한국식생활문화학회지 39(2): 96-105, 2024
J. Korean Soc. Food Cult. 39(2): 96-105, 2024

ISSN 1225-7060(Print)
ISSN 2288-7148(Online)
https://doi.org/10.7318/KJFC/2024.39.2.96

Two-Part Model Analysis of Artificially Sweetened Soda Purchase Behavior In Terms of the Food Health Stereotypes of "Vice" and "Virtue"

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Abstract

The domestic artificially sweetened beverage market has grown rapidly in recent years, and sodas have led this growth. This study investigated consumer food purchasing behavior of artificially sweetened sodas in terms of the food health stereotypes of "vice" and "virtue"; used to denote unhealthy and healthy food purchases, respectively. The study was conducted using consumer panel data collected by the Rural Development Administration from 2017 to 2020. Given the semi-continuous nature of artificially sweetened soda purchases, Cragg's two-part model was used for the analysis. The probability of purchasing artificially sweetened sodas increased as expenditure on snacks (a vice food category) increased. However, of those panelists who purchased artificially sweetened sodas, expenditure on artificially sweetened sodas decreased with expenditure on snacks and increased with expenditure on fruits (a virtue food category). These results suggest that vicious-lifestyle consumers choose artificially sweetened sodas when they regulate eating habits, whereas virtuous-lifestyle consumers increase artificially sweetened soda expenditure for hedonic consumption to reduce guilt based on a sensible trade-off effect.

Key Words : Consumer behavior, artificially sweetened sodas, vice-virtue, two-part model

I. Introduction

Over the past several decades, the world has become increasingly aware of the role of added sugars in food and beverage products. The high consumption of added sugar plays a central role in the connection between health issues and dietary habits (Agulló et al. 2022). The World Health Organization (WHO) has raised growing concerns about the consumption of free sugars, particularly through the intake of sugar sweetened beverages (SSBs), as they are associated with an increase in overall energy intake. The consumption of free sugars may reduce the intake of foods containing more nutritionally adequate calories, thus promoting unhealthy diets that may further lead to weight gain and increased risk of noncommunicable diseases (WHO 2015). In recognition of such consequences, the Korean Nutrient Intake Guidelines published by the Ministry of Health and Welfare recommends that sugar intake be limited to 10-20% of total energy intake, with added sugars being no more than 10% of total energy intake.

The food group that contributes the most to sugar intake is processed foods, with beverages accounting for a high proportion of this intake. Among these beverages, sodas (carbonated soft drinks) are the largest contributors to sugar intake (Yoon 2018). To address the health issues associated with dietary habits, the global beverage market is focusing on the production of healthy beverages using alternative sweeteners (Sloan 2016). Artificially sweetened beverages (ASBs) are marketed as healthy alternatives to SSBs based on their ability to mimic the sensory properties of SSBs while providing zero (or a low amount of) energy content (Borges et al. 2017).

In this regard, the global beverage industry has witnessed an expansion of product portfolios as well as a shift toward the production of ASBs, which are perceived as healthier by some consumers (Borges et al. 2017). The domestic artificially sweetened soda market has also grown significantly, with sales reaching 218.9 billion Korean won (KRW) in 2021 (Han 2022). As such, the growth of the artificially sweetened soda market has been spectacular at both the local and global levels.

Given this rapidly growing market for artificially sweetened

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sodas, most academic literature has focused on medical trial, industry and market trend analysis, or consumer sensory preferences related to product properties. A relatively small number of studies have explored consumers' purchasing behavior factors associated with artificially sweetened sodas. As the artificially sweetened soda market is no longer a small market niche nor a short-term trend (in fact, it is becoming a mainstream market), it is important to understand the consumers who purchase these products and their food purchasing behavior.

The main goal of this study is to examine consumers' food purchasing behavior of artificially sweetened sodas in terms of the food health stereotypes of "vice" and "virtue". "Vice" and "virtue" products are related concepts that differ in the gain and loss domain; for example, relative vice foods refer to products that provide short-term benefits but have potentially negative long-term consequences (i.e., tasty yet fattening desserts), while relative virtue foods refer to those that offer less short-term satisfaction but have greater long-term benefits (i.e., less tasty yet healthier vegetables) (Wertenbroch 1998; Ketron et al. 2021). In general, consumers perceive virtue foods as inherently healthier than vice foods (Anghelcev et al. 2020).

From this perspective, sodas that contain excessive amounts of sugars are perceived as vice foods, whereas calorie-free sparkling water is perceived as a healthy beverage (Ryu et al. 2017; Tahmassebi & BaniHani 2020). However, a new type of beverage, artificially sweetened sodas, has both vice and virtue aspects; thus, it is necessary to understand how consumers perceive and purchase artificially sweetened sodas. Based on prior research, consumers' beverage consumption has been found to be highly associated with their lifestyle (Brunkwall et al. 2019). By adopting a vice-virtue framework, this study explores whether vicious- or virtuous-lifestyle consumers are likelier to purchase artificially sweetened sodas.

Based on self-licensing effect, when people lack perceived control, the resulting stress prompts them to look for ways to self-license, leading to the consumption of vice foods (Lunardo et al. 2022). In other words, the concept of self-licensing contends that people are likelier to choose hedonic goods when the decision context allows them to justify the consumption (Khan & Dhar 2006). Indeed, people may rely on justifications for their indulgent behaviors: ex-smokers allowing themselves a cigarette during stressful times or dieters permitting themselves to a large fast food meal after a challenging exam. As the key feature of self-licensing lies in permitting oneself an otherwise disallowed pleasure, self-licensing serves as a relevant explanation for a wide range of hedonic consumption behaviors (De Witt Huberts et al. 2012).

On the other hand, according to the sensible trade-off effect, people increase their consumption of virtue foods to reduce their feelings of guilt surrounding food consumption (Lenne et al. 2017). As such, compensatory behavior is conceptualized as consumers' food consumption behavior being linked to health (Lenne et al. 2017). A health stereotype vice-virtue framework can be used to understand consumers' underlying purchase motivations. Do vicious-lifestyle consumers attempt to regulate their eating habits while self-licensing, while virtuous-lifestyle consumers try to reduce guilt and increase hedonic consumption?

Relatively few previous studies have examined the relationship between artificially sweetened sodas and health-related food purchasing behavior. Therefore, this study aims to investigate consumers' decision-making processes when choosing and consuming artificially sweetened sodas as influenced by certain health-related food categories. More precisely, this study examines whether consumers who purchase foods with certain characteristics generally accept the purchase of artificially sweetened sodas by focusing on which consumers are likelier to adopt artificially sweetened sodas between consumers with vicious food purchasing behavior or those with virtuous food purchasing behavior. Next, this study investigates whether consumers with certain food purchasing characteristics associated with health stereotypes increase their expenditure on artificially sweetened sodas.

To investigate the relationship between artificially sweetened soda purchase behavior and a particular food category, we used consumer panel data collected by the Rural Development Administration from 2017 to 2020. For the analysis, we utilized the two-part model developed by Cragg (1971). This study examines the factors that lead consumers who do not purchase artificially sweetened sodas to purchase and increase their expenditure on artificially sweetened sodas.

II. Materials and Methods

1. Data

This study uses household panel data on Korean consumers collected by the Rural Development Administration (RDA) to investigate the relationship between the purchase of artificially sweetened sodas and vice-virtue food categories. Household grocery shoppers nationwide submit their grocery

receipts to the RDA every month, containing information such as product name, category, price, and date of purchase. The consumer panel data includes demographic variables such as gender, age, monthly household income, number of family members, number of children, occupation, etc. as well as purchase specifies like purchase channel, purchase location, purchase date, purchase amount, purchase volume, and product details. The consumer panel data used to understand consumers' food purchasing behaviors and characteristics.

A total of 1,250 households that consistently submitted grocery purchase receipts for at least 10 months each year from 2017 to 2020 were selected for analysis. For the December 2020 data, in which no receipts for grocery purchases were submitted, the consumer price index was factored into the previous year's purchase data and used in the analysis after a direct rollover (Park & An 2020).

2. Variables and measurements

According to prior research, food found in a grocery store can generally be categorized into vice, virtue, or neither category (Hui et al. 2009). To illustrate, "indulgent" foods (e.g., chocolate, burgers, fries) are considered inherently unhealthy and are thus classified as vice foods. In contrast, vegetables and fruits are commonly seen as healthy options and are thus classified as virtue foods (Chernev & Gal 2010). In alignment with Hui et al. (2009) classification, we examined whether all food categories represented in the consumer panel data could be definitively categorized into vice or virtue. However, certain foods may not have neatly fit into these pre-established classifications due to either cultural distinctions or their omission from previous research frameworks. Consequently, foods that did not align with the vice or virtue categories, such as those demonstrating a mixed intake or other distinct types, were excluded from our analysis as independent variables to maintain clarity and consistency in the categorization process. By applying this classification to our consumer panel data, food categories that can be represented as vice and virtue were used in our analysis as independent variables. The food categories of snacks, frozen desserts, and alcohol are typical vice foods, while fruits, vegetables, eggs, dairy products, and chicken breasts are typical virtue foods.

The dependent variables in this study are the purchase probability of artificially sweetened sodas and the purchase expenditure on artificially sweetened sodas. The purchase probability of artificially sweetened sodas is determined by whether they appear on grocery receipts over a four-year period. It is coded as '1' if the grocery receipts contained artificially sweetened sodas and '0' otherwise. The purchase expenditure on artificially sweetened sodas represents the total amount spent on artificially sweetened sodas by each panelist over the four years. This variable excludes panelists whose receipts do not include purchase of artificially sweetened sodas.

In addition, each of the 1,250 household panelists' ages, number of family members, monthly household incomes, BMIs, total food expenditures, and total carbonated beverage expenditures were controlled in the analysis, which represents the personal characteristics of the panelists. All the control variables were continuous variables. The variables used in this study and their definitions are shown in <Table 1>.

We used the total expenditure of each food category purchased by each panelist over a four-year period as the basis for our analysis. Since the four-year total food expenditure on artificially sweetened sodas is very small compared to other categories, the total expenditure on all other categories was divided by 100,000 won and used in the analysis.

3. Data analysis

Based on the assumption that different factors determine the initial purchase of artificially sweetened sodas and subsequent expenditure, a two-part model analysis was conducted to determine the impact of specific food categories on 1) the purchase probability of artificially sweetened sodas and 2) the purchase expenditure on artificially sweetened sodas. The tobit model is widely used to analyze such censored data. However, it is limited in estimating that the effects of the independent variable on the participation and outcome of the dependent variable are the same (Eom et al. 2023). Therefore, for this study, we used the two-part model developed by Cragg (1971). The two-part model relaxes the restrictive assumptions of the tobit model by separately estimating (1) the probability of a non-zero value using the total sample (1st Part) and (2) the value of the continuous variable conditional on a non-zero value (2nd Part).

Artificially sweetened sodas are not essential materials to be purchased every month, so the dependent variable, artificially sweetened soda expenditure, has many zero values. Consequently, to verify the relationship between the purchase of artificially sweetened sodas and a particular health-related food category, the two-part model was used. The two-part model separately estimates (1) the probability of purchasing artificially sweetened sodas due to a particular

<Table 1> Descriptions of the variables

Variables	Description
Dependent Variables	
$\text{Log}\left(\frac{P}{1-P}\right)$	Logarithm transformation of the odds ratio of each panelist's probability of purchasing artificially sweetened sodas over a four-year period
(Y|y>0)	Total expenditure of each panelist on artificially sweetened sodas over a four-year period
Independent Variables	
Vice foods	
Total snack expenditure	Total expenditure of each panelist on snacks purchased over a four-year period divided by 100,000 won
Total frozen dessert expenditure	Total expenditure of each panelist on frozen dessert purchased over a four-year period divided by 100,000 won
Total alcohol expenditure	Total expenditure of each panelist on alcohol purchased over a four-year period divided by 100,000 won
Virtue foods	
Total fruit expenditure	Total expenditure of each panelist on fresh fruits purchased a four-year period divided by 100,000 won
Total vegetable expenditure	Total expenditure of each panelist on fresh vegetables purchased over a four-year period divided by 100,000 won
Total egg expenditure	Total expenditure of each panelist on fresh eggs purchased over a four-year period divided by 100,000 won
Total dairy product expenditure	Total expenditure of each panelist on dairy products purchased over a four-year period divided by 100,000 won
Total chicken breast expenditure	Total expenditure of each panelist on fresh and processed chicken breasts purchased over a four-year period divided by 100,000 won
Control Variables	
Age (unit: yrs.)	Age of each panelist in years
Number of family members	Number of family members of each panelist (includes the panelist themselves)
Monthly household income (unit: won)	Monthly income of each panelist in won
BMI	BMI of each panelist
Total food expenditure	Total expenditure of each panelist on all food categories purchased over a four-year period divided by 100,000 won
Total carbonated beverage expenditure	Total expenditure of each panelist on all carbonated beverages (including sparkling water) purchased over a four-year period divided by 100,000 won

food category (by a logistic regression) and (2) for the consumers that purchased artificially sweetened sodas, artificially sweetened soda expenditure due to a particular food category (by a linear regression). A significance level of 10% was considered for all statistical tests. All statistical analyses were performed using R 4.2.3.

The regression analysis equation for the above analyses is as follows:

$$\text{1st Part: } \text{Log}\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

(P: probability of purchasing artificially sweetened sodas, X_1: vector of the vice and virtue food categories, X_2: vector of control variables, ε: error terms)

$$\text{2nd Part: } (Y|y>0) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

(P: purchase expenditure on artificially sweetened sodas, X_1: vector of the vice and virtue food categories, X_2: vector of control variables, ε: error terms)

III. Results and Discussion

1. Descriptive statistics

An examination of the demographic characteristics of the 1,250 household panelists based in Korea, the average age of the head of household is 53.30 years old, with 16 households having their head in their 20s (1.3%), 100 households having their head in their 30s (8.0%), 356 households having their head in their 40s (28.5%), 408 households having their head

in their 50s (32.6%), 308 households having their head in their 60s (24.6%), and 62 households having their head in their 70s or older (5.0%). The average number of family members per household is 2.91, the average monthly household income is about 4.7 million won, and the average BMI is 21.70. The average four-year amount of total food expenditure is about 16.94 million won, and the average four-year total soda expenditure is about 93,460 won <Table 2>.

The results of the descriptive statistics of dependent variables are shown in <Table 3>. The purchase of artificially sweetened sodas is characterized as semi-continuous, which means the data has a mixture of zero values and continuous positive (+) values. Therefore, we divided the purchase of artificially sweetened sodas into two variables, namely, "purchase probability" and "purchase expenditure".

<Table 2> Demographic characteristics of panel members

Variables		N	(%)
Age (yrs.)	20-29	16	1.3
	30-39	100	8.0
	40-49	356	28.5
	50-59	408	32.6
	60-69	308	24.6
	Above 70	62	5.0
Number of family members	1	163	13.0
	2	336	26.9
	3	321	25.7
	4	339	27.1
	Above 5	91	7.3
Monthly household income (won)	Less than 2,000,000	172	13.8
	2,000,000-2,990,000	128	10.2
	3,000,000-3,990,000	205	16.4
	4,000,000-4,990,000	205	16.4
	5,000,000-5,990,000	194	15.5
	6,000,000-6,990,000	131	10.5
	7,000,000-7,990,000	79	6.3
	8,000,000-8,990,000	65	5.2
	9,000,000-9,990,000	20	1.6
	More than 10,000,000	51	4.1
BMI	Less than 18.5	105	8.4
	18.5-less than 23	624	49.9
	23-less than 25	287	23.0
	More than 25	234	18.7
Total food expenditure	Less than 10,000,000	212	17.0
	10,000,000-less than 15,000,000	314	25.1
	15,000,000-less than 20,000,000	346	27.7
	20,000,000-less than 25,000,000	203	16.2
	More than 25,000,000	175	14.0
Total carbonated beverage expenditure	Less than 50,000	646	51.7
	20,000-less than 100,000	228	18.2
	100,000-less than 150,000	130	10.4
	More than 150,000	246	19.7

As to artificially sweetened soda purchases, in <Table 3>, only 36.6% (457 households) of the total panel purchased artificially sweetened sodas between 2017 and 2020. In other words, the data is characterized by the fact that only a minority of households purchased artificially sweetened sodas and that the majority did not purchase artificially sweetened sodas at all within the observed period. This semi-continuous nature of artificially sweetened soda consumption should be accounted for in the analysis. A total artificially sweetened soda expenditure (over a four-year period) for those who purchased artificially sweetened sodas is about 6,010 won on average.

2. Impact of health-related food categories on artificially sweetened soda purchase

The results of the first part of the two-part model analyzing the probability of purchasing artificially sweetened sodas due to a particular health-related food category (which can be classified as vice or virtue foods) are shown in <Table 4>. Snack expenditure ($p<0.1$) has a significant positive impact on the purchase probability of artificially sweetened sodas. In terms of demographics, age ($p<0.05$) has a significant negative impact on the purchase probability of artificially sweetened sodas. A100-unit increase in age decreased the probability of purchasing artificially sweetened sodas by 1.6%. In addition, total carbonated beverage expenditure ($p<0.001$) has a significant positive impact on the purchase probability of artificially sweetened sodas. A100-unit increase in age increased the probability of purchasing artificially sweetened sodas by 47.8%.

The results of the second part of the two-part model analyzing the impact of certain health-related food category (which can be classified as vice or virtue foods) on artificially sweetened sodas expenditure are shown in <Table 5>. Snack expenditure ($p<0.001$) has a significant negative impact on artificially sweetened soda expenditure, while fruit expenditure ($p<0.001$) has a significant positive impact on artificially sweetened soda expenditure. None of the demographic variables were significant, however, total food expenditure ($p<0.05$) has a significant negative impact on artificially sweetened soda expenditure, while total carbonated beverage expenditure ($p<0.001$) has a significant positive impact on

<Table 3> Descriptive statistics of dependent variables

Dependent variable	N	Mean	SD	Min.	Max.
Purchase probability of artificially sweetened sodas	1,250	0.37	0.48	0	1
Purchase expenditure on artificially sweetened sodas	457	6,010	15,490	200	228,670

<Table 4> Results of the first part of the two-part model

Variables	B	SE	p	OR	95% CI	
					LLCI	ULCI
Independent variables						
Vice foods						
Total snack expenditure	0.033	0.018	0.070	1.033	0.998	1.071
Total frozen dessert expenditure	-0.011	0.049	0.818	0.989	0.898	1.089
Total alcohol expenditure	0.001	0.011	0.925	1.001	0.980	1.023
Virtue foods						
Total fruit expenditure	-0.002	0.007	0.740	0.998	0.984	1.012
Total vegetable expenditure	0.009	0.009	0.313	1.009	0.991	1.028
Total egg expenditure	-0.003	0.039	0.948	0.997	0.923	1.077
Total dairy product expenditure	0.018	0.015	0.221	1.018	0.989	1.049
Total chicken breast expenditure	-0.027	0.111	0.806	0.973	0.779	1.209
Control variables						
Age	-0.016	0.008	0.042*	0.984	0.969	0.999
Number of family members	-0.018	0.068	0.788	0.982	0.858	1.122
Monthly household income	0.000	0.000	0.160	1.000	1.000	1.001
BMI	0.009	0.011	0.435	1.009	0.987	1.032
Total food expenditure	0.001	0.002	0.769	1.001	0.997	1.005
Total carbonated beverage expenditure	0.391	0.071	0.000***	1.478	1.292	1.704
McFadden R-squared	0.086					
Number of observations	1,250					

[1)]DV=purchase probability of artificially sweetened sodas
[2)]*p<0.05, ***p<0.001

artificially sweetened soda expenditure.

Using a two-part model that divides the consumer's decision-making process into choice and amount, this study analyzes the impact of certain health-related categories of foods on the probability of purchasing artificially sweetened sodas and the purchase expenditure. A negative and positive relationship indicates that consumers are likelier to purchase artificially sweetened sodas based on their purchase behavior of certain health-related categories of foods, such as vice or virtue foods. The results showed that several variables impacted the choice and the amount of artificially sweetened soda purchases.

The positive relationship between the expenditure on a vice food (snacks) and artificially sweetened soda purchase probability means that consumers who seek to purchase more vice foods are likelier to purchase artificially sweetened sodas. In other words, consumers who routinely purchase unhealthy foods show a higher probability of choosing artificially sweetened sodas. In Binkley & Golub (2007) study, those who purchased the most artificially sweetened sodas also purchased the largest quantity of snacks, implying that those who replace regular sodas with artificially sweetened sodas may be compensating for the increased calorie intake from snacks.

Furthermore, the demographic factor that significantly influences the purchase probability of artificially sweetened sodas is age. The younger the consumer, the likelier they are to choose artificially sweetened sodas. The finding aligns with prior studies indicating that artificially sweetened sodas are associated with a younger age (Elfhag et al. 2007). These results suggest that younger age groups are likelier to choose artificially sweetened sodas, as the "healthy pleasure" trend,

<Table 5> Results of the second part of the two-part model

Variables	Unstandardized Coefficients		Standardized Coefficients	t(p)	VIF
	B	SE	β		
Independent variables					
Vice category foods					
Total snack expenditure	-540.353	153.104	-0.229	-3.529***	2.739
Total frozen dessert expenditure	87.443	431.442	0.010	0.203	1.721
Total alcohol expenditure	30.901	108.086	0.013	0.286	1.264
Virtue category foods					
Total fruit expenditure	236.596	70.515	0.196	3.355***	2.228
Total vegetable expenditure	-5.645	93.572	-0.004	-0.060	3.275
Total egg expenditure	429.401	408.153	0.053	1.052	1.681
Total dairy product expenditure	99.638	126.188	0.042	0.790	1.869
Total chicken breast expenditure	1284.879	1004.513	0.055	1.279	1.208
Control variables					
Age	19.619	79.380	0.012	0.247	1.572
Number of family members	-1012.387	688.296	-0.076	-1.471	1.732
Monthly household income	3.165	2.829	0.051	1.119	1.352
BMI	-59.615	109.206	-0.022	-0.546	1.047
Total food expenditure	-51.961	20.534	-0.264	-2.530*	7.097
Total carbonated beverage expenditure	6534.159	471.369	0.664	13.862***	1.499
F(p)			15.09***		
Adjusted R-squared			0.302		
Durbin-Watson statistic			2.091		
Number of observations			457		

[1)]DV=purchase expenditure on artificially sweetened sodas
[2)]*p<0.05, ***p<0.001

which combines “fun” and “happiness” in health care, is growing among younger generations (Kim et al. 2022b).

On the other hand, consumers who purchased artificially sweetened sodas showed the opposite food purchasing behavior. Expenditure on artificially sweetened sodas had a negative relationship with vice food expenditure (snacks) and a positive relationship with virtue food expenditure (fruits). That is, consumers who seek to purchase fewer vice foods and more virtue foods are likelier to increase their expenditure on artificially sweetened sodas. This implies that consumers with healthy food purchasing behavior are likelier to increase the artificially sweetened soda expenditure. According to Binkley & Golub (2007), those who chose artificially sweetened sodas had a general tendency to spend a larger share on nutritious foods (fresh fruit and yogurt) and to avoid foods higher in calories and of less nutritional value (fruit juices and fruit drinks, frozen French fries, and sugar). Thus, the result is consistent with prior studies in terms of the fact that a healthy lifestyle is a main reason for the consumption of low-calorie sweeteners, which are contained in artificially sweetened sodas (Daher et al. 2022). Moreover, a negative relationship between the total food expenditure and expenditure on artificially sweetened sodas could be attributed to the frequent consumption of these artificially sweetened sodas for weight management purposes (Kim et al. 2022a).

IV. Summary and Conclusion

As consumer interest in health increases, many existing SSBs have recently been released as ASBs, using alternative sweeteners. The domestic ASB market has grown rapidly in recent years, with sodas leading the way. Artificially sweetened sodas are becoming a mainstream beverage group in Korea, so it is necessary to understand consumers’ purchasing behavior of artificially sweetened sodas in order to establish a more effective marketing strategy. Therefore,

this study uses the vice–virtue framework to understand the underlying purchase motivations of consumers. Using panel data from 1,250 households across four years (2017-2020), this study determined the relationship between artificially sweetened sodas and health-related food purchasing behavior.

While artificially sweetened sodas are an emerging beverage category, it is not an essential material to be purchased every month; only 36.6% (457 households) of the total panel purchased artificially sweetened sodas between 2017 and 2020. Given the semi-continuous nature of the artificially sweetened soda purchase, Cragg's two-part model was used for the analysis. By studying consumers' food purchasing behavior of artificially sweetened sodas in terms of food type by health stereotype (vice and virtue), the study explores compensatory behavior of artificially sweetened soda purchases. The results showed that several variables impacted the choice and the expenditure amount of artificially sweetened soda purchases. The probability of purchasing artificially sweetened sodas increases as expenditure on snacks (a vice food) increases. This implies that vicious-lifestyle consumers purchasing artificially sweetened sodas try to regulate their eating habits while self-licensing. However, for the panelists who purchased artificially sweetened sodas, expenditure on artificially sweetened sodas increased as expenditure on snacks (a vice food) decreased and expenditure on fruits (a virtue food) increased. It seems that virtuous-lifestyle consumers purchasing artificially sweetened sodas try to reduce guilt, in line with a sensible trade-off effect, and increase hedonic consumption.

The study makes the following contributions to the literature by examining the impact of health-related purchasing behavior on artificially sweetened sodas. First, it extends the literature on artificially sweetened soda purchasing behavior in terms of its health-related aspects. Previous studies have mainly investigated purchasing behavior based on the physical and environmental factors of artificially sweetened sodas (Ahn 2018; Choi et al. 2019). As the perceived healthfulness of food items has figured prominently among factors influencing consumers' grocery shopping decisions, the exploration of health-related purchasing behavior is needed to understand consumers' motivations for artificially sweetened soda purchases (Grunert 2013). Building on this view, this study attempted to identify health-related aspects by categorizing food categories into health stereotypes—"vice" and "virtue"—based on prior research (Hui et al. 2009). Consuming low-calorie sweeteners is primarily driven by the desire for a healthy lifestyle (Daher et al. 2022); therefore, understanding consumer behavior through health-related perceptions is crucial. By applying a health-based vice/virtue food stereotype perspective, the results of this study expand our understanding of the key motivations that drive consumers to purchase artificially sweetened sodas.

However, our operationalization of vice and virtue food is defined at the food-category level is a limitation of this study; in other words, this study was unable to further differentiate between relative vice and virtue stock keeping units (SKU) within a food category—for example, a diet product (a relative virtue food) that is within the snacks category (a vice food category). This may partially explain the relatively weak effects observed in our results. Future research should expand the perspective by incorporating more objective criteria such as nutritional content and considering cultural differences.

Second, given that using an artificial sweetener in beverages is a way to create healthy alternatives, this study also provides practical implications for ASB manufacturers' marketing strategies (Borges et al. 2017). Given the varied influences on the choice and expenditure on artificially sweetened soda purchases, ASB marketers should clarify their target consumer groups and build their marketing strategies accordingly. The first group should target consumers who have never purchased artificially sweetened sodas before. Consumer acceptance of artificially sweetened sodas (from not purchasing to accepting the product) is linked to vicious food purchasing behavior, suggesting that vicious-lifestyle consumers try to regulate their eating habits while self-licensing by accepting artificially sweetened sodas. As SSBs are generally perceived to be associated with vicious food purchasing behavior, similar food purchasing behavior on artificially sweetened sodas may mean that the same strategies can be applied (Chung et al. 2004). Marketing communications suggesting that artificially sweetened sodas can be a substitute for SSBs can be used to drive new consumer demand.

The second target group is consumers who have experience purchasing artificially sweetened sodas, and a marketing strategy is needed to encourage their continued expenditures. Consumers who have experience purchasing artificially sweetened sodas recognize it as a new, specific food category and show healthy purchasing behavior to increase expenditures. The results suggest that once consumers accept artificially sweetened sodas, they would perceive the beverage as a new category and exhibit healthy purchase behaviors. In other words, consumers with virtuous lifestyles trying to reduce

guilt and increase hedonic consumption have increased their expenditure on artificially sweetened sodas. Therefore, it is necessary to position artificially sweetened sodas as healthy beverages in order to increase consumer's continued consumption of artificially sweetened sodas.

To increase the competitiveness of artificially sweetened sodas in the rapidly changing Korean beverage market, it is important to understand consumer purchasing behavior. This study aimed to explain artificially sweetened soda purchase behaviors by identifying consumers' food purchasing behaviors. Specifically, the study found that health-related food purchasing behaviors significantly influenced the adoption of and purchase expenditure on artificially sweetened sodas. Therefore, implementing a marketing strategy based on the characteristics of the target consumers will help increase artificially sweetened soda purchases.

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Acknowledgment

This work was carried out with the support of "Cooperative Research Program for Agriculture Science and Technology Development (Project No. PJ017104)" Rural Development Administration, Republic of Korea.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Received November 15, 2023; revised February 29, 2024; accepted March 20, 2024