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# The correlation of depression with Internet use and body image in Korean adolescents

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**Purpose:** To examine the correlation of depression with Internet use and body image perception, and to analyze the risk factors of depression in a total of 920 students in Seoul, Korea.

**Methods:** Students were recruited by contacting school principals and teachers and were encouraged to fill out a self-report questionnaire designed specifically for this study in July of 2008.

**Results:** Female participants had an increased risk for depression than did male participants (adjusted odds ratio [aOR], 1.790; 95% confidence interval [CI], 1.330–2.410,  $P < 0.001$ ). Older students were more susceptible to depression (aOR, 1.246; 95% CI, 1.115–1.392,  $P < 0.001$ ). Longer daily Internet use and more frequent Internet use were analyzed as risk factors for depression. No physical activity was a risk factor for depression (aOR, 0.392; 95% CI, 1.264–4.526,  $P = 0.014$ ). Dissatisfaction with one's body image increased the risk for depression (aOR, 1.373; 95% CI, 1.169–1.613;  $P < 0.001$ ). Obesity and perception of body image showed no significant relationship with increased risk for depression.

**Conclusion:** Prevalence of depression was 13.8% in adolescents in Seoul, Korea, in July 2008. Female sex, age, daily Internet use duration, weekly Internet use frequency, physical activity, and dissatisfaction with one's body image independently increased risk of depression.

**Key words:** Depression, Internet, Body image, Risk factors, Adolescent

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## Introduction

Since its beginnings as a new technology in the 1990s, the Internet has rapidly become a common fixture in daily life, especially among young people<sup>1</sup>. Adolescents have adopted its use extensively, integrating it into many aspects of their lives<sup>2,3</sup>. Adolescence is the period when dietary and other lifestyle patterns are developed. Physical activity in children and adolescents has immediate health benefits, and can also set a pattern that may be carried into adulthood, resulting in long-term health benefits. However, many children and adolescents in developed countries have sedentary lifestyles<sup>4</sup>. There is an evident trend away from active leisure pursuits and recreational sports, while reliance on sedentary entertainment, such as television, video games, and computers, has increased. Sedentary lifestyles, including those that are characterized by decreased physical activity and excessive Internet use, have been associated with obesity, violent behaviors, mood disorders, and other problems in children and adolescents<sup>5</sup>.

Over the past 2 decades, the South Korean government has strongly promoted the establishment of a nationwide Internet network. As a result, in 1999, about 22.4% of South Koreans had Internet access, and Internet use had more than tripled to 71.9% by 2005. In South Korea, adolescents use the Internet more than any other age group. For adolescents, the Internet is not only the most common daily activity, but is also a major recreational activity. In 2005, about 97.3% of South Korean adolescents between 6 and 19 years of age

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reportedly used the Internet<sup>6</sup>). Hence, the Internet is already a part of daily life in South Korea, especially for children and adolescents. It is not simply a specific new brand of media for adolescents and young adults; for many, it is an integral part of life. The psychopathology, social influences, and problems of Internet addiction have been reported repeatedly<sup>7,8</sup>.

Adolescents are more vulnerable to pathological Internet use than adults because they have less ability to control their enthusiasm for something that captures their interests, like the Internet. The growing importance of the Internet for adolescents has gradually led health professionals to examine the mental health problems associated with this activity. Anxiety disorders, depression, and suicidal ideation are reported among adolescent Internet addicts and other problematic users<sup>9</sup>.

Many studies have examined the role of media exposure in adolescents' body image perceptions. In particular, Keery et al.<sup>10</sup> sought to investigate whether exposure to one of the "new" forms of media, namely the Internet, would be similarly associated with lower levels of weight satisfaction and increased drive for thinness. Body dissatisfaction is particularly prevalent during adolescence, a time when self-awareness, self-consciousness, introspection, and preoccupation with self-image all dramatically increase<sup>11</sup>. It is also a contributor to the lower levels of self-esteem and greater depression observed among adolescents<sup>12,13</sup>.

The aim of this study is to examine correlation of depression with Internet use and body image. Additionally, current study analyzed the risk factors of depression among the regional sample of adolescent in Seoul, Korea.

## Materials and methods

### 1. Subjects and data collection

This cross-sectional health survey was conducted in Seoul, Korea in July of 2008. The sample consisted of adolescents between 15 and 17 years of age and was generated using a stratified random sampling method. A total of 920 students who were lived in Seoul, South Korea and in either their third year of middle school or first year of high school participated. Students were recruited by contacting school principals and teachers and were encouraged to fill out a self-report questionnaire designed specifically for this study in July of 2008. Consent was implied by voluntarily response to the questionnaire (Supplementary material 1).

The data collected from each participant included anthropometric features like body mass index (BMI), health condition, behavior patterns, physical activity, the education level of the student and their parents, the family's financial situation, body image recognition, and primary Internet-related activities. Overweight, obese, and descriptive terms were predefined.

### 2. The degree of dependence on the Internet

For the purpose of this study, the children who use the Internet less than 1 hour a day were categorized into the light Internet users group. The children who use the Internet between 1 and 3 hours a day were categorized into the moderate Internet users group. The children who use the Internet more than 3 hours a day were categorized into the heavy Internet users group. Common descriptive statistics were used to describe the characteristics of these 3 groups.

### 3. Definitions of BMI and obesity

BMI is a widely used measure of adiposity that is calculated as weight in kilograms divided by height in meters squared ( $\text{kg}/\text{m}^2$ ). When assessed within particular age and sex groups, BMI is a statistically valid measure of obesity among children and adolescents<sup>14</sup>. We used age-specific and sex-specific body mass categories. Acceptable weight was below the 85th percentile, overweight was between the 85th and 95th percentiles+2 BMI units, and obesity was at or above the 95th percentile+2 BMI units, respectively, in accordance with the Korean standard pediatric growth chart devised by Korea Centers for Disease Control and Prevention (2007).

### 4. Depression symptom screening questionnaire

The depression status of students was also assessed using the Center for Epidemiologic Studies Depression Scale (CES-D). CES-D is well known and remains one of the most widely used instruments in the field of psychiatric epidemiology. The 20 items in the CES-D scale measure symptoms of depression in different groups as defined by the US National Longitudinal Study of Adolescent Health and the SEARCH for Diabetes in Youth study. The questionnaire contained a total of twenty questions assessed on a scale from 0 to 3 (rarely, 0; occasionally, 1; some, 2; most, 3). The total score was calculated by summation of the scores given for each question; thus it ranged from 0 to 60. We stratified depression severity as "minimal" (0–15), "mild" (16–23), or "moderate/severe" ( $\geq 24$ )<sup>15,16</sup>. We used the conventional cutoff score of  $\geq 24$  to define cases of depression<sup>17</sup>.

### 5. Data analysis

The data were analyzed using IBM SPSS Statistics ver. 20.0 (IBM Co., Armonk, NY, USA). The Pearson chi-square test was used to compare the proportions of the independent variables versus dependent variables. Logistic regression analysis was performed to determine which variables are associated with depression (vs. nondepression). The independent and dependent variables were used to create a dummy variable coded 0 or 1 (0 for nonrisk and 1 for risk). The significant variables were used in the multivariate binary logistic regression analysis. The odds ratios and corresponding 95% confidence intervals (CIs) were calculated.

## Results

### 1. Characteristics of subjects

Among the 937 participants, 920 usable and informative responses to the survey were provided, with a response rate of 98.1%. The characteristics and outcome measures of the respondents are summarized in Table 1. A large proportion of the 920 respondents was male (633 of 920, 68.8%) or 16 years old (647 of 920, 70.3%). The prevalence of depression was 13.8% (129 of 920) and the majority of respondents were classified as having no depression (791 of 920, 86.2%). More than half of the respondents had average school records (595 of 920, 64.7%) and generally used the Internet for 1 to 3 hours a day (521 of 920, 56.6%). Of the respondents, 56.6% (521 of 920) reported that their parents were university-educated. The Internet was most commonly used for entertainment (393 of 920, 42.7%), followed by searching (333 of 920, 36.2%) and online chatting (48 of 920, 5.2%). An overwhelming percentage of respondents had similar, average family financial situations (764 of 920, 83%) and acceptable weights (BMI<85th, 726 of 920, 78.6%). A total of 869 subjects (94.4%) lived with their parents. A total of 383 subjects (47%) spent less than 1 hour a day on physical activity, and 309 subjects (45%) spent 1 to 2 hours a day.

### 2. Comparisons between the depression and nondepression groups

Comparisons between the depression and nondepression groups in regard to age, sex, BMI, health behaviors, physical activity, primary Internet use, and the education level of their parents were performed (Table 2). Information on respondents' perceptions of their families' financial situation, their school records, and their body image recognition were also examined. Without adjusting for other confounding variables, depression was significantly associated with a number of variables. These variables were included in further multivariate logistic analyses. Daily Internet usage and frequency of access, time spent on physical activity, and figure satisfaction were also selected for multivariate

**Table 1.** Frequency distribution of factors in the study sample (n=920) (continued)

Variable	No. (%)
School records	
Below average	144 (15.6)
Average	595 (64.7)
Above average	181 (19.7)
Family financial situation	
Poorer than others	29 (3.2)
About the same as others	764 (83.0)
Richer than others	127 (13.8)
Parents cohabit	
No	51 (5.6)
Yes	869 (94.4)
Parent's education level	
Middle school	31 (3.4)
High school	255 (27.7)
University	521 (56.6)
Graduate school	113 (12.3)
Internet using time (hr/day)	
<1	315 (34.2)
1-3	521 (56.6)
>3	84 (9.1)
Internet using frequency (day/wk)	
1-3	385 (41.8)
4-6	352 (38.3)
Everyday	183 (19.9)
Time spent for physical activity (hr/day)	
<1	383 (47)
1-2	309 (45)
>2	141 (16)
Not at all	87 (18)
Main use	
Searching	333 (36.2)
Game	393 (42.7)
E-mail	18 (2.0)
Online chatting	48 (5.2)
Except for that	128 (13.9)
Body mass index (BMI)	
Acceptable weight (BMI<85th)	726 (78.6)
Overweight (BMI, 85th-95th)	112 (11.8)
Obese (BMI >95th)	83 (9.6)
Perception on body image	
Ordinary	342 (37.2)
Lean	275 (29.9)
Obese	303 (32.9)
Figure satisfaction	
Ordinary	278 (30.2)
Dissatisfied	268 (29.1)
Satisfied	374 (40.7)

**Table 1.** Frequency distribution of factors in the study sample (n=920)

Variable	No. (%)
Sex	
Male	633 (68.8)
Female	287 (31.2)
Age (yr)	
15	217 (23.5)
16	647 (70.3)
17	56 (6.2)
Depression	
Yes	129 (13.8)
No	791 (86.2)

**Table 2.** Comparisons between depression and nondepression groups (n=920)

Variable	No depression (n=791)	Depression (n=129)	P value
Sex			0.073
Male	552	80	
Female	239	49	
Age (yr)			0.142
15	191	23	
16	554	95	
17	46	12	
Mean	15.8	16.0	
School records			0.238
Below average	113	27	
Average	516	79	
Above average	162	23	
Parents cohabit			0.079
No	41	13	
Yes	750	116	
Parent's education level			0.870
Middle school	26	5	
High school	223	32	
University	446	75	
Graduate school	96	17	
Family financial situation			0.390
Poorer than others	24	7	
About the same as others	655	107	
Richer than others	112	15	
Internet using time (hr/day)			0.002
<1	286	29	
1–3	439	80	
>3	66	20	
Internet using frequency (day/wk)			0.014
1–3	337	45	
4–6	309	46	
Everyday	145	38	
Time spent for physical activity (hr/day)			0.014
<1	352	48	
1–2	278	46	
>2	110	17	
Not at all	51	18	
Body mass index (BMI)			0.064
Acceptable weight (BMI<85th)	628	100	
Overweight (BMI, 85th–95th)	100	11	
Obese (BMI>95th)	65	18	
Perception on body image			0.344
Ordinary	295	47	
Lean	241	33	
Obese	255	49	

**Table 2.** Comparisons between depression and nondepression groups (n=920) (Continued)

Variable	No depression (n=791)	Depression (n=129)	P value
Figure satisfaction			0.006
Ordinary	242	37	
Dissatisfied	243	25	
Satisfied	306	67	

Statistical significance was tested using a chi-square test.

logistic analyses because they were statistically significant, with a P value under 0.05.

### 3. The risk factors of depression

The results from the multivariate logistic regression analyses are presented in Table 3. Female participants had a greater risk factor for depression than males (adjusted OR [aOR], 1.790; 95% CI, 1.330–2.410,  $P<0.001$ ). Older respondents were more likely to show signs of depression than younger respondents (aOR, 1.246; 95% CI, 1.115–1.392;  $P<0.001$ ). Longer daily Internet time was analyzed as a risk factor for depression. When compared to those who use the Internet less than 1 hour per day, respondents whose daily Internet use ranged from 1 to 3 hours (aOR, 1.679; 95% CI, 1.007–2.800,  $P=0.294$ ) or exceeded 3 hours (aOR, 2.235; 95% CI, 1.078–4.637,  $P=0.032$ ) had an increased risk for depression. Additionally, whether students use the Internet more days per week was analyzed as risk factor for depression. When compared to those who only used the Internet on 1 to 3 days per week, weekly Internet use for 4 to 6 days (aOR, 1.234; 95% CI, 0.911–1.672,  $P=0.175$ ) increased the risk for depression. But there was no statistical significance. On the other hand, every day Internet use showed significantly increased risk for depression (aOR, 2.062; 95% CI, 1.426–2.983;  $P<0.001$ ). In the analysis of the relationship between depression and time of physical activity, having no physical activity was found to be a risk factor for depression (aOR, 2.392; 95% CI, 1.264–4.526;  $P=0.014$ ). Otherwise, there was no statistical significance relationship between depression and time of physical activity. Obesity and overweight showed no significant relationship with increased risk for depression. There was a similar result for body image perception. Regarding as satisfaction for their body image, when compared with the ordinary satisfied subject of respondents, those who were dissatisfied with their figures had an increased risk for depression (aOR, 1.373; 95% CI, 1.169–1.613;  $P<0.001$ ).

### 4. The interesting results

The risk of depression was highest in the group that considered themselves obese and lowest in the group that considered themselves lean, but this result was not statistically significant. Previous studies found that experiencing a negative mood may

**Table 3.** Results of a logistic regression analysis on sex, age, Internet use, physical activity, BMI, perception on body image, and figure satisfaction as predictors of depression

Variable	Exp(B)	95% CI for Exp(B)
<b>Sex</b>		
Male		
Female	1.790***	1.330–2.410
<b>Age</b>		
	1.246***	1.115–1.392
<b>Internet using time (hr/day)</b>		
<1		
1–3	1.679*	1.007–2.800
>3	2.235*	1.078–4.637
<b>Internet using frequency (day/wk)</b>		
1–3		
4–6	1.234	0.911–1.672
Everyday	2.062***	1.426–2.983
<b>Time spent for physical activity (hr/day)</b>		
<1		
1–2	1.189	0.759–1.861
>2	1.197	0.644–2.228
Not at all	2.392*	1.264–4.526
<b>Body mass index (BMI)</b>		
Acceptable weight (BMI<85th)		
Overweight (BMI, 85th–95th)	0.565	0.279–1.142
Obese (BMI>95th)	1.259	0.680–2.330
<b>Perception on body image</b>		
Ordinary		
Lean	0.792	0.562–1.115
Obese	1.036	0.909–1.181
<b>Figure satisfaction</b>		
Ordinary		
Dissatisfied	1.373***	1.169–1.613
Satisfied	0.982	0.677–1.425

CI, confidence interval.  
\* $P<0.05$ . \*\*\* $P<0.001$ .

aggravate a negative body image and cause it to become persistent, as qualifying additional information or neutral and positive body information are not attended to and are thus neglected. This, in turn, may increase the frequency of periods of depression, thereby maintaining and strengthening the negative body schema<sup>18,19</sup>. We also analyzed the relevance of respondents' actual BMI scores and levels of subjective awareness of body image. That analysis indicated a difference in perception of body image depending on actual level of obesity (Statistical significance was tested using a chi-square;  $P=0.000$ ). Ninety-eight point nine percent (272 of 275, 98.9%) of the lean body image perception group was the acceptable weight (BMI<85th) group. Only about a quarter of the obese body image perception group was Obese (BMI >95th).

## Discussion

The rate of depression among third year middle school students and first year high school students between the ages of 15 and 17 was 13.8% (126 of 920) in 2008. Depression prevalence is known to increase progressively with age, occurring in less than 1% of preschool children, 2%–3% of 6- to 12-year-old children, and 6%–9% of adolescents (13 to 20 years)<sup>20</sup>. Although this study found a higher rate of depression than other studies, the prevalence rate appears to change from 3% to 30% depending on how strictly we apply the criteria in one epidemiologic study<sup>21</sup>. There was no significant difference in depression prevalence between males and females in this study (80 of 552 [14.5%] vs. 49 of 239 [20.5%],  $P=0.073$ ). But, the depression prevalence in females (from 4% to 23%) is greater than that in males (from 1% to 11%) according to a meta-analysis done by Hankin et al.<sup>22</sup>. This previous meta-analysis indicated that differences in pubertal development between males and females correlates with the differences in depressive symptoms and rates of depression<sup>23</sup>. But we have not collected information about pubertal development of the subject. Therefore we have to further consider pubertal development and investigate how depression rates differ between males and females.

As time spent using the Internet increases gradually, the incidence of depression becomes more frequent. In previous studies, some researchers reported that depressive symptoms correlate with Internet dependence<sup>24,25</sup>. However, in our study, we divided the levels of Internet dependence based on daily time spent using the Internet. In most previous studies, Internet dependence was assessed using the Internet Addiction Scale (IAS). So we could not exactly compare our results with other studies' results because the standards for relating Internet dependency were different. Even so, the relationship between Internet dependency and depression in our study was similar to the relationship found in other previous studies. Additionally, in our study, it was not clearly proven that there is a sequencing relationship between depression and Internet use. However, in multiple studies, reciprocal relationships were found between depressive symptoms and Internet dependence<sup>26</sup>. Internet dependence victimization leads to an increase in depressive symptoms, and depressive symptoms intensify Internet dependence, which results in a self-perpetuating cycle. Some researchers suggested that one possible explanation for the reciprocal relationship between Internet use and depression is that depressed adolescents may have fewer social skills and a tendency toward isolation that makes them less attractive to peers. These factors may increase the likelihood of Internet dependency which, in turn, could lead to loneliness, a state that is typically defined as the awareness of a deficiency in one's personal and social relationships associated to feelings of sadness and rejection others<sup>27</sup>.



The group that did not engage in any physical activity had more than double the rate of depression of the physically active group. However, in the physically active group, there was a similar prevalence of depression regardless of the time of physical activity. There are currently numerous studies that support the efficacy of exercise for reducing symptoms of depression. In those studies, the efficacy of exercise for decreasing symptoms of depression has been well-established. Data regarding the positive mood effects of exercise suggest that the focus should be on frequency of exercise rather than duration or intensity until the behavior has been well-established. Based on the meta-analytic findings in this area, an exercise regimen of 20 minutes per day, 3 times per week, at a moderate intensity is sufficient to significantly reduce symptoms of depression<sup>28)</sup>. In our study, despite the fact that physical activity was not classified according to the type and intensity of exercise, we think that even small amounts of regular physical activity, such as walking, running and so on, help to reduce symptoms of depression.

In our study, the incidence of depression was lower in the overweight group (BMI, 85th–95th) and higher in the obese group compared with the acceptable weight group (BMI<85th), but this result was not statistically significant. In a previous meta-analysis, authors found bidirectional associations between depression and obesity<sup>29)</sup>. Findings from multiple surveys suggest that overweight people are more likely to be depressed, in part because they are dieting to lose weight, a process that is stressful and emotionally distressing<sup>30)</sup>. However, another study found that the incidence of depression was lowest in the overweight group (BMI, 85th–95th), which is concordant with our findings. This is probably because that they intake healthy foods like fruits and vegetables, and they often exercise. And as a result, the incidence of depression is reduced<sup>31)</sup>.

We divided the respondents into 3 categories depending on body satisfaction: dissatisfied group, ordinary group, and satisfied group. The prevalence of depression was highest in the dissatisfied group and lowest in the satisfied group. Previous studies have found that body satisfaction is negatively associated with risk of depression<sup>32)</sup>. One hypothesis based on a previous study is that adolescents are introduced to a formal body image by mass media through such modes as TV, magazines and the Internet, which causes a thin or glamorous body image to become internalized. After that, adolescents experience identity confusion because this internalization will not allow them to remain satisfied with their body image. As a result, a depressed mood occurs<sup>33)</sup>. We need to further observe whether the issues related to physical satisfaction or dietary issues in each group are persistent over a long time.

Several limitations must be mentioned. First, our study is limited by the narrow age range of our sample. Although we accounted for age in our models and these measures have been

used with mid-teen adolescents (15 to 17 years of age) in the past, some predictors may be more important for broad age-range adolescents (12 to 20 years of age) than specific age range (15 to 17 years of age). Second, while we did not inquire about the subjects' type of school, school social and academic context may contribute to adolescents' beliefs and behaviors regarding health. For example, previous research suggests that adiposity and socioeconomic status are inversely related, and females who attend private schools have lower BMIs than those who attend public schools<sup>34)</sup>. Third, we did not propose objective criteria for Internet dependency. Currently, the IAS is one of the most widely used scales to detect Internet addiction. Therefore, we should consider how the results might have differed if we applied the IAS standards that are currently and widely used. Fourth, our study's hypotheses predicted that exercise would result in a reduction of depression, but we did not subdivide the type and intensity of exercise when defining physical activity. Future research should obtain objective measures of the type and intensity of exercise. Fifth, in this study, the measurement of BMI was performed indirectly through the questionnaire. Not only are such self-reporting methods open to a range of biases, but the questionnaire also may have had a large number of missing values. This means that the BMI results should be considered with caution. Future research should obtain objective measures of height and weight. Finally, in this study, most of the Internet using place was at home. Internet access using a mobile phone is only 0.5%. But smartphone ownership rate of youth began to increase significantly since 2012 in Korea. According to a new survey by The Korea Information Society Development Institute (2016), 59.3% of elementary school students, 86.6% of middle school students, and 90.2% of high school students own a smartphone, and most phone owners use their phone to go online in 2015 in South Korea. Therefore we should further study the above our results with regard to changes in Internet usage patterns.

Our study results have several important implications. First, the high affinity of Internet dependency with depression among South Korean adolescents suggests that parents and school staff, including teachers and other health care providers working in middle schools and high schools, should pay closer attention to students who show dependency to the Internet. To detect high-risk students, it might be important to regularly screen for Internet addiction and psychiatric symptoms before clinicians suggest a transition to intermittent Internet dependency. Second, the groups that ever had physical activity had lower prevalence of depression compared to nonphysical activity group. This implicates that the exercise regimens and health education counseling that encourage physical activity might be needed. Additionally, based on the relationship between body image satisfaction and depression, health care providers, including clinicians, need to help adolescents attain not only a realistic perception of their body image,

but also a positive perception of their body image in order to prevent depression. We reported the various risk factors of depression in this study. Further prospective studies using structured diagnostic methods are required to confirm additional risk factors for adolescent depression.

## Conflict of interest

No potential conflict of interest relevant to this article was reported.

## Supplementary materials

Supplementary material can be found via <http://www.kjp.or.kr/src/sm/kjp-60-page-s001.pdf>.

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