



■ Original Article

Association of body image distortion with smartphone dependency and usage time in adolescents: a cross-sectional Korean Youth Study

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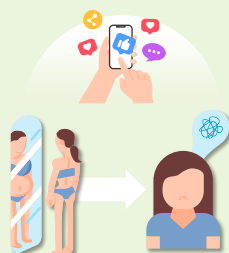
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Background



- Body image distortion (BID) linked to mental health issues.
- Social media exposure promotes unrealistic body standards.

Methods

Cross-sectional analysis of 42,981 adolescents
16th Korean Youth Risk Behavior Web-Based Survey (2020)

Variables

Smartphone dependency
(low, moderate, high)

Smartphone usage time
(quartiles)

Body image distortion
(perceived vs. actual BMI)



Results

Smartphone dependency

High smartphone dependency → Higher BID risk

Boys

Moderate (adjusted odds ratio [aOR], 1.11)
High (aOR, 1.18)

Girls

Moderate (aOR, 1.14)
High (aOR, 1.30)



Smartphone usage time

Smartphone usage time
→ No significant effect on BID



BID prevalence

Boys

Girls

Conclusion

Our study demonstrated that moderate to high levels of smartphone dependency are associated with body image distortion in adolescents. Therefore, it is necessary to establish strategies for checking and managing adolescents' smartphone dependence.

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See editorial commentary page on 58

Background: Adolescent dependency on smartphones is the highest among all age groups. Adolescents can be influenced to evaluate their body image by popular ideals about beautiful bodies via smartphone content, which can cause body image distortion. This study aimed to examine the association between body image distortion and smartphone dependency and the duration of smartphone usage among Korean adolescents.

Methods: This study used data from the 16th Korean Youth Risk Behavior Web-Based Survey (2020), and included 42,981 participants, who were grouped according to self-reported duration of smartphone usage and smartphone dependency, as measured by a questionnaire. Body image distortion is defined as an exaggerated subjective body image compared to the actual body image. Multivariable-adjusted logistic regression was used to determine the odds ratios (ORs) with 95% confidence intervals (CIs) of body image distortion on smartphone dependency and usage time after adjusting for various factors related to body image distortion.

Results: Among the 42,981 participants, both moderate and high levels of smartphone dependency were associated with body image distortion in boys (moderate: adjusted OR [aOR], 1.11; 95% CI, 1.01–1.22; high: aOR, 1.18; 95% CI, 1.05–1.32) and girls (moderate: aOR, 1.14; 95% CI, 1.05–1.23; high: aOR, 1.30; 95% CI, 1.18–1.42) compared to the low-level dependency group. However, no significant association was found between smartphone usage duration and body image distortion.

Conclusion: Our study demonstrated that moderate to high levels of smartphone dependency are associated with body image distortion in adolescents. Therefore, it is necessary to establish strategies for checking and managing adolescents' smartphone dependence.

Keywords: Body Dissatisfaction; Smartphone; Body Image; Adolescent; Internet Addiction Disorder

Introduction

Body image is an individual's subjective experience of their appearance, and is a complex concept involving one's body-related self-perceptions, thoughts, feelings, attitudes, and behaviors [1]. Body image distortion is the inconsistency between one's perceived weight and actual weight status, which is the result of a combination of perceptual disturbances that do not accurately evaluate one's body size and body dissatisfaction, including negative feelings and cognitions about one's body [2,3]. Body image distortion can be associated with eating disorders, unhealthy weight control behavior, and mental health, including depression [3].

Adolescence is a critical period in body image development in which rapid physical, psychological, and social changes interact [4]. Developing a healthy body image during this period is an important issue because development of a negative body image and body distortion in this stage can lead to negative physical and mental outcomes [3].

Another important problem faced by adolescents in recent years is the excessive use of smartphones. According to a survey report on the Current Condition of Overdependence on Smartphones by the National Information Society Agency (2021), the risk of smartphone overdependence among adolescents was 37.0%, the highest among all other age groups [5]. Some studies have shown that excessive smartphone use is related to impaired cognitive function, low sleep quality, and mental health problems such as depression, low self-esteem, and low self-control [6,7]. Therefore, there are growing concerns that such increased use of smartphones could have negative effects on the de-

velopment of adolescents.

The recent increased use of digital media that uses imagery, such as Instagram and Facebook, has further increased the focus on ideal body image [8]. This use of social media exacerbates body dissatisfaction through the comparison of physical appearance with others [9]. Adolescents mainly use the Internet or social media through smartphones [10]. In studies investigating the association between body image distortion and smartphone use, body image distortion was positively correlated with smartphone dependence and smartphone use duration [11,12]. Although the association between smartphone usage time and dependence with body image distortion has already been studied individually, little is known about whether this relationship remains after the effect between smartphone usage time and dependence is considered together.

Furthermore, there is a difference in the ideal body images by gender that women and men encounter through mass media. Media content, including social media, can promote the internalization of the ideal body image of slimness and skinniness in women, and muscularity and strength in men [13,14]. Some studies have shown that while body image distortion in men skews towards thinking they are thinner than their true weight, in women, the reverse is shown; perceived body image is fatter than their true body status [15,16]. This suggests that expressions of body dissatisfaction with the ideal body varies with gender. Therefore, this study aimed to investigate the association between body image distortion and smartphone usage duration and dependence, separately by gender among Korean adolescents.

Methods

Participants and procedure

This study used data from the 16th Korea Youth Risk Behavior Survey (KYRBS) which was conducted from August to November, 2020 [17]. The KYRBS is an anonymous, self-reported online survey of middle and high school students, conducted every year by the Korea Centers for Disease Control and Prevention (KCDC). The sampling process of this survey was divided into population stratification, sampling, and sampling stages, and in the population stratification stage, the population was divided into 117 layers using 39 regional groups and school levels nationwide as stratification variables. The sample schools were allocated using the proportional distribution method. Of the 800 target sample schools, 54,948 adolescents from 793 schools participated in the survey.

Body image distortion was measured according to the index definition of the 2021 KYRBS raw data usage guidelines, referring to the age-specific body mass index (BMI) of the 2017 Pediatrics and Adolescent Growth Chart [18,19]. Therefore, a total of 42,981 adolescents (20,683 boys and 22,298 girls) were analyzed, excluding those who had missing values for height or weight and those who underestimated their body image compared to their actual body (Figure 1). The data for this study were downloaded from the KCDC website after obtaining approval.

This study was approved by the Institutional Review Board (IRB) of the Samsung Medical Center (IRB approval no., SMC 2023-01-095; IRB examination exemption approval: 2023.01.21). The requirement for informed consent from individual patients was waived because this retrospective study used publicly available data.

Measurements

General characteristics

Schools were classified as middle school or high school. Academic achievement and household income were subjectively classified by the adolescents into five categories (high, middle-high, middle, middle-low, and low). In this study, we reclassified the five categories into three categories: high (high and middle-high), middle, and low (middle-low and low). The residential type was categorized into five types (living with family, living with relatives, lodging, dormitories, and

childcare facilities); we reclassified living with family or relatives as “yes” and the rest as “no.” Drinking was classified as “yes” if the adolescents drank more than one glass in the last 30 days and “no” if they had not. Smoking was also classified as “yes” if there was a day or more when even one regular cigarette was smoked in the last 30 days and “no” if they had not. For breakfast skipping, skipping breakfast more than 5 days a week was classified as “yes” and less than 4 days a week as “no,” according to the 2021 KYRBS raw data usage guidelines [19]. Nutrition education was measured as having undergone such education in school within the last 12 months, and was classified as a “yes” or “no” response. Fast food consumption was classified into three categories: 0 times per week, 1-2 times per week, and more than 3 times per week. Physical activity was classified into three categories: 0 times per week, 1-2 times per week, and more than 3 times per week. Weight control measured weight control efforts in the past month, and was reclassified into three groups: no efforts, efforts to lose weight, and efforts to maintain or gain weight. The stress category was measured based on the question asking how much stress one usually feels, with “very much” or “a lot” classified as “yes,” and “a little,” “not much,” and “not at all” classified as “no.” Depression was classified into two categories (answered yes or no) to a question asking if adolescents felt sad or hopeless enough to stop their daily life for 2 weeks in the last 12 months. Experiences of suicidal ideation were also classified into two categories: yes or no to a question asking if they had seriously considered suicide in the last 12 months. Self-rated health level was classified into two categories: high for those who answered “thinking very healthy” or “thinking healthy,” and not high for those who answered “thinking normal,” “thinking unhealthy,” or “thinking very unhealthy.” Anxiety was classified using the Generalized Anxiety Disorder 7-item scale (GAD-7) as high if they reported moderate anxiety or higher (GAD-7 score ≥ 10), and as not high if they reported mild or no anxiety (GAD-7 score < 10).

Body image distortion

BMI was calculated as weight (kg)/height² (m²) using self-reported weight and height values collected at the 16th KYRBS. Based on the 2017 Korean Child and Youth Growth Chart, adolescents were classified into three categories: underweight (less than the 5th percentile for age and gender), normal (between the 5th percentile and 84th percentile for age and gender) and overweight (more than 85th percentile for

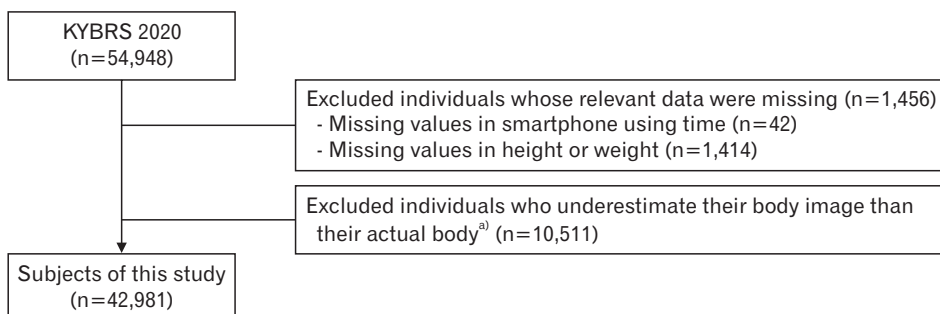


Figure 1. Selection process of the study participants. KYRBS, Korean Risk Behavior Web-based Survey; BMI, body mass index. ^{a)}If the overweight individuals (BMI $\geq 85\%$) answered “normal,” “a little thin,” or “very thin” to the subjective body recognition question or the normal-weight individuals (5% \leq BMI $< 85\%$) answered “a little thin” or “very thin” to the same question, they were excluded from the study.

Table 1. General characteristics of the participants according to body image distortion by gender

Characteristic	Men			Women			
	Total	Body image distortion		Total	Body image distortion		
		No	Yes		No	Yes	
						P-value	
Total participants							
Unweighted	20,683	16,910 (81.8)	3,773 (18.2)	22,298	16,281 (73.0)	6,017 (27.0)	
Weighted	998,104	814,154 (81.6)	183,951 (18.4)	1,065,861	773,282 (72.6)	292,579 (27.4)	
Smartphone using time (h/d)							0.002
<3	6,765 (32.8)	5,555 (33.0)	1,210 (32.0)	3,882 (17.9)	2,897 (18.3)	985 (16.6)	
≥3 to <4.5	5,495 (26.8)	4,489 (26.7)	1,006 (26.8)	5,135 (23.6)	3,769 (23.7)	1,366 (23.2)	
≥4.5 to <6.5	4,497 (21.7)	3,622 (21.3)	875 (23.1)	6,195 (27.7)	4,539 (27.9)	1,656 (27.2)	
≥6.5	3,926 (18.8)	3,244 (18.9)	682 (18.1)	7,086 (30.9)	5,076 (30.1)	2,010 (33.0)	
Smartphone dependence ^{a)}							<0.001
Low	8,373 (39.8)	6,957 (40.5)	1,416 (36.5)	6,116 (27.1)	4,663 (28.4)	1,453 (23.8)	
Middle	8,143 (39.4)	6,621 (39.1)	1,522 (40.5)	9,585 (43.1)	7,035 (43.4)	2,550 (42.5)	
High	4,167 (20.8)	3,332 (20.3)	835 (23.0)	6,597 (29.8)	4,583 (28.3)	2,014 (33.7)	
School grade ^{b)}							0.977
Middle school	10,836 (49.3)	8,746 (48.7)	2,090 (52.1)	11,733 (49.4)	8,587 (49.4)	3,146 (49.4)	
High school	9,847 (50.7)	8,164 (51.3)	1,683 (47.9)	10,565 (50.6)	7,694 (50.6)	2,871 (50.6)	
Household income							<0.001
Low	2,642 (12.4)	2,121 (12.2)	521 (13.7)	2,892 (12.3)	2,010 (11.7)	882 (14.1)	
Middle	9,532 (45.3)	7,811 (45.5)	1,721 (44.7)	11,407 (50.9)	8,314 (50.9)	3,093 (51.0)	
High	8,509 (42.3)	6,978 (42.4)	1,531 (41.7)	7,999 (36.7)	5,957 (37.4)	2,042 (35.0)	
Self-assessed academic achievement							<0.001
Low	6,819 (33.1)	5,557 (33.0)	1,262 (33.8)	7,347 (32.7)	5,148 (31.4)	2,199 (36.1)	
Middle	6,133 (29.3)	5,034 (29.4)	1,099 (28.9)	7,105 (32.1)	5,221 (32.3)	1,884 (31.8)	
High	7,731 (37.6)	6,319 (37.6)	1,412 (37.3)	7,846 (35.2)	5,912 (36.3)	1,934 (32.1)	
Residential status							0.167
Living with family/relatives	19,747 (96.4)	16,135 (96.3)	3,612 (96.8)	21,496 (97.3)	15,690 (97.2)	5,806 (97.5)	
Other	936 (3.6)	775 (3.7)	161 (3.2)	802 (2.7)	591 (2.8)	211 (2.5)	
Perceived stress level							<0.001
Low	14,996 (72.1)	12,376 (72.8)	2,620 (69.0)	13,253 (59.5)	9,958 (61.4)	3,295 (54.4)	
High	5,687 (27.9)	4,534 (27.2)	1,153 (31.0)	9,045 (40.5)	6,323 (38.6)	2,722 (45.6)	
Experience of sadness or despair in the last 12 months							<0.001
No	16,675 (80.4)	13,700 (80.9)	2,975 (78.1)	15,476 (69.6)	11,477 (70.9)	3,999 (66.2)	
Yes	4,008 (19.6)	3,210 (19.1)	798 (21.9)	6,822 (30.4)	4,804 (29.1)	2,018 (33.8)	
Self-rated health level ^{c)}							<0.001
High	15,383 (74.1)	12,714 (74.9)	2,669 (70.5)	14,606 (65.0)	10,877 (66.2)	3,729 (61.7)	
Not high	5,300 (25.9)	4,196 (25.1)	1,104 (29.6)	7,692 (35.0)	5,404 (33.8)	2,288 (38.3)	
Feeling anxiety in the last 2 weeks ^{d)}							<0.001
Not high	19,120 (92.2)	15,684 (92.5)	3,436 (90.9)	19,063 (85.5)	14,092 (86.7)	4,971 (82.5)	
High	1,563 (7.8)	1,226 (7.5)	337 (9.1)	3,235 (14.5)	2,189 (13.3)	1,046 (17.5)	

(Continued on next page)

Table 1. Continued

Characteristic	Men			Women			P-value
	Total	Body image distortion		Total	Body image distortion		
		No	Yes		No	Yes	
Experience of suicidal ideation in the last 12 months							
No	19,090 (92.2)	15,641 (92.5)	3,449 (91.4)	19,226 (86.4)	14,197 (87.4)	5,029 (83.9)	<0.001
Yes	1,593 (7.8)	1,269 (7.5)	324 (8.6)	3,072 (13.6)	2,084 (12.6)	988 (16.1)	
Drinking in the last 30 days							
No	18,224 (88.1)	14,882 (88.1)	3,342 (88.0)	20,241 (91.0)	14,849 (91.4)	5,392 (89.9)	0.002
Yes	2,459 (11.9)	2,028 (11.9)	431 (12.0)	2,057 (9.0)	1,432 (8.6)	625 (10.1)	
Smoking in the last 30 days							
No	19,498 (94.3)	15,920 (94.2)	3,578 (94.7)	21,696 (97.5)	15,849 (97.5)	5,847 (97.3)	0.495
Yes	1,185 (5.7)	990 (5.8)	195 (5.3)	602 (2.5)	432 (2.5)	170 (2.7)	
Breakfast skipping ^{a)}							
No	13,322 (64.5)	10,963 (64.9)	2,359 (62.6)	13,337 (60.5)	9,833 (61.1)	3,504 (59.0)	0.011
Yes	7,361 (35.5)	5,947 (35.1)	1,414 (37.4)	8,961 (39.5)	6,448 (38.9)	2,513 (41.0)	
Education of nutrition and eating habits in the last 12 months							
No	10,475 (51.4)	8,630 (51.8)	1,845 (49.8)	12,018 (54.5)	8,704 (54.1)	3,314 (55.5)	0.099
Yes	10,208 (48.6)	8,280 (48.2)	1,928 (50.2)	10,280 (45.5)	7,577 (45.9)	2,703 (44.5)	
No. of fast food intake per week (times)							
0	3,742 (17.5)	3,026 (17.4)	716 (18.0)	4,212 (18.9)	3,072 (18.8)	1,140 (19.0)	0.021
1-2	11,671 (56.3)	9,561 (56.2)	2,110 (56.3)	12,976 (57.9)	9,570 (58.5)	3,406 (56.4)	
≥3	5,270 (26.2)	4,323 (26.3)	947 (25.7)	5,110 (23.2)	3,639 (22.7)	1,471 (24.56)	
Physical activity (q) ^{b)}							
0	3,650 (18.2)	2,925 (17.8)	725 (19.7)	7,970 (37.3)	5,822 (37.4)	2,148 (37.0)	0.688
1-2	4,098 (20.3)	3,276 (19.8)	822 (22.5)	6,119 (27.3)	4,440 (27.1)	1,679 (27.7)	
≥3	12,935 (61.5)	10,709 (62.4)	2,226 (57.8)	8,209 (35.4)	6,019 (35.5)	2,190 (35.3)	
Weight-control efforts							
No efforts	9,344 (45.9)	7,746 (46.5)	1,598 (43.3)	8,910 (40.8)	6,900 (43.4)	2,010 (34.0)	<0.001
Efforts to lose weight	7,021 (33.5)	5,406 (31.5)	1,615 (42.3)	10,174 (45.0)	6,832 (41.2)	3,342 (55.0)	
Efforts to maintain or gain weight	4,318 (20.7)	3,758 (22.1)	560 (14.4)	3,214 (14.2)	2,549 (15.4)	665 (11.0)	

Values are presented as unweighted number (weighted %).

^{a)}Smartphone dependence was measured by overdependence screening tools of total score is 40 points. Based on smartphone overdependence screening tools by the Korea Intelligent Information Society Agency in 2016, low dependency was defined as 10-15 points, middle dependency as 16-22 points and high dependency as over 23 points. ^{b)}Grade in school was used as a proxy for age in the analyses. ^{c)}'High' was defined as individual who answered 'thinking very healthy' or 'thinking healthy' and 'not high' was defined as individuals who answered 'thinking normal', 'thinking unhealthy', and 'thinking very unhealthy'. ^{d)}'High' was defined when the Generalized Anxiety Disorder 7 item (GAD-7) score is 10 points or higher, and 'not high' was defined when the GAD-7 score is less than 10 points. ^{e)}Breakfast skipping was defined as not eating breakfast for more than 5 days a week. ^{f)}Physical activity was defined by the number of days with moderate intensity activity of 60 minutes or more, or high intensity activity of 20 minutes or more.

age and gender), according to BMI levels [18]. Participants reported their subjective recognition of body type as five categories: “very thin,” “a little thin,” “normal,” “a little obese,” and “very obese [19].” Those who overestimated their body image than their actual body, were defined as having body image distortion, according to the index definition of the 2021 KYRBS raw data usage guidelines. Hence, if underweight participants answered “normal,” “a little obese,” or “very obese” to the subjective body type recognition question, and if participants with normal-weight answered “a little obese” or “very obese” to these questions, they were classified as having a “distorted body image [19].” Contrarily, participants with opposite direction body image distortion who thought their body shape was thinner than their actual body were excluded from the study. Therefore, if overweight participants answered “normal,” “a little thin,” or “very thin” to the subjective body type recognition question, and participants with normal-weight answered “a little thin” or “very thin” to these questions, they were excluded from this study.

Smartphone behavior

In this survey, the participants reported their average weekday and weekend smartphone usage during the past month. Using self-reported usage time on weekdays and weekends, the mean smartphone usage time per day was calculated as the sum of 5 times the weekday average usage time and 2 times of weekend average usage time and then divided by seven. The calculated mean daily smartphone usage time was categorized into quartiles: 1–179 min/d, 180–269 min/d, 270–389 min/d, and ≥ 390 min/d. Participants also responded on a 4-point scale of “not at all,” “not,” “yes,” or “absolutely” to 10 questions on the smartphone overdependence screening tool. These 10 questions were developed by the Korea Intelligent Information Society Agency in 2016 as a measure of smartphone dependence [20]. These overdependence screening tools are subdivided into infant observers, adolescents, and adults/elderly, and in this survey, tool for adolescents was used. The

higher the score, the greater the dependence on smartphones. Based on this screening tool score (total score of 40 points), smartphone dependence was divided into three categories: 10–15 points as low, 16–22 points as medium, and 23 or more points as high.

Statistical analysis

The 16th KYRBS dataset used a complex sample design method; hence, the analysis of this data followed the KCDC complex sampling analysis guidelines, reflecting stratified variables, colony variables, and weights. Complex sample chi-square (χ^2) test was used to identify the differences in body image distortion according to gender, general characteristics, mental health, and smartphone behavior of adolescents. Multiple logistic regression analysis was used to determine the association of smartphone usage time and dependence with body image distortion while correcting each smartphone dependence and usage time and the general/mental characteristics that were confirmed to be statistically significant in the Pearson’s chi-square test. The program used for statistical analysis was STATA MP ver. 14.0 (Stata Corp.), and the statistical significance of this study was $P=0.05$.

Results

Participant characteristics

Among the 42,981 participants, 20,683 (48.1%) were boys and 22,298 (51.9%) were girls, of which 9,790 (22.78%) showed body image distortion (Supplement 1). The weighted prevalence of body image distortion was 18.43% and 27.45% among boys and girls, respectively. Table 1 presents the participant characteristics according to gender and a comparison of the characteristics between participants with and without body image distortion.

Adolescents with prolonged smartphone usage time (over 6.5 hours per day) versus minimal smartphone usage time (less than 3 hours per day) were 25.0% versus 25.1% of the total, but 18.8% versus 32.8% in

Table 2. aOR and 95% CI for body image distortion according to smartphone dependency and smartphone usage time

	Men (n=20,683)		Women (n=22,298)		P for interaction by gender ^{c)}
	aOR ^{a)} (95% CI)	P-value	aOR ^{b)} (95% CI)	P-value	
Smartphone dependence					
Low (10–15)	1 (Ref)		1 (Ref)		<0.001
Middle (16–22)	1.11 (1.01–1.22)	0.024	1.14 (1.05–1.23)	0.001	
High (≥ 23)	1.18 (1.05–1.32)	0.005	1.30 (1.18–1.42)	<0.001	
Smartphone usage time (h/d)					
<3	1 (Ref)		1 (Ref)		0.004
≥ 3 to <4.5	1.02 (0.91–1.14)	0.776	1.00 (0.89–1.11)	0.957	
≥ 4.5 to <6.5	1.08 (0.97–1.20)	0.174	0.94 (0.84–1.05)	0.266	
≥ 6.5	0.93 (0.82–1.04)	0.205	0.96 (0.85–1.07)	0.440	

aOR, adjusted odd ratio; CI, confidence interval; Ref, reference.

^{a)}Adjusted for school grade, perceived stress level, depressive experience, self-rated health level, feeling anxiety in 2 weeks, experience of suicidal ideation in last 12 months, frequency of eating breakfast, education of nutrition and eating habits in last 12 months, physical activity, weight-control efforts and each of smartphone dependence or smartphone usage time. ^{b)}Adjusted for household income, self-assessed academic achievement, perceived stress level, depressive experience, self-related health level, feeling anxiety in 2 weeks, experience of suicidal ideation in last 12 months, drinking in last 30 days, frequency of eating breakfast, education of nutrition and eating habits in last 12 months, number for fast food intake per week, weight-control efforts and each of smartphone dependence or smartphone usage time. ^{c)}P for interaction by gender was estimated using the linear regression for the interaction term between gender and smartphone dependence scale, gender and smartphone usage time.

boys and 30.9% versus 17.9% in girls, showing that girl smartphone usage time is longer than that of boys. Adolescents with low dependence on smartphones versus high dependence on smartphones accounted for 33.3% versus 25.4% of the total, but 39.8% versus 20.8% in boys and 27.1% versus 29.8% in girls, which also shows that girl smartphone dependence is higher than that of boys.

In addition, the proportions of groups with high perceived stress levels, those who experienced sadness or suicidal ideation, those who thought their health was not rated high, and those with moderate or higher anxiety levels were higher in girls than in boys. The proportion of boys performing physical activity more than 3 times per week was higher than that of girls.

Differences in body image distortion by smartphone usage time and dependence

After conducting complex sample χ^2 test, the factors that have a significant association with body image distortions differed by gender; therefore, a multivariate logistic regression was separately performed to analyze differences in body image distortion according to smartphone usage time and dependence for boys and girls (Table 2, Supplement 2). After adjusting for covariates, including smartphone usage time, both moderate and high levels of smartphone dependency were associated with body image distortion in boys (moderate: adjusted OR [aOR], 1.11; 95% confidence interval [CI], 1.01–1.22; high: aOR, 1.18; 95% CI, 1.05–1.32) as well as in girls (moderate: aOR, 1.14; 95% CI, 1.05–1.23; high: aOR, 1.30; 95% CI, 1.18–1.42) compared to the reference group. The interaction by gender was significant ($P < 0.001$). However, no significant association was found between smartphone usage duration and body image distortion after adjusting for covariates, including smartphone dependency.

Discussion

Our study is the first study to investigate the association between body image distortion with smartphone dependence and usage duration after adjusting for smartphone usage duration and dependence separately. A notable strength of this study is that it used data representing a national sample of Korean students which implemented strict quality control using standardized operating procedures.

The study findings showed that smartphone usage time was not significantly associated with body image distortion in either boys or girls. A study by Kwon et al. [12], using the 2017 KYRBS survey data showed the prolonged smartphone use (≥ 301 min/d) was positively associated with body image distortion after adjusting for types of contents. However, smartphone dependence was not considered in this study. Another study using the 2021 KYRBS survey data demonstrated that smartphone usage time was not significantly associated with body image distortion after adjusting for other covariates [21]. A study by Yang et al. [22] with adolescent girls in some countries, mainly China, found a relative indirect effect of excessive smartphone usage time on low body esteem, but this effect was not significant when controlling for

overall social media screen time. Considering adolescents' exposure to various media contents, especially social media, which idealizes thin body image, which is related to a negative body image, and that smartphone usage time also included educational purposes or information searching, the usage time of the smartphone itself may not necessarily be associated to the body image [12,14,22,23].

In this study, it was found that the higher the smartphone dependency, the greater the body image distortion in both boys and girls. In a study of middle school students in Korea, social network services and music/video content among smartphone usage types found a significantly positive effect on smartphone addiction [24]. In addition, Yang et al. [22] demonstrated that among various smartphone activities, social network services, listening to music, browsing websites, and watching TV shows showed significant indirect effects on low body esteem. Considering the above studies and our results that body image distortion is significantly related to smartphone dependence, and not smartphone usage time, the use of smartphone content that emphasizes ideal body image may be closely related to both smartphone dependence and body image distortion. For example, through music content, adolescents are exposed to videos of skinny models, celebrities, and pop stars, and through social network services, they can compare their bodies with ideal bodies [9,25]. The use of content that increases the likelihood of exposure to idealized body images and appearance-related content could lead to negative body images by increasing the opportunity to participate in cognitive internalization and body comparison of idealized body shapes [13,22,23].

The results of this study indicated that the proportion of body image distortion that overestimates one's body was significantly higher in girl than in boys, which is consistent with previous studies [3,12,21]. In addition, this study showed that in the higher smartphone dependency group, girls showed higher body image distortion than boys. Smartphone usage behavior also differed according to gender. Boys' smartphone dependence scores and smartphone usage time were significantly lower than those of girls. A study of Korean adolescents using 2017 KYRBS data and a 2021 survey report on the current condition of overdependence on smartphones showed that girls used messengers, social network services, and music content more than boys, while boys used educational content more than girls [5,12]. A possible explanation for this may be that smartphone usage is lower in adolescent boys, and is even lesser for content that exposes them to ideal body images. In general, women perceive their bodies as larger and heavier than they truly are, and men tend to underestimate their body size, probably because the ideal body image encountered through the media is skinny in women and muscular in men [3,13,14]. This study focused on investigating only the body image distortion that considers oneself fatter than one actually is. This could explain the lower level of body image distortion in boys compared to girls. Lastly, one study revealed that across various media, images of an ideal skinny women body are more prominently displayed than the ideal muscular men body. Moreover, the study also provided evidence that messages implying the attainability of ideal appearance are directed more toward women

[26]. Due to such gender differences in sociocultural norms for ideal appearance, women who have similar smartphone behaviors as men may be more negatively associated with body image than men.

In contrast, there was a significant difference in the prevalence of body image distortion between middle and high school boys, whereas there was no significant difference in girls (Table 1). Further analysis stratified by gender and age group revealed that smartphone dependence was not significantly associated with body image distortion in boy middle school students (Supplement 3). However, in boy high school students, higher smartphone dependence was significantly associated with increased body image distortion (moderate: aOR, 1.17; 95% CI, 1.01–1.36; high: aOR, 1.29; 95% CI, 1.09–1.29). Among high school students, the influence of gender on body image distortion due to smartphone dependence was not significant (P for interaction by gender=0.067). In boys, body image distortion and smartphone dependence showed a significant association only in the high school age group; therefore, it is possible that the association between the two was diluted in boys compared to girls when analyzed for all age groups. Furthermore, the significant association between smartphone dependence and body image distortion was observed only in the high school group, not in the middle school group; this may suggest the possibility of the need for sufficient time between exposure to appealing body images or appearance-related content through smartphones and the internalization of idealized body perceptions.

In addition, many studies have shown that smartphone dependence itself is significantly related to mental health issues, such as depression, anxiety, and decreased self-esteem [6,27]. Mental health-related factors, such as depression and anxiety, are also widely known to be significantly related to body image distortion [8]. Therefore, further research is needed to determine the causal relationship or mediating effect between smartphone dependence, body image distortion, and mental health.

Body image formed in adolescents can affect their physical and mental health [3]; therefore, it is necessary to establish measures to reduce adolescents' body image distortion and form healthy body images. According to the results of this study, smartphone dependence measurements is one of the ways to detect and screen adolescents vulnerable to body image distortion, early. In addition, to reduce body image distortion, simply limiting smartphone usage time may not be sufficient; effective and comprehensive strategies to prevent smartphone addiction are needed. A recent study showed that reducing social media use is significantly associated with body image improvement in adolescents [28]. Limiting or managing the use of social network services, which is known to be a significant factor in predicting smartphone addiction [24,29], and influencing the formation of negative body image could help reduce body image distortions [13,22].

This study had several limitations. First, owing to the nature of cross-sectional studies, the interpretation of the results was limited, and it was difficult to confirm the causal relationship between body image distortion and smartphone dependence. To contribute to the understanding of the areas related to body image distortion in adolescence,

it is necessary to clarify the direction of this relationship through additional prospective research. Second, this study used online survey data, which may have had measurement errors because weight and smartphone usage time were measured through self-reports. Third, it is thought that the content used through smartphones is closely related to body image distortion; however, the data on usage content was unavailable; therefore, related factors could not be sufficiently reflected. To overcome these limitations, further systematic research should be conducted based on the results of this study.

In conclusion, our findings showed that high smartphone dependence, but not smartphone usage duration, was significantly associated with body image distortion among Korean adolescents. Considering that body image distortion is a major pathology of eating disorders, which are important mental disorders in adolescence, it is necessary to establish a strategy to check and manage adolescents' dependence on smartphones.

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Supplementary materials

Supplementary materials can be found via <https://doi.org/10.4082/kjfm.23.0159>. Supplement 1. General characteristics of the participants according to body image distortion. Supplement 2. Adjusted aOR and 95% CI for body image distortion and other characteristics. Supplement 3. Adjusted aOR and 95% CI for body image distortion according to smartphone dependency stratified by grade.

References

- Cash TF. Body image: past, present, and future. *Body Image* 2004;1:1-5.
- Liechty JM. Body image distortion and three types of weight loss behaviors among nonoverweight girls in the United States. *J Adolesc Health* 2010;47:176-82.
- Hosseini SA, Padhy RK. *Body image distortion*. StatPearls Publishing; 2023.
- Voelker DK, Reel JJ, Greenleaf C. Weight status and body image perceptions in adolescents: current perspectives. *Adolesc Health Med Ther* 2015;6:149-58.
- Ministry of Science and ICT. The current condition of overdependence on smartphones [Internet]. National Information Society Agency; 2021 [cited 2024 Mar 10]. Available from: https://www.nia.or.kr/site/nia_kor/ex/bbs/View.do?cbIdx=65914&bcIdx=24288&parentSeq=24288
- Wacks Y, Weinstein AM. Excessive smartphone use is associated with health problems in adolescents and young adults. *Front Psychiatry* 2021;12:669042.
- Ding Y, Wan X, Lu G, Huang H, Liang Y, Yu J, et al. The associations between smartphone addiction and self-esteem, self-control, and social support among Chinese adolescents: a meta-analysis. *Front Psychol* 2022;13:1029323.
- Derenne J, Beresin E. Body image, media, and eating disorders: a 10-year update. *Acad Psychiatry* 2018;42:129-34.
- Fardouly J, Vartanian LR. Negative comparisons about one's appearance mediate the relationship between Facebook usage and body image concerns. *Body Image* 2015;12:82-8.
- Korea Press Foundation. *Tweens' and teens' media use in Korea 2019*. Korea Press Foundation; 2019.
- Liu Q, Sun J, Li Q, Zhou Z. Body dissatisfaction and smartphone addiction among Chinese adolescents: a moderated mediation model. *Child Youth Serv Rev* 2020;108:104613.
- Kwon S, Kim R, Lee JT, Kim J, Song S, Kim S, et al. Association of smartphone use with body image distortion and weight loss behaviors in Korean adolescents. *JAMA Netw Open* 2022;5:e2213237.
- Vuong AT, Jarman HK, Doley JR, McLean SA. Social media use and body dissatisfaction in adolescents: the moderating role of thin- and muscular-ideal internalisation. *Int J Environ Res Public Health* 2021;18:13222.
- Hargreaves DA, Tiggemann M. Idealized media images and adolescent body image: "comparing" boys and girls. *Body Image* 2004;1:351-61.
- Park E. Overestimation and underestimation: adolescents' weight perception in comparison to BMI-based weight status and how it varies across socio-demographic factors. *J Sch Health* 2011;81:57-64.
- Chae H. Factors associated with body image perception of adolescents. *Acta Psychol (Amst)* 2022;227:103620.
- Kim Y, Choi S, Chun C, Park S, Khang YH, Oh K. Data Resource Profile: The Korea Youth Risk Behavior Web-based Survey (KYRBS). *Int J Epidemiol* 2016;45:1076.
- Kim JH, Yun S, Hwang SS, Shim JO, Chae HW, Lee YJ, et al. The 2017 Korean National Growth Charts for children and adolescents: development, improvement, and prospects. *Korean J Pediatr* 2018;61:135-49.
- Korea Disease Control and Prevention Agency. *2021 Korea Youth Risk Behavior Survey raw data usage guidelines*. Ministry of Health and Welfare; 2021.
- National Information Society Agency. *Smartphone overdependence scale*. National Information Society Agency; 2016.
- Jung EH, Jun MK. Factors affecting body image distortion in adolescents. *Children (Basel)* 2022;9:1944.
- Yang H, Wang JJ, Tng GY, Yang S. Effects of social media and smartphone use on body esteem in female adolescents: testing a cognitive and affective model. *Children (Basel)* 2020;7:148.
- Groesz LM, Levine MP, Murnen SK. The effect of experimental presentation of thin media images on body satisfaction: a meta-analytic review. *Int J Eat Disord* 2002;31:1-16.
- Cha SS, Seo BK. Smartphone use and smartphone addiction in middle school students in Korea: prevalence, social networking service, and game use. *Health Psychol Open* 2018;5:2055102918755046.
- Bell BT, Lawton R, Dittmar H. The impact of thin models in music videos on adolescent girls' body dissatisfaction. *Body Image* 2007;4:137-45.
- Buote VM, Wilson AE, Strahan EJ, Gazzola SB, Papps F. Setting the bar: divergent sociocultural norms for women's and men's ideal appearance in real-world contexts. *Body Image* 2011;8:322-34.
- Sohn SY, Rees P, Wildridge B, Kalk NJ, Carter B. Prevalence of problematic smartphone usage and associated mental health outcomes amongst children and young people: a systematic review, meta-analysis and GRADE of the evidence. *BMC Psychiatry* 2019;19:356.
- Thai H, Davis CG, Mahboob W, Perry S, Adams A, Goldfield GS. Reducing social media use improves appearance and weight esteem in youth with emotional distress. *Psychol Pop Media* 2024;13:162-9.
- Jeong SH, Kim H, Yum JY, Hwang Y. What type of content are smartphone users addicted to?: SNS vs. games. *Comput Hum Behav* 2016;54:10-7.