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Association between adolescents' body mass index and excessive use of electronic media

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Abstract

Background: High body mass index (BMI) is associated with many health risks. Studies on the effect of excessive use of electronic media (EM) on high BMI are inconsistent.

Objectives: The purpose of this study was to investigate the relationship between excessive use of EM and BMI among adolescents.

Methods: A cross-sectional study was conducted with 382 students from middle and secondary schools in Kerbala City, Iraq. Data were collected from November 29, 2022, to March 7, 2023. Data collection was performed using a two-part self-report instrument. The first part contained items on participants' characteristics (including BMI) and the second part was the Excessive Use of Electronic Media Questionnaire (EUEMQ). Data were analyzed using independent t-test, analysis of variance, and linear regression analysis.

Results: The mean age of the students was 15.90 ± 1.36 years, and most of them were middle school students (62.6%). Approximately half of the students had a normal BMI, while 22.2% were overweight or obese. Mean BMI differed significantly between males and females (21.02±5015 vs. 23.14±4.33, P< 0.001). The majority of students (47.4%) spent 2-5 hours on the Internet/electronic media each day. Approximately 56.8% and 18.1% of the students reported moderate and severe EM use, respectively. The mean hours spent on the Internet and mean EM use did not differ significantly among students in different BMI categories. However, linear regression analysis showed that male gender ($P < 0.001$), number of hours spent online ($P = 0.026$), and excessive use of EM ($P < 0.001$) significantly influenced BMI.

Conclusion: Excessive use of EM was found to increase the likelihood of being overweight in adolescents. Because of the health risks associated with high BMI, education and health authorities, and nurses, need to educate adolescents, about the health risks of excessive use of EM.

Keywords: Electronic media, Body Mass Index, Adolescent.

Introduction

The use of electronic media (EM) offers a wide range of benefits, including access to social networks and the Internet, text and instant messaging, multimedia, and entertainment. EM excess is common among adolescents and is now a serious public health problem. Excessive use of EM causes adolescents to become distracted from and escape from everyday life, which has devastating effects on their physical health, psychological well-being, and academic achievement.[1]

Excessive use of EM such as television (TV), cell phones, personal computers (PC), video game consoles, and tablets is also associated with reduced physical activity, irregular sleep patterns, unhealthy eating habits, nighttime eating, overweight, obesity, high body mass index (BMI), and increased risk of developing metabolic syndrome.[2-4]

A study reported that 43% of children aged 8 to 11 years and 86% of adolescents aged 12 to 15 years own mobile phones, making them vulnerable to potential adverse health effects.[5] Another study found that prolonged nighttime screen viewing (including TV and cell phone use) in adolescents although not directly affecting their diet, was associated with greater waist circumference and inadequate sleep.[6] A study in Switzerland showed that adolescents spend an average of 196 min/day in front of TV, PC, laptops, tablets, and mobile phones. High screen watching time was associated with problems in falling

asleep, restless sleep, too early morning awakening, low-quality sleep, exhaustibility, lack of energy, and poor concentration.[7]

Although developed countries have higher levels of EM penetration rate (86.6%) than developing (47%) and least developed countries (19.1%), a recent study found that low- and middle-income countries have experienced a sharp rise in Internet usage.[8] A survey conducted in six Asian nations found that about 62% of adolescents aged 12 to 18 own smartphones. The ease of access to EM and the Internet has made this generation highly interested in using EM,[9] with 73% and 25% of teenagers at risk or exhibiting signs of media addiction, respectively.[10] Another European study also found that using one or more types of EM for more than two hours a day increased the risk of being overweight, but this association differed for boys and girls and by the level of physical activity. Use of EM has been shown to be associated with increased BMI and risk for overweight especially in girls.[11] However, a study found no significant association between the length of TV watching and cell phone usage and BMI.[12]

Nurses play a key role in identifying risk factors for overweight and in raising awareness among people of all ages, especially adolescents, about the health problems arising from high BMI and excessive use of EM. Given the critical role of nurses and the controversy in studies regarding the association between excessive use of EM and BMI, the question remains whether BMI is associated with the use of EM in adolescents.

Objectives

The aim of this study was to evaluate the association between excessive use of EM and BMI in adolescents.

Methods

Study design and participants

A cross-sectional study was conducted with students from 10 middle and secondary schools in Kerbala city, Iraq, from November 29, 2022, to March 7, 2023. We calculated the sample size using the formula for calculating the sample size for a finite population [Formula 1]. In an earlier study, 57% of adolescent boys exceeded two hours in EM behaviors.[11] Then, considering a confidence level of 95%, a p of 0.57, and a measurement precision (*d*) of 0.05, 348 students out of a total of 4450 were estimated to be needed for the study. However, we increased the sample size to 400 to compensate for the possible dropouts.

$$n = \frac{N(z_{1-\frac{\alpha}{2}})^2 \times pq}{(N-1)d^2 + (z_{1-\frac{\alpha}{2}})^2 \times pq}$$

Formula 1. Sample size calculation formula

Samples were conveniently selected from schools located in different areas of the center of the Kerbala Holy Governorate, as they were easily accessible to the researcher. Inclusion criteria were adolescent students aged 13–18 years, studying in middle and secondary schools in the center of the Holy Karbala Province, consenting to participate in this study, and being present while collecting data. Students who refused to participate in the study or left at least 10% of the questionnaire items blank were excluded from the study.

Data collection instruments

Data collection was performed using a two-part self-report instrument. The first part contained items on participants' characteristics including age, gender, education level, socioeconomic status, height, weight, body mass index (BMI), devices used as a means of EM, and number of hours each day spend in front of EM (i.e. watching TV, playing video games, or using a PC, laptop, or tablet). The second part of the instrument was the Excessive Use of Electronic Media Questionnaire (EUEMQ), which was adapted from the Internet Addiction Questionnaire (IAQ),[13] whose items were adapted to the target population. The EUEMQ includes 15 items distributed in 3 domains. All items are rated on a three-point Likert-type scale (always = 3, sometimes = 2, never = 1). The overall score can range from 15 to 45. Scores between 15 and 24, 25 and 34, and 35 and 45 reflect mild, moderate, and severe use of EM, respectively. The content validity of the EUEMQ was evaluated and confirmed by 17 professionals from the Kerbala, Baghdad, Babylon and Kirkuk Universities. The reliability of the EUEMQ was assessed through a pilot study with 38 secondary school students from the Holy Kerbala city and the Cronbach's alpha was 0.780.

All participating students completed the questionnaire at school and returned it to the researcher the same day. Those who did not answer completely were excluded.

Ethical considerations

This study was approved by the Ethics Committee of the College of Nursing, University of Kerbala, on October 28, 2022, with approval number D.A.278. A legal document requesting permission from the University of Karbala's College of Nursing to gather data, addressed to the Holy

Kerbala Province's Directorate General of Education. An official document from the Holy Kerbala Province's Directorate General of Education was sent to the staff members of middle and secondary schools in every governorate center. All students were briefed on the purpose of the study, data confidentiality, and their freedom to withdraw from the study, and their personal written informed consent was obtained. The study was conducted in accordance with the Declaration of Helsinki.

Statistical analysis

The data were analyzed using the statistical package of social sciences (SPSS) version 16. Means and standard deviations were calculated for descriptive statistics, and frequencies and percentages were calculated for categorical variables. BMI was calculated by dividing weight (in kilograms) by the square of height (in meters). The Kolmogorov-Smirnov test was used for testing normality. Linear regression was used to assess the influence of the independent variables on BMI as the dependent variable. To this end, all variables with $P < 0.5$ in univariate analyses were entered into the model and analyzed using the backward method. Before we performed the regression analysis, the categorical variables were first converted to dummy variables to represent subgroups of the samples. The level of significance was set at < 0.05.

Results

Out of 400 students, 382 completed the questionnaires and returned them to the researcher. Participants included 243 males and 139 females (the number of males was higher because most of the schools were male-only). The mean age of the students was 15.90 ± 1.36 years, and less than half (45.3%) were 14-15 years old. Most participants were middle school students (62.6%), and 73.8% reported that their families were of fair socioeconomic status. Approximately half of the students (49%) had a normal BMI, whereas 22.2% were overweight or obese. However, the mean BMI was significantly different between males and females (21.02 ± 5015 vs. 23.14 ± 4.33, $P < 0.001$). The majority of students (47.4%) spent 2-5 hours on the Internet each day. Approximately, 75% of the students reported moderate and severe EM use [Table 1].

Male students spent more hours online than female students ($P < 0.001$). Middle school students also spent more hours online than high school students ($P = 0.002$).

However, the mean hours students spent on the Internet did not differ significantly across different age groups, socioeconomic status, and BMI categories. Mean of EM use was significantly higher in students aged 16-17 years ($P < 0.04$), males ($P < 0.001$), and middle school students ($P < 0.001$). However, mean EM use did not differ significantly in terms of socioeconomic status and BMI categories [Table 2].

The mean hours spent on the Internet and mean EM use did not differ significantly among students within different BMI categories [Table 3]. However, linear regression analysis showed that male gender ($P < 0.001$), number of hours spent online ($P = 0.026$), and excessive use of EM ($P < 0.001$) significantly influenced BMI and explained 0.92% of its variance (adjusted $R^2 = 0.92$) [Table 4].

Table 1. Participants' sociodemographic characteristics

Variables	Frequency (%)
Age (Years)	
14-15	173 (45.3)
16-17	157 (41.1)
18-19	52 (13.6)
Gender	
Male	243 (63.6)
Female	139 (36.4)
Socioeconomic status	
Good	63 (16.5)
Fair	282 (73.8)
Poor	37 (9.7)
Study stage	
Middle school	239 (62.6)
High school	143 (37.4)
Hours of electronic media use a day	
≤ 1	22 (5.8)
2-5	108 (47.4)
6-10	138 (36.3)
11-15	35 (9.2)
16-20	5 (1.3)
BMI Categories	
Underweight	110 (28.8)
Normal weight	187 (49.0)
Overweight	56 (14.7)
Obesity	29 (7.5)
Severity of Electronic media use	
Mild	96 (25.1)
Moderate	217 (56.8)
Severe	69 (18.1)

Table 2. The mean severity of electronic media use and hours of electronic media use a day

Variables	Hours of spent on the Internet in a day, Mean ± SD	Excessive Use of Electronic Media Questionnaire, Mean ± SD
Age (Years)		
14-15	6.04 ±3.60	28.75 ± 5.53
16-17	6.15 ±4.05	29.22 ± 5.24
18-19	6.69 ±3.85	27.01 ± 5.18
P value (ANOVA)	0.56	0.04
Gender		
Male	6.70 ±3.92	29.88 ±5.29
Female	5.26 ±3.46	26.65 ±4.98
P value (t-test)	< 0.001	< 0.001
Socioeconomic status		
Good	6.35±3.55	28.25 ±4.97
Fair	6.19±3.95	28.76 ±5.37
Poor	5.82±3.26	29.05 ±6.37
P value (ANOVA)	0.79	0.73
Study stage		
Middle school	6.64 ±3.84	29.86 ±5.32
High school	5.40 ±3.66	26.77 ±4.98
P value (t-test)	0.002	< 0.001
BMI Categories		
Underweight	6.24±3.61	29.60±5.71
Normal weight	6.06±3.90	28.15±5.13
Overweight	5.79±3.55	28.12±4.98
Obesity	6.98±4.51	20.36±6.21
P value (ANOVA)	0.124	0.175

Table 3. The mean electronic media use and hours spent on the Internet according to BMI

Body mass index	Number of hours every day spend on the Internet, Mean±SD	Excessive Use of Social Media, Mean±SD
Underweight	6.24±3.61	29.60±5.71
Normal	6.06±3.90	28.15±5.13
Overweight	5.79±3.55	28.12±4.98
Obese	7.48±4.44	30.03±6.20
	6.18±3.82	28.70±5.40
P-value (ANOVA)	0.27	0.06

Table 4. Results of regression analysis for determining factors associated with students' body mass index [a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	P-value
	B	Std. Error	Beta		
Male gender	-2.817	0.699	-0.100	-4.030	< 0.001
Number of hours you spend on the Internet everyday	0.197	0.088	0.064	2.241	0.026
Excessive use of electronic media	0.754	0.026	0.985	29.491	< 0.001

[a] Adjusted R^2 = 0.92

Discussion

This study revealed that excessive use of EM, along with male gender, and number of hours spent on the Internet, could significantly influence BMI in middle and secondary students. Findings showed that male students spent more time online and used EM more than female

students.

Over one-fifth of the students who participated in the present study were obese or overweight. Although the average use of EM did not differ significantly across students in different BMI categories, linear regression results showed that the number of hours spent online and excessive use of EM can significantly influence students' BMI. In a study of the association between screen times, sleep duration, and BMI in under-five-year-old children, Sourtiji et al. have linked the observed association with greater amounts of unintentional eating during screen watching.[14] A systematic review also connected the high BMI and some other biomedical health indicators in young people to their sedentary behavior. Although the latter study concluded that there was inadequate data to conclusively link excessive use of EM to a high BMI.[15] A study in Saudi Arabia found that EM use, including TV, video games, and PC use, and reduced physical activity were risk factors for increased BMI and overweight.[16] However, there is controversy regarding the association between EM types, time of EM use, sex, and BMI in students and young adults.[16,17] A study also failed to find a direct association between BMI and excessive use of EM. However, high BMI was substantially correlated with parental body weight.[18]

In the current study, male students spent more hours on the Internet/electronic media than females and also had higher EUEMQ scores. However, they had lower BMI than the female students. Male gender was also negatively associated with BMI in the regression analysis. These findings might be attributable to the fact that there were more males than females in this study, and because males are typically more physically active and burn more energy than adolescent girls. Gender differences in growth during puberty must also be considered. Boys in adolescence are more likely to have higher muscle mass than females, so they will also burn more calories while exercising. Studies also show that the prevalence of behavioral patterns differs by gender, with males spending more time on screen watching and engaging in physical activity than females.[19-21]

This study has a number of strengths, including a large sample size with high statistical power. A major advantage of our study lies in the population-based data collection process. Nonetheless, we used a nonrandom sampling method, which decreases the generalizability of the findings. In addition, we used a self-report instrument, and data collected through such instruments are subject to social desirability bias. We recommend future studies use a more thorough design and objective methods to measure use of EM and time spent online. Finally, future studies need to identify reasons for EM use, such as leisure or learning, and consider intervention programs to reduce social media use and modify problems in adolescent healthcare packages.

Conclusions

Excessive use of EM was discovered to raise the likelihood of being overweight, especially among female students. This study discovered and controlled a number of variables related to the excessive use of EM. The study also revealed the influence of excessive use of EM on BMI in adolescents. Due to the health risks associated with high BMI, education and health authorities, as well as nurses, especially public health nurses, should educate adolescents, particularly middle and secondary school students, about the health risks of excessive use of EM.

Competing interests

The authors declare that they have no competing interests.

Abbreviations

Body mass index: BMI;
Electronic media: EM;
Excessive Use of Electronic Media Questionnaire: EUEMQ;
Television: TV;
Cell phones, personal computers: PC;
Internet Addiction Questionnaire: IAQ;
Statistical package of social sciences: SPSS.

Authors' contributions

All authors equally substantially contributed to the work design, acquisition, analysis, and interpretation of the data; Drafting or revising it critically for important intellectual content. All authors read and approved the final manuscript. All authors take responsibility for the integrity of the data and the accuracy of the data analysis.

Availability of data and materials

The data used in this study are available from the

corresponding author on request.

Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki. This study was approved by the Ethics Committee of the College of Nursing, University of Kerbala, on October 28, 2022, with approval number D.A.278. A legal document requesting permission from the University of Karbala's College of Nursing to gather data, addressed to the Holy Kerbala Province's Directorate General of Education. All participants signed an informed consent form.

Consent for publication

By submitting this document, the authors declare their consent for the final accepted version of the manuscript to be considered for publication.

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