This suggests that the sensory elements, rather than health benefits, are more important for younger consumers.

In other studies, factors that discouraged milk intake were high fat content (French, Vernace-Inserra, & Hawker, 2008; Gulliver & Horwath, 2001; Klesges et al., 1999), self-perceived lactose intolerance (Barr, 2013), cost (Marcinow et al., 2017; Wham & Worsley, 2003), taste preferences (Wham & Worsley, 2003), inconvenience of milk products, and negative practices of dairy farmers (Marcinow et al., 2017). The consumer perceptions in this study did not differ from studies in other countries; however, there were differences between age groups. The situation calls for a differentiated approach to increase milk intake among age groups, and more well-designed studies to develop consumer-friendly milk products.

The IPA technique was first outlined in marketing literature (Martilla & James, 1977), and has since been applied to a wide variety of products and services as a basis for setting management priorities and determining how scarce resources might be best allocated (Matzler, Fuchs, & Schubert, 2004). In this study, IPA was used as a tool to evaluate the perceived importance and current satisfaction of the factors that influence milk consumption to determine how to increase milk intake. To best of our knowledge, it

is the first attempt to use IPA method to detect milk marketing priority.

The factors in quadrant I had high importance but were not satisfactory, and therefore demand improvement. In this study, the only factor in this quadrant was price, as reported by adults. The perception that milk is expensive stands out among adults who are engaged in economic activities. However, in the past (2000), a considerable proportion (39.9%) of Korean female participants (average, 29.7 years of age) responded that milk and yoghurt are comparatively affordable (Sohn, Min, Lee, & Lee, 2000). In fact, milk [265 Korean won (₩) per 100 mL] is not expensive compared with other popular drinks such as Ion beverages (Gatorade, ₩325 per 100 mL) or tea drinks (Corn Silk Tea, ₩353 per 100 mL) based on Korea Consumer Agency's statistics (Korea Consumer Agency, 2017). Thus, efforts should be made to change the perception of adults regarding the price of milk, especially considering that it is richer in nutrients compared with other beverages.

The attributes in quadrant II were perceived as important factors to consumers that were satisfactory, and included hygiene, nutrition, and health across all age groups. Adolescents included taste, and adults included taste and colour/smell to this quadrant. In a study of middle school students in the Chuncheon area, students reported taste as more important than nutrition when choosing milk and dairy products (taste > price > nutrition). Moreover, their favourite choice among milk and dairy products was flavoured milk (Han, Min, & Lee, 2016). A previous study has also shown that adolescents prioritise flavour when choosing dairy products (Hong, Lee, Park, & Cho, 2007). However, sugar content within flavoured milk can cause chronic diseases such as obesity. Thus, it is recommended to drink white milk rather than flavoured milk. Fortunately, despite the preference, in reality Koreans consume more white milk than flavoured milk nationally based on 2016 KNHANES.

The factors in quadrant III were perceived as unimportant and not satisfactory; they did not have a large influence on consumers' choice. Hence, limited amounts of effort should be dedicated to factors in this quadrant that include calories and fat content, according to adolescents and adults. Adolescents and elderly rated 'price' in this quadrant. The importance of 'fat composition and calories' may change in the future. An American study indicated that low-fat milk consumption is positively associated with age, education level, and income level (Robb, Reynolds, & Abdel-Ghany, 2007). In fact, non-fat milk products are easily found in the US, but not in Korean markets. Thus, a variety of attributes that consumers perceive important should be considered in the market.

The factors in quadrant IV were rated as less important but highly satisfactory. Convenience commonly appeared in this quadrant among adolescents, adults, and the elderly. Adolescents rated colour/smell in quadrant IV as well. In addition to convenience, the elderly included taste, colour/smell, calories, and fat content in this quadrant. In the context of foods, convenience is often associated with unhealthy foods such as ramen and fast foods (Hanks, Just, Smith, & Wansink, 2012). Nevertheless, milk is easy to drink and also a healthy food.

Finally, adults who did not consume milk were drinking coffee, fruit juice, soda, or soy milk. However, these beverages do not have enough nutrients to replace milk, so appropriate alternatives are needed, such as lattes with milk or yoghurt for individuals with lactose intolerance.

This is the first study to evaluate the consumption patterns and perceptions regarding milk by different age groups in Korea. The results of this study could be applied to promote milk consumption and help improve the calcium intake of the Korean population. These results also can be extended to other Asian countries because they have similar market characteristics to the Korean market as reported (Dong, 2006; Zang, Shen, Du, Chen, & Zou, 2015).

Based on the results of this study, the taste of milk can be increased by adding various flavours, fruits or grains or by increasing freshness. Although the price of milk was not expensive compared with other beverages, there may be a way to reduce the commercial margin of the milk distribution structure (e.g., farm direct consumer transactions) to lower the price, especially for adults.

However, as the sample sizes in the adolescents and the elderly are too small compared with adults, even though the sampling was carried out according to the Korean population composition ratio (KOSIS, 2015), the preference comparison across age groups might be biased. In addition, the fact that customers' perception might be different according to kinds and frequency in milk consumption of customers was not considered in this study. Thus, it is necessary to confirm our findings in a well-designed large study.

In conclusion, this study identified that milk consumption patterns and perceptions toward milk differ by age. Korean adolescents had distinctive contexts regarding milk consumption, such as place, time, and reasons of drinking milk. Adolescents and adults considered the taste of milk to be important, but their level of satisfaction was low. The satisfaction was low in adults and the elderly regarding the price of milk. Considering these findings, it is necessary to develop effective strategies for each age group to increase milk intake.

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