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Association between Smartphone Use and High-Caffeine Drink among Adolescents

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Abstract

The purpose of this study was to investigate the association between smartphone use and consumption of high-caffeine drinks among adolescents. We studied with secondary data from 2022(18th) Korea Youth Risk Behavior (KYRBS). The respondents of this study were 51,850 participants. Data analysis was performed using IBM SPSS 25 ver. Descriptive statistics, chi-square analysis and complex sample logistic regression analysis. As a research result, participants reporting 3 times over of high-caffeine drink consumption showed 1.65 times higher of smartphone us(OR 1.65; 95% CI 1.220–2.243) and participants reporting 3 times and less of high-caffeine drink consumption showed 1.17 times higher smartphone use than '≤4 hours smartphone use. Our study results will be provided with basis information for the developing an intervention program to reduce smartphone usage time and high-caffeine drink consumption for adolescents high.

Keywords: *Smartphone, Usage, High-Caffeine Drink, Adolescents*

1. Introduction

Smartphone has already become a keyword often used in describing our society, and daily use of smartphones has become commonplace [1]. The use of smartphones for both daily life and academic purposes has increased rapidly, and the multi-functionality of smartphones has made them an essential information and communication tool in daily life [2]. Smartphone usage is rapidly increasing worldwide, and smartphones have become an important part of life, especially among adolescents who are at the forefront of technology and media use [3]. Adolescents are more vulnerable to the negative effects of smartphone use because they are less likely to adapt to new technologies and are less critical of them. The spread of the Internet and the development of various devices including smartphones have problems that can lead to addiction due to excessive Internet use [4]. Adolescents are also more sensitive to the influence of their environment and peers. Adolescents are more vulnerable to smartphone addiction than adults, which is like substance addiction and other types of behavioral addiction [5]. Some studies have suggested that excessive smartphone use among adolescents may be associated with a variety of health-related risk behavioral problems. Excessive smartphone use has negative

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effects on physical and mental health [6-8]. Excessive smartphone use has also been reported to be negatively associated with students' academic achievement [8]. High-caffeine drink contains a large amount of caffeine, which is a stimulant and a key ingredient that activates the body [9].

Therefore, it is consumed to increase energy, concentration, alertness and exercise performance. Adolescents consume high-caffeine drinks to reduce fatigue and improve concentration and activity when studying and exercising. In previous research, consumption of high-caffeine drinks appears to be related to health-related issues in adolescents [10-12]. It was reported that high school students who consume high caffeine drinks every day have mental health issue compare to non-drinker [13]. Some studies have reported associations with risk behaviors such as concurrent use of alcohol and drugs, smoking, sexual activity and violence [14]. As mentioned above, there are many studies on the relationship between excessive use of smartphones and health-related variables, also the relationship between high-caffeine drink and health-related variables. But there has been little research on the use of smartphones and high-caffeine drinks, which are consumed in large quantities by adolescents and are highly addictive. Therefore, this study aims to investigate the association between smartphone use and consumption of high-caffeine drinks among adolescents for providing proper smartphone usage and high-caffeine drink consumption guidelines. By educating adolescents about the relationship between smartphone usage time and caffeine intake, it will improve the physical, mental, and social health of adolescents.

2. Methods

2.1 Study Design

This study is a secondary data analysis study to investigate the association between smartphone use and consumption of high-caffeine drinks among adolescents. Data on the study participants were obtained from the 2022(18th) KYRBS, which was administered in 2022 by the Korean Ministry of Education, Science and Technology, the Ministry of Health and Welfare, and the Korea Centers for Disease Control and Prevention.

2.2 Data Collection

This study used raw data from the 2022(18th) KYRBS. KYRBS is an ongoing national cross-sectional survey that assesses health-risk behaviors among middle and high school students monitor progress toward achieving national health objectives and health plan of South Korea. Respondents of this study were 51,850 participants. Written informed consent was obtained from each participant prior to the survey. All the data used in this study were fully anonymized before access and were analyzed anonymously.

2.3 Measurements

The survey comprised 123 questionnaires assessing demographic characteristics and various areas of health-related behaviors and mental health. The data collected by the survey includes information on respondent’s demographic characteristics such as gender, school, academic achievement, household income, cohabitation type, father’s education level, mother’s education level. In health-related behaviors, high-intensity physical activity, high-caffeine drink, smartphone use, cigarette smoke and drinking were included. As an outcome variable, we analyzed the association between smartphone use and consumption of high-caffeine drinks. The variable of ‘smartphone use’ was determined the questions as n “Over the past 7 days, how many hours on average did you use your smartphone per weekday? Participants were divided into two groups according to the time spent on smartphone use: (1) 4 hours and less; (2) 4 hours or more. The variable of ‘high-caffeine

drink' was determined the questions as 'Over the past 7 days, how often have you drunk high-caffeine drink?' . The response categories was coded as 1 (None), 2 (≤3 time/day), 3 (>3 time/day).

2.4 Data Analysis

The complex sampling was used for analysis. Weighs, stratification variables and colony variables were used as factors for the analysis of complex samples in this study. Statistical analysis was performed using IBM SPSS ver.25 program. Complex sample chi-square analysis and logistic regression analysis were performed to analyze the factors.

3. Results

3.1 Characteristics of Respondents

The characteristics of respondents are shown in Table 1. Male is 51.6 % and female is 48.4 %. Respondents in middle school are 51.6 % and those of high school is 48.4 %. In area of academic achievement, 'upper' was the highest at 38.8 % followed by 'lower' 31.2 %, 'middle' 30.0 %. In area of household income, 'middle' was the highest at 46.0 % followed by 'upper' 43.3 %, 'lower' 10.7 %. In cohabitation type, 95.5 % of respondents were currently living with their family followed by 'other' 4.5 %. In parental education level, college or higher' is the most common, accounting for 60 % of fathers and 59.2 % of mothers, respectively.

In variable of high-intensity physical activity, 62.6 % of respondents answered less than 3 days/week and 37.4 % is '3 days/week and over'. In high-caffeine drink consumption per week, 'none' is the most at 51.3 % followed by 'less than three times' (26.4 %), 'three times and over' (22.3 %). In cigarettes smoking (in 30 days). 'None' is 51.3 % of respondents then '<10 days' (16.2 %) and '≥10 days' (34.7 %). In drinking (in 30 days), '1 bottle or less' is the highest at 45.9 % followed by '2-7 bottles' (26.7 %), '8 bottles or over' (30.0 %).

Table 1. Characteristics of respondents (N=51,850)

Variables	Categories	N (%)
Gender	Male	26,397(51.6)
	Female	25,453(48.4)
School	Middle	28,015(51.6)
	High	23,835(48.4)
Academic achievement	Lower	16,313(31.2)
	Middle	15,484(30.0)
	Upper	20,051(38.8)
Household income	Lower	5,816(10.7)
	Middle	24,143(46.0)
	Upper	21,888(43.3)
Cohabitation type	Family	49,182(95.5)
	Other	2,663(4.5)
Father's education level	Middle or lower	528(1.3)
	High	8,073(20.5)
	College or higher	23,599(60.0)
	Unknown	7,158(18.2)
Mother's education level	Middle or lower	458(1.1)

	High	9,134(22.9)
	College or higher	23,609(59.2)
	Unknown	6,674(16.7)
High-intensity physical activity (week)	<3days	32,235(62.6)
	≥3days	19,615(37.4)
High-caffeine drink (week)	None	26,876(51.3)
	<3 times	13,717(26.4)
	≥3 times	11,257(22.3)
Cigarettes smoking (in 30days)	None	2,301(49.1)
	<10 days	749(16.2)
	≥10 days	1,495(34.7)
Drinking amount (in 30days, based on beer)	1 bottle or less	3,058(45.9)
	2-7 bottles	1,785(26.7)
	8 bottles or over	1,836(27.4)

3.2 Differences of Smartphone Use by Respondent's Characteristics

The results are shown in Table 2. Smartphone use was statistically significant differences with gender (p<.001), school (p<.001), academic achievement (p<.001), household income (p<.001), father's education level (p<.001), mother's education level (p<.001), high-intensity physical activity (week) (p<.001), high-caffeine drink (week) (p<.001), cigarettes smoking (in 30days) (p<.001). But Cohabitation type and drinking amount (in 30days) were not statistically related to smartphone use in Adolescents. The specific results are as follows. Female (56.6 %) used more than male (43.4 %) in smartphone use over 4 hours during the weekdays. Middle school students (60.1 %) were more likely to use smartphones for less than 4 hours during the week, while high school students (49.3 %) were more likely to use smartphones for more than four hours during the week. When their usage was more than 4 hours per week, the academic achievement was relatively highest at 'low' (41.6 %). When their usage was 4 hours or less per week, the household income was relatively highest at 'upper' (48.2 %). Regardless of the time of smartphone use, most parents had a college degree. In case of high-intensity physical activity, students who exercised less than 3 days used more time for smartphones compared to those who did exercise '3 days and more'. And people who consume high-caffeine drink 3times or more per week use smartphone for more than 4 hours (24.6 4%) than for less than 4 hours (20.0 %). More than half of the respondents did not smoke. There was a positive relationship between smoking cigarettes and spending time on smartphones. For example, participants who smoked more than 10 cigarettes in a month showed that smartphone use for more than 4 hours (39.3 %) than using it for less than 4 hours (24.6 %).

Table 2. Differences of smartphone use by respondent's characteristics (N=51,850)

Variables	Categories	smartphone Use (weekdays)		F or x^2(p)
		≤4 hours	> 4 hours	
		N (%)	N (%)	
Gender	Male	15,758(57.0)	9,627(43.4)	914.346 (<.001)
	Female	12,117(43.0)	12,927(56.6)	
School	Middle	16,238 (60.1)	11,260(39.9)	451.041 (<.001
	High	11,637(50.7)	11,294(49.3)	
Academic achievement	Lower	6,580(23.2)	9,392(41.6)	1088.576

	Middle	8,309(29.8)	6,835(30.7)	(<.001)
	Upper	12,986(47.0)	6,326(27.7)	
Household income	Lower	2,487(8.4)	3,152(13.6)	355.535 (<.001)
	Middle	12,316(43.4)	11,353(50.2)	
	Upper	13,071(48.2)	8,048(36.2)	
Cohabitation type	Family	26,573(96.1)	21,552(96.2)	.276 (=.737)
	Other	1,299(3.9)	1,001(3.8)	
Father's education level	Middle or lower	205(0.9)	308(1.8)	164.921 (<.001)
	High	3,702(17.1)	4,283(25.1)	
	College or higher	14,183(65.7)	8,950(52.4)	
	Unknown	3,525(16.3)	3,528(20.7)	
Mother's education level	Middle or lower	174(0.8)	275(1.6)	162.028 (<.001)
	High	4,170(19.1)	4,853(27.9)	
	College or higher	14,188(65.0)	8,968(51.6)	
	Unknown	3,292(15.1)	3,282(18.9)	
High-intensity physical Activity (week)	<3days	16,691(60.5)	14,736(65.5)	136.965 (<.001)
	≥3days	11,184(39.5)	7,818(34.5)	
High-caffeine drink (week)	None	15,319(54.4)	10,955(48.0)	101.682 (<.001)
	≤3 times	7,175(25.6)	6,187(27.4)	
	>3 times	5,381(20.0)	5,412(24.6)	
Cigarettes smoking (in 30days)	None	932(59.4)	1,310(44.8)	47.657 (<.001)
	<10 days	245(16.0)	464(15.9)	
	≥10 days	357(24.6)	1,041(39.3)	
Drinking amount (in 30days, based on beer)	1 bottle or less	1,356(53.2)	1,655(43.0)	41.357 (=.114)
	2-7 bottles	640(25.6)	1,069(27.1)	
	8 bottles or over	533(21.2)	1,171(29.9)	

3.3 Logistic Regression Analyses of Smartphone Use and High-Caffeine Drink

Complex sample logistic regression analysis was performed after adjusting gender, school, academic achievement, household income, father's education level, mother's education level, high-intensity physical activity, cigarettes smoking, drinking. Table 3 shows that longer time on smartphone use was significantly associated with high-caffeine drink consumption in logistic regression analyses. In case of non-adjusting variables, participants reporting 3 times over of high-caffein drink consumption showed 1.40 times higher of '> 4 hours smartphone use' (OR 1.40; 95% CI 1.327–1.469) than '≤4 hours smartphone use' and participants reporting 3 times and less of high-caffein drink consumption showed 1.21 times higher of '> 4 hours smartphone use' (OR 1.21; 95% CI 1.161–1.268) than '≤4 hours smartphone use' (Model 1). But, after adjusting variables, Participants reporting 3 times over of high-caffein drink consumption showed 1.65 times higher of '> 4 hours smartphone use' (OR 1.65; 95% CI 1.220–2.243) than '≤4 hours smartphone use'. And participants reporting 3 times and less of high-caffein drink consumption showed 1.17 times higher of '> 4 hours smartphone use' (OR 1.17; 95% CI .825–.915) than '≤4 hours smartphone use' (Model 2).

Table 3. Logistic regression analyses of smartphone use and high-caffeine drink

Variables		Smartphone use (weekdays) (Ref. ≤4 hours)	
		Model 1[2)]	Model 2[3)]
		> 4 hours	> 4 hours
		OR[1)] (95% CI)	OR (95% CI)
High-caffeine drink (week) (Ref. None)	≤3 times	1.21 (1.161-1.268) ***	1.17 (.825-.915)*
	>3 times	1.40 (1.327-1.469) ***	1.65 (1.220-2.243)*

Logistic regression was done on the complex sample.
* .01≤p<.05, ** .001≤p< .01, *** p< .001
[1)] OR: adjusted odds ratio
[2)] Analyzed smartphone use and high-caffeine drink with non- adjust variables.
[3)] Analyzed smartphone use and high-caffeine drink after adjusting gender, school, academic achievement, household income, father's education level, mother's education level, high-intensity physical activity, Cigarettes smoking, drinking.

4. Discussion

This study was conducted to investigate the association between smartphone use and consumption of high-caffeine drinks among adolescents. Data was used from the 2022(18th) KYRBS. The statistically significant variables in chi-square analysis were gender, school, academic achievement, household income, father's education level, mother's education level, high-intensity physical activity(week), high-caffeine drink(week), cigarettes smoking. There was previous research that showed similar results to this study. These sturdy results showed that female used more than male in smartphone use. This is like the research results from the smartphone survey presented by the National Information Society Agency (2017), which showed that female adolescents (31.9%) were higher than male adolescents (28.8%) in smartphone use.

Academic performance and household economic level were found to affect the experience of smartphone use [15]. In case of academic achievement, participants with 'upper' tended to have more smartphone use in this sturdy. However, this result was the opposite of the previous study [3]. These results seem to be various situations where smartphone use reduces the time to focus on schoolwork or smartphone use is used for schoolwork. Therefore, further research is needed to segment and compare the purpose of use. In case of household income, participants with 'middle' tended to have more smartphone use in this sturdy. Also, household income tended to consume more 'high' caffeine drinks [16]. But economic conditions and smartphone usage time showed a negative correlation in previous research [17]. In the case of high economic status, there is a relatively high opportunity to participate in various extracurricular activities, whereas in the case of low economic status, there is a high possibility that they will tend to rely on smartphone media due to such activity restrictions. In case of high-intensity physical activity, students who exercised less than 3 days used more time for smartphones compared to those who did exercise '3 days and more'. This is like previous studies that vigorous physical activity related to smartphone addiction and duration [18].

Moreover, adolescents' sitting time increases annually. It has been reported that the longer the computer usage and TV viewing time at home, the less physical activity [19]. And people who consume high-caffeine drink 3times or more per week use smartphone for more than 4 hours (24.6 4%) than for less than 4 hours (20.0 %). People with high physical activity consumed more high-caffeine drinks. There are research results showing that consuming high-caffeine drinks has a positive effect on improving exercise performance [20]. Considering the positive correlation between smartphones and high-caffeine drinks, physical activity is an important parameter. Therefore, follow-up studies considering these three variables are necessary. Also, previous research showed significant differences in smoking, drinking, experience, and high-caffeine drink [14, 21]. There was a positive relationship between smoking cigarettes and spending time on smartphones in

this study. Participants who smoked more than 10 cigarettes in a month showed that smartphones are used more. Students who use smartphones a lot are reported to have a higher risk of smoking and drinking [14, 22].

In result of complex sample logistic regression analysis after adjusting the control variable, participants reporting 3 times over of high-caffeine drink consumption showed 1.65 times higher of '> 4 hours smartphone use' than '≤4 hours smartphone use'. Most previous studies have shown a positive correlation between smartphone use and high-caffeine drink [3, 15]. When smartphone usage time exceeded 2 hours, the frequency of high-caffeine drink increased by more than 2 times. Also, In an American study reported that the use of various screen devices include smartphone could increase the frequency of sugary beverage consumption [15].

Longer smartphone use can be interpreted as less communication with peers or family, and long periods of isolation. In this context, it appears to be related to adolescent problem behaviors such as excessive consumption of high-caffeine drink [23, 24]. Adolescents are exposed to the risk of health-risk behaviors and are more accustomed to using smartphones alone than talking to people. The negative effects of long-term smartphone use have already been reported in several studies. Smartphone use reduces face-to-face interpersonal skills and makes it easier to access high-caffeine drink, smoking and drinking. Therefore, it is urgent to provide continuous education and guidelines on the risk factors associated with long-term smartphone use. This study has several limitations. It does not reflect long-term changes due to a cross-sectional study. Considering the increasing rate of smartphone use among adolescents in recent years, effective strategies are needed to prevent high smartphone use-related adverse health related outcomes. There is a limit to the selection and adjustment of variables in secondary data analysis. So, it is necessary to conduct further research including more control variables for verification.

5. Conclusion

This study was conducted to investigate the association between smartphone use and consumption of high-caffeine drinks among adolescents using the 2022(18th) KYRBS. As a research result of chi-square analysis, the statistically significant variable was gender, school, academic achievement, household income, father's education level, mother's education level, high-intensity physical activity, cigarettes smoking, drinking. The results of the logistic analysis after adjusting control variables reported that participants reporting 3 times over of high-caffeine drink consumption showed 1.65 times higher than smartphone use and participants reporting 3 times and less of high-caffeine drink consumption showed 1.17 times higher smartphone use than '≤4 hours smartphone use. It is valuable that we confirmed a significant relationship between smartphone use and consumption if high-caffeine drink in a nationally representative sample of adolescents in Korea.

Based on the results of this study, the following suggestions for future research are made. Adolescents are an asset that will lead the future of the country. Therefore, it is necessary to prepare a policy alternative for healthy smartphone use and high-caffeine drink consumption the government level. Further research is needed to understand the impact of specific length of time using a smartphone on health-related problems to develop preventive approaches and to help strengthen current smartphone use guidelines.

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