

Original Research



A study on the consumer behavior and attitude toward low-sodium convenience store foods

Suah Moon ¹, Jimin Lim ¹, Gaeun Yeo ¹, Yuri Kim ^{1,2}, and Jieun Oh ^{3S}

¹Department of Nutritional Science and Food Management, Ewha Womans University, Seoul 03760, Korea

²Graduate Program in System Health Science and Engineering, Ewha Womans University, Seoul 03760, Korea

³College of Science and Industry Convergence, Ewha Womans University, Seoul 03760, Korea

OPEN ACCESS

Received: Dec 22, 2023

Revised: Apr 19, 2024

Accepted: Apr 30, 2024

Published online: Jun 25, 2024

^SCorresponding Author:

Jieun Oh

College of Science and Industry Convergence,
Ewha Womans University, 52 Ewhayeodae-gil,
Seodaemun-gu, Seoul 03760, Korea.

Tel. +82-2-3277-6586

Fax. +82-2-3277-6586

Email. oje96@ewha.ac.kr


©2024 The Korean Nutrition Society and the
Korean Society of Community Nutrition

This is an Open Access article distributed
under the terms of the Creative Commons
Attribution Non-Commercial License ([https://
creativecommons.org/licenses/by-nc/4.0/](https://creativecommons.org/licenses/by-nc/4.0/))
which permits unrestricted non-commercial
use, distribution, and reproduction in any
medium, provided the original work is properly
cited.


ORCID iDs

Suah Moon 


<https://orcid.org/0000-0003-3945-407X>

Jimin Lim 


<https://orcid.org/0000-0002-4554-3880>

Gaeun Yeo 

<https://orcid.org/0000-0002-0785-3407>

Yuri Kim 

<https://orcid.org/0000-0001-7606-8501>

Jieun Oh 

<https://orcid.org/0000-0003-4152-8306>

Funding

This study was supported by the Ministry of
Food and Drug Safety (PJ00228072400).

ABSTRACT

BACKGROUND/OBJECTIVES: This study aims to explore the potential of convenience stores as platforms for healthy food consumption, including low-sodium options, in response to the increasing trend of meal behaviors at convenience stores and the growing demand for healthy eating.

SUBJECTS/METHODS: In the study, 627 Korean participants aged 10 to 39 were involved. A self-reported questionnaire survey was used and questions were regarding purchase patterns, consumption behaviors, perceptions and selection attributes of convenience store foods, and consumer perception factors for low-sodium options. Data analysis was conducted using SPSS 26.0 (SPSS, Version 26.0 for Windows, SPSS Inc., Chicago, IL, USA).

RESULTS: The study uncovered significant disparities in the consumption behavior and perception of convenience store foods, as well as variations in the importance and satisfaction levels with convenience store food attributes, including consumer perception factors for low-sodium options, based on sex and age. Furthermore, it was observed that awareness of the need for low-sodium options significantly influenced purchase intentions.

CONCLUSION: This study analyzed consumer attitude toward low-sodium convenience store foods to assess the potentiality for promoting healthy eating in convenience stores. These findings indicate the important role that convenience stores can play as platforms for healthy food sales.

Keywords: Meals; sodium; health behavior; attitude to health; consumer behavior

INTRODUCTION

Convenience store foods, characterized by quick and easy preparation and consumption, have become increasingly popular due to meal time constraints. Furthermore, the number of convenience stores has markedly increased in East Asia [1,2]. While convenience stores in Western countries are typically located near gas stations and primarily offer simple snacks for drivers, those in South Korea and Japan are strategically located in areas with high foot traffic and provide a more diverse variety of food options [3].

Conflict of Interest

The authors declare no potential conflicts of interests.

Author Contributions

Conceptualization: Moon S, Oh J; Formal analysis: Moon S, Oh J; Investigation: Moon S, Lim J, Yeo G, Kim Y, Oh J; Methodology: Moon S, Oh J; Supervision: Kim Y; Writing - original draft: Moon S, Oh J; Writing - review & editing: Moon S, Yeo G, Kim Y, Oh J.

With their extensive operating hours and high accessibility, the numbers of convenience stores and their patrons continue to grow. However, concerns are growing that the consumption of convenience store foods may contribute to unhealthy eating habits [4-8]. Studies conducted in Japan and China have found a positive association between the density of convenience stores near schools and an increased risk of obesity among adolescents [9,10]. Similarly, research conducted in the United States demonstrated that greater access to convenience stores is correlated with a higher body mass index as well as an elevated risk of being overweight [11].

Due to the COVID-19 pandemic, consumers' dietary habits have dramatically changed, leading to the increased consumption of instant foods, frozen meals, and processed foods, which are recognized as high-sodium products [12]. Notably, the average sodium content of a lunchbox (*dosirak*), a food item frequently purchased from convenience stores in South Korea, is 1,361 mg, which equates to 68.1% of the daily recommended sodium intake (2,000 mg) set by the World Health Organization (WHO) [13,14]. The sodium consumption of people in East Asian countries exceeds the WHO's recommendations (average salt intake in South Korea: 7.8 g; in Japan: 10.1 g; and in China: 11 g) [13,15-17]. High sodium levels contribute to imbalanced nutrition and an increased risk of hypertension, cardiovascular diseases, and stroke [18-20]. In addition, studies have reported that younger generations are predisposed to abdominal obesity and type 2 diabetes due to their frequent consumption of ultra-processed, sodium-rich foods, including chips, crackers, soda, and instant noodles [21-25]. To promote the development of low-sodium convenience store foods, it is first necessary to investigate consumers' purchase patterns, main items purchased, accompanying food choices, and perceptions of convenience store foods. Furthermore, understanding consumers' perceptions and attitudes toward low-sodium foods could assist in identifying appropriate directions for the development and sale of such products.

In South Korea, sales of triangular gimbap (*samgak gimbap*), a cheap and convenient rice-based snack purchased from convenience stores, are continuously increasing, especially among younger generations [8,26]. Moreover, the popularity of gimbap is also increasing in the United States [27]. However, the average sodium content of one triangular gimbap from a Korean convenience store exceeds the recommended daily sodium intake per meal by 50%, which suggests that consuming triangular gimbap contributes to an excessive sodium intake [28]. Therefore, triangular gimbap and rice balls should be target products in the development of low-sodium items for sale in convenience stores in South Korea.

Therefore, the present study aimed to investigate people's convenience store food consumption behaviors and to examine their perceptions and attitudes toward low-sodium foods, focusing on triangular gimbap and rice balls in particular. Through doing so, we aimed to ascertain whether convenience stores could serve as platforms for expanding low-sodium food consumption among the younger generation (people aged 10–30 years), who frequent convenience stores.

SUBJECTS AND METHODS

Study participants

The sample size for the population was determined using the G*Power 3.1.9.7 software package. Based on a significance level of 0.05, power of 0.90, and effect size of 0.15, a

minimum sample size of 567 individuals was calculated. After factoring in a dropout rate of 10%, a total of 630 participants were targeted for this study. The data were collected from 627 Korean individuals aged 10–39 years who possessed experience of consuming ready-to-eat foods (triangular gimbap and rice balls) and convenience store products. Furthermore, they all resided in Seoul or the surrounding Gyeonggi Province. Participation was restricted by presenting prescreening questions to ensure that only individuals who met these criteria could participate. All responses were valid and used for the analysis. The survey was conducted online through the online survey platform Data Spring (<https://www.d8aspring.com>) from September 19 to 23, 2022. All subjects agreed to participate in the study and completed a self-reported questionnaire. Valid data from 627 participants were analyzed. This study was conducted after approval was obtained from the Institutional Review Board of Ewha Womans University (IRB No. ewha-202208-0001-02).

Survey instrument

The survey comprised 5 questions on demographic characteristics, 4 on consumption behavior and perceptions of ready-to-eat foods, 20 on the importance of and satisfaction with the attributes of ready-to-eat foods, and 5 on consumer perception factors related to low-sodium products.

First, the survey's demographic characteristics section consisted of questions regarding sex, age, marital status, educational level, and occupation. Second, the section on consumption behavior and perceptions of ready-to-eat foods consisted of questions about the most purchased ready-to-eat product as a meal, most purchased product with triangular gimbap or rice ball, main reason for purchasing ready-to-eat products from a convenience store, and main time of day for purchasing ready-to-eat products at a convenience store. Third, the section on the importance of and satisfaction with ready-to-eat foods' attributes comprised questions regarding taste, total product weight, amount of fillings, satiety, texture, price, appearance, package design, saltiness, seasonings, food additives, nutritional content, calories per serving, nutritional labeling, hygiene, expiration/manufacturing date, brand/manufacturer, promotional events, new product, and advertising promotion. The respondents rated these question items on a 7-point scale (1 = extremely unimportant/extremely unsatisfied, 7 = extremely important/extremely satisfied). Lastly, the section on consumer perception factors related to low-sodium products consisted of questions about whether respondents liked low-sodium products, the perceived need for low-sodium triangular gimbap and rice balls, and the willingness to purchase them. These items were rated on a 7-point scale (1 = strongly disagree, 7 = strongly agree).

The questions regarding consumption behavior and perceptions of ready-to-eat foods were informed by studies that have examined convenience store behaviors among Japanese consumers [29] and food purchasing behaviors among American consumers [30]. Furthermore, the questions regarding the attributes of ready-to-eat foods were derived from prior studies on consumers' food choice factors [31-35]. Lastly, the questions regarding consumer perception factors related to low-sodium products were based on previous studies on consumers' food purchasing intentions [36,37].

To assess the validity and reliability of the items, an exploratory factor analysis (EFA) and a reliability analysis were conducted. Principal component analysis was used as the factor extraction method, while VARIMAX rotation was employed for factor rotation. Regarding the importance of the attributes of ready-to-eat foods, the results of the EFA yielded a Kaiser–

Meyer–Olkin (KMO) value of 0.878 and a significant Bartlett’s test of sphericity value of 6,109.323 ($P < 0.001$), which indicated adequacy. Moreover, the Cronbach’s α coefficient was 0.891. Regarding satisfaction with the attributes of ready-to-eat foods, the EFA yielded a KMO value of 0.912 and a significant Bartlett’s test result of 7,093.639 ($P < 0.001$), which indicated suitability. The Cronbach’s α coefficient was 0.919. Lastly, regarding consumer perception factors, the EFA yielded a KMO value of 0.700 and a significant Bartlett’s test result of 610.238 ($P < 0.001$), which indicated adequacy. The Cronbach’s α coefficient was 0.801.

Statistical analysis

The data were analyzed using SPSS (Version 26.0 for Windows; SPSS Inc., Chicago, IL, USA). For the demographic characteristics, consumption behavior, and perceptions of ready-to-eat foods, frequency analysis and χ^2 tests were employed. To assess the importance of and satisfaction with the attributes of ready-to-eat foods as well as consumer perception factors related to low-sodium products, t -tests and one-way analyses of variance were conducted with Duncan’s *post hoc* test. Next, the importance of and satisfaction with the attributes of ready-to-eat foods were further examined using paired t -tests and importance–satisfaction analysis (ISA). Paired t -tests are used to compare the differences between 2 paired results obtained from a single sample. The importance and satisfaction scores for identical attributes were paired and subsequently compared using paired t -tests [38]. Yang [39] proposed ISA in reference to importance–performance analysis. It is an effective analytical method for categorizing product or service quality attributes into those that are excellent and those that require improvement. Additionally, it serves as a straightforward and potent tool for enterprises to use to promptly identify attributes that necessitate immediate actions for improvement [39,40]. ISA has been employed to identify home meal replacement (HMR) attributes to enhance consumer satisfaction [41] as well as to evaluate consumers’ satisfaction with online food delivery service providers [42].

In ISA, the x-axis represents importance while the y-axis represents satisfaction, delineating 4 quadrants. Attributes in Quadrant I, being both important to consumers and satisfying, are regarded as superior attributes; Quadrant II attributes exceed consumer expectations in satisfaction despite their perceived lack of importance; Quadrant III attributes are not deemed important by consumers nor service/product providers; and Quadrant IV attributes are considered important but unsatisfactory by consumers, indicating a need for prompt improvement [42].

Initially, a multiple linear regression analysis was conducted using the stepwise method to assess the impact of consumer perception factors related to low-sodium products on purchase intention. Subsequently, an additional multiple linear regression analysis employing dummy variables and the stepwise method was conducted to investigate the influence of sex and age group on purchase intention. Finally, to comprehensively understand the effects of consumer perception factors related to low-sodium products, along with sex and age group, on purchase intention, the same analytical approach was employed. Attitude toward low-sodium triangular gimhap and rice balls was assessed using the following 3 items, which were rated on a 7-point scale (1 = strongly disagree, 7 = strongly agree): “I prefer low-sodium products,” “I have a positive attitude toward low-sodium products,” and “I am interested in low-sodium products.” Respondents’ attitude was calculated as the mean of the scores across the 3 items. Moreover, awareness of the need for low-sodium triangular gimhap and rice balls was evaluated with the following question, which was rated on a 7-point scale (1 = strongly disagree, 7 = strongly agree): “There is a need to develop low-sodium triangular

gimbap and rice ball products” Furthermore, the intention to purchase low-sodium triangular gimbap or rice balls was evaluated with the following question, which was rated on a 7-point scale (1 = strongly disagree, 7 = strongly agree): “I have intention to purchase low-sodium triangular gimbap and rice ball products” The multiple linear regression model obtained an R-squared value of 0.458 and an adjusted R-squared value of 0.456, and the Durbin–Watson statistic was 1.987. The significance value of the multiple regression model was 0.000, which indicated statistical significance ($P < 0.001$). Additionally, the residuals of the regression equation followed a normal distribution, as depicted in **Figs. 1 and 2**.

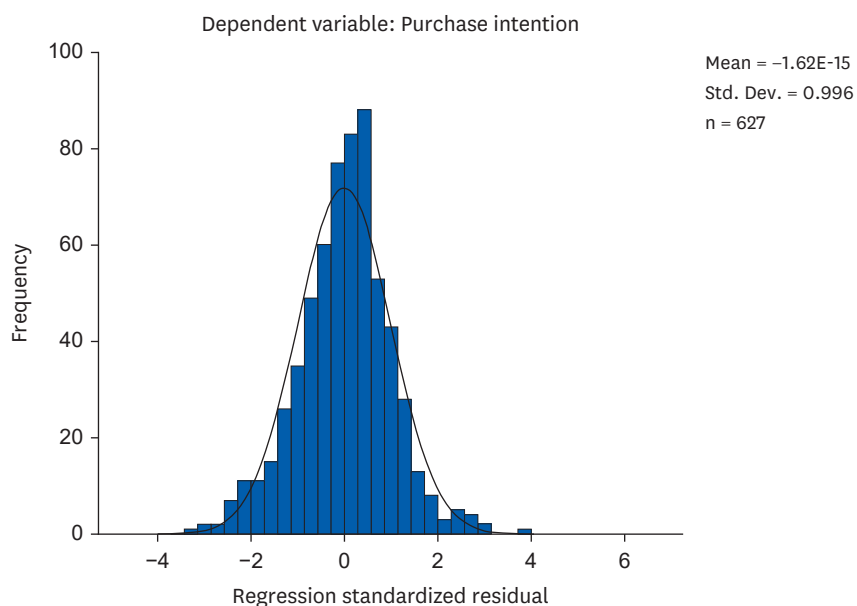


Fig. 1. Histogram of residuals.

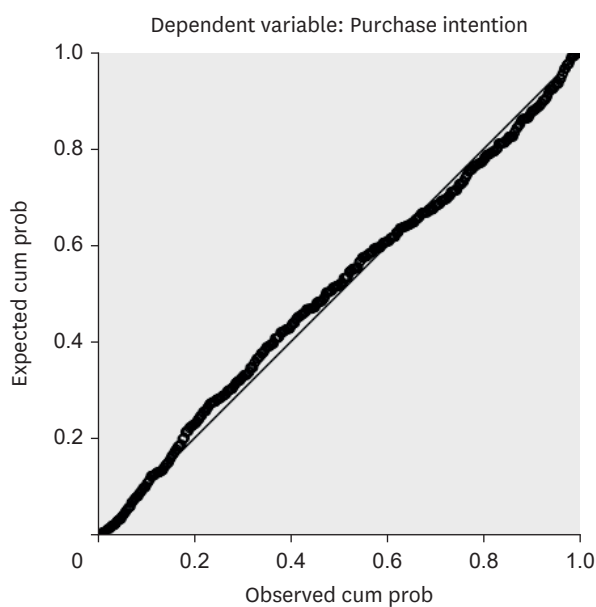


Fig. 2. Normality plot of residuals.

RESULTS

Demographic characteristics of the participants

Table 1 presents the demographic characteristics of the 627 study participants. They comprised 316 female (50.4%) and 311 male participants (49.6%). The age distribution was as follows: 204 participants (32.5%) were in their teens, 211 (33.7%) were in their 20s, and 212 (33.8%) were in their 30s. Among the participants, 489 (78.0%) were unmarried, while 129 (20.6%) were married. Regarding educational level, 73 participants (11.6%) had attended or graduated middle school, 160 (25.5%) had attended or graduated high school, 77 (12.3%) had attended or graduated junior college, 287 (45.8%) had attended or graduated university, and 30 (4.8%) had attended or graduated from graduate school. Lastly, regarding occupation, 264 participants (42.1%) were students; 188 (30.0%) were employed in administrative, clerical, management, or specialized fields; 76 (12.1%) worked in production, technical, sales, or service; 42 (6.7%) were unemployed; 23 (3.7%) were self-employed; 20 (3.2%) were housewives; and 14 (2.2%) were employed in other occupations.

Consumption behavior and perceptions of ready-to-eat convenience store foods according to sex and age

Table 2 presents the respondents' consumption behavior and perceptions of ready-to-eat convenience store foods. Triangular gimhap and rice balls were the most frequently consumed ready-to-eat foods (382, 60.9%), followed by lunchboxes (111, 17.7%). Significant differences were observed in consumption patterns according to respondents' sex and age ($P < 0.001$ for both). Male respondents primarily consumed triangular gimhap (162, 52.1%) followed by lunchboxes (69, 22.2%), while female respondents also preferred triangular gimhap (220, 69.6%), followed by lunchboxes (42, 13.3%) and sandwiches/hamburgers (42, 13.3%). Thus, women exhibited a higher triangular gimhap consumption rate than men. Regarding the age

Table 1. Characteristics of the study participants (n=627)

Variables	Values
Sex	
Male	311 (49.6)
Female	316 (50.4)
Ages	
Teens	204 (32.5)
20s	211 (33.7)
30s	212 (33.8)
Marriage status	
Married	129 (20.6)
Single	489 (78.0)
Educational level	
Middle school attendance/graduation	73 (11.6)
High school attendance/graduation	160 (25.5)
Junior college attendance/graduation	77 (12.3)
University attendance/graduation	287 (45.8)
Graduate school and above	30 (4.8)
Occupation	
Student	264 (42.1)
Production, technical post, sales, or service	76 (12.1)
Administrative, clerical, management, or specialized	188 (30.0)
Housewife	20 (3.2)
Self-employed	23 (3.7)
Unemployed	42 (6.7)
Other	14 (2.2)

Values are expressed as number (%).

distribution of triangular gimbap/rice ball consumers, 144 (70.6%) were in their teens, 127 (60.2%) were in their 20s, and 111 (52.4%) were in their 30s; thus, the highest proportion were in their teens. The most frequently purchased products alongside triangular gimbap/ rice balls were instant noodles (373, 59.5%) and soda (104, 16.6%), with no significant differences observed according to sex or age. The primary motivation for purchasing ready-to-eat foods at convenience stores was identified as them being “simple to eat,” which was reported by 407 respondents (64.9%). Statistically significant differences in the primary reason for purchasing were observed in relation to both sex ($P < 0.01$) and age ($P < 0.001$). Among men, the predominant reasons were the foods being “simple to eat” (198, 63.7%) and “delicious” (58, 18.7%), while for women, the foods being “simple to eat” (209, 66.1%) and “easy to buy” (41, 13%) were the leading reasons. This finding suggests that women place a greater emphasis on the convenience of purchasing and consuming these foods compared with men. Moreover, the preference for foods that are “simple to eat” increased with age. While “delicious” was the most common response among respondents in their teens, “easy to buy” was the most common response among those in their 30s. Furthermore, the peak times for purchasing ready-to-eat foods at convenience stores were identified as dinnertime (264, 42.1%) and lunchtime (181, 28.9%). The age-related differences were statistically significant ($P < 0.01$), with younger age groups being more likely to purchase such foods around dinnertime.

Table 2. Consumption behavior and perceptions of ready-to-eat products at convenience stores according to sex and age

Variables	Total (n = 627)	Sex		χ^2/P	Ages			χ^2/P
		Male (n = 311)	Female (n = 316)		Teens (n = 204)	20s (n = 211)	30s (n = 212)	
Ready-to-eat product most commonly purchased as a meal				21.514***				35.522***
Triangular gimbap/rice ball	382 (60.9)	162 (52.1)	220 (69.6)		144 (70.6)	127 (60.2)	111 (52.4)	
Lunchbox	111 (17.7)	69 (22.2)	42 (13.3)		23 (11.3)	39 (18.5)	49 (23.1)	
Sandwich/hamburger	100 (15.9)	58 (18.6)	42 (13.3)		21 (10.3)	34 (16.1)	45 (21.2)	
Corndog/sausage/fishcake bar	21 (3.4)	14 (4.5)	7 (2.2)		9 (4.4)	6 (2.8)	6 (2.8)	
Other	6 (1.0)	3 (1)	3 (1.0)		5 (2.4)	0 (0.0)	1 (0.5)	
Never purchased	7 (1.1)	5 (1.6)	2 (0.6)		2 (1)	5 (2.4)	0 (0.0)	
Product most commonly purchased with triangular gimbap/rice ball				7.831				14.626
Instant noodles	373 (59.5)	186 (59.8)	187 (59.2)		127 (62.3)	114 (54.0)	132 (62.3)	
Soda	104 (16.6)	52 (16.7)	52 (16.5)		36 (17.6)	40 (19.0)	28 (13.2)	
Fruit juice	33 (5.3)	20 (6.4)	13 (4.1)		11 (5.4)	10 (4.7)	12 (5.7)	
Water	39 (6.2)	19 (6.1)	20 (6.3)		9 (4.4)	15 (7.1)	15 (7.1)	
Milk	24 (3.8)	8 (2.6)	16 (5.1)		5 (2.5)	8 (3.8)	11 (5.2)	
Corndog/sausage/fishcake bar	24 (3.8)	15 (4.8)	9 (2.8)		6 (2.9)	13 (6.2)	5 (2.3)	
Chips, biscuits, and other snacks	21 (3.4)	8 (2.6)	13 (4.1)		8 (3.9)	6 (2.8)	7 (3.3)	
Fruits	9 (1.4)	3 (1)	6 (1.9)		2 (1)	5 (2.4)	2 (0.9)	
Main reason for purchasing ready-to-eat products from a convenience store				13.799**				30.421***
Delicious	89 (14.2)	58 (18.7)	31 (9.8)		50 (24.5)	23 (10.9)	16 (7.5)	
Simple to eat	407 (64.9)	198 (63.7)	209 (66.1)		119 (58.3)	142 (67.3)	146 (68.9)	
Easy to buy	66 (10.5)	25 (8)	41 (13)		15 (7.4)	22 (10.4)	29 (13.7)	
Cheap	48 (7.7)	24 (7.7)	24 (7.6)		14 (6.9)	19 (9)	15 (7.1)	
Lack of time	17 (2.7)	6 (1.9)	11 (3.5)		6 (2.9)	5 (2.4)	6 (2.8)	
Main time for buying ready-to-eat products from a convenience store				8.218				22.804**
Breakfast time	71 (11.3)	25 (8)	46 (14.6)		15 (7.4)	20 (9.5)	36 (17)	
Lunchtime	181 (28.9)	95 (30.6)	86 (27.2)		46 (22.5)	67 (31.7)	68 (32.1)	
Dinnertime	264 (42.1)	131 (42.1)	133 (42.1)		102 (50)	86 (40.8)	76 (35.8)	
Midnight	64 (10.2)	37 (11.9)	27 (8.5)		20 (9.8)	25 (11.8)	19 (9)	
Breaktime	47 (7.5)	23 (7.4)	24 (7.6)		21 (10.3)	13 (6.2)	13 (6.1)	

Values are presented as number (%).

** $P < 0.01$, *** $P < 0.001$.

Importance of and satisfaction with triangular gimbap/rice ball attributes

Table 3 presents the importance and satisfaction ratings for attributes of triangular gimbap/rice balls among the respondents along with the average differences between them. Of the 20 assessed attributes, taste (6.01 ± 1.20), price (5.89 ± 1.25), and hygiene (5.89 ± 1.25) received the highest importance scores, while advertising/promotion (3.76 ± 1.69), package design (3.96 ± 1.65), and appearance (4.06 ± 1.62) scored lower than the other attributes. Significant sex differences were observed in the importance scores for expiration/manufacturing date, with women scoring it as more important (5.99 ± 1.23) than men (5.62 ± 1.38 ; $P < 0.001$). Additional sex differences were found in the scores for the amount of fillings, price, package design, hygiene, and advertising/promotion. Taste and total amount of fillings received the highest importance scores from respondents in their teens (6.27 ± 1.11 and 5.75 ± 1.30 , respectively), while appearance and package design were rated higher by respondents in their 30s (4.44 ± 1.46 and 4.28 ± 1.49 , respectively) compared with those in their teens and 20s ($P < 0.001$). Moreover, significant age differences were noted in the importance scores for taste, total product weight, amount of fillings, satiety, price, appearance, package design, added seasoning, food additives, brands/manufacturers, and new product.

Regarding satisfaction, taste (5.58 ± 1.25), expiration/manufacturing date (5.35 ± 1.36), and hygiene (5.29 ± 1.36) were the highest-scoring attributes among the 20 evaluated, while advertising/promotion (4.09 ± 1.44), added seasoning (4.49 ± 1.38), and new product (4.51 ± 1.41) received the lowest scores. Men rated most factors significantly higher than women, particularly added seasoning, food additives, nutritional content, and new product, while women rated expiration/manufacturing date higher than men. Moreover, participants in their teens reported greater satisfaction than the other age groups across multiple attributes, including taste, total weight, amount of fillings, satiety, price, nutritional content, calories per serving, nutritional labeling, expiration/manufacturing date, promotional events, and new product.

Except for saltiness and calories per serving, all attributes exhibited significant differences between importance and satisfaction scores. Among the 20 attributes, taste, total weight, amount of fillings, satiety, texture, price, hygiene, expiration/manufacturing date, and promotional events received markedly higher importance scores than satisfaction scores, indicating areas for improvement. Furthermore, both men and women assigned significantly higher importance scores than satisfaction scores for taste, total weight, amount of fillings, satiety, price, hygiene, expiration/manufacturing date, and promotional events. Notably, women assigned significantly higher importance to calories per serving ($P < 0.05$). Across all age groups, taste, amount of fillings, satiety, price, hygiene, and expiration/manufacturing date displayed significantly higher importance scores than satisfaction scores. Differences in importance and satisfaction scores for promotional events were significant among participants in their 20s and 30s, but not for those in their teens. Lastly, participants in their 30s exhibited considerably larger differences in importance and satisfaction scores for texture and saltiness compared with those in their teens and 20s.

Fig. 3 presents the ISA results of various attributes associated with triangular gimbap and rice balls according to sex. Except for (3) amount of fillings and (14) nutritional labeling, all attributes are situated in the same quadrant for both sexes. However, (3) the amount of fillings is positioned in Quadrant I for men (m3) and Quadrant IV for women (f3), which suggests that while both sexes deemed this attribute significant, women exhibited lower satisfaction levels than men. Furthermore, nutritional labeling appeared in Quadrant II for

Table 3. Importance of and satisfaction with triangular gimbap/rice ball attributes when purchasing from a convenience store and their mean difference

Variables	Total (n = 627)	Sex		t/P	Ages			F/P
		Male (n = 311)	Female (n = 316)		Teens (n = 204)	20s (n = 211)	30s (n = 212)	
Taste								
Importance	6.01 ± 1.20	5.93 ± 1.30	6.09 ± 1.08	-1.669	6.27 ± 1.11 ^b	5.94 ± 1.18 ^a	5.83 ± 1.25 ^a	7.757***
Satisfaction	5.58 ± 1.25	5.56 ± 1.34	5.60 ± 1.15	-0.387	5.98 ± 1.20 ^c	5.51 ± 1.25 ^b	5.25 ± 1.18 ^a	19.283***
Paired t/P	10.101***	6.081***	8.220***		4.807***	5.350***	7.286***	
Total product weight (amount)								
Importance	5.35 ± 1.31	5.44 ± 1.37	5.25 ± 1.24	1.823	5.68 ± 1.38 ^b	5.20 ± 1.31 ^a	5.18 ± 1.19 ^a	9.805***
Satisfaction	5.13 ± 1.35	5.23 ± 1.42	5.04 ± 1.28	1.794	5.37 ± 1.43 ^b	5.04 ± 1.39 ^a	4.99 ± 1.20 ^a	4.995**
Paired t/P	3.728***	2.631**	2.638**		2.88**	1.455	2.177*	
Amount of fillings								
Importance	5.57 ± 1.31	5.44 ± 1.41	5.69 ± 1.19	-2.363*	5.75 ± 1.30 ^b	5.39 ± 1.37 ^a	5.57 ± 1.23 ^{ab}	3.895*
Satisfaction	4.84 ± 1.55	4.95 ± 1.56	4.74 ± 1.53	1.711	5.13 ± 1.58 ^b	4.79 ± 1.59 ^a	4.62 ± 1.43 ^a	5.822**
Paired t/P	10.972***	5.492***	10.016***		5.689***	5.078***	8.333***	
Satiety								
Importance	5.28 ± 1.27	5.31 ± 1.26	5.26 ± 1.27	0.454	5.50 ± 1.33 ^b	5.21 ± 1.21 ^a	5.15 ± 1.23 ^a	4.654*
Satisfaction	4.95 ± 1.34	5.01 ± 1.37	4.90 ± 1.29	0.980	5.16 ± 1.42 ^b	4.88 ± 1.39 ^a	4.83 ± 1.17 ^a	3.768*
Paired t/P	5.585***	3.644***	4.238***		3.275***	3.172**	3.217**	
Texture								
Importance	4.83 ± 1.41	4.87 ± 1.42	4.79 ± 1.41	0.654	4.78 ± 1.56	4.82 ± 1.38	4.89 ± 1.31	0.318
Satisfaction	4.72 ± 1.36	4.77 ± 1.40	4.67 ± 1.31	0.901	4.79 ± 1.51	4.74 ± 1.36	4.63 ± 1.18	0.732
Paired t/P	2.103*	1.363	1.603		-0.050	0.939	2.714**	
Price								
Importance	5.89 ± 1.25	5.78 ± 1.31	5.99 ± 1.18	-2.104*	6.10 ± 1.09 ^b	5.85 ± 1.33 ^a	5.72 ± 1.29 ^a	4.950**
Satisfaction	5.22 ± 1.43	5.19 ± 1.46	5.24 ± 1.40	-0.472	5.44 ± 1.46 ^b	5.15 ± 1.48 ^a	5.07 ± 1.33 ^a	3.903*
Paired t/P	10.412***	6.515***	8.200***		5.99***	5.817***	6.270***	
Appearance (shape)								
Importance	4.06 ± 1.62	4.12 ± 1.71	4.01 ± 1.53	0.871	3.80 ± 1.67 ^a	3.94 ± 1.65 ^a	4.44 ± 1.46 ^b	9.297***
Satisfaction	4.62 ± 1.44	4.61 ± 1.52	4.62 ± 1.37	-0.025	4.58 ± 1.62	4.52 ± 1.48	4.75 ± 1.20	1.373
Paired t/P	-8.623***	-5.715***	-6.455***		-6.169***	-5.406***	-3.175**	
Package design (packaging)								
Importance	3.96 ± 1.65	4.15 ± 1.71	3.78 ± 1.57	2.843**	3.71 ± 1.73 ^a	3.89 ± 1.69 ^a	4.28 ± 1.49 ^b	6.696***
Satisfaction	4.54 ± 1.45	4.59 ± 1.50	4.49 ± 1.40	0.844	4.53 ± 1.58	4.45 ± 1.50	4.64 ± 1.26	0.919
Paired t/P	-8.916***	-4.740***	-7.926***		-6.765***	-4.913***	-3.628***	
Saltiness								
Importance	4.73 ± 1.39	4.73 ± 1.45	4.73 ± 1.35	-0.067	4.66 ± 1.45	4.72 ± 1.46	4.81 ± 1.28	0.614
Satisfaction	4.69 ± 1.31	4.78 ± 1.29	4.60 ± 1.33	1.657	4.85 ± 1.37	4.62 ± 1.35	4.60 ± 1.21	2.274
Paired t/P	0.698	-0.554	1.523		-1.700	0.949	1.977*	
Added seasoning								
Importance	4.29 ± 1.55	4.40 ± 1.62	4.20 ± 1.47	1.639	4.09 ± 1.66 ^a	4.21 ± 1.59 ^a	4.56 ± 1.34 ^b	5.130**
Satisfaction	4.49 ± 1.38	4.66 ± 1.41	4.33 ± 1.32	2.992**	4.65 ± 1.52	4.41 ± 1.41	4.42 ± 1.18	2.071
Paired t/P	-3.239**	-2.912**	-1.640		-4.689***	-2.021*	1.424	
Food additives								
Importance	4.37 ± 1.64	4.44 ± 1.73	4.30 ± 1.54	1.044	4.21 ± 1.78 ^a	4.25 ± 1.71 ^a	4.64 ± 1.38 ^b	4.376*
Satisfaction	4.62 ± 1.39	4.80 ± 1.45	4.44 ± 1.30	3.304**	4.76 ± 1.55	4.56 ± 1.35	4.55 ± 1.26	1.529
Paired t/P	-4.198***	-4.301***	-1.653		-4.745***	-3.102**	0.973	
Nutritional content								
Importance	4.46 ± 1.63	4.54 ± 1.69	4.38 ± 1.56	1.212	4.33 ± 1.77	4.43 ± 1.67	4.60 ± 1.42	1.484
Satisfaction	4.64 ± 1.42	4.79 ± 1.48	4.50 ± 1.36	2.513*	4.90 ± 1.51 ^b	4.52 ± 1.42 ^a	4.52 ± 1.30 ^a	4.827**
Paired t/P	-3.101**	-2.951***	-1.449		-5.192***	-0.873	0.832	
Calories per serving								
Importance	4.71 ± 1.59	4.63 ± 1.65	4.79 ± 1.53	-1.238	4.67 ± 1.71	4.71 ± 1.64	4.76 ± 1.59	0.183
Satisfaction	4.67 ± 1.40	4.75 ± 1.41	4.59 ± 1.39	1.469	4.87 ± 1.51 ^b	4.53 ± 1.39 ^a	4.61 ± 1.27 ^{ab}	3.318*
Paired t/P	0.724	-1.239	2.377*		-1.592	1.532	1.63	
Nutritional labeling								
Importance	4.66 ± 1.58	4.64 ± 1.62	4.68 ± 1.55	-0.270	4.68 ± 1.71	4.56 ± 1.61	4.75 ± 1.40	0.748
Satisfaction	4.79 ± 1.32	4.86 ± 1.38	4.73 ± 1.26	1.208	4.98 ± 1.43 ^b	4.66 ± 1.32 ^a	4.75 ± 1.19 ^{ab}	3.221*
Paired t/P	-2.371*	-2.639**	-0.689		-2.925**	-1.064	0	

(continued to the next page)

Table 3. (Continued) Importance of and satisfaction with triangular gimbap/rice ball attributes when purchasing from a convenience store and their mean difference

Variables	Total (n = 627)	Sex		t/P	Ages			F/P
		Male (n = 311)	Female (n = 316)		Teens (n = 204)	20s (n = 211)	30s (n = 212)	
Hygiene								
Importance	5.89 ± 1.25	5.76 ± 1.35	6.02 ± 1.13	-2.644**	5.90 ± 1.37	5.86 ± 1.22	5.91 ± 1.17	0.100
Satisfaction	5.29 ± 1.36	5.31 ± 1.36	5.26 ± 1.37	0.452	5.48 ± 1.43 ^b	5.21 ± 1.37 ^a	5.18 ± 1.29 ^a	2.937
Paired t/P	10.792***	5.557***	9.839***		4.523***	6.633***	7.460***	
Expiration/manufacturing date								
Importance	5.81 ± 1.32	5.62 ± 1.38	5.99 ± 1.23	-3.538***	5.89 ± 1.34	5.65 ± 1.42	5.89 ± 1.17	2.236
Satisfaction	5.35 ± 1.36	5.23 ± 1.43	5.48 ± 1.27	-2.280*	5.47 ± 1.47 ^b	5.15 ± 1.38 ^a	5.44 ± 1.20 ^b	3.523*
Paired t/P	9.219***	5.322***	7.870***		4.868***	5.522***	5.581***	
Brand/manufacturer								
Importance	4.17 ± 1.64	4.17 ± 1.66	4.17 ± 1.61	0.021	4.02 ± 1.77 ^a	4.02 ± 1.68 ^a	4.47 ± 1.41 ^b	5.276**
Satisfaction	4.54 ± 1.41	4.59 ± 1.43	4.50 ± 1.38	0.787	4.60 ± 1.50	4.37 ± 1.41	4.67 ± 1.30	2.572
Paired t/P	-5.755***	-4.584***	-3.570***		-4.676***	-3.318***	-1.863	
Promotional events (discounts, gifts, and bundles)								
Importance	5.20 ± 1.41	5.20 ± 1.43	5.21 ± 1.40	-0.084	5.22 ± 1.53	5.14 ± 1.37	5.24 ± 1.35	0.284
Satisfaction	4.86 ± 1.39	4.86 ± 1.46	4.86 ± 1.32	-0.020	5.08 ± 1.45 ^b	4.74 ± 1.43 ^a	4.77 ± 1.26 ^a	3.876*
Paired t/P	5.795***	3.809***	4.428***		1.197	4.067***	5.319***	
New product								
Importance	4.39 ± 1.68	4.61 ± 1.67	4.17 ± 1.66	3.356**	4.54 ± 1.79 ^b	4.14 ± 1.74 ^a	4.49 ± 1.47 ^b	3.531*
Satisfaction	4.51 ± 1.41	4.69 ± 1.48	4.34 ± 1.32	3.112**	4.69 ± 1.54 ^b	4.35 ± 1.49 ^a	4.50 ± 1.17 ^{ab}	3.035*
Paired t/P	-2.189*	-0.948	-2.120*		-1.490	-1.981*	-0.163	
Advertising and promotion								
Importance	3.76 ± 1.69	3.90 ± 1.75	3.61 ± 1.62	2.151*	3.76 ± 1.74	3.63 ± 1.77	3.89 ± 1.56	1.310
Satisfaction	4.09 ± 1.44	4.20 ± 1.52	3.99 ± 1.36	1.812	4.07 ± 1.64	4.01 ± 1.46	4.20 ± 1.20	0.904
Paired t/P	-5.680***	-3.515***	-4.509***		-2.861**	-3.805***	-3.175**	

Values are presented as mean ± standard deviation. The 7-point Likert scale (1 = extremely unimportant/extremely unsatisfied, 7 = extremely important/extremely satisfied).

*P < 0.05, **P < 0.01, ***P < 0.001, post hoc analysis using Duncan's test: a < b < c.

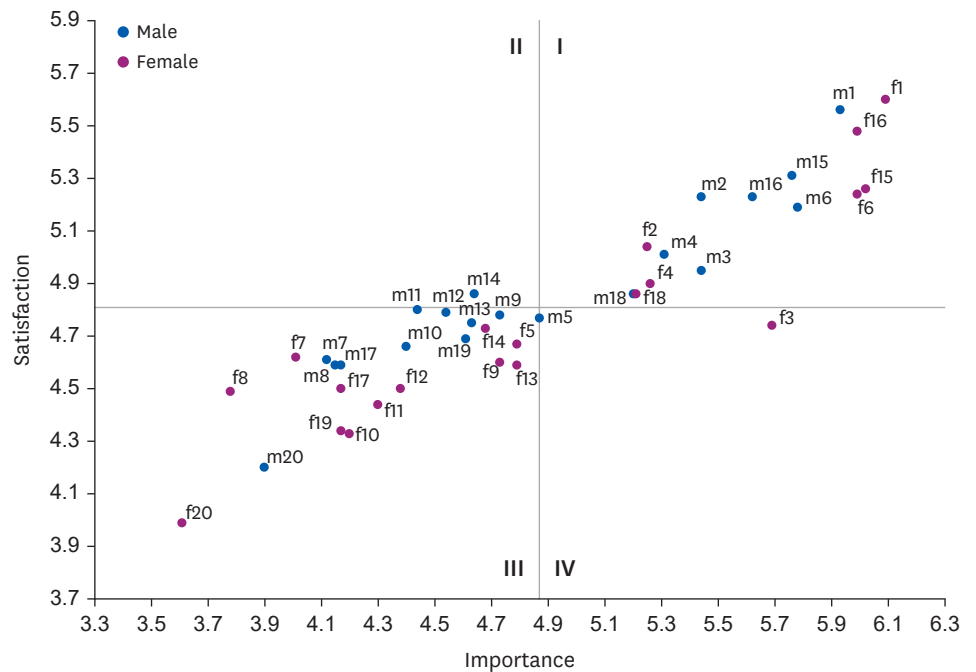


Fig. 3. Importance-satisfaction analysis chart for ready-to-eat product attributes by sex. (1) Taste, (2) total weight (amount), (3) amount of fillings, (4) satiety, (5) texture, (6) price, (7) appearance (shape), (8) packaging design, (9) saltiness, (10) added seasoning, (11) food additives, (12) nutritional content, (13) calories per serving, (14) nutritional labeling, (15) hygiene, (16) expiration/manufacturing date, (17) brands/manufacturers, (18) promotional events (discounts, gifts, and bundles), (19) new products, and (20) advertising and promotion.

men (m14) and Quadrant III for women (f14), which implies that both sexes considered this feature less critical, although men displayed higher satisfaction levels than women. Quadrant I encompasses attributes with high importance and satisfaction levels, necessitating active quality management to preserve the current standard. Attributes in this quadrant included (1) taste, (2) total weight, (4) satiety, (6) price, (15) hygiene, (16) expiration/manufacturing date, and (20) promotional events for both men and women as well as (3) the amount of fillings for men. Quadrant II encompasses attributes with low importance but high satisfaction levels, and nutritional labeling was the only attribute that fell in this category for men. By promoting awareness and methods for verifying nutritional information to male consumers, the importance they assign such information can be increased, potentially shifting this factor into Quadrant I. Quadrant III encompasses attributes with low importance and satisfaction levels, and thus, these factors are not considered priorities. Attributes in this quadrant included (5) texture, (7) appearance, (8) package design, (9) saltiness, (10) added seasoning, (11) food additives, (12) nutritional content, (13) calories per serving, (17) brands/manufacturers, (19) new products, and (20) advertising/promotion for both sexes as well as (14) nutritional labeling for women. Lastly, Quadrant IV encompasses attributes with high importance but low satisfaction, which thus require immediate improvement. Only (3) amount of fillings fell into this quadrant for women.

Fig. 4 presents the results of the age-specific ISA of triangular gimbap/rice ball attributes. Attributes such as (1) taste, (2) total weight, (4) satiety, (6) price, (15) hygiene, and (16) expiration/manufacturing date were consistently ranked in Quadrant I across all age groups. For individuals in their teens, (3) amount of fillings and (18) promotional events also fell into

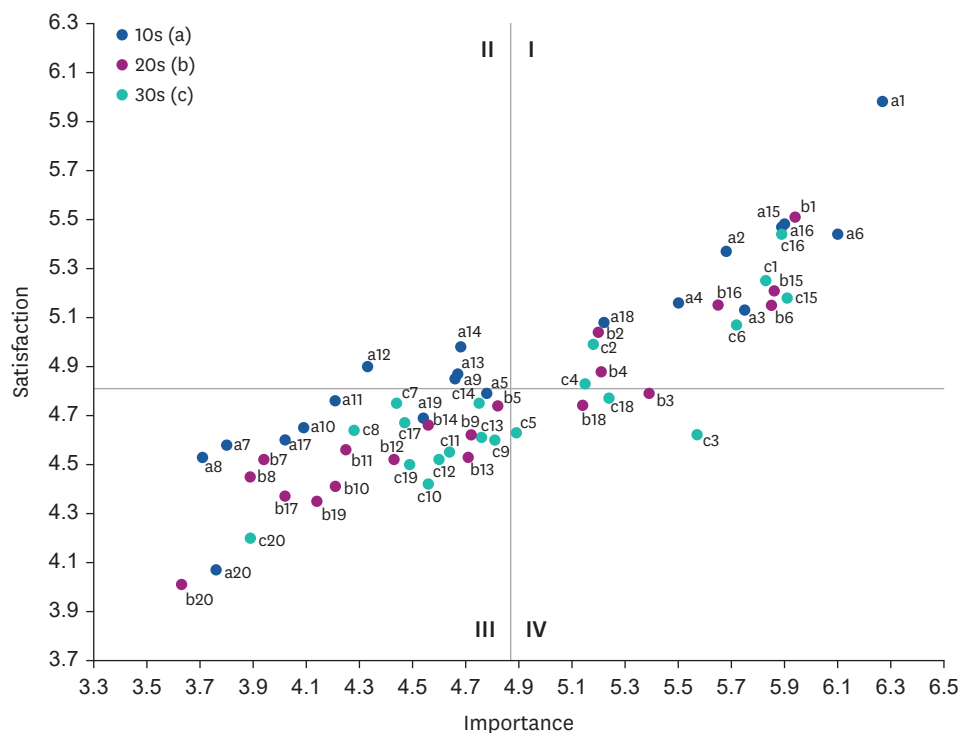


Fig. 4. Importance-satisfaction analysis chart for ready-to-eat food attributes by age group. (1) Taste, (2) total weight (amount), (3) amount of fillings, (4) satiety, (5) texture, (6) price, (7) appearance (shape), (8) packaging design, (9) saltiness, (10) added seasoning, (11) food additives, (12) nutritional content, (13) calories per serving, (14) nutritional labeling, (15) hygiene, (16) expiration/manufacturing date, (17) brands/manufacturers, (18) promotional events (discounts, gifts, and bundles), (19) new products, and (20) advertising and promotion.

Quadrant I; by contrast, (9) saltiness, (12) nutritional content, (13) calories per serving, and (14) nutritional labeling fell into Quadrant II for this age group. To move these attributes to Quadrant I, it is crucial to emphasize their importance when marketing ready-to-eat foods to teens. Attributes such as (7) appearance, (8) packaging design, (10) added seasoning, (11) food additives, (17) brand/manufacturer, (19) new product, and (20) advertising/promotion fell into Quadrant III for all age groups. In addition, (5) texture fell into this quadrant for those in their teens and 20s, as did (9) saltiness, (12) nutritional content, (13) calories per serving, and (14) nutritional labeling for those in their 20s and 30s. Quadrant IV contained (3) amount of fillings and (18) promotional events for respondents in their 20s and 30s as well as (5) texture for those in their 30s. Over half of the 20 attributes were consistently found in the same quadrant across all age groups; however, (3) amount of fillings and (18) promotional events fell into Quadrant I for those in their teens, whereas they were found in Quadrant IV for those in their 20s and 30s. This signifies high importance for these attributes across all age groups but lower satisfaction among those aged 20 years and above. Similarly, (5) texture fell into Quadrant III for individuals in their teens and 20s, whereas it appeared in Quadrant IV for those in their 30s, indicating low satisfaction for all age groups. However, higher importance was found for texture among individuals in their 30s compared with other age groups. Lastly, (9) saltiness, (12) nutritional content, (13) calories per serving, and (14) nutritional labeling fell into Quadrant II for those in their teens, whereas they fell into Quadrant III for those in their 20s and 30s. This suggests the low importance of these attributes across all age groups but also increased satisfaction among teens.

Table 4 delineates the distinctions in quadrant positions with respect to sex and age as ascertained through the ISA. In terms of sex, amount of fillings was situated in Quadrant I for men but Quadrant IV for women, while nutritional labeling was situated in Quadrant II for men but Quadrant III for women. In terms of age, amount of fillings and promotional events fell into Quadrant I for teens but Quadrant IV for individuals in their 20s and 30s. Moreover, saltiness, nutritional content, calories per serving, and nutritional labeling fell into Quadrant II for teens but Quadrant III for those in their 20s and 30s. In addition, texture

Table 4. Comparison of quadrant positions derived from the importance–satisfaction analysis by sex and age

No.	Variables	Average (importance: 4.87, satisfaction: 4.81)				
		Quadrant				
		Male	Female	Teens	20s	30s
1	Taste	I	I	I	I	I
2	Total weight (amount)	I	I	I	I	I
3	Amount of fillings	I	IV	I	IV	IV
4	Satiety	I	I	I	I	I
5	Texture	III	III	III	III	IV
6	Price	I	I	I	I	I
7	Appearance (shape)	III	III	III	III	III
8	Package design (packaging)	III	III	III	III	III
9	Saltiness	III	III	II	III	III
10	Added seasoning	III	III	III	III	III
11	Food additives	III	III	III	III	III
12	Nutritional content	III	III	II	III	III
13	Calories per serving	III	III	II	III	III
14	Nutritional labeling	II	III	II	III	III
15	Hygiene	I	I	I	I	I
16	Expiration/manufacturing date	I	I	I	I	I
17	Brands/manufacturers	III	III	III	III	III
18	Promotional events (discounts, gifts, and bundles)	I	I	I	IV	IV
19	New product	III	III	III	III	III
20	Advertising and promotion	III	III	III	III	III

fell into Quadrant III for both teens and individuals in their 20s but Quadrant IV for those in their 30s. The diminished overall satisfaction of individuals in their 20s and 30s, compared with teens, was ascribed to variations in economic status. In conclusion, taste, total weight, satiety, price, hygiene, and expiration/manufacturing date were considered to be significant by all age groups.

Consumer perception factors related to low-sodium ready-to-eat products

Table 5 presents the attitude toward, awareness of the need for, and purchase intention of participants regarding low-sodium ready-to-eat products. Significant differences were observed in the awareness of the need and purchase intention for low-sodium triangular gimbap and rice balls based on sex ($P < 0.05$ for both). However, there were no significant differences among age groups. In particular, the awareness of the need (5.16 ± 1.28) and purchase intention (5.23 ± 1.25) for said foods was relatively higher compared with attitude (4.37 ± 1.36) toward them.

Multiple linear regression analysis of consumer perception factors

A multiple linear regression analysis was performed to investigate the connections among sex, age group, attitude, awareness of the need, and purchase intention regarding low-sodium products. **Table 6** presents the analysis results. Female respondents served as the reference group for sex dummy variables, while teenage respondents were the reference group for age dummy variables. The explanatory power of the independent variables on the dependent variable, namely purchase intention, was 45.8%, and the regression model exhibited statistical significance ($P < 0.001$). Furthermore, attitude toward and awareness of the need for low-sodium products ($P < 0.001$ for both) as well as sex (female; $P < 0.05$) were found to have significantly positive effects on purchase intention. Moreover, the extent of the influence on purchase intention followed the order of awareness of the need ($\beta = 0.504$), attitude ($\beta = 0.241$), and sex (female; $\beta = 0.059$).

Table 5. Consumer perception factors related to low-sodium products

Variables	Total (n = 627)	Sex		t/P	Ages			F/P
		Male (n = 311)	Female (n = 316)		Teens (n = 204)	20s (n = 211)	30s (n = 212)	
Attitude toward low-sodium products	4.37 ± 1.36	4.27 ± 1.43	4.47 ± 1.29	-1.914	4.33 ± 1.39	4.35 ± 1.34	4.43 ± 1.36	0.327
Awareness of the need for low-sodium triangular gimbap/rice balls	5.16 ± 1.28	5.04 ± 1.35	5.28 ± 1.21	-2.317*	5.14 ± 1.34	5.07 ± 1.28	5.26 ± 1.23	1.280
Purchase intention toward low-sodium triangular gimbap/rice balls	5.23 ± 1.25	5.07 ± 1.35	5.38 ± 1.12	-3.120*	5.24 ± 1.30	5.15 ± 1.22	5.29 ± 1.23	0.736

The 7-point Likert scale (1 = a strong no, 7 = a strong yes).

* $P < 0.05$.

Table 6. Multiple linear regression analysis of consumer perception factors

Dependent variable	Independent variable	B	SE	β	t(P)	TOL	VIF
Purchase intention toward low-sodium triangular gimbap/rice balls	(Constant)	1.688	0.168		10.025***		
	Attitude toward low-sodium products	0.222	0.033	0.242	6.798***	0.689	1.451
	Awareness of need for low-sodium triangular gimbap/rice balls	0.489	0.035	0.503	14.107***	0.685	1.459
	Sex (female)	0.147	0.074	0.059	1.980*	0.990	1.010
	Age (20s)	-0.058	0.091	-0.022	-0.643	0.740	1.351
	Age (30s)	-0.029	0.091	-0.011	-0.321	0.740	1.652
$F(P) = 105.282***, R^2 = 0.459, \text{adj. } R^2 = 0.454$							

Reference group: sex*male, age*teens.

* $P < 0.05$, *** $P < 0.001$.

DISCUSSION

The present study observed significant differences according to sex and age. Men frequented convenience stores more often than women and primarily selected ready-to-eat foods based on taste. By contrast, women emphasized these foods' convenience. The primary reason for purchasing ready-to-eat foods from convenience stores was the ease of consumption, particularly among individuals in their 20s and 30s. Similarly, a large-scale study conducted by the Korea Rural Economic Institute found that the main reason for purchasing HMRs among people in their 20s and 30s is the perception of cooking as troublesome and bothersome [43]. The ready-to-eat products most frequently purchased as a meal in convenience stores were found to be triangular gimbap and rice balls, particularly among women and teens. Moreover, a study conducted in Japan found that rice balls were the most frequently purchased food items in convenience stores, which is consistent with the results of the present study [29]. These results suggest the necessity of reducing sodium in triangular gimbap and rice balls.

In addition, the product most frequently purchased alongside triangular gimbap and rice balls in convenience stores is instant noodles. Noteworthy, the Korea Agro-Fisheries & Food Trade Corporation reported instant noodles to be the product most commonly mentioned on social networking services in conjunction with gimbap (41.7%) [44]. The consumption of gimbap and instant noodles can lead individuals to exceed the WHO's daily recommended sodium intake of 2,000 mg [45]. Notably, the purchase rate of triangular gimbap/rice balls among teens was found to be significantly higher than that among individuals in their 20s and 30s, which raises concerns about excessive sodium intake through such foods among teens. As adolescents require adequate nutrient intake for growth, an excessive sodium intake through convenience store foods could increase the risk of obesity, inflammation, and hypertension in early ages as well as that of related chronic diseases in later adulthood [46-48]. Therefore, to promote the development of low-sodium convenience foods targeted at teens, marketing strategies such as recommending the consumption of low-sodium triangular gimbap and the combination of ready-to-eat convenience store foods with healthier foods should be considered.

Moreover, when purchasing triangular gimbap/rice balls, women were found to place greater importance on the expiration/manufacturing date than men, which is consistent with a previous study conducted in Belgium [49]. Conversely, men were found to value new products more highly than women, which is consistent with a Chinese study that demonstrated that men exhibited a higher level of food neophilia than women [50]. This indicates that men are more willing to try new foods.

Additionally, regarding age, participants in their teens prioritized taste and total weight more than those of other age groups. A study conducted in the United States supported this observation by reporting that hunger and taste were the most influential factors in adolescents' food choices [51]. This suggests that teens might prefer products that offer both excellent taste and a sufficient amount to satiate their hunger. Moreover, participants in their 30s placed greater importance on appearance and package design, which highlights a stronger consideration of aesthetic factors.

Furthermore, the average differences in importance and satisfaction by sex were analyzed, leading to the finding that women had a significantly higher importance score than satisfaction score for calories per serving ($P < 0.05$). Previous research on fast food purchases

demonstrated that women tend to be more influenced by calorie information and often select products with fewer calories [52]. Another study that examined nudges for promoting low-calorie food choices in fast food settings reported that women had a lower target calorie intake than men [53]. Consequently, reducing the calorie content of triangular gimbap and rice balls could potentially bridge the gap between women's importance and satisfaction ratings based on their preference for low-calorie products. In terms of age, significant average differences were observed in the importance and satisfaction scores of promotional events between participants in their 20s and 30s compared with those in their teens ($P < 0.001$). This finding implies that promotional events should consider consumers' specific needs. In addition, compared with participants in their 20s, larger average differences in total weight were found for those in their teens ($P < 0.01$) and 30s ($P < 0.05$). Additionally, for participants in their 30s, the average differences in texture ($P < 0.01$) and saltiness ($P < 0.05$) were significantly larger than those in other age groups. Taken together, the aforementioned findings indicate that when developing low-sodium triangular gimbap and rice balls, it is crucial to consider reducing the number of calories per serving for women and creating new products for men. In terms of age, maintaining taste and quantity for teens and enhancing low-sodium promotional events for individuals in their 20s and 30s may be effective marketing strategies.

In the ISA chart that presented significance and satisfaction by sex and age group (**Table 4**), attributes such as taste, total weight, satiety, price, hygiene, and expiration/manufacturing date fell into Quadrant I. As this means that both their importance and satisfaction are high, careful management of these attributes is essential to sustain consumers' satisfaction levels. These attributes should thus be meticulously maintained during the development of low-sodium triangular gimbap and rice balls.

Moreover, significant differences were found in consumer perception factors based on sex. Women exhibited significantly higher scores for awareness of the need and purchase intention compared with men. These findings are consistent with previous studies that have demonstrated that women exhibit a greater interest and active engagement in reducing their sodium intake than men [39,54,55]. Furthermore, women have been reported to be more likely to adopt healthy dietary habits than men, such as reduced salt intake [56], as well as to prefer healthier options when purchasing fast food products [57]. Therefore, this could be good marketing target for women who select healthier foods. Furthermore, the results of the multiple regression analysis of the influence of consumer perception factors and demographic variables on purchase intention indicated that awareness of the need, attitude, and sex (female) had significant positive effects (in that order). While significant differences were found to exist based on sex, none were found based on age groups. In addition, the results revealed that awareness of the need for low-sodium products had the most substantial impact on purchase intention. Need recognition is the initial step in consumers' purchasing decision process, and they make purchases to fulfill such needs [58]. Therefore, to promote the consumption of low-sodium triangular gimbap and rice balls, it is crucial to cultivate consumers' awareness of the need for such foods as well as their positive attitude toward them by emphasizing their health benefits. According to one study [59], employees in the food industry recognize the health benefits of low-sodium products and the need to promote them sufficiently. Thus, it is essential for convenience store food retailers, manufacturers, and distributors to thoroughly comprehend the consumer demand for low-sodium products as a priority, as this will enable them to respond appropriately. Moreover, food companies should engage in diverse promotional activities across various platforms to increase consumers' awareness of the necessity for low-sodium products.

The present study has some limitations. First, it was unable to generalize the findings to the broader Korean or Asian population as it only targeted a limited number of Korean consumers, who ranged in age from their teens to their 30s. If the participants were recruited from all age groups, the results regarding convenience store usage behavior and preferred food attributes may differ. Second, this study only focused on sodium reduction in triangular gimbap and rice balls, not in other convenience store foods. Despite these limitations, this study is significant for its analysis of the perception of and demand for low-sodium convenience store foods according to sex and age group, and it provided not only the characteristics of each age group but also the potential directions for food product development. Furthermore, this study suggests that convenience stores can serve as an accessible platform for low-sodium food options considering the high demand and purchase intention for low-sodium options, particularly triangular gimbap and rice balls, which are among the most frequently consumed items at convenience stores. If convenience stores expand their offerings to include fresh fruits, vegetables, and other healthy choices beyond HMRs, they could contribute to promoting healthier dietary habits.

In conclusion, a comprehensive follow-up investigation encompassing a wide range of age groups is warranted, expanding convenience store user demographics to encompass all age brackets. Additionally, in light of the growing diversity of convenience store food offerings and the frequent consumption of associated products, research into the development of low-sodium alternatives should extend to other items, such as instant noodles, beverages, lunchboxes, hamburgers, and sandwiches. In addition, studies that investigate the production techniques for and viability of manufacturing low-sodium foods from the perspective of producers are also essential. Lastly, to facilitate the enhancement of convenience store food quality and reduce sodium consumption in East Asian nations, a large-scale investigation that targets convenience store patrons in South Korea, China, Japan, and Singapore is required to obtain suitable recommendations for each country.

REFERENCES

1. Huse O, Reeve E, Baker P, Hunt D, Bell C, Peeters A, Backholer K. The nutrition transition, food retail transformations, and policy responses to overnutrition in the East Asia region: a descriptive review. *Obes Rev* 2022;23:e13412. [PUBMED](#) | [CROSSREF](#)
2. Imtiyaz H, Soni P, Yukongdi V. Understanding consumer's purchase intention and consumption of convenience food in an emerging economy: role of marketing and commercial determinants. *J Agric Food Res* 2022;10:100399. [CROSSREF](#)
3. Yoon NH, Shon C. Convenience store use and the health of urban adolescents in Seoul, South Korea. *Int J Environ Res Public Health* 2020;17:6486. [PUBMED](#) | [CROSSREF](#)
4. Kaji A, Hashimoto Y, Sakai R, Okada H, Hamaguchi M, Ushigome E, Majima S, Yamazaki M, Fukui M. Frequent usage of convenience stores is associated with low diet quality. *Nutrients* 2019;11:1212. [PUBMED](#) | [CROSSREF](#)
5. Lind PL, Jensen PV, Glümer C, Toft U. The association between accessibility of local convenience stores and unhealthy diet. *Eur J Public Health* 2016;26:634-9. [PUBMED](#) | [CROSSREF](#)
6. Rummo PE, Meyer KA, Boone-Heinonen J, Jacobs DR Jr, Kiefe CI, Lewis CE, Steffen LM, Gordon-Larsen P. Neighborhood availability of convenience stores and diet quality: findings from 20 years of follow-up in the coronary artery risk development in young adults study. *Am J Public Health* 2015;105:e65-73. [PUBMED](#) | [CROSSREF](#)
7. McKerchar C, Smith M, Gage R, Williman J, Abel G, Lacey C, Ni Mhurchu C, Signal L. Kids in a candy store: an objective analysis of children's interactions with food in convenience stores. *Nutrients* 2020;12:2143. [PUBMED](#) | [CROSSREF](#)

8. Park SK, Lee JH. Factors influencing the consumption of convenience foods among Korean adolescents: analysis of data from the 15th (2019) Korea Youth Risk Behavior Web-based Survey. *J Nutr Health* 2020;53:255-70. [CROSSREF](#)
9. Oishi K, Aoki T, Harada T, Tanaka C, Tanaka S, Tanaka H, Fukuda K, Kamikawa Y, Tsuji N, Komura K, et al. Association of neighborhood food environment and physical activity environment with obesity: a large-scale cross-sectional study of fifth-to ninth-grade children in Japan. *Inquiry* 2021;58:469580211055626. [PUBMED](#) | [CROSSREF](#)
10. Zhou S, Cheng Y, Cheng L, Wang D, Li Q, Liu Z, Wang HJ. Association between convenience stores near schools and obesity among school-aged children in Beijing, China. *BMC Public Health* 2020;20:150. [PUBMED](#) | [CROSSREF](#)
11. Powell LM, Auld MC, Chaloupka FJ, O'Malley PM, Johnston LD. Associations between access to food stores and adolescent body mass index. *Am J Prev Med* 2007;33:S301-7. [PUBMED](#) | [CROSSREF](#)
12. Zhang X, Chen B, Jia P, Han J. Locked on salt? Excessive consumption of high-sodium foods during COVID-19 presents an underappreciated public health risk: a review. *Environ Chem Lett* 2021;19:3583-95. [PUBMED](#) | [CROSSREF](#)
13. World Health Organization. *Guideline: Sodium Intake for Adults and Children*. Geneva: World Health Organization; 2012.
14. Korea Consumer Agency. *Investigation of Safety Conditions of Convenience Store Lunch Boxes: Safety Report*. Eumseong: Korea Consumer Agency; 2021.
15. Korea Centers for Disease Control and Prevention. 2021 National health statistics [Internet]. Cheongju: Korea Centers for Disease Control and Prevention; 2022 [cited 2023 September 8]. Available from: https://knhanes.kdca.go.kr/knhanes/sub04/sub04_04_01.do.
16. National Institute of Health and Nutrition (JP). *The National Health and Nutrition Survey (NHNS) Japan* [Internet]. Tokyo: National Institute of Health and Nutrition; 2019 [cited 2023 September 8]. Available from: <https://www.nibiohn.go.jp/eiken/kenkounippon21/en/eiyouchousa/>.
17. Li Y, Zhang P, Wu J, Ma J, Xu J, Zhang X, Luo R, Liu M, Sun Y, Li X, et al. Twenty-four-hour urinary sodium and potassium excretion and their associations with blood pressure among adults in China: baseline survey of action on salt China. *Hypertension* 2020;76:1580-8. [PUBMED](#) | [CROSSREF](#)
18. Meneton P, Jeunemaitre X, de Wardener HE, MacGregor GA. Links between dietary salt intake, renal salt handling, blood pressure, and cardiovascular diseases. *Physiol Rev* 2005;85:679-715. [PUBMED](#) | [CROSSREF](#)
19. Bibbins-Domingo K, Chertow GM, Coxson PG, Moran A, Lightwood JM, Pletcher MJ, Goldman L. Projected effect of dietary salt reductions on future cardiovascular disease. *N Engl J Med* 2010;362:590-9. [PUBMED](#) | [CROSSREF](#)
20. Nagata C, Takatsuka N, Shimizu N, Shimizu H. Sodium intake and risk of death from stroke in Japanese men and women. *Stroke* 2004;35:1543-7. [PUBMED](#) | [CROSSREF](#)
21. Enes CC, de Camargo CM, Justino MIC. Ultra-processed food consumption and obesity in adolescents. *Rev Nutr* 2019;32:e180170.
22. Onita BM, Azeredo CM, Jaime PC, Levy RB, Rauber F. Eating context and its association with ultra-processed food consumption by British children. *Appetite* 2021;157:105007. [PUBMED](#) | [CROSSREF](#)
23. Costa CS, Rauber F, Leffa PS, Sangalli CN, Campagnolo PD, Vitolo MR. Ultra-processed food consumption and its effects on anthropometric and glucose profile: a longitudinal study during childhood. *Nutr Metab Cardiovasc Dis* 2019;29:177-84. [PUBMED](#) | [CROSSREF](#)
24. Srour B, Fezeu LK, Kesse-Guyot E, Allès B, Debras C, Druenes-Pecollo N, Chazelas E, Deschasaux M, Hercberg S, Galan P, et al. Ultraprocessed food consumption and risk of type 2 diabetes among participants of the NutriNet-Santé prospective cohort. *JAMA Intern Med* 2020;180:283-91. [PUBMED](#) | [CROSSREF](#)
25. Fiolet T, Srour B, Sellem L, Kesse-Guyot E, Allès B, Méjean C, Deschasaux M, Fassier P, Latino-Martel P, Beslay M, et al. Consumption of ultra-processed foods and cancer risk: results from NutriNet-Santé prospective cohort. *BMJ* 2018;360:k322. [PUBMED](#) | [CROSSREF](#)
26. Pae M. Dietary habits and perception toward food additives according to the frequency of consumption of convenience food at convenience stores among university students in Cheongju. *Korean J Community Nutr* 2016;21:140-51. [CROSSREF](#)
27. Kim MS, Sohn DJ. [K-food goes global] Viral frozen 'Kimbap' on a roll in the U.S. [Internet]. Seoul: JoongAng Daily Co., Ltd.; 2023 [cited 2023 September 8]. Available from: <https://koreajoongangdaily.joins.com/news/2023-08-23/business/industry/KFOOD-GOES-GLOBAL-Viral-frozen-Gimbap-on-a-roll-in-the-US/1853406>.
28. Korea Consumer Agency. *Quality Test Report of Convenience Store Triangular Gimbap: Test Result Report*. Eumseong: Korea Consumer Agency; 2013.

29. Marshall D. Convenience stores and well-being of young Japanese consumers. *Int J Retail Distrib Manag* 2019;47:590-604. [CROSSREF](#)
30. Glanz K, Basil M, Maibach E, Goldberg J, Snyder D. Why Americans eat what they do: taste, nutrition, cost, convenience, and weight control concerns as influences on food consumption. *J Am Diet Assoc* 1998;98:1118-26. [PUBMED](#) | [CROSSREF](#)
31. Dono J, Ettridge K, Wakefield M, Pettigrew S, Coveney J, Roder D, Durkin S, Wittert G, Martin J, Miller C. Nothing beats taste or convenience: a national survey of where and why people buy sugary drinks in Australia. *Aust N Z J Public Health* 2020;44:291-4. [PUBMED](#) | [CROSSREF](#)
32. Martinez-Perez N, Telleria-Aramburu N, Insúa P, Hernández I, Telletxea S, Ansoategui L, Rebato E, Basabe N, de Pancorbo MM, Rocandio A, et al. On-campus food purchase behaviors, choice determinants, and opinions on food availability in a Spanish university community. *Nutrition* 2022;103-104:111789. [PUBMED](#) | [CROSSREF](#)
33. Wills W, Danesi G, Kapetanaki AB, Hamilton L. Socio-economic factors, the food environment and lunchtime food purchasing by young people at secondary school. *Int J Environ Res Public Health* 2019;16:1605. [PUBMED](#) | [CROSSREF](#)
34. Lee JH, Lee JJ. Changes in retail stores in South Korea and Japan: centered on convenience stores in both countries. *Jpn Cult Stud* 2018;67:277-92. [CROSSREF](#)
35. Yeo GE, Lee KW, Lee EY, Jeon YW, Lee JO, Oh JE, Cho MS. Selection attributes of non-timber forest products and consumer attitudes among food-related lifestyle segmentation. *J Korean Soc Food Sci Nutr* 2020;49:1152-60. [CROSSREF](#)
36. Wong SL, Hsu CC, Chen HS. To buy or not to buy? Consumer attitudes and purchase intentions for suboptimal food. *Int J Environ Res Public Health* 2018;15:1431. [PUBMED](#) | [CROSSREF](#)
37. Ryu MH. Undergraduate consumers' information needs according to purchase intention toward convenience store private brand foods. *Fam Environ Res* 2013;51:623-35. [CROSSREF](#)
38. Kim TK. T test as a parametric statistic. *Korean J Anesthesiol* 2015;68:540-6. [PUBMED](#) | [CROSSREF](#)
39. Yang CC. Improvement actions based on the customers' satisfaction survey. *Total Qual Manage Bus Excell* 2003;14:919-30. [CROSSREF](#)
40. Chen S, Shan LC, Tao W, Lu T, Regan Á, Han H, Guo L, Deng T, Wall P. A survey of Chinese consumers' knowledge, beliefs and behavioural intentions regarding salt intake and salt reduction. *Public Health Nutr* 2020;23:1450-9. [PUBMED](#) | [CROSSREF](#)
41. Ji Y, Han J. Sustainable home meal replacement (HMR) consumption in Korea: exploring service strategies using a modified importance–performance analysis. *Foods* 2022;11:889. [PUBMED](#) | [CROSSREF](#)
42. Liu YY, Chen SH, Zhang JX. Applying importance–satisfaction model to evaluate customer satisfaction: an empirical study of foodpanda. *Sustainability (Basel)* 2021;13:10985. [CROSSREF](#)
43. Korea Rural Economic Institute. 2022 Processed food consumer attitude survey [Internet]. Naju: Korea Rural Economic Institute; 2023 [cited 2023 May 2]. Available from: <http://www.krei.re.kr/>.
44. Ministry of Agriculture, Food and Rural Affairs (KR); Korea Agro-Fisheries Trade Corporation. 2019 Report on the current status of the processed food market for convenience and processed foods [Internet]. Naju: Korea Agro-Fisheries Trade Corporation; 2019 [cited 2023 May 2]. Available from: <https://www.atfis.or.kr/home/board/FB0027.do?act=read&bpoId=3260&bcId=0&pageIndex=1>.
45. National Food Safety Information Service (KR). A survey on the nutritional components of home meal replacements sold in convenience stores [Internet]. Cheongju: National Food Safety Information Service; 2020 [cited 2023 May 2]. Available from: https://www.mfds.go.kr/brd/m_99/view.do?seq=44833.
46. Lee SK, Kim MK. Relationship of sodium intake with obesity among Korean children and adolescents: Korea National Health and Nutrition Examination Survey. *Br J Nutr* 2016;115:834-41. [PUBMED](#) | [CROSSREF](#)
47. Zhu H, Pollock NK, Kotak I, Gutin B, Wang X, Bhagatwala J, Parikh S, Harshfield GA, Dong Y. Dietary sodium, adiposity, and inflammation in healthy adolescents. *Pediatrics* 2014;133:e635-42. [PUBMED](#) | [CROSSREF](#)
48. Simons-Morton DG, Obarzanek E. Diet and blood pressure in children and adolescents. *Pediatr Nephrol* 1997;11:244-9. [PUBMED](#) | [CROSSREF](#)
49. Van Boxtael S, Devlieghere F, Berkvens D, Vermeulen A, Uyttendaele M. Understanding and attitude regarding the shelf life labels and dates on pre-packed food products by Belgian consumers. *Food Control* 2014;37:85-92. [CROSSREF](#)
50. Okumus B, Dedeoğlu BB, Shi F. Gender and generation as antecedents of food neophobia and food neophilia. *Tour Manag Perspect* 2021;37:100773. [CROSSREF](#)
51. Neumark-Sztainer D, Story M, Perry C, Casey MA. Factors influencing food choices of adolescents: findings from focus-group discussions with adolescents. *J Am Diet Assoc* 1999;99:929-37. [PUBMED](#) | [CROSSREF](#)

52. Gerend MA. Does calorie information promote lower calorie fast food choices among college students? *J Adolesc Health* 2009;44:84-6. [PUBMED](#) | [CROSSREF](#)
53. Mohr B, Dolgoplova I, Roosen J. The influence of sex and self-control on the efficacy of nudges in lowering the energy content of food during a fast food order. *Appetite* 2019;141:104314. [PUBMED](#) | [CROSSREF](#)
54. McKenzie B, Santos JA, Trieu K, Thout SR, Johnson C, Arcand J, Webster J, McLean R. The science of salt: a focused review on salt-related knowledge, attitudes and behaviors, and gender differences. *J Clin Hypertens (Greenwich)* 2018;20:850-66. [PUBMED](#) | [CROSSREF](#)
55. Iaccarino Idelson P, D'Elia L, Cairella G, Sabino P, Scalfi L, Fabbri A, Galletti F, Garbagnati F, Lionetti L, Paoletta G, et al. Salt and health: survey on knowledge and salt intake related behaviour in Italy. *Nutrients* 2020;12:279. [PUBMED](#) | [CROSSREF](#)
56. Wardle J, Haase AM, Steptoe A, Nillapun M, Jonwutiwes K, Bellisle F. Gender differences in food choice: the contribution of health beliefs and dieting. *Ann Behav Med* 2004;27:107-16. [PUBMED](#) | [CROSSREF](#)
57. Driskell JA, Meckna BR, Scales NE. Differences exist in the eating habits of university men and women at fast-food restaurants. *Nutr Res* 2006;26:524-30. [CROSSREF](#)
58. Qazzafi S. Consumer buying decision process toward products. *Int J Sci Res Eng Dev* 2019;2:130-4.
59. Lim J, Moon S, Yeo GE, Kim ES, Kim Y, Oh JE. A study on a perception and promotion plan for employees to increase the consumption of low-sodium foods using importance performance analysis (IPA) - focused on ready-to-eat foods (samgak-kimbap, riceballs) -. *J Korean Soc Food Cult* 2023;38:129-42. [CROSSREF](#)