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Research Article

The relationship between smartphone usage and eating behavior for elementary school students in Gangneung, South Korea: cross-sectional study

Minji Kim[1], **Meera Jang**[2,†]

[1]Master's Degree, Major in Nutrition Education, Graduate School of Education, Gangneung-Wonju National University, Gangneung, Korea
[2]Professor, Department of Food and Nutrition, Gangneung-Wonju National University, Gangneung, Korea

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†Corresponding author:
Meera Jang
Department of Food and Nutrition, Gangneung-Wonju National University, 7 Jukheon-gil, Gangneung 25457, Korea
Tel: +82-33-640-2334
Fax: +82-33-640-2330
Email: jmr@gwnu.ac.kr

Objectives: This study investigates the relationship between smartphone usage and eating behavior among elementary school students.
Methods: This survey was conducted on 4th- to 6th-grade students at elementary schools in Gangneung from September 6th to September 15th, 2023. Of the 129 copies of the questionnaire that were distributed to 5 schools, 66 copies (51.2%) were returned.
Results: Compared to the nationwide statistics, the smartphone ownership rate of elementary school students in Gangneung was lower, but the rate of smartphone overdependence was higher. Smartphone dependence was 21.12 points for study subjects and 26.00 points for the overdependence risk group (Org). Compared to national statistics, the self-control failure factor was higher, so study participants in Gangneung City are thought to have great difficulty with self-control. The Org's weekend smartphone use time of 7.54 hours was significantly more than the general user group (Gug)'s 4.06 hours. The number of days in which the Org consumed late-night snacks per week was 2.92 days, and the Gug had 2.15 days, but the difference was not significant. Eating fast food showed a positive correlation with eating sweet food, eating fatty food, and eating heavily seasoned food. It was found that frequent consumption of fast food is closely correlated with unhealthy eating behavior. Weekend smartphone use time showed a significant positive correlation with smartphone dependence and the number of days late-night snacks consumed per week.
Conclusions: Study participants in Gangneung are more dependent on smartphones than national statistics. Smartphone dependence had a negative correlation with healthy eating behavior and a correlation with average unhealthy eating behavior.

Keywords: smartphone; eating behavior; schools

INTRODUCTION

In 2022, the smartphone ownership rate of elementary school students nationwide was 93.9%, up from 24.1% in 2012 [1]. The smartphone is an intelligent terminal that adds several computer support functions to the mobile phone and is characterized by the user's ability to install an application desired by the user [2]. Because smartphones can be used immediately without time and space con-

straints, smartphones are preferred over the Internet [3]. Smartphone addiction causes maladjustment in school, home, and daily life. The maladjustment occurs because they are too immersed in the use of smartphones and cannot control themselves [4]. Overdependence has replaced addiction, a word that can give negative perceptions [5].

According to National Information Society Agency (NIA), overdependence on smartphones is a state in which the prominence of smartphones increases, and the self-control power decreases due to excessive use of smartphones, resulting in serious consequences. Among the three factors that cause dependence on smartphones, the first self-control failure is the user's poor ability to self-regulate smartphone use compared to their personal goals. Second, salience is when smartphone use becomes the most critical activity in an individual's life above anything else. Third, serious consequences are defined by continued smartphone use despite various negative consequences to the user because of smartphone use [6].

According to a survey conducted by the Ministry of Gender Equality and Family in 2021, 129,543, or 10.4% of 1.25 million adolescents, were overdependent on smartphones. The overdependence on the Internet and smartphones also increased in 2020 for both boys and girls in the fourth grade of elementary school [7]. In a 2022 survey by NIA, middle school students were the most at-risk group for smartphone overdependence: kindergarten (24.7%), elementary school students (33.6%), middle school students (44.5%), high school students (40.0%), and college students (34.1%) [6]. The excessive use and dependence of these smart devices has become a new social problem in the health and psychology of infants and adolescents who find it difficult to self-regulate [8].

In 2014, the access to dietary information through smartphones in high school students in Incheon increased compared to the past when using computers [9]. In 2018, middle school students in Seoul mainly used social network service and smartphone as mass media to obtain dietary nutrition information [10]. According to previous studies on the influence of the Internet and various media on eating habits of 4th- to 6th-grade elementary school students, the number of snacks consumed, preference for processed food snacks, and frequency of consumption were high in groups with more than two hours of television viewing in Gyeongsangnam-do in 2013 [11]. In 2014, elementary school students in Ansan showed a negative correlation between weekend smartphone usage time and good eating habits scores. As smartphone usage time increased, they tended to consume excessive snacks [12]. In 2016, the group who used smartphones for more than two hours in Cheongju had a higher frequency of eating ice cream, snacks, and soda compared to the group who used smartphones for less than two hours; furthermore, those who used a smartphone for less than two hours had generally desirable eating behavior [13].

In 2011, among middle school students in Gyeonggi-do, the Internet-using group reported that eating speed increased and snacks increased, and the higher the degree of Internet use, the more negatively affected dietary attitudes [14]. In 2014, among high school students in Incheon, male students had increasingly poor eating habits, reflected by lower scores on eating behavior, as the degree of addiction to smartphones was higher [9]. In 2018, high school students in the Gyeonggi area and Seoul had negative effects on their eating habits if they watched food content [15]. In 2022, young people in their 20s and 30s across the country primarily viewed social media on their smartphones, and the average daily social media usage time was longer in groups with high levels of food content use. When the level of food content use was high, some poor eating habits were higher [16]. These studies demonstrate that excessive use of the Internet or smartphones negatively affects snack and eating habits.

According to the Ministry of Education's elementary school student health test conducted in 2022, the rate of fast-food consumption more than once a week increased from 68.6% in 2019 to 77.8%, and the rate of beverage consumption more than once a week also increased from 80.9% in 2019 to 85.8%, increasing negative eating habits [17], indicating the need for improvement in dietary behavior [18]. The prevalence of obesity among elementary school students has also increased [17]. In a 2020 study of elementary school students in Busan, the overweight and obese groups had a higher intake of snacks with higher sugar content [19]. There-

fore, the eating habits of elementary school students in Korea are deteriorating, and the prevalence of obesity is also increasing.

An increase in the body mass index (BMI) in childhood can be an important predictor of obesity in adolescence and adulthood [20], hence it is necessary to form eating habits properly at a young age [21]. In middle and high school students, the higher the score of obesity-related eating attitude and the shorter the eating time, the higher the BMI [22]. The ratio of overweight and obesity combined (OOC) middle school students in Gangwon-do was 42.1% (male students 43.1%, female students 40.9%) [23], which was higher than the national rate of 32.8% (male students 37.3%, female students 27.6%), and the proportion of OOC female middle school students in Gangwon-do was especially high. However, the proportion of OOC elementary school students is 27.0% in Gangwon-do, which is lower than the national rate of 29.8% [17,23], so elementary school students in Gangwon-do must form proper eating habits in the process of growing into middle school students.

Therefore, we investigated whether the use of smartphones is related to eating behavior for 4th- to 6th-graders of elementary schools in Gangneung via survey.

METHODS

Ethics statement

The informed written consent was obtained from each participant. The study was approved by the Institutional Review Board of Gangneung-Wonju National University (approval number: GWNUIRB-2023-21).

1. Study subject and duration

In the Gangneung Office of Education data on April 1, 2023, the number of elementary school students in the 4th- to 6th grades in Gangneung was 4,832. As a result of calculating the number of study subjects with a power of 0.8 and a significance level of 0.05 using G*Power, the minimum number of samples was 84, and considering the 20% dropout rate, it was 100. 66 copies (51.2%) were returned after distributing 129 copies of the questionnaire for 10 days, from September 6th to September 15th, 2023, for students from the 4th- to 6th grades of five elementary schools in Gangneung.

2. Study content and methods

The questionnaire used in this study included the questions related to general characteristics, eating behaviors, snacks [11-13,24,25] and smartphone dependence [6] and it was revised and supplemented to suit elementary school students. The 'Youth, Adult, and Elderly (Self-report) Scale' among the 'Smartphone Overdependence Integrated Scale' developed by NIA [6] consists of 11 questions, consisting of 3 questions for self-control failure, 3 for salience, and 4 for serious consequences. It was measured on a Likert 4-point scale (strongly disagree: 1 point, disagree: 2 points, agree: 3 points, strongly agree: 4 points). Subjects with a score of 31 or more were divided into the high-risk group, subjects with scores of 23 to 30 were divided into the potential risk group, and subjects with a score of less than 23 were divided into the general user group (Gug) [6]. The questionnaire was completed by supplementing it after conducting a preliminary survey of elementary school students.

3. Statistical analysis

For statistical processing, IBM SPSS Statistics 28 (IBM Corp.) was used, and the significance level was based on $P < 0.05$. When the group size was small, with less than 30 people, the Shapiro-Wilk test was performed, and statistical analysis of the nonparametric method was performed because it was not a normal distribution. In the case of questions scored on a continuous variable and a scale, the mean and standard deviation were obtained, and the difference between the two groups was verified by the Mann-Whitney *U* test. For categorical variables, after the frequency and percentage were obtained, the difference in distribution was verified by Fisher's exact test. Pearson correlation analysis was performed to find out the relationship between eating behavior questions and smartphone-related variables.

RESULTS

1. Smartphone ownership and dependence

In Table 1, the smartphone ownership rate was 86.4% (57 students) of the study subjects, 84.6% (33 students) of male students, and 88.9% (24 students) of female students, and there was found to have no significant dif-

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Table 1. General characteristics of subjects according to smartphone ownership and smartphone dependence

Variable	Smartphone ownership				Smartphone dependence			
	Total	Yes	No	*P*-value[1)]	Total	Org	Gug	*P*-value[1)]
Total	66 (100)	57 (86.4)	9 (13.6)	-	57 (100)	24 (42.1)	33 (57.9)	-
Sex				0.727				0.596
Male	39 (100)	33 (84.6)	6 (15.4)		33 (100)	15 (45.5)	18 (54.5)	
Female	27 (100)	24 (88.9)	3 (11.1)		24 (100)	9 (37.5)	15 (62.5)	
Academic year				0.018				0.878
4th-grade	21 (100)	15 (71.4)	6 (28.6)		15 (100)	6 (40.0)	9 (60.0)	
5th-grade	14 (100)	12 (85.7)	2 (14.3)		12 (100)	6 (50.0)	6 (50.0)	
6th-grade	31 (100)	30 (96.8)	1 (3.2)		30 (100)	12 (40.0)	18 (60.0)	

n (%).
Org, overdependence risk group; Gug, general user group.
[1)]*P*-value was determined by Fisher's exact test.

ference according to gender ($P = 0.727$). The percentage of possession by grade was 71.4% (15 students) in the fourth grade, 85.7% (12 students) in the fifth grade, and 96.8% (30 students) in the sixth grade, which increased as the grade increased ($P = 0.018$). Among the subjects of the study, the high-risk group included one male and one female in the sixth grade, so the high-risk group and the potential risk group were combined and classified into the overdependence risk group (Org). The proportion of students in the Org was 42.1% (24 students); 45.5% male, and 37.5% female among the subjects of the study, and there was no significant difference in dependence on smartphones according to gender ($P = 0.596$). There was no significant difference in the proportion of the Org by grade ($P = 0.878$).

2. Comparison of factors of dependence on smartphone

In Table 2, the total score of smartphone dependence of the study subjects was 21.12 points. This was less than 23 points, the standard for classification of the general group. Among the factors of dependence on smartphones, the self-control failure factor was the highest at 2.49 points, the salience factor was 2.05 points, and the serious consequences factor was 1.87 points. The total score of smartphone dependence of the Org (26.00 points) was higher than that of the Gug, 17.58 points ($P < 0.001$). In Org, the self-control failure factor was the highest at 3.03 points, the salience factor was 2.67 points, and the serious consequences factor was 2.23 points, which were higher than the Gug ($P < 0.001$). The factor of self-control failure was the highest in both the Org and the Gug. Among the items on the smartphone dependence scale, the item with the highest score was that the Org always failed to reduce the smartphone use time, and for the Gug, it was difficult to limit to appropriate smartphone use time.

3. Smartphone usage time and eating behavior

In Table 3, the weekend smartphone use time of the study subjects was about 5.53 hours, and the 7.54 hours of the Org were significantly more than the 4.06 hours of the Gug ($P = 0.014$). The Gug used the most 1–4 hours at 69.7%, while the Org used the most 5–10 hours ($P = 0.043$).

In Table 4, the average healthy eating behavior of the study subjects was 2.35 points, and the average unhealthy eating behavior was 1.89 points. At 2.26 points, the average healthy eating behavior of the Org was lower than that of the Gug (2.42 points), but there was no significant difference. Among the questions for the healthy eating behavior survey, the Org regularly eats three meals a day (2.38 points), eats a variety of foods (2.21 points), and eats fruits and vegetables (2.29 points) were lower than those of the Gug, but there was no significant difference.

The average unhealthy eating behavior of the Org (2.02 points) was higher than that of the Gug (1.80 points), but there was no significant difference. In all four of the survey questions on unhealthy eating behavior, the Org was higher than that of the Gug, but the question that showed the significantly high in the Org was eating sweet food (2.33 points) ($P = 0.036$). The study subjects

Table 2. Analysis of smartphone dependence factors according to smartphone dependence

Factor	Total (n = 57)	Org (n = 24)	Gug (n = 33)	*P*-value[1)]
Self-control failure	2.49 ± 0.78	3.03 ± 0.49	2.10 ± 0.72	< 0.001
I always fail to reduce my smartphone use time	2.53 ± 0.93	3.13 ± 0.68	2.09 ± 0.84	< 0.001
I find it difficult to control my smartphone use time	2.49 ± 0.89	3.04 ± 0.75	2.09 ± 0.77	< 0.001
I find it difficult to limit myself to appropriate smartphone use time	2.46 ± 0.87	2.92 ± 0.78	2.12 ± 0.78	< 0.001
Salience	2.05 ± 0.75	2.67 ± 0.66	1.61 ± 0.43	< 0.001
It is hard to focus on other things if I have a smartphone next to you	2.14 ± 0.88	2.75 ± 0.85	1.70 ± 0.59	< 0.001
I am often thinking about my smartphone	2.02 ± 0.83	2.54 ± 0.88	1.64 ± 0.55	< 0.001
I strongly desire to use smartphone	2.00 ± 0.89	2.71 ± 0.75	1.48 ± 0.57	< 0.001
Serious consequences	1.87 ± 0.55	2.23 ± 0.48	1.61 ± 0.44	< 0.001
I have problems with my health because of smartphone use	1.75 ± 0.79	2.17 ± 0.82	1.45 ± 0.62	< 0.001
My smartphone use negatively affects my relationship with my family	1.95 ± 0.81	2.21 ± 0.83	1.76 ± 0.75	0.047
My smartphone use has led to severe conflicts with friends	1.84 ± 0.90	2.04 ± 0.81	1.70 ± 0.95	0.055
My smartphone use negatively affects my studying	1.95 ± 0.85	2.50 ± 0.83	1.55 ± 0.62	< 0.001
Total score	21.12 ± 5.38	26.00 ± 2.99	17.58 ± 3.66	< 0.001

Mean ± SD.
The responses were based on a 4-point Likert scale: 1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree.
Org, overdependence risk group; Gug, general user group.
[1)]*P*-value was determined by Mann-Whitney *U* test.

Table 3. Weekend smartphone use time for subjects

Variable	Total (n = 57)	Org (n = 24)	Gug (n = 33)	*P*-value
Smartphone use time (hour)				0.043[1)]
1–4	32 (56.1)	9 (37.5)	23 (69.7)	
5–10	19 (33.3)	11 (45.8)	8 (24.2)	
11–34	6 (10.5)	4 (16.7)	2 (6.1)	
Average use time (hour)	5.53 ± 5.55	7.54 ± 7.31	4.06 ± 3.18	0.014[2)]

n (%) or Mean ± SD.
Org, overdependence risk group; Gug, general user group.
[1)]*P*-value was determined by Fisher's exact test.
[2)]*P*-value was determined by Mann-Whitney *U* test.

consumed snacks for more than five days, about 5.35 days per week, and the Org was 5.75 days, compared to the Gug, which consumed stacks 5.06 days out of the week. There was no significant difference according to smartphone dependence ($P = 0.190$). The study subjects consumed about 2.47 days of late-night snacks a week; the Org was 2.92 days, and the Gug was 2.15 days, but the difference was not significant ($P = 0.220$).

4. Correlation between eating behavior and smartphone-related variables

Table 5 shows the results of the correlation analysis between eating behavior and smartphone-related variables. Eating fruits and vegetables showed a positive correlation with eating a variety of foods (r = 0.372, $P < 0.01$). Eating fast food showed positive correlation with eating sweet food (r = 0.415, $P < 0.01$), eating fatty food (r = 0.708, $P < 0.01$), eating heavily seasoned food (r = 0.314, $P < 0.05$). Eating fatty foods showed a positive correlation with eating sweet foods (r = 0.439, $P < 0.01$)

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Table 4. Mean value of eating behavior factors according to smartphone dependence

Variable	Total (n = 57)	Org (n = 24)	Gug (n = 33)	*P*-value
Healthy eating behavior				
I regularly eat 3 meals	2.54 ± 0.60	2.38 ± 0.71	2.67 ± 0.48	0.122
I eat a variety of foods	2.42 ± 0.63	2.21 ± 0.72	2.58 ± 0.50	0.052
I eat milk or dairy foods (cheese or yogurt)	2.11 ± 0.75	2.17 ± 0.82	2.06 ± 0.70	0.555
I eat fruits and vegetables	2.33 ± 0.69	2.29 ± 0.75	2.36 ± 0.65	0.790
Average	2.35 ± 0.42	2.26 ± 0.50	2.42 ± 0.36	0.369
Unhealthy eating behavior				
I eat fast-food (hamburgers, pizza, fried chicken)	1.60 ± 0.65	1.67 ± 0.70	1.55 ± 0.62	0.547
I eat sweet food (ice cream, soda, chocolate)	2.14 ± 0.61	2.33 ± 0.64	2.00 ± 0.56	0.036
I eat fatty foods (fried foods or pork belly)	1.70 ± 0.63	1.79 ± 0.66	1.64 ± 0.60	0.380
I eat heavily seasoned food (sweet or salty or spicy food)	2.12 ± 0.68	2.29 ± 0.69	2.00 ± 0.66	0.105
Average	1.89 ± 0.48	2.02 ± 0.51	1.80 ± 0.44	0.098
No. of days of snacks consumed per week	5.35 ± 1.80	5.75 ± 1.99	5.06 ± 1.62	0.190
No. of days of late-night snacks consumed per week	2.47 ± 1.81	2.92 ± 2.17	2.15 ± 1.46	0.220

Mean ± SD.
Scores represent as follows, 1 = 0–1 times per week, 2 = 2–4 times per week, 3 = more than 5 times per week.
Org, overdependence risk group; Gug, general user group.

and eating heavily seasoned foods (r = 0.296, $P < 0.05$).

When looking at the correlation between smartphone dependence and eating behavior factors, smartphone dependence showed a negative correlation with eating three meals regularly (r = –0.276, $P < 0.05$), eating a variety of foods (r = –0.398, $P < 0.01$), the average of healthy eating behavior (r = –0.350, $P < 0.01$). On the other hand, smartphone dependence showed a positive correlation with the average of unhealthy eating behavior (r = 0.310, $P < 0.05$), eating sweet food (r = 0.272, $P < 0.05$), and eating heavily seasoned food (r = 0.341, $P < 0.01$).

Weekend smartphone usage time showed a negative correlation with eating three meals regularly (r = –0.270, $P < 0.05$). Also, it showed a negative correlation with other healthy eating behavior questions, but it was not significant. Weekend smartphone usage time showed a positive correlation with eating fast food (r = 0.307, $P < 0.05$), eating fatty foods (r = 0.329, $P < 0.05$), eating heavily seasoned food (r = 0.397, $P < 0.01$), and the average of unhealthy eating behavior (r = 0.419, $P < 0.01$).

Weekend smartphone usage time showed a positive correlation with smartphone dependence (r = 0.275, $P < 0.05$) and the number of late-night snacks consumed per week (r = 0.333, $P < 0.05$), but no significant correlation with the number of snacks consumed per week.

The number of snacks consumed per week was not significantly correlated with the eating behavior variables, but the number of late-night snacks consumed per week showed a significant positive correlation with all unhealthy eating behavior variables.

DISCUSSION

This study investigated whether the use of smartphones is related to eating behavior in the 4th- to 6th-grade elementary students in Gangneung. The 86.4% smartphone ownership rate of the study subjects was lower than the 89.3% ownership rate for people aged 3–19 living in small and medium-sized cities in 2022 [6] and was also lower than the 93.9% of elementary school students nationwide in 2022 [1]. The smartphone ownership rates were 84.6% of the boys and 88.9% of the girls, and there was no significant difference according to gender, and the higher the grade, the higher the smartphone ownership rate. The proportion of students in the Org was 42.1% (24 students), which is higher than the 33.6% of elementary school students nationwide in 2022 [6]. In previous studies of elementary school students, the proportion of the risk group of overdependence continued to increase to 10.1% in Ansan in 2014 [12], 2.7% in Cheongju in 2016 [13], and 18.2% in Siheung and Ansan in 2017 [26]. Despite the lower smartphone ownership

Table 5. Correlation coefficient (r) between eating behavior and smartphone-related variables (n = 57)

Var	Reg	Vari	Milk	Fru	H-eat	Fast	Sweet	Fat	Spi	U-eat	Spd	Time	Snack	Nsnack
Reg	1	0.140	0.109	0.201	0.538**	-0.068	0.032	0.059	-0.122	-0.037	-0.276*	-0.270*	-0.035	-0.192
Vari		1	0.247	0.372**	0.682**	-0.058	-0.158	-0.038	0.044	-0.067	-0.398**	-0.122	-0.197	-0.179
Milk			1	0.138	0.630**	0.125	0.123	0.183	-0.096	0.108	-0.119	-0.134	-0.121	-0.037
Fru				1	0.679**	-0.053	-0.198	-0.069	0.177	0.005	-0.127	0.121	-0.096	-0.057
H-eat					1	-0.012	-0.073	0.116	0.003	0.012	-0.350**	-0.151	-0.153	-0.174
Fast						1	0.415**	0.708**	0.314*	0.818**	0.193	0.307*	0.016	0.377**
Sweet							1	0.439**	0.258	0.697**	0.272*	0.199	0.198	0.278*
Fat								1	0.296*	0.815**	0.107	0.329*	0.142	0.410**
Spi									1	0.645**	0.341**	0.397**	-0.123	0.370**
U-eat										1	0.310*	0.419**	0.072	0.484**
Spd											1	0.275*	0.237	0.151
Time												1	0.155	0.333*
Snack													1	0.381**
Nsnack														1

Pearson's correlation coefficient was used.

Var, variable; Reg, I regularly eat 3 meals; Vari, I eat a variety of foods; Milk, I eat milk or dairy foods (cheese or yogurt); Fru, I eat fruits and vegetables; H-eat, average healthy eating behavior; Fast, I eat fast foods (hamburgers; pizza; fried chicken); Sweet, I eat sweet food (ice cream; soda; chocolate); Fat, I eat fatty foods (fried foods or pork belly); Spi, I eat heavily seasoned food (sweet or salty or spicy food); U-eat, average unhealthy eating behavior; Spd, smartphone dependence; Time, weekend smartphone use time; Snack, number of days of snacks consumed per week; Nsnack, number of days of late-night snack consumed per week.

*$P < 0.05$, **$P < 0.01$.

rates for elementary school students in Gangenung, the proportion of the Org was higher.

In terms of smartphone dependence, 45.5% of boys and 37.5% of girls were at risk of overdependence, and there was no significant difference according to gender [12]. In the 2018 survey, male students in elementary school were more dependent on smartphones than female students [27]. In the 2022 survey, the rate of dependence on smartphones for kids between the ages of 10 and 19 was higher in girls than boys [6]. As such, previous studies showed differences in the rate of dependence on smartphones according to gender, but this study does not demonstrate a significant difference due to the small number of study subjects. Looking at the dependence on smartphones according to grade, the difference was not significant in the number of students in the Org.

Compared to the control failure (2.88 points), salience (2.75 points), and serious consequences (2.75 points) of the 2022 survey's the risk group of overdependence on elementary school students [6], the control failure factor (3.03 points) of the Org was higher and the salience factor (2.67 points) and serious consequences (2.23 points) were lower. So the Org in Gangneung are considered to have a great difficulty in the self-control failure. The study subjects' weekend smartphone use time was about 5.53 hours, the Org was 7.54 hours, and the Gug was 4.06 hours, which was more than the 3.86 hours for 4th-grade elementary school students nationwide reported in 2018 [27]. The use time of the Org was significantly higher than that of the Gug, and the Gug used 1–4 hours the most at 69.7%, while the Org used more than 5–10 hours the most at 45.8%.

The average healthy eating behavior of the study subjects was 2.35 points, and the average unhealthy eating behavior was 1.89 points. The average healthy eating behavior of the Org (2.26 points) was lower than the Gug (2.42 points), but the difference was not significant. The average unhealthy eating behavior (2.02 points) of the Org was higher than that (1.80 points) of the Gug, but the difference was not significant.

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According to previous studies on the eating habits of elementary school students, a 2006 study [28] showed that the longer the computer use time, the lower the eating habits score. In the 2014 study [12], the smartphone addiction group had lower scores on good eating habits than the general group and higher scores on bad eating habits. In the 2017 study [26], the food behavior score of the risk group of overdependence was lower than that of the general group. As such, in previous studies, the eating habits of the risk group of overdependence were not more desirable than those of the general group. The Org in this study tended to have fewer healthy eating behaviors and more unhealthy eating behaviors than the Gug, but the reason why there was no significant difference is considered to be due to the small number of study subjects. In this study, eating sweet food of the Org (2.33 points) was higher than that of the Gug (2.00 points). In the 2016 study of 5th- to 6th-grade elementary school students, the group who used the smartphone for more than 2 hours had a higher frequency of eating ice cream, snacks, and soda than the group who used it for less than 2 hours [13]. In a 2020 study of 4th- to 6th-grade elementary school students in Busan, the overweight and obese groups had a higher intake of snacks with higher sugar content than the normal weight group [19], so it is considered necessary to control the intake of snacks with high sugar content in the risk group of overdependence.

The number of days of snack consumed per week of the study subjects was about 5.35 days, the Org was 5.75 days, and the Gug was 5.06 days, and there was no significant difference, as they all were eating snacks more than five days of the week. In 2021, the percentage of elementary school students in Gyeonggi-do who ate snacks more than twice a day was the highest at 37.6% [25]. The number of days of late-night snacks consumed per week of the study subjects was 2.47 days, the Org was 2.92 days, and the Gug consumed late-night snacks 2.15 days, and there was no significant difference. In the 2021 Gyeonggi-do study of 4th- to 6th-grade elementary school students, 55.9% of them rarely eat late-night snacks during the week and 28.3% of them eat once or twice a week [25], so it is considered that elementary school students in Gangneung eat late-night snacks more often.

As a result of analyzing the subject's eating behavior, consumption of fast food had a positive correlation with eating fatty foods, sweet foods, and heavily seasoned foods, indicating that frequently eating fast food is closely related to unhealthy eating behavior. The number of days of snack consumed per week was not significantly related to the eating behavior variable, but in Kim & Kim's study [12], the number of snacks consumed was positively correlated with the bad eating habits score, resulting in different results. The number of days of late-night snacks consumed per week showed a significant positive correlation with all variables of unhealthy eating behavior, so it is considered that the number of days of late-night snacks consumed per week should be treated as an important factor when investigating eating behavior.

Smartphone dependence showed a negative correlation with the average healthy eating behaviors, eating three regular meals, and eating a variety of foods, as well as showed a positive correlation with the average unhealthy eating behavior, eating sweet food, and eating heavily seasoned food.

Weekend smartphone usage time showed a significant negative correlation with eating three regular meals, and a negative correlation with other healthy eating behavior questions was found but was not significant. In Kim & Kim's study [12], weekend smartphone usage time and good eating habits scores showed a negative correlation. And the group using smartphones for less than 2 hours had more desirable eating behavior than the group who used phones for more than 2 hours [13]. Weekend smartphone usage time was positively correlated with the average unhealthy eating behavior, eating fatty food, heavily seasoned food, and eating healthy. However, in Kim & Kim's study [12], weekend smartphone usage time was not significantly correlated with bad eating habits.

Weekend smartphone usage time showed a positive correlation with smartphone dependence and the number of days of late-night snacks consumed per week, but in both this study and Kim & Kim's study [12], weekend smartphone usage time was not significantly correlated with the number of days of snack consumption. This study recruited survey subjects through the convenience sampling method, and the number of respon-

dents is small, so it is difficult to generalize.

CONCLUSIONS

As a result of investigating the relationship between smartphone usage in elementary school students in Gangneung region, the percentage of smartphone ownership was lower than the nationwide statistics, but the rate of smartphone overdependence was higher. Smartphone dependence had a negative correlation with healthy eating behavior and a positive correlation with unhealthy eating behavior.

CONFLICT OF INTEREST

There are no financial or other issues that might lead to conflict of interest.

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DATA AVAILABILITY

The study participants did not give written consent for their data to be shared publicly, so supporting data is unavailable due to the research's sensitive nature.

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