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Cross-Sectional Associations between Physical Activity and Internet Addiction among Undergraduate Students in Taiwan

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ABSTRACT

Purpose
Internet addiction is a major health concern among undergraduate students; however, few studies have addressed modifiable behavioral factors associated with internet addiction in the context of Taiwan. This study aimed to investigate associations between physical activity and the risk of internet addiction among undergraduate students in Taiwan.

Methods
In 2017, we recruited 320 undergraduate students from Northern Taiwan to participate in a cross-sectional questionnaire-based survey. Physical activity was measured by the Taiwanese short-form version of the International Physical Activity Questionnaire, which evaluates an individual's weekly levels of vigorous-intensity aerobic physical activity (VPA) and moderate-intensity aerobic physical activity (MPA). Internet addiction was measured by the Chen Internet Addiction Scale (CIAS).

Results
For the 320 surveyed students, the average CIAS score was 53.3, and 18.13% of participants were at risk for internet addiction (defined as CIAS score >64). The results of the multiple regression analysis indicated that a routine of at least 150 min of MPA per week was negatively associated with risk for internet addiction (β=−4.39, 95% CI=[-8.10, -0.66]). No significant associations were observed between internet addiction and 75 min of VPA or 150 min of total physical activity per week. Among the 5 dimensions of the CIAS scale, MPA was negatively associated with tolerance symptoms, time-management problems, and interpersonal and health-related problems when a routine of 150 min per week was adopted.

Conclusion
A routine of 150 min of MPA per week was associated with a lower risk for internet addiction. Intervention efforts aimed at reducing undergraduate students' problematic internet use should promote recommended levels of MPA. We also recommend longitudinal research on the effects of engaging in physical activity on the risk of internet addition.

Keywords
Physical activity; Internet addiction; Undergraduate students.

INTRODUCTION

The internet usage rate has increased rapidly worldwide, and internet use has become an integral component of leisure time. In 2005, the number of internet users was one billion around the world, and in 2019, the number of internet users reached four billion.[1] Because of technological advancements, people use the internet to enjoy leisure time, strengthen interpersonal relationships, and learn new information efficiently. However, excessive and out-of-control internet use may lead to undesirable outcomes, such as educational or health problems.[2-5]

The conceptualization and operationalization of internet addiction have been debatable in past decades.[6] Internet addiction

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disorder, defined as the inability to control internet use, can lead to physical, psychological, and social difficulties.[7] Internet addiction, a type of behavioral addiction, also defined by the Diagnostic and Statistical Manual of Mental Disorders with respect to the following factors: tolerance, withdrawal, larger amounts, impaired control, time spent, neglect of activities, and continued use despite problems.[8,9] Considering the popularity of the internet, the risk of internet addiction may become a major public health concern, but the literature on the efforts on prevention of internet addiction is limited.[10] To develop interventions targeting on internet addiction prevention, the exploration of modifiable behavioral factors associated with internet addiction is necessary.

The World Health Organization (WHO) has recommended a specific level of physical activity for adults between the ages of 18 and 64-years. Activities were measured in metabolic equivalents (METs). For adults, one MET is defined as 1 kcal/kg/hour and is roughly equivalent to the energy expenditure of sitting quietly. Moderate-intensity activities burn 3-6 METs, vigorous-intensity activities burn >6 METs; walking, for example, consumes 3.5 METS.[11] Factors that may affect physical activity levels have been well-studied, and the link between screen time and physical activity has been proposed. People with excessive screen time may participate in insufficient physical activity.[12,13] However, notwithstanding studies on excess screen time, little is known regarding whether problematic internet use, particularly internet addiction, is associated with physical activity. The purpose of this study was to investigate the cross-sectional association between physical activity and risk of internet addiction among undergraduate students.

MATERIALS AND METHODS

Study Participants

We conducted a cross-sectional survey in Northern Taiwan in 2017 and recruited 320 undergraduate students. Sample size was determined by 95% confidence level and a confidence interval of 5. No incentive was provided for participants. The Institutional Review Board of National Taiwan Normal University approved the procedure and materials used in this study.

Measurements

The data used in this study were collected using a self-administrated questionnaire developed. Two valid and reliable scales were applied: the International Physical Activity Questionnaire (IPAQ)[14] and the Chen Internet Addiction Scale (CIAS).[15] Sociodemographic information, including sex, age, school type (university *versus* vocational college), and employment status, was also collected.

Physical activity was measured using the Taiwanese short-form version of the IPAQ, which evaluates an individual's weekly vigorous-intensity aerobic physical activity (VPA) level, moderate-intensity aerobic physical activity (MPA) level, and walking habits. According to the recommended levels of physical activity for adults, surveyed participants' VPA level was classified by whether the individual achieved at least 75 min of VPA throughout the week; MPA level was classified by whether the individual achieved at least 150 min of MPA and walking throughout the week; and total physical activity was classified by whether the individual achieved at least a 150-min equivalent combination of VPA, MPA, and walking.

The CIAS was used to measure the risk of internet addiction. The CIAS consists of 26 items, and it evaluates five dimensions concerning internet addiction: compulsive use of the internet, internet addiction withdrawal symptoms, internet addiction tolerance symptoms, interpersonal and health-related problems, and time-management problems. Compulsive use of the internet, internet addiction withdrawal symptoms, and internet addiction tolerance symptoms were defined as the core symptoms of internet addiction, and interpersonal and health-related problems and time-management problems were defined as problems associated with internet addiction. Each response was scored on a 4-point Likert scale. A higher score indicated a higher risk of internet addiction. Those with total scores higher than 64 were classified as being at risk for internet addition.

Statistical Analysis

Data were analyzed using descriptive statistics and multiple regression analysis in SAS version 9.4 (SAS Institute Inc., Cary, NC, USA). Significance was set at a p value of 0.05 or less. The regression model was adjusted for sociodemographic variables, including sex, age, school type, and employment status.

RESULTS

For the 320 surveyed undergraduate students, the average CIAS score was 53.3, and 18.13% of participants were at risk for internet addiction (Table 1). In terms of IPAQ, 45.63% of participants reported at least 75 min of VPA per week, 79.69% reported at least 150 min of MPA per week, and 59.06% reported at least 150 min of total physical activity per week.

Multiple regression analysis results indicated that a routine of at least 150 min of MPA per week was negatively associated with the risk of internet addiction (β=−4.39, 95% CI=[-8.10, -0.66]). No significant association was observed between the risk of internet addiction and 75 min of VPA or 150 min of total physical activity per week (Table 2).

With respect to the five dimensions of internet addiction, a routine of at least 150 min of MPA per week was negatively associated with tolerance symptoms, time-management, and interpersonal and health-related problems. No significant association was observed between physical activity and withdrawal symptoms or compulsive use symptoms (Table 3).

DISCUSSION

The findings of this study indicated that a routine of at least 150 min of MPA per week was negatively associated with the risk of internet addiction in the context of Taiwan. In this study, we further analyzed the five dimensions of the CIAS and found that a routine of 150 min of MPA was negatively associated with tol-

Table 1. *Demographic Characteristics, Internet Addiction Risk, and Physical Activity Level of 320 Surveyed Undergraduate Students*

	N	%	Mean	SD
Sex				
Male	131	40.94		
Female	189	59.06		
Age			22.4	1.5
School Type				
University	298	93.13		
Vocational College	22	6.88		
Employment Status				
Not employed	142	44.38		
Full-time/ part-time job	178	55.62		
CIAS Score			53.3	13.7
Internet Addiction Risk				
No risk	262	81.88		
At risk	58	18.12		
VPA				
<75 min/week	174	54.38		
>=75 min/week	146	45.62		
MPA				
<150 min/week	65	20.31		
>=150 min/week	255	79.69		
Total PA				
<150 min/week	131	40.94		
>=150 min/week	189	59.06		

SD: Standard deviation; CIAS: the Chen Internet Addiction Scale;VPA:Vigorous physical activity; MPA: Moderate physical activity; PA: Physical activity.

Table 3. *Multiple Regression Models of Physical Activity and the Five Dimensions of Internet Addiction Measured Using the CIAS*

	F	B	95% CI	*p* value
Tolerance Symptoms				
VPA (reference: <75min/ week)	1.21	-0.32	(-0.92,0.27)	0.28
MPA (reference: 150min/ week)	1.81	-0.91	(-1.63,-0.20)	0.01
Total PA (reference: <150min/week)	1.12	-0.17	(-0.77,0.42)	0.56
Withdrawal Symptoms				
VPA (reference: <75min/ week)	1.26	-0.40	(-1.11,0.30)	0.26
MPA (reference: 150min/ week)	1.18	-0.27	(-1.37,0.33)	0.23
Total PA (reference: <150min/week)	1.28	-0.52	(-0.97,0.43)	0.43
Compulsive Use				
VPA (reference: <75 min/ week)	1.75	-0.47	(-1.20,0.27)	0.21
MPA (reference: 150 min/ week)	1.75	-0.56	(-1.45,0.33)	0.22
Total PA (reference: <150min/week)	1.71	-0.41	(-1.15,0.32)	0.27
Time Management Problems				
VPA (reference: <75 min/ week)	2.26	-0.35	(-1.08,0.37)	0.34
MPA (reference: 150 min/ week)	3.06	-1.23	(-2.10,-0.36)	0.01
Total PA (reference: <150 min/week)	2.25	-0.34	(-1.07,0.38)	0.35
Interpersonal and Health-related problem				
VPA (reference: <75 min/ week)	3.06	-0.59	(-1.50,0.31)	0.20
MPA (reference: 150 min/ week)	3.39	-1.16	(-2.25,-0.07)	0.04
Total PA (reference: <150 min/week)	3.27	-0.85	(-1.75,0.06)	0.07

Adjusted: sex, age, type of school, and employment status
CIAS: the Chen Internet Addiction Scale,VPA:Vigorous physical activity, MPA: Moderate physical activity, PA: Physical activity.

Table 2. *Multiple Regression Models of Physical Activity and CIAS Scores*

	F	B	95% CI	*p* value
VPA (reference: <75 min/week)	2.13	-2.14	(-5.22,0.95)	0.17
MPA(reference: 150 min/week)	2.54	-4.39	(-8.10,-0.66)	0.02
Total PA (reference: <150 min/week)	2.11	-2.05	(-5.13,1.05)	0.19

Adjusted: sex, age, type of school, and employment status
CIAS: the Chen Internet Addiction Scale,VPA:Vigorous physical activity, MPA: Moderate physical activity, PA: Physical activity.

erance symptoms, time-management problems, and interpersonal and health-related problems. In previous literature, physical activity is also reportedly associated with a low risk of problematic internet use among Korean adolescents.[16] Students spend a great deal of time using the internet, which might limit the amount of time that they can devote to physical activity. Data from Pakistan also indicated that the prevalence of internet addiction is higher among students who do not participate in any physical activity compared with those who do.[17]

A possible explanation for this negative association is self-control. It was previously observed that higher levels of self-control and self-management skills can reduce the risk for internet addiction. If individuals enhance their self-control and self-management skills, their risk for internet addiction may consequently be reduced.[18] A study of Korean adolescents suggested the effect of sports participation on internet addiction mediated by self-control.[19] Future study may investigate the mediation effects of life skills, such as self-control, time management, goal setting, or decision making, on the associations between physical activity levels and internet addiction.

Using two valid and reliable scales to measure the level of physical activity and internet addiction, this study indicated that a routine of 150 min of MPA per week was associated with a lower risk of internet addiction, particularly tolerance symptoms, time-management problems, and interpersonal and health-related problems. In the existing literature, little is known about the association between physical activity and internet addiction risk in the context of Taiwan. Among youths in Taiwan, the prevalence of internet addiction was noteworthy,[20] and it related to lower health-related quality of life.[21] Intervention efforts aimed at reducing undergraduate students' problematic internet use should promote student participation to ensure recommended levels of MPA. MPA is usually recommended as an appropriate form of regular exercise because it does not require specific skills or equipment and is convenient to engage in. Regular MPA can be an alternative behavior of internet use, which is an intervention strategy to reduce the risk of internet addiction.

LIMITATIONS

This study employed a self-administrated questionnaire-based survey; thus, recall bias is a possible limitation. Information on the details of internet use habits, such as the activities types that participants have done online, was not collected. The purposive sampling method also limits the representativeness of the study sample. Moreover, causality between physical activity and internet addiction could not be conclusively determined in this cross-sectional study. Future research on the longitudinal effects of physical activity on the risk of internet addiction is recommended.

CONCLUSION

A routine of 150 min of MPA per week was negatively associated with the risk of internet addiction among surveyed undergraduate students in Taiwan. Intervention efforts aimed at reducing problematic internet use should promote recommended levels of MPA in this population.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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