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Original Article

The Relationship between Dietary Habits, Body Mass Index, and Oral Symptoms in Korean Adolescents

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ABSTRACT

Objectives: Objectives: This study examined the relationship between dietary habits, body mass index (BMI), and oral disease symptoms among Korean adolescents using data from the 17th (2021) Youth Health Behavior Survey, aiming to provide foundational evidence for preventing and managing oral diseases in this population. **Methods:** Using the 2021 Youth Health Behavior Survey data, we assessed adolescents' consumption frequencies of carbonated drinks, sweetened beverages, and fast foods, as well as tooth brushing frequency and BMI categories. Statistical analyses evaluated associations among dietary habits, BMI, and oral disease symptoms, while considering demographic and socioeconomic factors impacting BMI. **Results:** Tooth sensitivity was the most common symptom (30.6%), followed by toothache (21.2%), gingival bleeding/swelling (19.1%), and tooth fracture (8.7%). Increased consumption of carbonated drinks, sweetened beverages, and fast foods correlated significantly with higher rates of all oral disease symptoms. Lower tooth brushing frequency also associated with greater symptom prevalence. BMI was significantly influenced by gender, academic achievement, and economic status. Dietary habits varied across BMI groups, and toothache occurred 1.09 times more frequently in obese adolescents; gingival bleeding/swelling were 1.07 and 1.08 times more common among overweight and obese groups, respectively, compared to normal-weight peers. **Conclusions:** Effective adolescent oral health promotion should include weight management programs tailored to dietary and brushing behaviors rather than relying on general stereotypes, thereby better addressing both BMI control and oral disease prevention.

Keywords: Adolescent, Body mass index, Diet, Obesity, Oral health

1. Introduction

Adolescence is a critical period during which individuals develop health-related habits and coping strategies. The cognitive and psychological changes experienced during this time can have long-term implications for health promotion and disease prevention throughout life [1]. Therefore, adolescents' awareness of health, their health status, and the implementation of health-related behaviors are essential components of lifelong health management.

With the growth of the national economy, the physical development and nutritional status of Korean adolescents have markedly improved [2]. However, in the past two years, the COVID-19 pandemic has led to widespread changes such as remote learning and social distancing, significantly limiting opportunities for physical activity. These societal shifts are presumed to have influenced adolescent health behaviors and outcomes. For instance, a study by Kim and Woo [3] reported an increase in overweight and obesity rates among adolescents following the COVID-19 outbreak.

Changes in body mass index (BMI) are associated with a variety of health conditions. According to Jang et al. [4], both obese and underweight children and adolescents exhibit a higher number of decayed and decayed-filled teeth compared to their normal-weight peers. Oh and Lee

[5] found a positive association between increased BMI and the prevalence of periodontal disease among female adolescents. Similarly, Kim et al. [6] reported that a higher BMI is linked to an increased risk of oral diseases. These findings collectively suggest a significant relationship between BMI and oral health.

Poor oral health among adolescents has been linked not only to adverse academic and social outcomes—such as impaired peer relationships, decreased academic performance, and increased absenteeism [7,8]—but also to long-term consequences including tooth loss, recurrent dental caries, and periodontal disease. These oral health issues may lead to nutritional imbalances and social withdrawal, ultimately compromising quality of life during adulthood and old age [9,10]. Consequently, the establishment of healthy dietary habits that support oral health during adolescence is crucial for ensuring a healthy adulthood.

In addition to dietary habits and BMI, several sociodemographic characteristics—such as sex, school level, academic achievement, and perceived economic status—are known to influence adolescents' health behaviors and oral health status [11,12]. Prior studies have shown that gender differences may affect oral health outcomes due to biological, behavioral, and psychosocial factors [11]. Academic performance has also been associated with oral hygiene practices and preventive behaviors, while perceived economic status is a well-documented determinant of access to dental care and nutritional quality [12,13]. School level, which reflects age and developmental stage, further contributes to differences in health awareness and behavior [12]. Therefore, these general characteristics were included as key variables to identify their potential moderating effects on the associations among dietary habits, BMI, and oral disease symptoms.

To this end, this study analyzes data from the 17th wave of the Korea Youth Risk Behavior Survey (KYRBS), a nationally representative survey conducted annually by the Korea Disease Control and Prevention Agency (KDCA) and the Ministry of Education. The KYRBS is designed to assess the health behaviors of Korean adolescents and provides a key source of evidence for national health policy and cross-national comparisons. The findings from this study are intended to provide foundational evidence for adolescent oral disease prevention and health promotion policies.

2. Methods

2.1. Participants and data collection

The 17th Korea Youth Risk Behavior Survey (KYRBS), conducted in 2021, targeted middle and high school students nationwide as of April 2021 [14]. A complex sampling design was employed, consisting of three stages: stratification, sample allocation, and cluster sampling.

In the stratification stage, the population was stratified into 117 strata based on geographic region and school level (middle or high school) to ensure national representativeness. During the sample allocation stage, a proportional number of schools were selected—specifically, 400 middle schools and 400 high schools—according to the distribution of students within each stratum.

A two-stage stratified cluster sampling method was utilized. In the first stage, schools were selected as the primary sampling units (PSUs) using probability proportional to size. In the second stage, classes within each selected school were randomly chosen as secondary sampling units (SSUs), and all students within those selected classes were surveyed.

To ensure data quality and feasibility amid the COVID-19 pandemic, schools experiencing excessive administrative burdens or lacking access to computer facilities were excluded. As a result, the final sample comprised 796 schools, with a total of 59,066 students selected for participation. After excluding incomplete or non-responses, the final analytical sample consisted of 54,848 students, yielding a response rate of 92.9%.

2.2. Variables

General characteristics of the participants included four variables: sex, school level (middle or high school), academic achievement, and perceived economic status. Body mass index (BMI) was calculated using self-reported height and weight, applying the formula weight (kg) divided by height squared (m^2). Participants were classified into four BMI categories according to the Korean Society for the Study of Obesity guidelines: underweight (<18.5 kg/m^2), normal weight (18.5–22.9 kg/m^2), overweight (23.0–24.9 kg/m^2), and obese ($\geq$25.0 kg/m^2).

Dietary habits were assessed based on the frequency of consumption of four food items—fruits, carbonated beverages, sugar-sweetened beverages, and fast food—during the past 7 days. Response categories were reclassified into four groups: "none," "1–2 days per week," "3–4 days per week," and "5 or more days per week."

Oral health behaviors included the daily frequency of toothbrushing, which was reclassified into three groups: "once or less per day," "twice per day," and "three or more times per day." Additionally, the practice of toothbrushing after lunch was separately examined.

Experience of oral disease symptoms over the past 12 months was assessed using four self-reported items: (1) tooth fracture or chipping, (2) tooth pain in response to hot or

cold food or beverages (dental hypersensitivity), (3) continuous or throbbing tooth pain, and (4) gum pain or bleeding. Responses were dichotomized as "yes" or "no", and each symptom was defined respectively as: tooth fracture, sensitive teeth, general toothache, and gingival bleeding/swelling for analytic purposes.

2.3. Statistical analysis

All statistical analyses were conducted using IBM SPSS Statistics version 21.0 (IBM Corp., Armonk, NY, USA). A complex sample analysis approach was applied to account for the survey design, incorporating stratification variables, cluster variables, and sampling weights. A complex sample plan file was generated to ensure appropriate variance estimation under the complex sampling design.

Descriptive statistics, including complex sample frequency and cross-tabulation analyses, were performed to examine the distributions of general characteristics, dietary habits, oral health behaviors, and the experience of oral disease symptoms among participants.

To identify factors associated with BMI, complex sample linear regression analysis was performed. Additionally, to evaluate the association between BMI categories and the experience of oral symptoms, complex sample logistic regression analysis was conducted to estimate odds ratios (ORs) with 95% confidence intervals (CIs). All statistical tests were two-tailed, and a p-value of less than 0.05 was considered statistically significant.

3. Results

3.1. Distribution of oral disease symptoms by general characteristics

The distribution of oral disease symptoms according to general characteristics is presented in Table 1. Among all participants, tooth sensitivity was the most frequently reported symptom, with a prevalence of 30.6%, followed by toothache (21.2%), gingival bleeding and swelling (19.1%), and tooth fracture (8.7%).

The prevalence of tooth fracture was significantly higher among male students (9.3%), as well as among those with lower academic performance and lower perceived economic status.

Tooth sensitivity was more prevalent among female students (33.5%), high school students (31.3%), and those with either high (31.5%) or low (32.4%) academic performance. In terms of economic status, students who perceived themselves as lower-middle (36.6%) or low (34.9%) also reported significantly higher levels of sensitivity.

Table 1. Distribution of oral disease symptoms according to general characteristics

Variables	Division	*n* (%)	Tooth fracture	Tooth sensitivity	Toothache	Gingival bleeding and swelling
total		54,848(100.0)	4,915(8.7)	16,724(30.6)	11,456(21.2)	10,322(19.1)
Sex	Male	28,401(51.7)	2,707(9.3)	7,844(27.8)	4,989(18.0)	4,649(16.6)
	Female	26,447(48.3)	2,208(8.2)	8,880(33.5)	6,467(24.7)	5,673(21.8)
	$\chi^2(p)$		20.401 (<0.001)	211.646 (<0.001)	365.146 (<0.001)	238.498 (<0.001)
School level	Middle school	30,015(51.0)	2,716(8.8)	8,907(29.8)	5,629(19.0)	5,258(17.7)
	High school	24,833(49.0)	2,199(8.6)	7,817(31.3)	5,827(23.6)	5,064(20.6)
	$\chi^2(p)$		0.752 (0.417)	14.555 (0.003)	169.077 (<0.001)	73.737 (<0.001)
Academic performance	High	7,084(12.7)	528(7.3)	2,248(31.5)	1,514(21.5)	1,348(19.0)
	Upper-middle	13,444(24.5)	1,048(7.8)	4,194(31.2)	2,745(20.8)	2,573(19.5)
	Middle	16,903(31.0)	1,467(8.4)	4,786(28.6)	3,323(20.3)	3,006(18.2)
	Lower-middle	12,004(22.0)	1,192(9.5)	3,738(31.2)	2,618(21.8)	2,312(19.5)
	Low	5,413(9.9)	680(12.1)	1,758(32.4)	1,256(23.5)	1,083(20.2)
	$\chi^2(p)$		123.501 (<0.001)	47.430 (<0.001)	30.733 (<0.001)	16.562 (0.007)
Economic status	High	5,944(10.9)	525(8.9)	1,554(26.8)	998(17.8)	977(17.1)
	Upper-middle	15,624(29.3)	1,307(8.2)	4,663(29.9)	3,059(20.0)	2,798(18.3)
	Middle	27,077(49.0)	2,371(8.5)	8,242(30.5)	5,701(21.4)	5,074(19.0)
	Lower-middle	5,091(9.0)	553(10.4)	1,868(36.6)	1,381(27.2)	1,191(23.6)
	Low	1,112(1.9)	159(13.9)	397(34.9)	317(28.5)	282(24.6)
	$\chi^2(p)$		59.866 (<0.001)	136.029 (<0.001)	196.006 (<0.001)	106.940 (<0.001)

Values are presented as unweighted number and weighted %
by complex samples chi-square test

The prevalence of toothache was significantly higher among female students (24.7%), high school students (23.6%), students with low academic performance (23.5%), and those with lower economic status.

Similarly, gingival bleeding and swelling were more commonly reported by female students (21.8%), high school students (20.6%), those with low academic performance (20.2%), and students from lower economic backgrounds, showing a statistically significant trend.

3.2. Distribution of oral disease symptoms according to dietary habits and oral health behaviors

The distribution of oral disease symptoms according to dietary habits and oral health behaviors is shown in Table 2. Among participants who did not consume fruits, the prevalence of tooth fracture (10.0%), tooth sensitivity (31.0%), toothache (22.7%), and gingival bleeding and swelling (20.5%) was significantly higher.

For the consumption of carbonated beverages, sugar-sweetened beverages, and fast food, the prevalence of all oral disease symptoms significantly increased with higher frequency of intake.

Regarding oral health behaviors, all oral disease symptoms showed a significantly higher prevalence among those who brushed their teeth less frequently. For toothbrushing after lunch, tooth fracture was significantly more prevalent in those who brushed sometimes (10.2%). Tooth sensitivity was more prevalent in both those who brushed always (31.1%) and those who did not brush (31.1%). Toothache was significantly more prevalent among those who always (23.2%) brushed after lunch.

Table 2. Distribution of oral disease symptoms by dietary habits and oral health behaviors

Variables	Division	*n* (%)	Tooth fracture	Tooth sensitivity	Toothache	Gingival bleeding and swelling
total		54,848(100.0)	4,915(8.7)	1,6724(30.6)	1,1456(21.2)	10,322(19.1)
Fruit consumption (weekly)	No	6,544(11.8)	673(10.0)	2,016(31.0)	1,435(22.7)	1,310(20.5)
	1-2	17,639(32.2)	1,589(8.8)	5,513(31.3)	3,748(21.5)	3,388(19.4)
	3-4	15,293(27.7)	1,320(8.4)	4,697(30.7)	3,177(21.0)	2,825(18.7)
	≥5	15,372(28.3)	1,333(8.5)	4,498(29.4)	3,096(20.5)	2,799(18.7)
	$\chi^2(p)$		16.951 (0.002)	14.293 (0.008)	14.164 (0.008)	12.532 (0.015)
Carbonated beverages	No	13,169(24.3)	1,003(7.4)	3,850(29.1)	2,693(20.8)	2,461(19.3)
	1-2	22,596(41.3)	1,881(8.1)	6,768(30.2)	4,576(20.6)	4,174(18.6)
	3-4	11,973(21.7)	1,192(9.6)	3,801(31.7)	2,519(21.4)	2,260(19.0)
	≥5	7,110(12.7)	839(11.6)	2,305(32.5)	1,668(23.8)	1,427(20.5)
	$\chi^2(p)$		122.658 (<0.001)	33.955 (<0.001)	33.992 (<0.001)	12.879 (0.014)
Sugar-sweetened drinks	No	8,476(15.6)	676(7.9)	2,290(27.0)	1,547(18.6)	1,490(18.0)
	1-2	19,949(36.1)	1,612(7.9)	5,658(28.4)	3,786(19.3)	3,580(18.2)
	3-4	14,782(27.0)	1,383(9.1)	4,733(32.1)	3,206(22.1)	2,827(19.4)
	≥5	11,641(21.4)	1,244(10.3)	4,043(34.9)	2,917(25.4)	2,425(21.1)
	$\chi^2(p)$		64.460 (<0.001)	215.848 (<0.001)	205.779 (<0.001)	49.483 (<0.001)
Fast food	No	9,319(16.8)	750(7.6)	2,475(26.6)	1,678(18.3)	1,597(17.5)
	1-2	31,284(57.0)	2,695(8.4)	9,339(29.9)	6,326(20.5)	5,747(18.7)
	3-4	11,294(20.7)	1,081(9.4)	3,864(34.4)	2,676(24.2)	2,314(20.7)
	≥5	2,951(5.4)	389(13.0)	1,046(35.3)	776(26.7)	664(22.7)
	$\chi^2(p)$		93.772 (<0.001)	182.610 (<0.001)	168.608 (<0.001)	61.448 (<0.001)
Frequency of tooth brushing (daily)	≤1	5,079(9.0)	548(10.4)	1,840(36.3)	1,286(25.7)	1,155(23.0)
	2	27,060(49.7)	2,411(8.7)	8,538(31.6)	5,699(21.6)	5,031(19.1)
	≥3	22,709(41.3)	1,956(8.5)	6,346(28.0)	4,471(19.8)	4,136(18.3)
	$\chi^2(p)$		18.665 (<0.001)	161.934 (<0.001)	90.804 (<0.001)	59.613 (<0.001)
Frequency of tooth brushing (after lunch)	Always	7,759(13.6)	633(7.8)	2,437(31.1)	1,781(23.2)	1,540(19.8)
	Mostly	5,182(9.0)	475(8.7)	1,555(30.3)	1,124(21.7)	1,006(19.5)
	Sometimes	9,480(16.9)	968(10.2)	2,672(28.4)	1,826(19.6)	1,727(18.6)
	Never	32,427(60.5)	2,839(8.5)	10,060(31.1)	6,725(21.2)	6,049(19.0)
	$\chi^2(p)$		34.721 (<0.001)	25.290 (<0.001)	33.960 (<0.001)	4.707 (0.277)

Values are presented as unweighted number and weighted % by complex samples chi-square test

3.3. Factors affecting body mass index

To identify the factors affecting body mass index (BMI) of the participants, a complex sample linear regression analysis was conducted. Among general characteristics, sex, academic performance, and economic status showed statistically significant differences. Regarding dietary habits, fruit intake, carbonated beverage intake, and fast food intake also showed significant associations.

Males had a 1.918 higher BMI compared to females ($p < 0.001$). Participants with high academic performance had a 0.725 lower BMI than those with low performance ($p < 0.001$), and those with high economic status had a 0.487 lower BMI than those with low economic status ($p = 0.002$).

For dietary habits, participants who did not consume fruit had a 0.419 higher BMI compared to those who consumed fruit five or more times per week ($p < 0.001$). Similarly, those who did not consume carbonated beverages had a 0.252 higher BMI than those who consumed them five or more times per week ($p < 0.001$), and those who did not consume fast food had a 0.536 higher BMI than those who consumed it five or more times per week ($p < 0.001$).

3.4. Odds ratios for oral symptoms according to BMI

The odds ratios for oral symptoms according to BMI, based on the normal weight group, are shown in Table 4. The distribution of participants by BMI was as follows: normal weight 47.7%, underweight 21.0%, obese 18.5%, and overweight 12.8%.

Toothache was significantly higher in the obese group,

Table 3. Factors affecting body mass index

Variables	Estimate	SE	t	*p*
Gender(ref.: female)				
Male	1.918	0.048	40.244	<0.001
Academic performance (ref.: Low)				
High	-0.725	0.083	-9.083	<0.001
Upper-middle	-0.509	0.075	-6.770	<0.001
Middle	-0.294	0.076	-3.873	<0.001
Lower-middle	0.047	0.072	0.656	0.512
Economic status (ref.: Low)				
High	-0.487	0.155	-3.319	0.002
Upper-middle	-0.516	0.151	-3.410	0.001
Middle	-0.498	0.150	-3.321	0.001
Lower-middle	-0.232	0.157	-1.478	0.140
Fruit consumption (ref.: ≥5)				
No	0.419	0.063	6.655	<0.001
1-2	0.353	0.046	7.691	<0.001
3-4	0.182	0.046	3.924	<0.001
Carbonated beverages (ref.: ≥5)			3.672	
No	0.252	0.069	4.205	<0.001
1-2	0.286	0.068	3.415	<0.001
3-4	0.232	0.068		0.001
Sugar-sweetened drinks (ref.: ≥5)				
No	0.079	0.065	1.219	0.223
1-2	0.092	0.056	1.652	0.099
3-4	0.118	0.056	2.113	0.035
Fast food (ref.: ≥5)				
No	0.536	0.089	5.988	<0.001
1-2	0.436	0.084	5.190	<0.001
3-4	0.330	0.082	4.024	<0.001

BMI: body mass index, SE: standard error, ref.: reference

Table 4. Odds ratios for oral symptoms according to BMI

BMI	*n* (%)	Tooth fracture		Tooth sensitivity		Toothache		Gingival bleeding and swelling	
		OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Underweight	10988(21.0)	0.94	0.86-1.03	1.05	1.00-1.11	1.05	0.99-1.12	0.98	0.92-1.05
Nomal	24830(47.7)	1	Ref.	1	Ref.	1	Ref.	1	Ref.
Overweight	6663(12.8)	0.99	0.89-1.10	1.02	0.96-1.09	1.00	0.93-1.08	1.07*	0.99-1.15
Obese	9738(18.5)	0.98	0.90-1.07	1.01	0.96-1.07	1.09*	1.02-1.16	1.08*	1.01-1.16

Values are presented as odds ratio (95% confidence interval)
The data were analysed by complex sample multivariate logistics regression
* $p < 0.001$

with an odds ratio of 1.09 (95% CI: 1.02–1.16).

Gingival bleeding and swelling were significantly higher in both the overweight group, with an odds ratio of 1.07 (95% CI: 0.99–1.15), and the obese group, with an odds ratio of 1.08 (95% CI: 1.01–1.16).

4. Discussion

Adolescence is a period marked by significant changes. Health behaviors learned during this time have an important impact on health in adulthood, making it crucial to promote the establishment of proper health habits [15]. The dietary habits of adolescents influence their body mass index (BMI), and changes in BMI are closely related to oral health. Therefore, this study analyzed the relationship among dietary habits, BMI, and the experience of oral disease symptoms in Korean adolescents using data from the 17th (2021) Korea Youth Risk Behavior Survey (KYRBS).

Among all participants, tooth sensitivity was the most common oral symptom (30.6%), followed by toothache (21.2%), gingival bleeding and swelling (19.1%), and tooth fracture (8.7%). This finding is consistent with previous studies showing that dentin hypersensitivity is common among adolescents, possibly due to improper brushing techniques, frequent consumption of acidic beverages and snacks, and insufficient fluoride exposure [16–17]. Enamel erosion and gingival recession—often caused by aggressive toothbrushing or orthodontic treatment—can lead to exposure of dentin tubules, triggering hypersensitivity. Increased intake of carbonated drinks during the COVID-19 pandemic may have also contributed to these symptoms [18].Tooth fracture was more common in male students, while all other oral symptoms were more prevalent among female students. Overall, the prevalence of oral symptoms increased as academic performance and economic status decreased. These findings are similar to those of Lee and Lee [19], as well as Kim and Lee [20] and Lee et al. [21], which also found that female students experienced more oral symptoms than male students. It has been suggested that biological and sociostructural factors contribute to higher oral disease prevalence among females [22], along with their greater interest and sensitivity toward oral health.

In terms of academic performance, the present results were consistent with the findings of Lee and Lee [23], who reported that lower academic performance was associated with more oral health-related symptoms. Regarding economic status, previous studies have shown that lower socioeconomic status is associated with a higher likelihood of engaging in unfavorable oral health behaviors [24] and that positive oral health practices tend to be lower in lower socioeconomic groups [25]. These findings suggest the need for government-level support programs targeting students in socioeconomically disadvantaged environments to improve their oral health outcomes.

In the analysis of oral symptoms according to dietary habits and oral health behaviors, the experience of all symptoms increased significantly with higher consumption of carbonated beverages, sugar-sweetened beverages, and fast food. All oral symptoms were also significantly more prevalent among participants who brushed their teeth less frequently. Similarly, in a study by Kim and Lee [26], greater consumption of sweetened drinks and snacks was associated with more oral symptoms, and fewer daily toothbrushing sessions were linked to higher symptom prevalence. Toothbrushing is the most basic method of oral health care, and brushing at least twice a day is recommended [27]. The practice should be done accurately and effectively [28]. Based on these findings, the development and implementation of more active school-based oral health education programs for adolescents are necessary.

As for the factors affecting BMI, sex, academic performance, and economic status showed significant differences among general characteristics, and fruit, carbonated beverage, and fast food intake were significant among dietary habits. In a study by Jang and Jung [29], BMI was 0.251 higher in males than in females. Similar findings were reported in studies by Lee and Kim [30] on adolescents aged 13–18, and Li et al. [31], who investigated risk factors for dental caries-related obesity in Hong Kong adolescents, reporting a higher obesity rate in males (27.1%) than females (10.7%).

The present results also align with previous research [32] indicating that BMI is influenced by dietary habits, including fruit, sweetened drink, and fast food intake. In this study, the distribution of BMI was: normal weight 47.7%, underweight 21.0%, obese 18.5%, and overweight 12.8%. Compared to the findings of Jang and Jung [29], who reported normal 52.9%, obese 19.5%, overweight 14.1%, and underweight 13.5%, this study observed a higher proportion of underweight adolescents and a lower proportion of normal weight.

Choi et al. [33] also reported a continued increase in adolescent obesity during the first and second years of the COVID-19 pandemic, attributed to worsening dietary behaviors such as decreased physical activity, irregular breakfast consumption, and reduced fruit intake. International studies have similarly reported a relationship between physical inactivity and obesity [34].

When examining oral symptoms according to BMI (with normal weight as the reference group), toothache was significantly more common in the obese group, with an odds ratio of 1.09, and gingival bleeding and swelling were more prevalent in both the overweight group (OR: 1.07) and

the obese group (OR: 1.08). These associations may be explained not only by behavioral factors but also by physiological and pathological mechanisms. Obesity is characterized by chronic systemic inflammation, which can dysregulate immune responses and increase susceptibility to periodontal inflammation and pain. Adipose tissue secretes pro-inflammatory cytokines such as TNF-α and IL-6, which have been linked to periodontal tissue destruction. Additionally, insulin resistance and glucose metabolism disturbances may further aggravate gingival inflammation and increase vulnerability to oral infections [35,36].

Kim [37] also reported that experiences of tooth sensitivity, toothache, and gingival symptoms were higher in the overweight group and lowest in the underweight group. Specifically, the odds of toothache and gingival symptoms were 1.08 times higher in the overweight group than in the normal weight group. Park [38] similarly found that adolescents with obesity reported more subjective oral symptoms.

Kim and Lee [14] found that tooth sensitivity was significantly lower in the underweight group (OR: 0.95), while the experience of toothache and gingival symptoms was significantly higher in the overweight group (OR: 1.08). However, Park [39] reported contrasting findings, where the prevalence of tooth trauma, pain, and bleeding was higher in the non-obese group than in the obese group.

Based on the findings, it is necessary to develop and implement programs for appropriate weight management among adolescents. To enhance program effectiveness, it is important to move beyond fixed ideas about health behavior and apply personalized health management programs that reflect the unique dietary habits and oral health behaviors of different groups or individuals.

This study analyzed the relationships among dietary habits, BMI, and the experience of oral symptoms using data from the KYRBS. However, due to the cross-sectional nature of the data, it was not possible to establish clear causal relationships between variables. Additionally, variables not included in the original dataset could not be considered in the analysis. Therefore, caution is needed in generalizing the findings. Nonetheless, the data used in this study were nationally representative, and the results provide meaningful insights into the dietary habits, BMI, and oral disease symptoms of Korean adolescents.

5. Conclusions

This study aimed to examine the relationship among dietary habits, body mass index (BMI), and the experience of oral disease symptoms in Korean adolescents using data from the 17th (2021) Korea Youth Risk Behavior Survey (KYRBS), and the following conclusions were drawn.

Among all participants, tooth sensitivity was the most commonly reported symptom (30.6%), followed by toothache (21.2%), gingival bleeding and swelling (19.1%), and tooth fracture (8.7%). The experience of oral disease symptoms according to dietary habits and oral health behaviors significantly increased with the frequency of carbonated beverage, sugar-sweetened beverage, and fast food consumption, and was also significantly higher among those who brushed their teeth less frequently.

Factors influencing BMI included sex, academic performance, and economic status among general characteristics, and fruit intake, carbonated beverage intake, and fast food intake among dietary habits, all showing statistically significant differences.

When comparing oral symptom experiences by BMI with the normal weight group as the reference, toothache was significantly more common in the obese group (OR: 1.09), and gingival bleeding and swelling were more common in both the overweight group (OR: 1.07) and the obese group (OR: 1.08).

Therefore, it is necessary to develop and implement programs for appropriate weight management in adolescents. Alongside these efforts, concrete strategies to improve adolescents' dietary habits should also be established. Early recognition of the risks associated with poor dietary and oral health behaviors is crucial, as these behaviors can significantly contribute to the development of oral diseases. Accordingly, tailored educational programs that reflect the specific dietary patterns and oral hygiene practices of each group or individual should be implemented to effectively promote proper oral health management in adolescents.

Author Contribution

Conceptualization: Sunmi Lee; Data collection: Sunmi Lee; Formal analysis: Sunmi Lee; Writing-original draft: Hongmin Kwon ; Writing-review&editing: Sunmi Lee, Hongmin Kwon

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Conflicts of Interest

No author has any other conflict of interest to declare.

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