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Mediating Effect of Smartphone Addiction Predisposition on the Relationship between Perceived Stress and Health-Promoting Lifestyle in University Students

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대학생의 지각된 스트레스와 건강증진 생활양식 간의 관계에서 스마트폰 중독성향의 매개효과

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Abstract The purpose of this convergence study was to examine whether smartphone addiction predisposition mediated the relationship between perceived stress and health-promoting lifestyle in university students. A total of 332 subjects, recruited from a university in Seoul, participated by completing a survey which included questions about perceived stress, health-promoting lifestyle and smartphone addiction predisposition. As are result of the analysis, perceived stress had a significant positive effect on smartphone addiction predisposition. Perceived stress and smartphone addiction predisposition had significant negative effect on health-promoting lifestyle. Therefore, smartphone addiction predisposition had a mediating effect within the relationship of perceived stress and health-promoting lifestyle. Based on these results, we discussed the necessity of managing the stress and smartphone addiction to improve the health-promoting lifestyle of university students.

Key Words : Stress, Smartphone, Addictive behavior, Health-promoting lifestyle, Convergence study

요 약 본 융합연구의 목적은 대학생의 지각된 스트레스와 건강증진 생활양식 간의 관계에서 스마트폰 중독성향의 매개효과를 검증하고자 수행하였다. 서울에 소재한 S대학에서 332명의 재학생이 지각된 스트레스, 건강증진 생활양식 및 스마트폰 중독성향에 관한 질문을 포함한 설문조사에 참여하였다. 연구결과, 대학생의 지각된 스트레스는 스마트폰 중독성향에 유의한 정적 영향을 미쳤고, 지각된 스트레스와 스마트폰 중독은 건강증진 생활양식에 유의한 부적 영향을 미쳤다. 또한, 지각된 스트레스와 건강증진 생활양식 간의 관계에서 스마트폰 중독성향의 매개효과가 유의한 것으로 나타났다. 이와 같은 결과를 토대로 대학생의 건강증진 생활양식을 향상시키기 위해 스트레스 및 스마트폰 중독을 관리할 필요성을 논의하였다.

주제어 : 스트레스, 스마트폰, 중독행위, 건강증진 생활양식, 융합연구

1. Introduction

Smartphone use provides many benefits of both usefulness, convenience, and easy accessibility for voice communication and information management[1]. Use of smartphones has exploded in South Korea in recent years, and the country now has the world's highest rate of smartphone ownership, with about 89%

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of adults owning a smartphone[2]. Therefore, using smartphone in everyday life has become a common phenomenon.

However, overusing the product in such a fashion is the main reason people are becoming addicted to smartphone use. In Korea, the predisposition to smartphone addiction increased slightly in 2016 (2.5%) as compared with the previous year (2.1%); however, the rate of adults the high-risk group of smartphone addiction increased rapidly from 2.2% to 13.6%[3]. In particular, adults who were in their 20s, exhibited higher rates of smartphone addiction predisposition when compared with the other adult groups, high-risk group and possible-risk group exhibited 3.3% and 19.0%, respectively[3]. High-risk group represent all of the characteristics and possible-risk group exhibit one or two characteristics: salientness, out of control, and serious consequences of smartphone[3]. Therefore, the excessive use of smartphone may be lead to smartphone addiction among university students.

Until now, it was shown that smartphone addiction predisposition was related to age, sex, stress, depression, anxiety, attachment, low self-esteem, and an unhealthy lifestyle such as smoking, alcohol consumption, physical inactivity, and poor sleep habits[4,5]. Furthermore, using smartphones might relieve their stress about their unpredictable future and interpersonal conflicts[6]. For university students, depression was the highest predictor of other risk factors for addiction, yielding a significantly positive correlation with smartphone addiction[7,8]. Previous studies found that smartphone dependence is associated with unhealthy lifestyle factors[7,9].

Stress in university students is known to be related to smartphone addiction. Korean university students experience stronger stress than ever before due to their choice of career path after graduation, fierce competition due to job hunting, and adaptation to changes in the living environment[10]. Previous studies reported that, as the perceived stress of university students increased, their predisposition to smartphone addiction increased[6,11,12].

In addition, university students' stress is related to a health-promoting lifestyle. According to previous research, the stress of university students has a negative effect on their physical health by decreasing the practice of healthy behavior[13]. Additionally, the inadequate lifestyle of university students has been found to increase depression, anxiety, and stress symptoms[14]. There are differences in cause and effect according to the research; however, as stress increases, healthy behavior decreases. Thus, stress and a health-promoting lifestyle are closely related.

Pender mentions the importance of lifestyle because addictive behaviors, such as smoking, drinking, and drugs, threaten one's health[15]. Lifestyle refers to the habits or behaviors of an individual regarding the way to live[15]. The formation of an ideal health-promoting lifestyle during adolescence is very important for maintaining a healthy lifestyle throughout the lifetime[16]. However, previous studies reported that current university students are practicing inappropriate lifestyle habits such as drinking, smoking, irregular eating and sleeping, and lack of exercise[9,17,18]. The health-promoting lifestyle of university students is influenced by former health- related behaviors, self-efficacy, emotions related to behaviors, social support, stress, and establishment of an action plan[19]. Therefore, it is necessary to pay attention to the factors influencing a health-promoting lifestyle to enable university students to form a healthy lifestyle in an independent and competitive social atmosphere.

Earlier studies have found that the health-promoting lifestyle of university students and smartphone addiction are correlated. Using smartphones has been changed routines, habits, social behaviors, family relationships and social interactions[20]. The constant checking and use of smartphone applications throughout the day has been linked to sleep disturbances, stress, anxiety, withdrawal, poor well-being, decreased academic performance, and reduced physical activity[17,20]. Therefore, it is

important to widen the understanding of the potential impact that these devices may have on users' health.

The relationship between stress in university students, predisposition to smartphone addiction, and a health-promoting lifestyle, based on previous studies, can be summarized. As the stress in university students increases, so does their predisposition to smartphone addiction[6,11]. Further, higher stress has been found to reduce the practice of a health-promoting lifestyle[13]. Additionally, predisposition to smartphone addiction has been found to increase the tendency to lead an unhealthy lifestyle[20]. University students' lifestyle is the most important factor in promoting their physical and mental health. In recent years, interest in smartphone addiction has been increasing worldwide, and it is necessary to examine the impact of smartphone addiction on the health-promoting lifestyle of university students. The purpose of this study was to investigate the relationship between perceived stress and a health-promoting lifestyle among university students and to analyze the mediating effect of a predisposition to smartphone addiction.

2. Methods

2.1. Research design

This study used a convenience sample with a descriptive cross sectional survey design.

2.2. Participations

Participants were undergraduate students recruited from a university in Seoul. The inclusion criteria were participants who (1) were aged 18 years or older, (2) used a smartphone, and (3) were able to understand the study and agreed to take part.

To determine the appropriate sample size for this study, a power analysis was performed using the computer program G power, version 3.1. Based on an alpha of 0.05, a power level of 0.95, and 10 predictors, the calculation showed that 172 participants were required for a moderate effect size (0.15) to be detected. Taking into consideration the possibility of a low participation rate and disqualifications, the study was conducted with 350 undergraduate students. A total of 332 participants were selected after omitting 18 respondents with missing data.

2.3 Data collection and ethical considerations

The data were collected from 10 September to 30 November 2016. Undergraduate students who use smartphones were recruited from a university and eight trained research assistants collected data through face-to-face interviews. Participants completed the questionnaire at a restaurant and classroom on campus. The questionnaire took 10 to 15 minutes to complete.

This study was approved by the institutional research board of SY University in Seoul (IRB: 2-1040781-AB-N-01-2016033HR). The research assistants provided the verbal information including purpose of study, participants' autonomy, and confidentiality to all participants.

2.4 Measures

2.4.1 Perceived Stress Scale-10

The Perceived Stress Scale-10 (PSS-10) was used to measure perceived stress in undergraduate students[21]. The validated Korean version of the PSS-10 was used[22]. PSS-10 is a self-report measure of global perceived stress and consists of 10 items rated on a 0-4-point scale with 0 = never, 1= almost never, 2 = sometimes, 3 = fairly often, and 4 = to very often. Total score of 0-40 is calculated by reverse scoring the four positively framed questions (Items 4, 5, 7, and 8) and then computing the sum of all of the items in the scale. Higher scores indicate higher perceived stress. Cronbach's α coefficient was .94 in Cohen study[21] and .81 in this study.

2.4.2 Health-Promoting Lifestyle Profile

The health-promoting lifestyle profile was assessed

using the Adolescent Lifestyle Profile (ALP)[23]. The ALP was modeled after the Health-Promoting Lifestyle Profile Ⅱ (HPLP Ⅱ) and tested on a sample of early adolescents[23]. This instrument was obtained with permission from the original author and adapted to the Korean language through a translation-back translation process. The scale consists of 44 items in seven subscales: health responsibility (7 items), physical activity (6 items), nutrition (7 items), positive life perspective (6 items), interpersonal relations (6 items), stress management (6 items) and spiritual health (6 items). The instrument uses a 4-point scale response format to obtain data regarding the frequency of reported behaviors (1 = never, 2 = sometimes, 3 = often, and 4 = always). Total scores range from 44 to 176 and higher scores indicate a higher frequency of health-promoting lifestyle behaviors. Cronbach's α coefficient was .92 in Hendricks et al. study[23] and .87 in this study.

2.4.3 Smartphone Addiction Scale

The Smartphone Addiction Scale (S-scale) was used to measure smartphone addiction predisposition in undergraduate students was tested for validity and reliability[24]. This scale consists of 15 items in four subscales: disturbance of adaptive function (5 items), virtual life orientation (2 items), withdrawal (4 items), and tolerance (4 items). The scale uses a 4-point scale ranging from 1 = never to 5 = always. The total scores range from 15 to 60, and higher scores indicate a higher addiction predisposition. Cronbach's α coefficient was .88 in the National Information Society Agency study[24] and .91 in this study.

2.5 Statistical analysis

Data analysis was conducted using SPSS for Windows Version 22.0 (SPSS, Inc., Chicago). Descriptive statistics were used to summarize all the variables. T-test, ANOVA and Scheffé's post hoc test were used to compare the perceived stress, health-promoting lifestyle and smartphone addiction predisposition. Pearson's correlation coefficients were performed to identify the relationship between the perceived stress, health-promoting lifestyle and smartphone addiction predisposition. Hierarchical linear regression analysis was used to identify the predictors of smartphone addiction predisposition by sequentially adding blocks of related variables to a model. The mediate effect test was performed through the bootstrap method to obtain confidence intervals (CIs) based on 10,000 resamples[25].

3. Results

3.1 General characteristics of the subject

General characteristics were summarized in Table 1. The total number of participants was 332, of whom 183 (55.1%) were female students. The average age was 21.37 (±1.85) years, and 174 (52.4%) were in the 21-23 age group. There were 142 (42.8%) third year students, 96 (28.9%) fourth year, 50 (15.1%) second year, and 44 (13.3%) were in their first year. By department, 142 (42.8%) were in Humanity, 78 (23.5%) were in Art, and 76 (22.9%) were Nature.

Differences in major research variables according to general characteristics are as follows (Table 1). The difference between perceived stress and gender was significant (t=-4.72, p<.001), the perceived stress score of female students was higher than male students. Smartphone addiction predisposition was significantly different on gender (t=-4.31, p<.001) and age group (F=6.12, p=.002). Female students showed a higher level of smartphone addiction predisposition than male students and Scheffé's post hoc test results showed that groups younger than 20 years old were significantly higher than those older than 24 years. Health-promoting lifestyle was significantly different between males and females (t=4.88, p<.001), with male students scoring high on the health-promoting lifestyle score than female students.

Table 1. Difference of Perceived Stress, Smartphone Addiction Predisposition, and Health-Promoting Lifestyle according to General Characteristics (N=332)

Characteristics	Categories	n(%)	M±SD	PS		SAP		HPL	
				M±SD	t/F(p)	M±SD	t/F(p)	M±SD	t/F(p)
Age	≤20[a]	115(34.6)	21.37±1.85	28.50±5.30	1.59(.204)	35.50±7.87	6.12(.002)	105.12±15.03	0.49(.615)
	21~23[b]	174(52.4)		28.29±5.85		30.56±7.81	a>c	105.99±16.36	
	≥24[c]	43(13.0)		26.74±5.72		30.56±7.81		107.93±16.71	
Gender	Male	149(44.9)		26.58±5.78	-4.72(<.001)	32.37±8.05	-4.31(<.001)	110.52±16.41	4.88(<.001)
	Female	183(55.1)		29.44±5.23		36.15±7.88		102.21±14.56	
Grade	1	44(13.3)		26.86±5.42	1.04(.374)	33.07±7.60	1.34(.263)	107.32±16.92	0.87(.457)
	2	50(15.1)		28.72±4.93		35.50±8.55		107.60±14.31	
	3	142(42.8)		28.42±6.10		35.09±8.18		104.33±15.59	
	4	96(28.9)		28.07±5.42		33.60±8.15		106.82±16.79	
Department category	Humanity	142(42.8)		27.66±5.17	1.54(.204)	34.72±8.33	2.32(.075)	108.51±16.40	2.25(.082)
	Nature	76(22.9)		27.82±5.62		35.51±7.17		104.11±15.52	
	Art	78(23.5)		28.72±6.22		34.41±8.57		103.50±14.52	
	No answer	36(10.8)		29.64±6.18		31.28±8.13		104.94±17.01	
PS			18.17±5.64						
SAP			34.45±8.17						
HPL			105.94±15.94						

PS=Perceived Stress; SAP=Smartphone Addiction Predisposition; HPL=Health-Promoting Lifestyle.

3.2 Mean Score and Correlation of Perceived Stress, Smartphone Addiction Predisposition and Health-Promoting Lifestyle

The mean of the major research variables was examined (Table 2). The average perceived stress was 18.17 points (±5.64) and the health-promoting lifestyle was 105.94 points (±15.94). The average smartphone addiction predisposition was 34.45 points (±8.17).

The correlation of perceived stress, smartphone addiction predisposition and health-promoting lifestyle were analyzed (Table 2). Perceived stress showed a significant negative correlation with health-promoting lifestyle (r=-.34, p<.001), and a significant positive correlation with smartphone addiction predisposition (r=.36, p<.001). Smartphone addiction predisposition showed a significant negative correlation with health-promoting lifestyle (r=-.27, p<.001).

Table 2. Mean Score and Correlation of Perceived Stress, Smartphone Addiction Predisposition, and Health-Promoting Lifestyle (N=332)

Variables	PS	SAP
	r(p)	r(p)
SAP	0.36(<.001)	
HPL	-0.34(<.001)	-0.27(<.001)

PS=Perceived Stress; SAP=Smartphone Addiction Predisposition; HPL=Health-Promoting Lifestyle.

3.3 Mediating Effect of Smartphone Addiction Predisposition between Perceived Stress and Health-Promoting Lifestyle

The procedure recommended by Baron and Kenny[26] was used to verify the mediating effect of smartphone addiction predisposition on the relationship between perceived stress and health-promoting lifestyle. Among the general characteristics, gender and age were controlled because they showed a significant difference in smartphone addiction. Next, the mediating effect was verified (Table 3). In the first step, the independent variable (perceived stress) had a significant effect on the mediator variable (smartphone addiction predisposition)(β=.34, p<.001). In the second step, the independent variable (perceived stress) had a significant effect on the dependent variable (health-promoting lifestyle)(β=-.30, p<.001). In the third step, the mediator variable (smartphone addiction predisposition) had a significant effect on the dependent variable (health-promoting lifestyle)(β=-.14, p=.011), while the independent variable (perceived stress) also had a significant effect on the dependent variable (health-promoting lifestyle)(β=-.25, p<.001). The regression coefficient (B=-.71) of the three steps, showing the effect of the independent variables on the dependent variable, was less than the step-two

Table 3. Mediating Effect of Smartphone Addiction Predisposition in the Relationship between Perceived Stress and Health-Promoting Lifestyle (N=332)

Step	Variables	B(SE)	β	t	*p*	F(*p*)	Adjusted R^2
1	PS → SAP	0.49(0.75)	0.34	6.56	<.001	22.54***	0.163
2	PS → HPL	−0.84(0.15)	−0.30	−5.68	<.001	19.44***	0.143
3	SAP → HPL	−0.27(0.11)	−0.14	−2.54	.011	16.44***	0.157
	PS → HPL	−0.71(0.16)	−0.25	−4.52	<.001		

PS=Perceived Stress; SAP=Smartphone Addiction Predisposition; HPL=Health-Promoting Lifestyle.
Note. Gender and Age Controlled. ***p<.001.

regression coefficient (B=−.84). Therefore, it was confirmed that smartphone addiction predisposition had a partial mediating effect on the influence of perceived stress on health-promoting lifestyle. Perceived stress and smartphone addiction predisposition accounted for 15.7% of the variance in health-promoting lifestyle.

The total effect of perceived stress on health-promoting lifestyle was 0.84, and the direct effect was 0.71. The indirect effect through smartphone addiction predisposition was 0.13. The significance of the indirect effect through smartphone addiction predisposition by the bootstrap method was statistically significant because the 95% confidence interval did not include 0 (lower limit value .018, upper limit value .131). Therefore, it was confirmed that perceived stress has a direct effect on health-promoting lifestyle, and smartphone addiction predisposition acts as a mediator in the relationship between perceived stress and health-promoting lifestyle.

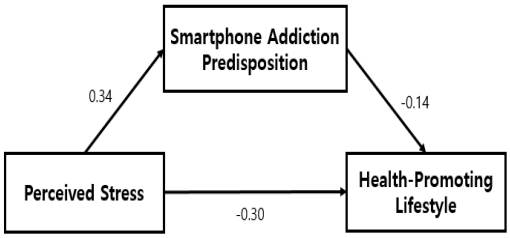

Fig. 1. Mediating effect of smartphone addiction predisposition in the relationship between perceived stress and health-promoting lifestyle

4. Discussion

The objective of this study was to examine whether university students' predisposition to smartphone addiction mediated the relationship between perceived stress and a health-promoting lifestyle.

Perceived stress and smartphone addiction predisposition explained 15.7% of the variance in the health-promoting lifestyle. Furthermore, the relationship between perceived stress and health-promoting lifestyle was partially mediated by smartphone addiction predisposition. First, university students' smartphone addiction predisposition directly affects their health-promoting lifestyle, and it is confirmed that the practice of a health-promoting lifestyle decreases in high-stress situations, especially in the presence of a smartphone addiction predisposition[17,20]. It has been observed that Korean university students tend to escape from stressful situations by using smartphones that can be easily accessed. Therefore, even as a university student, they tend to use their smartphone habitually because smartphone provide various functions including multimedia player, Internet browser, gaming device, and social networking services (SNS)[27-29]. Recently, the university have begun using smartphones for attendance, task management, and announcements, and the use of smartphones has become an essential element of university life. Therefore, it is necessary to guide university students to use smartphones efficiently. In addition, it is necessary to identify ways to mitigate various problematic behaviors related to excessive use of smartphones. In a previous study,

Ryu[30] suggested the necessity to create an environment where university students can enjoy leisure activities at low cost through the government's leisure policy. And the smartphone game addiction prevention program, which is composed of improvement of self-esteem, impulse control, stress coping, social support, communication skills, alternative activity, and realistic compromise, was found to improve self-life management and stress coping ability[27]. In addition, universities should encourage the students to form healthy habits by immediately controlling dangerous behaviors such as excessive drinking, unhealthy diet, and smoking[31]. As a demonstrable measure, universities should offer health-related courses so that all students can take the necessary measures to control stress in university life and to practice a health-promoting lifestyle. As a result, a culture that promote good health behaviors should be formed within universities so that a lifestyle that has a great influence on lifelong healthcare can be well formed.

Perceived stress of university students explained 16.3% of the variance in smartphone addiction predisposition, and as the former increased, so did the latter. In addition, perceived stress accounted for 14.3% of the variance in health-promoting lifestyle, and the health-promoting lifestyle decreased with higher perceived stress. These findings were consistent with the study previous studies that found that the higher the stress or depression level of university students, the higher was the risk of smartphone addiction[6,32]. Furthermore, this study supported the earlier findings that stress in university students lowers their tendency to practice healthy behavior[13]. The increase of stress in university life hinders the formation of academic and interpersonal relationships, and reduces the practice of a health-promoting lifestyle, which in turn adversely affects physical and mental health[13,16]. Based on the results of the present study, university students should be encouraged to actively practice a health-promoting lifestyle, and empowered to manage their stress better.

This study revealed a significant correlation between perceived stress, smartphone addiction predisposition, and a health-promoting lifestyle. This is consistent with the results of previous studies demonstrating a positive correlation between stress and smartphone addiction[11,17,32] and a negative correlation between stress and health-promoting lifestyle[16,19]. The negative correlations between smartphone addiction predisposition and health-promoting lifestyle support research findings that higher dependence on mobile phones is associated with an unhealthy lifestyle[20].

Major research variables are significant differences according to gender. First, perceived stress was higher in women than in men. Consistent with the results of previous studies, female students were more stressed than male students[12]. In the study by Ko and Jeong[16], there was no significant difference in stress in daily life according to gender. The subjects of this study were university students who did not consider their major, but in Ko and Jeong 's study[16], students majoring in health were selected. Therefore, it seems that there is a difference in stress level according to one's major. Second, smartphone addiction predisposition differed with age and gender. Specifically, younger female students had a higher smartphone addiction predisposition. This is consistent with several previous studies that reported that female students exhibited higher levels of smartphone addiction predisposition than male students[6,8,33]. According to a previous study, female students are more likely to use a smartphone as an accessory for self-expression, not merely as a communication device. Therefore, their addiction tendency may be higher than that of male students[6,12]. In the relationship between stress and smartphone addiction predisposition, gender had a moderating effect. Therefore, stressed female students are more likely to be exposed to smartphone addiction than stressed male students[6,33]. Third, a health-promoting lifestyle was higher in male than in female students, which was consistent with previous studies[19]. As such, female students are more

vulnerable to stress situations experienced in daily life than male students, and they are likely to be more exposed to smartphone addiction, which may reduce their tendency to practice a health-promoting lifestyle. Therefore, it is necessary to provide interventions for stress management, prevention of smartphone addiction, and encouraging a health-promoting lifestyle for female university students.

As this study was conducted on students from one university, the generalization of research results is limited. In addition, this study used measuring tool developed for adolescents in health-promoting lifestyles. The lifestyle of early adulthood of university students may differ from adolescents and later adulthood. Therefore, it is necessary to be careful when interpreting the results of the study, and to develop health-promoting lifestyle tool for university students.

5. Conclusion

The present results showed that the perceived stress of university students increased their predisposition to smartphone addiction and decreased the practice of a health promoting lifestyle. In other words, the relationship between perceived stress and health-promoting lifestyle demonstrated a partial mediating effect of the predisposition to smartphone addiction. It is very important to establish an aggressive strategy to cope with the stress of university students and to prevent them from developing smartphone addiction. These preventive activities and practices could encourage them to lead a health promoting lifestyle. In order to prevent behavioral addiction, such as excessive use of smartphones, it is necessary to periodically conduct educational programs that include efficient time management, alternative activity development, and stress coping abilities.

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