JTS

The Journal of Transdisciplinary Studies, 7(1): 103-116, 2023
https://doi.org/10.22685/JTS.2023.7.1.103

The Relationship Between Sedentary Behavior and Physical Activity Level, and Oral Health Factors for the Female Adolescent Students

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ARTICLE INFO

Article history:
Received 20 March 2023
Revised 09 April 2023
Accepted 10 April 2023

Keywords:
Adolescents,
Female Students,
Oral Health,
Physical Activity,
Sedentary Behavior

ABSTRACT

In this study, 26,447 female adolescent students were analyzed based on the raw data of the 17th Online Survey on Adolescent Health Behavior (2021) to determine as to whether the oral health related factors and physical activity levels affect sedentary behavior other than the learning purpose. As a result of the study, the group who did not practice sedentary behavior other than learning during the week had low academic performance (lower, 1.245 times) and, depending on their dietary behavior, as they had the experience of consuming instant foods such as soda (1.255 times) and fast food (1.264 times), the number turned out to be higher ($p<0.001$). As for the group that did not practice sedentary behavior other than study during the weekend, academic performance was 'medium' (1.101 times, $p<0.001$), stress (1.303 times, $p<0.001$), and fatigue recovery after bedtime were inadequate (1.154 times, $p<0.001$). 0.001) turned out to be higher in the group that did physical activity for more than 60 minutes (1.155 times, $p<0.01$). Considering the results of this study, there were no significant differences in the frequency of brushing and oral symptoms as oral health related factors for female students belonging to the non-practice group, yet it was found to be related to differences according to the dietary behavior and physical activity experience. Hence, it is determined that there is a need for a plan to increase the practice rate of sedentary behavior along with the usual health management of female students through correct dietary behavior and appropriate physical activities.

1. Introduction

Adolescence is a preparatory stage for adulthood, and it is a time when one's identity is established through learning and experience in a social environment. However, it is reported that the increase

in physical activity and sedentary behavior due to heavy school work has negative physical and mental effects (Lee, 2013; Son et al., 2022). Lifestyles and behaviors formed during the adolescence are difficult to correct easily, and hence, the education for proper health care is very important. The rate of physical activity of the Korean adolescents for 60 minutes a day, 5 days or more per week was 2010 (male 14.5%, female 4.9%), 2016 (male 18.8%, female 7.0%), and 2021 (male 20.7%, female 8.1%) in on the rise, yet the high-intensity muscle strengthening exercise for three or more days a week was observed in 2010 (male 30.5%, female 10.0%), 2016 (male 30.9%, female 9.8%), and 2021 (male 34.7%, female 9.5%), among female students was demonstrated to be decreasing (Korea Centers for Disease Control and Prevention, 2021).

Furthermore, the time spent sitting outside of study on weekdays due to sedentary behavior was 229.7 minutes in 2020 and 209.5 minutes in 2021, and the time spent sitting outside of study on weekends decreased from 324.7 minutes in 2020 to 316.0 minutes in 2021. However, less than 2 hours a day recommended by the Physical Activity Guidelines (Ministry of Health and Welfare, 2013) is very inadequate. The excessive sedentary behavior among adolescents leads to a lack of physical activity, which not only increases disease incidence and mortality, but also negatively affects mental processes such as stress and depression (Min & Jung, 2018; Han, 2019; Min, 2018). Furthermore, the longer the sedentary behavior, the more neglected brushing after lunch, which can cause oral diseases (Park, 2022).

Thus far, the studies on sedentary behavior, physical activity, and health have included sedentary behavior, age, physical activity, and body fat percentage (Lee, 2016), sedentary behavior and school physical activity and health (Min & Jung, 2018), and sedentary behavior and oral health (Park, 2022), physical activity, sedentary behavior, and dietary behavior (Cho, 2011) have been somewhat advanced, yet the studies comparing the relationship between oral health status and behavior and physical activity levels as health behaviors that affect sedentary behavior are very inadequate. Based on the results of previous studies, the rate of non-practice of sedentary behavior was higher in female students than in male students (Min, 2018), so a study targeting them is necessary.

Accordingly, in this study, using the 17th Online Survey on Adolescent Health Behavior (Korea Centers for Disease Control and Prevention, 2021) surveyed by the Korea Centers for Disease Control and Prevention, the oral health and physical activity of a group of non-practicing sedentary behaviors other than the learning purpose were targeted at female students. It was also conducted to provide the basic data for the expansion and reinforcement of educational programs targeting adolescents as well as the formation of correct sedentary behavioral habits for the promotion of health and oral health of the adolescents.

2. Research Subjects and Method

2.1 Research subjects

This study was conducted by modifying and supplementing the raw data of the 17th Youth Health Behavior Online Survey in 2021 (Korea Centers for Disease Control and Prevention, 2021) (Approval

No. 117058). Of the 54,848 middle and high school students who participated in the survey at 796 schools, 26,447 female students were the final subjects of the study.

2.2 Research tools

The subjects were classified into general characteristics, sedentary behavior, oral health related factors, and level of physical activity. The general characteristics were classified into a total of 10 questions, 7 of the characteristics of the research subject and 3 of the physical activity level. years), and degree of recovery from fatigue (last 7 days). Classes were reclassified as 'middle school' and 'high school', and academic grades were reclassified into 'high', 'middle', and 'low'. The degree of subjective health awareness was reclassified as 'healthy' or 'unhealthy', and body type was reclassified as 'thin', 'normal', or 'fat'. Stress perception was reclassified as 'yes' or 'no', suicidal ideation was reclassified as 'yes' or 'no', and the degree of fatigue recovery as sleep time was reclassified as 'adequate' or 'not enough'. The level of physical activity was reclassified as 'yes' or 'no' according to physical activity of 60 minutes or more per day, high-intensity physical activity (jogging, soccer, etc.), and muscle strengthening exercise (sit-ups, push-ups, etc.) for more than 60 minutes a day for the past 7 days.

Sedentary behavior was measured by the question of "How many hours did you spend sitting per day on average over the past 7 days?" The time spent sitting for purposes (including TV viewing, gaming, Internet, chatting, etc.) was divided into weekdays and weekends, and the data entered were calculated and converted into minutes. In this study, only the data for any purposes other than learning were used, and the criteria for the practice group and the non-practice group were based on the recommendation of the Physical Activity Guidelines (Ministry of Health and Welfare, 2013), which provides that "It is recommended to reduce leisure time spent sitting without moving to less than 2 hours." For reference, the practice group was less than 2 hours, and the non-practice group was more than 2 hours.

The oral health related factors consisted of a total of nine questions, and the frequency of brushing yesterday was reclassified as 'less than once', 'two to three times', and 'more than four times'. Sealant experience over the past year was 'yes' or 'no', and oral symptoms such as broken or broken teeth, pain when chewing, sore, throbbing pain, sore or bleeding gums, based on the past year's experience, 'yes' or 'no' was given. Carbonated drinks, sweet drinks (excluding carbonated drinks and energy drinks), and fast food intake were reclassified as 'yes' or 'no' as the dietary behavior.

2.3 Analytical method

As for the collected data, the multiple sample analytical method was used, and the IBM SPSS Statistics (ver. 20.0; IBM Corp., Armonk, NY, USA) program was used. A file designed with strata as the stratification variable, cluster as the cluster variable, and weight (w) as the weight variable was used.

The general characteristics, oral health related factors, sedentary behavior, and physical activity

level of the subjects were subjected to a complex sample cross-analysis (Chi-square test). Lastly, to analyze the factors related to the non-sedentary behavior group, a composite sample logistic regression analysis was conducted with general characteristics, oral health related factors, and physical activity levels as independent variables. The significance level was set to 0.05.

3. Research Results

3.1 Sedentary behavior according to general characteristics

Among 25,996 subjects of sedentary behavior other than learning during the week, 19.0% (5,051 persons) of the practice group and 81% (20,945 persons) of the non-practice group were found. Among the 25,947 subjects of sedentary behavior over the weekend, there were 19.0% (3,082 persons) of the active group and 88.0% (22,865 persons) of the non-practice group. During the week, 52.9% and 50.7% of the 'high school students' were 52.9% and 50.7% of the non-practice group and non-practice group, respectively ($p<0.05$). Their body type was 'normal' (42.0%, 40.2%), and their usual stress (84.7%, 86.4%) was high ($p<0.01$). During the last 7 days, the degree of recovery from fatigue was found to be inadequate (53.8%, 51.5%, $p<0.01$), and there was an experience of physical activity for more than 60 minutes (55.9%, 57.8%, $p<0.05$).

During the weekend, 52.9% of 'high school students' were in the practice group other than learning, and 51.7% of 'middle school students' in the non-practice group ($p<0.001$). The academic performance of the practice group and the non-practice group was 'medium' (51.7%, 54.9%), and the health status was recognized as 'healthy' (87.2%, 89.9%) ($p<0.001$). During the last 7 days, the degree of recovery from fatigue was found to be inadequate (55.2%, 51.5%), and it turned out that there was physical activity for more than 60 minutes (53.7%, 58.0%) and high-intensity physical activity (52.3%, 55.1%) ($p<0.001$) Table 1.

Table 1. Sedentary behavior according to general characteristics

Unit: N(%)

Characteristics	Division	Sedentary behavior weekday(N=25,996)		χ^2 (p*)	Sedentary behavior weekend(N=25,947)		χ^2 (p*)
		Practice (N=5,051)	Unpractice (N=20,945)		Practice (N=3,082)	Unpractice (N=22,865)	
School	High school	2,228(47.1)	9,596(49.3)	7.395 (0.035*)	1,529(52.9)	10,258(48.3)	23.577 (0.000***)
	Middle school	2,823(52.9)	11,349(50.7)		1,553(47.1)	12,607(51.7)	
Academic performance	High	2,189(43.3)	7,403(35.1)	120.229 (0.000***)	1,148(37.7)	8,438(36.6)	19.706 (0.000***)
	Middle	2,442(48.3)	11,659(56.0)		1,598(51.7)	12,476(54.9)	
	Low	420(8.3)	1,883(8.9)		336(10.6)	1,951(8.5)	
Health status	Healthy	4,513(89.3)	18,741(89.5)	0.185 (0.673)	2,697(87.2)	20,523(89.9)	20.828 (0.000***)
	Unhealthy	538(10.7)	2,204(10.5)		385(12.8)	2,342(10.1)	

Characteristics	Division	Sedentary behavior weekday(N=25,996)		χ^2 (p*)	Sedentary behavior weekend(N=25,947)		χ^2 (p*)
		Practice (N=5,051)	Unpractice (N=20,945)		Practice (N=3,082)	Unpractice (N=22,865)	
Body type	Dryness	1,077(21.3)	4,325(20.9)	8.594 (0.009**)	658(21.7)	4,737(20.9)	1.349 (0.519)
	Normal	2,093(42.0)	8,369(40.2)		1,240(40.6)	9,198(40.4)	
	Fat	1,881(36.7)	8,251(38.9)		1,184(37.7)	8,930(38.6)	
Stress	Yes	4,281(84.7)	18,096(86.4)	10.297 (0.003**)	2,584(83.8)	19,752(86.4)	15.864 (0.000***)
	No	770(15.3)	2,849(13.6)		498(16.2)	3,113(13.6)	
Suicide	Yes	795(15.1)	3,433(16.2)	3.864 (0.079)	543(16.6)	3,681(16.0)	0.711 (0.386)
	No	4,256(84.9)	17,512(83.8)		2,539(83.4)	19,184(84.0)	
Recovery from fatigue	Yes	2,376(46.2)	10,262(48.5)	8.592 (0.004**)	1,414(44.8)	11,200(48.5)	14.570 (0.000***)
	No	2,675(53.8)	10,683(51.5)		1,668(55.2)	11,665(51.5)	
Physical activity (≥60 minutes)	Yes	2,866(55.9)	12,341(57.8)	6.303 (0.012*)	1,678(53.4)	13,507(58.0)	22.399 (0.000***)
	No	2,185(44.1)	8,604(42.2)		1,404(46.6)	9,358(42.0)	
High-intensity physical activity (≥60 minutes)	Yes	2,834(54.8)	11,807(54.8)	0.002 (0.968)	1,643(52.3)	12,966(55.1)	8.629 (0.003**)
	No	2,217(45.2)	9,138(45.2)		1,439(47.7)	9,899(44.9)	
Muscle strengthening exercise	Yes	1,618(30.8)	6,649(30.9)	0.007 (0.934)	947(30.1)	7,303(31.0)	0.953 (0.329)
	No	3,433(69.2)	14,296(69.1)		2,135(69.9)	15,562(69.0)	

* by chi-square test, * p<0.05, ** p<0.01, *** p<0.001.

3.2 Sedentary behavior according to the oral health related factors

During the week, the number of times of tooth brushing the day before by the sedentary behavior group and non-practice group was '2 to 3 times' (84.2%, 84.4%) (p<0.01), respectively, and 'pain when chewing' (67.6%, 66.2%) was felt (p<0.05).

On weekdays and weekends, the sedentary behavior group consumed foods such as carbonated drinks (63.7%, 65.4%), sweet drinks (80.0%, 80.8%), and fast food (83.0%, 82.6%) according to the dietary behavior (p<0.001) (p<0.01). Dietary behaviors of the sedentary behavior practice group on weekdays and weekends were demonstrated to consume foods such as carbonated drinks (70.4%, 69.6%), sweet drinks (83.6%, 83.2%), and fast food (83.0%, 82.6%) (p<0.001) (p<0.01) Table 2.

Table 2. Sedentary behavior according to the oral health factors

Unit: N(%)

Characteristics	Division	Sedentary behavior weekday(N=25,996)		χ^2 (p*)	Sedentary behavior weekend(N=25,947)		χ^2 (p*)
		Practice (N=5,051)	Unpractice (N=20,945)		Practice (N=3,082)	Unpractice (N=22,865)	
Number of toothbrushes (Yesterday)	1≥	281(5.4)	1,379(6.4)	13.345 (0.003**)	202(6.1)	1,454(6.2)	1.822 (0.454)
	2~3	4,221(84.2)	17,646(84.4)		2,569(83.7)	19,246(84.4)	
	4≤	549(10.4)	1,920(9.2)		311(10.2)	2,165(9.4)	
Sealant	Yes	1,533(30.7)	6,394(30.9)	0.082 (0.771)	914(29.8)	7,000(31.0)	1.940 (0.182)
	No	3,518(69.3)	14,551(69.1)		2,168(70.2)	15,865(69.0)	
Tooth broken	Yes	4,658(92.5)	19,174(91.7)	2.937 (0.080)	243(7.6)	1,910(8.2)	1.383 (0.215)
	No	393(7.5)	1,771(8.3)		2,839(92.4)	20,955(91.8)	
Pain of chew	Yes	3,410(67.6)	13,856(66.2)	3.799 (0.046*)	1,016(33.0)	7,686(33.5)	0.362 (0.545)
	No	1,641(32.4)	7,089(33.8)		2,066(67.0)	15,179(66.5)	
Teeth hurt Throbbing pain	Yes	3,878(76.2)	15,747(75.0)	3.340 (0.067)	2,319(75.3)	17,286(75.3)	0.001 (0.974)
	No	1,173(23.8)	5,198(25.0)		763(24.7)	5,579(24.7)	
Gingiva pain or bleeding	Yes	3,965(78.5)	16,454(78.2)	0.336 (0.578)	2,403(77.9)	17,984(78.3)	0.221 (0.629)
	No	1,086(21.5)	4,491(21.8)		679(22.1)	4,881(21.7)	
Soda	Yes	3,265(63.7)	14,852(70.4)	84.266 (0.000***)	2,056(65.4)	16,019(69.6)	22.359 (0.000***)
	No	1,786(36.3)	6,093(29.6)		1,026(34.6)	6,846(30.4)	
Sweet food	Yes	4,056(80.0)	17,517(83.6)	36.910 (0.000***)	2,498(80.8)	19,037(83.2)	11.322 (0.001**)
	No	995(20.0)	3,428(16.4)		584(19.2)	3,828(16.8)	
Pass food	Yes	3,942(78.0)	17,363(83.0)	70.589 (0.000***)	2,426(78.3)	18,846(82.6)	34.154 (0.000***)
	No	1,109(22.0)	3,582(17.0)		656(21.7)	4,019(17.4)	

* by chi-square test, * p<0.05, ** p<0.01, *** p<0.001.

3.3 Level of physical activity according to general characteristics

As a result of analyzing the level of physical activity for the last 7 days according to general characteristics, 57.4% of 'middle school students' and 57.2% of 'high school students' did not practice physical activity for 60 minutes (p<0.001). The academic performance of the practice group and the non-practice group was 'medium' (54.3%, 54.9%) (p<0.001), and the subjective health status was 'healthy' (91.4%, 87.0%, p<0.001). They recognized their body type as 'normal' (40.8%,

40.0%, p<0.01). Fatigue recovery was found to be inadequate for the last 7 days (50.2%, 54.4%) (p<0.001).

59.3% of the high-intensity physical activity group were ‘middle school students’ and 58.7% of the non-practice group were ‘high school students’ (p<0.001). The academic performance of the practice group and the non-practice group was ‘medium’ (54.4%, 54.8%) (p<0.001), and their subjective health status was ‘healthy’ (91.7%, 86.9%, p<0.001), and their body type was It was recognized as ‘normal’ (40.9%, 39.3%, p<0.01). There was no suicidal ideation during the past year (83.2%, 84.7%, p<0.001). Fatigue recovery (50.2%) of the practice group was found to be adequate, while 54.7% of the non-practice group was found to be inadequate (p<0.001).

38.8% and 53.3% of ‘high school students’ in the group practiced and did not practice muscle strengthening exercise, each respectively (p<0.001). The health status was ‘healthy’ (92.6%, 88.2%, p<0.001), and their body type was recognized as ‘normal’ (42.1%, 39.7%, p<0.01). There was usual stress (85.2%, 86.7%, p<0.01), but no suicidal thoughts (82.7%, 84.4%, p<0.01). 51.5% of the practice group said the degree of recovery from fatigue was adequate, while 53.6% of the non-practice group said it was not adequate (p<0.001) Table 3.

Table 3. General characteristics according to physical activity level

Unit: N(%)

Characteristics	Division	Physical activity (N=26,447)		χ^2 (p*)	High-intensity physical activity (N=26,447)		χ^2 (p*)	Muscle streng exercise(N=26,447)		χ^2 (p*)
		Yes (N=15,475)	No (N=10,972)		Yes (N=14,907)	No (N=11,540)		Yes (N=8,413)	No (N=18,034)	
School	High school	6,138(42.6)	5,880(57.2)	331.479 (0.000***)	5,633(40.7)	6,385(58.7)	393.068 (0.000***)	2,998(38.8)	9,020(53.3)	179.685 (0.000***)
	Middle school	9,337(57.4)	5,092(42.8)		9,274(59.3)	5,155(41.3)		5,415(18.9)	9,014(32.3)	
Academic performance	High	5,901(37.9)	3,825(34.9)	30.402 (0.000***)	5,614(37.4)	4,112(35.6)	9.587 (0.000***)	3,145(37.3)	6,581(36.3)	1.311 (0.270)
	Middle	8,346(54.3)	6,014(54.9)		8,055(54.4)	6,305(54.8)		4,533(54.0)	9,827(54.8)	
	Low	1,228(7.8)	1,133(10.2)		1,238(4.5)	1,123(4.3)		735(8.7)	1,626(8.9)	
Health status	Healthy	14,104(91.4)	9,558(87.0)	117.275 (0.000***)	13,631(91.7)	10,031(86.9)	153.342 (0.000***)	7,771(92.6)	15,891(88.2)	144.745 (0.000***)
	Unhealthy	1,371(8.6)	1,414(13.0)		1,276(8.3)	1,509(13.1)		642(7.4)	2,143(11.8)	
Body type	Dryness	3,113(20.2)	2,382(22.1)	7.353 (0.001**)	2,893(19.6)	2,602(22.8)	21.184 (0.000***)	1,693(20.1)	3,802(21.4)	6.312 (0.002**)
	Normal	6,254(40.8)	4,383(40.0)		6,041(40.9)	4,596(39.9)		3,506(42.1)	7,131(39.7)	
	Fat	6,108(39.0)	4,207(37.8)		5,973(39.6)	4,342(37.2)		3,214(37.8)	7,101(38.8)	
Stress	Yes	13,303(86.0)	9,483(86.4)	0.743 (0.389)	12,808(85.9)	9,978(86.6)	2.565 (0.110)	7,177(85.2)	15,609(86.7)	9.871 (0.002**)
	No	2,172(14.0)	1,489(13.6)		2,099(14.1)	1,562(13.4)		1,236(14.8)	2,425(13.3)	
Suicide	Yes	2,600(16.4)	1,717(15.7)	2.198 (0.139)	2,534(16.8)	1,783(15.3)	13.099 (0.000***)	1,471(17.3)	2,846(15.6)	11.898 (0.001**)
	No	12,875(83.6)	9,255(84.3)		12,373(83.2)	9,757(84.7)		6,942(82.7)	15,188(84.4)	
Recovery from fatigue	Yes	7,783(49.8)	5,059(45.6)	43.269 (0.000***)	7,541(50.2)	5,301(45.3)	56.642 (0.000***)	4,353(51.5)	8,489(46.4)	64.168 (0.000***)
	No	7,692(50.2)	5,913(54.4)		7,366(49.8)	6,239(54.7)		4,060(48.5)	9,545(53.6)	

* by chi-square test, ** p<0.01, *** p<0.001.

3.4 Factors related to sedentary behavior other than weekday learning

As a result of the logistic regression analysis performed to examine and understand the factors related to the sedentary behavior non-practice group other than weekday learning, the 'low' academic performance was higher (1.245 times) than the 'high' ($p<0.001$), and depending on the dietary behavior, the non-compliance rate was significantly higher ($p<0.001$) Table 4 if and when there was an experience of consuming foods such as soda (1.255 times) and fast food (1.264 times) over the past 7 days.

Table 4. Factors related to sedentary behavior other than weekday learning

Characteristics		Sedentary behavior weekday(N=25,996)
		OR(95% Cl)
General characteristics	School/Middle school	
	High school	0.970(0.896-1.051)
	Academic performance/High	
	Middle	1.390(1.298-1.488)
	Low	1.245(1.111-1.395)***
	Body type/Dryness	
	Normal	0.960(0.886-1.039)
	Fat	1.026(0.947-1.112)
	Stress/No	
	Yes	1.106(1.007-1.214)
Factors related to oral health	Number of toothbrushes/1 ≥	
	2~3	0.862(0.741-1.003)
	4 ≤	0.795(0.659-0.959)
	Pain of chew/No	
	Yes	0.962(0.901-1.027)
	Soda/No	
	Yes	1.225(1.148-1.308)***
	Sweet food/No	
	Yes	1.150(1.061-1.248)
	Pass food/No	
	Yes	1.264(1.171-1.364)***
	Physical activity/Yes	
	No	1.105(1.039-1.176)

* by logistic regression analysis, Date are expressed as a OR(95% CI), *$p<0.001$

3.5 Factors related to sedentary behavior other than learning during weekends

As a result of the logistic regression analysis performed to examine and understand the factors related to sedentary behavior other than learning over the weekend, the logistic regression analysis was performed. As for the academic performance, 'medium' was 1.101 times higher than 'high' ($p<0.001$), stress was high (1.303 times, $p<0.001$), and fatigue recovery after sleep was insufficient (1.154 times, $p<0.001$). 0.001), and the non-practice rate was significantly higher in the group that did physical activity for more than 60 minutes (1.155 times, $p<0.01$). Depending on the dietary behavior, the more people who have consumed foods such as carbonated drinks (1.143 times, $p<0.01$), sweet drinks (1.121 times, $p<0.05$), and fast food (1.258 times, $p<0.001$) over the past 7 days, the non-practice rate was significantly high Table 5.

Table 5. Factors related to sedentary behavior other than weekend learning

Characteristics		Sedentary behavior weekend(N=25,996)
		OR(95% Cl)
General characteristics	School/Middle school	
	High school	1.188(1.089-1.296)
	Academic performance/High	
	Middle	1.101(1.008-1.203)***
	Low	0.850(0.739-0.978)
	Health status/Unhealthy	
	Healthy	1.246(1.105-1.404)
	Stress/No	
	Yes	1.303(1.177-1.443)***
	Recovery from fatigue/Yes	
		1.154(1.071-1.244)***
	Recovery from fatigue/No	
	Yes	1.155(1.061-1.257)**
	High-intensity physical activity/No	
	Yes	1.008(0.929-1.093)
	Soda/No	
	Yes	1.143(1.052-1.243)**
	Sweet food/No	
	Yes	1.121(1.014-1.239)*
	Pass food/No	
	Yes	1.258(1.140-1.388)***

* by logistic regression analysis, Date are expressed as a OR(95% CI), * $p<0.05$, ** $p<0.01$, *** $p<0.001$

4. Consideration

Based on the raw data of the 17th Online Survey on Adolescent Health Behavior in 2021, 26,447 middle and high school female students were surveyed to determine as to whether the oral health related factors and physical activity levels affect sedentary behavior other than the learning purpose.

According to the general characteristics of the research subjects, 19.0% of female students practiced less than 2 hours a day, which is the recommended standard for sedentary behavior, and 81.0% of the non-practice group. Middle school students' sedentary behavior on weekdays and weekends were 50.7% and 51.7%, respectively, higher than high school students. In Min's study (Min, 2018), as a result of investigating the time spent sitting for leisure activities other than study, it turned out that middle school students spent more time sitting than high school students at 159.4 minutes and 282.9 minutes on weekdays and weekends, each respectively. As adolescents spend their leisure time mainly on screen-based sedentary activities as their smartphone and computer usage time increases (Ra, 2014), the time for sedentary behavior guidelines not practiced is gradually increasing (Ministry of Health and Welfare, 2013). To increase the level of physical activity of female adolescents in Korea, the opportunities to participate in physical activities ought to be provided even within a limited time, and behavioral habits such as reduction of sedentary behavior ought to be formed and maintained through the preparation of various programs.

Sedentary behavior according to the oral health related factors was 2-3 times (84.4%) of the non-practice group's daily brushing, pain when chewing (66.2%), and dietary behaviors of the non-practice group during the week and non-practice on the weekend, and turned out to be the same food consumed as with carbonated drinks (70.4%). %), (69.6%), sweet drinks (83.6%), (83.2%), and fast food (83.0%), (82.6%). In the previous and dental study, the stress level was higher in the case of lower number of brushing per day, pain during chewing, aching and throbbing pain during the last year, and pain in the gums and inner cheek. It turned out that the students with a high level of stress perception experienced more oral disease symptoms, so active education ought to be conducted for students who perceive a lot of stress when managing oral health among adolescents (Chun & Lee, 2017). In a study of female adolescents by Min and Jung, the group who spent less than 2 hours sitting had a higher rate of responding that they did not drink soda or sweet drinks than the other groups, and the rate of responding that they drank more than once a day was less. The group with less sedentary behavior demonstrated the highest response rate that they did not consume fast food for a week, showing a significant difference (Min & Jung, 2018). It can be seen that female students who practice sedentary behavior guidelines maintain a healthy eating life compared to the female students who do not practice the sedentary behavior guidelines. Hence, while the frequency of brushing is important for dental caries and periodontal management, which can occur due to high consumption of carbonated beverages, sweet drinks, and fast food among female students in the sedentary non-practice group, applying the correct brushing method for dental plaque management, securing adequate brushing time and flossing, and it would be necessary to use oral hygiene products such as waterpik.

As a result of analyzing the level of physical activity, the high school students' non-practice physical activity group (57.2%), high-intensity physical activity non-practice group (58.7%), and

muscle strengthening exercise non-practice group (53.3%) turned out to be high. Their subjective health status was 87%, 86.9%, and 88.2%, respectively, and 54.4%, 54.7%, and 46.4% indicated that the degree of fatigue recovery was not adequate. In a previous study (Min & Jung, 2018), as a result of a study on subjective health perception status according to whether female adolescents followed sedentary behavior guidelines, female students who spent more than 4 hours a day sitting for purposes other than learning were healthier than female students who spent less than 2 hours a day turned out to be 0.73 times lower. Furthermore, the amount of activity and high-intensity physical activity are associated with positive effects on health related factors, including cardiorespiratory fitness, muscle strength, bone health, and cardiovascular health among adolescents, and are associated with obesity prevention, depression reduction, cognitive ability, and academic performance. It was also said that there is a positive effect on achievement improvement (WHO, 2020; Chaput et al., 2020; Lee et al., 2007). It is determined that the higher the physical activity practice, the more the sedentary behavior guideline is practiced during leisure time, the more it can have a positive effect on the perception of health status of female adolescent students.

As for the dietary behavior during the week, the higher the experience of consuming foods such as soda and fast food, the higher the failure rate was 1.255 and 1.264 times, respectively. As for the type of diet on the weekend, the higher the experience of consuming foods such as soda, sweet drinks, and fast food, the higher the non-practice rate was 1.143 times, 1.121 times, and 1.258 times, respectively. In Min's study, it was also demonstrated that the students who were sedentary for less than 2 hours did not consume carbonated drinks, sweet drinks, high caffeine, and fast food, and their eating habits were good (Min, 2018). Adolescence is a period when dietary habits are formed, and correct eating habits are very important, but the Korean adolescents have a high ability to skip breakfast, consume a lot of instant food, and consume less fruits and vegetables (Woo et al., 2016). Hence, multiple interventions to reduce sedentary behavior, recognize the importance of correct eating habits, and form regular eating habits to improve the health of female students in adolescence (Min, 2018), and dietary interventions that can replace food and protected foods are essential to maintain the healthy oral conditions and dental care for female students in the growing period.

The higher the stress and the more adequate degree of recovery from fatigue after going to bed, the higher the non-practice rate turned out to be 1.303 times, 1.154 times, and 1.155 times, each respectively, in the group that did physical activity for more than 60 minutes. In a previous study (Min & Jung, 2018), the probability of not feeling stress was 0.83 times lower for female students who had sedentary behavior for a long time, and the case of recognizing that sleeping time was adequate to recover from fatigue was 0.89 times lower. In particular, sedentary behavior is known to have a significant impact on the physical and mental health of adolescents (Teychenne et al., 2015). Furthermore, sedentary behavior and anxiety were associated with metabolically unhealthy states, and participation in sedentary behavior increased the risk of sleep disturbance and anxiety (Mommersteeg et al., 2012). Hence, it would be necessary to prepare specific measures to improve mental and physical health by actively encouraging physical activity of female adolescent students and limiting the time spent in sedentary behavior in leisure time.

This study analyzed sedentary behavior, physical activity, and oral health related factors of female

adolescents in Korea using the representative data. It is also meaningful in that it comprehensively analyzed the sedentary behavior patterns, physical activity, and health and oral health relationships of students. However, as a cross-sectional analysis study, the time of sedentary behavior depends on the memory of the research subjects, and the intensity and duration of physical activity are also subjective judgments, and hence, objectivity cannot be guaranteed, and the variables of oral health related factors stand as limitations. Hence, in the future, a longitudinal analysis study that complements such limitations and a study using the methods that can objectively measure sedentary behavior and physical activity are needed.

5. Conclusion

This study analyzed the raw data of the 17th Adolescent Health Behavior Online Survey (2021) to examine and understand the relationship between oral health related factors, physical activity levels, and sedentary behavior other than the learning purpose among 26,447 female adolescent students, whose results are as follows.

1) Of 25,996 subjects for sedentary behavior other than weekday learning, 19.0% (5,051 persons) of the practicing group and 81% (20,945 persons) of the non-practicing group were subject to sedentary behavior on weekends and the non-practice group was 88.0% (22,865 people).
2) As for the group who did not practice sedentary behavior other than weekday learning, the lower the academic performance (1.245 times), the higher the consumption of instant food such as carbonated drinks (1.255 times) and fast food (1.264 times) according to the dietary behavior ($p < 0.001$).
3) As for the group that did not practice sedentary behavior other than weekend learning, stress (1.303 times, $p<0.001$) and fatigue recovery after bedtime were inadequate (1.154 times, $p<0.001$), and the group that did physical activity for more than 60 minutes (1.155 times, $p<0.001$) <0.01), it was higher.

As a result of this study, there were no significant differences in terms of the number of tooth brushing and oral symptoms as the oral health related factors of female adolescent students belonging to the non-practice group, but it was found to be related to differences according to the dietary behavior and physical activity experience. Hence, it would be necessary to prepare specific measures to improve the mental and physical health by actively encouraging the correct dietary behavior and appropriate physical activity and limiting the time spent for the sedentary behavior.

Conflicts of Interest

The authors declare no conflict of interest.

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