ORIGINAL ARTICLE

Relationship Between Smartphone Addiction, Depression, and Level of Physical Activity Among Undergraduate Students

Afeefa Raihana[1], Azliyana Azizan[1,2], Asmahanim Yusuf [3], Farid Rahman[4], Mu'jizatillah[5], Hiroki Saito[6]

[1] Centre of Physiotherapy, Faculty of Health Sciences, Universiti Teknologi MARA, Selangor Branch, Puncak Alam Campus, 42300 Bandar Puncak Alam, Selangor, Malaysia
[2] Coordinator of Social Creativity & Innovation (SCI), Research Nexus UiTM (ReNeU), Office of Deputy Vice Chancellor (Research & Innovation), 40450 Shah Alam, Selangor, Malaysia
[3] Akademi Pengajian Bahasa (APB), UiTM Cawangan Negeri Sembilan, Kampus Seremban, Persiaran Seremban Tiga/1, Seremban 3, 73000 Seremban, Negeri Sembilan, Malaysia
[4] Department of Physiotherapy, Faculty of Health Science, Universitas Muhammadiyah Surakarta, Jalan A. Yani Pabelan, Kartasura 57162, Indonesia
[5] Politeknik Unggulan Kalimantan Jl. Pangeran Hidayatullah Komplek Upik Futsal RT 14 Kelurahan Banua Anyar Banjarmasin Utara Kalimantan Selatan 70239
[6] Department of Physical Therapy, Tokyo University of Technology, 5-23-22 Nishikamata, Ota-ku, Tokyo 144-8535, Japan

ABSTRACT

Introduction: Smartphone addiction is one form of behavioral addiction that may affect an individual's mental and behavioral status. This addiction is especially an issue among students and has become one of the most significant public health concerns. Thus, this study aims to determine the association between smartphone addiction, depression, and physical activity among undergraduate students. **Methods:** A cross-sectional, online survey-based research was used to investigate further about this matter. A total of 151 participants who met the selection criteria were invited to participate in the study by answering a questionnaire attached with a consent form. The personal data sheet, Center for Epidemiological Studies Depression (CESD), the Smartphone Addiction Inventory-Short Form (SPAI-SF), and International Physical Activity Questionnaire - Short Form (IPAQ-SF) were used in this study. Data were statistically analyzed using the Statistical Package for Social Sciences (SPSS), version 27. **Results:** There was a strong and positive correlation between smartphone addiction and depression (r=0.313, p<0.01). The results also indicated that smartphone addiction was significantly associated with a low level of physical activity (r=-0.167, p<0.05). In contrast, there was no significant association between depression and level of physical activity among university students (r=-0.06, p>0.05). **Conclusion:** Smartphone addiction may lead to depression and reduced physical activity among undergraduate students.
Malaysian Journal of Medicine and Health Sciences (2022) 18(8):104-109. doi:10.47836/mjmhs18.8.15

Keywords: Depression, Physical activity, Smartphone addiction, Undergraduates

Corresponding Author:
Azliyana Azizan,PhD
Email: azliyana9338@uitm.edu.my

INTRODUCTION

Smartphones are widely available and have become pervasively used around the globe. As society is increasingly interconnected, the adoption of smartphone use remains one of the primary factors in technological development. Originally, unknown marketing strategists invented the term "smartphone" to refer to a new class of mobile phones that could allow access and process large amounts of data (1). According to a survey conducted to measure the adoption of smartphones in 2018 by Pew Research Center, more than 5 billion people globally have mobile devices, and more than half of these devices are smartphones (2). Based on a statistic from the Malaysian Communication and Multimedia Commission (MCMC) (3), smartphone users have increased from 75.9% in 2017 to 78.0 % in 2018. MCMC also reported that smartphone ownership was exceptionally high among young adults and those with a relatively high rate of income and with formal education. Additionally, the survey also reported that about 88% of people aged from 20 to 30 years old own a smartphone, and the adoption rate among university students is very high (at 95%) (3). There is also some factual evidence that most smartphone users are youths as this group mostly perceived shyness and lack of confidence, which caused

them to rely on smartphones to interact with others (4). The penetration of smartphones into livelihoods has been phenomenal in mainstream consumer markets worldwide, including media consumption, socializing, and others. Despite its many benefits, the overuse of smartphones can lead to smartphone addiction.

The rise of smartphone addiction among teenagers is undeniably real. An expert reported that excessive use of smartphones is when a person spends more than six hours on their phones per day, which may alter their thinking, influence their behaviours, and change their life identity. (5). Increased anxiety due to smartphone restriction often hindered students' ability to fully engage with other students and teachers throughout the school day. (6).

Smartphone addiction can lead to many health issues, including depression, anxiety (7), and poor physical activity (8). Moreover, depression is a major global mental health problem due to its high prevalence, chronic nature of the disease, and difficulties in diagnosis and rehabilitation (9). Previously, Ashraful Islam and his colleagues in 2018, found a significant proportion of depression (29.4%) among university students in Malaysia. Smartphone addiction might be one of the causes of depression among students. A few studies have recently revealed the significant associations between smartphone addiction scale scores and the level of depression among university students (7,10). Demirci et al. stated that based on the Beck Depression Inventory (BDI) cut-off rate, the group with the most smartphone usage had higher rates of depression than the group with the lowest smartphone usage. Regression analysis also found out that those with higher mobile use rates may have lower sleep quality which is anticipated to be caused by depression (7). In contrast, another researcher found no significant relationship between smartphone addiction and depression (11). This finding might be due to the monitoring of smartphone use that has curbed self-criticism in those with severe depression. As a result, these people tend to cut down their smartphone usage.

Specifically, smartphone addiction may negatively influence physical health by reducing the amount of physical activity, such as walking, resulting in an increase of fat mass and a decrease of muscle mass associated with adverse health consequences. Functions like calling, sending and receiving text messages, updating social networking sites, and browsing the Internet, have historically been defined as sedentary behaviors (12). There is a strong association between sedentary behavior and various health problems, including overweight or metabolic syndrome resulting in low levels of energy expenditure (13). Specifically, high Internet and computer use, considered as sedentary behaviors, are associated with higher body mass index and lower physical activity levels (14). It is believed that high-frequency users of smartphones can impede physical

activity, thus reducing cardiorespiratory fitness. To make things worse, in 2011, Malaysia has reported that about 35.2% of the total population were physically inactive (15). Therefore, our youth spent more time indoors and engaged in sedentary activities, predominantly involving electronic usage. Although numerous studies have been conducted on the relationship between smartphone addiction, depression, and physical activity, there is a lack of studies focusing on undergraduate students in Selangor, Malaysia. Moreover, previous evidence on the interactions between smartphone addiction, depression, and physical activity level was inconclusive. Hence, this interaction remains a significant aspect to consider as it may provide a new understanding of the implications of exposure towards the smartphone. This study was conducted to determine the relationship between smartphone addiction, depression, and level of physical activity among undergraduate students.

MATERIALS AND METHODS

This study was quantitative research, and it involved a multi-center cross-sectional approach. Ethics approval for this study was obtained from the Research Ethics Committee [reference: 600- TNCPI (5/1/6)] of UiTM. A total of 151 undergraduate students completed the questionnaire. Participants who met the selection criteria were invited to participate in the study by answering a questionnaire attached with a consent form. The inclusion criteria of the participants are as follows; (i) aged between (18-30 years), first-year Diploma students (ii) currently living in Malaysia, (iii) agreement to participate in this study by providing the consent form. The one exclusion criterion was students pursuing post-graduate education.

Questionnaires were distributed to the students via an online survey during the data collection process. Subjects are required to fill in 4 sets of questionnaires that include the patient's information sheet, smartphone addiction, depression, and level of physical activities. The questionnaire is a valid and reliable screening tool to assess smartphone addiction among university students (6). The questionnaire's contents were based on a few outcome measures. They are; 1) Smartphone Addiction Inventory (SPAI-SF) scale to assess the level of addiction towards smartphones, 2) Center for Epidemiologic Studies Depression scale (CES-D) for depression, and 3) International Physical Activity Questionnaire Short-Form (IPAQ-SF) and 4) Study Variables Smartphone Addiction Inventory (Short Form scale) SPAI-SF. The SPAI-SF scales that consist of four subscales are compulsive behaviours (9 items), functional impairment (8 items), withdrawal (6 items), and tolerance (3 items) to smartphones. These items were recorded as a 4-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). The cut-off point of 24/25 in the screening tool was to investigate heavy smartphone users at high risk for smartphone

addiction, based on time consumption. The CES-D was used to measure depressive symptomatology in the general population for the past week (17). Radloff (1977) has developed a four-factor structure which are depressed affect (DA), somatic/vegetative factors (SV), interpersonal factor (IP), and positive affect (PA) (17). This scale has 20 items that implement the Likert scale with four points. The points range from "rarely or none of the time" (0 point) to "most of the time" (3 points).

As for questions 4, 8, 12, and 16, the points were reversed as "rarely or none of the time" (3 points, to "most of the time" (0 point). The total score ranged from 0 to 60, where a higher score indicates more severe symptoms of depression. The final score was the sum of the 20 questions with the possible range of 0-60. If more than four questions had missing answers, a CES-D score of the questionnaire was not obtained. A score of 16 points or more considers the individual as being depressed. The reliability of CES-D has been demonstrated in a study of suicide attempters and residents with Cronbach's alpha values of 0.940 and 0.895, respectively (18).

IPAQ of the Short Form version was used to measure participants' level of physical activity in the past 7 days (19). Walking, moderate-intensity activities and vigorous-intensity activities are the specific types of activities measured in this questionnaire. The score was categorized into 3, which are low, moderate, and high-level physical activity. The following values were used to analyze IPAQ data: walking = 3.3 METs, Moderate PA = 4.0 METs, Vigorous PA = 8.0 METs.

RESULT

A total of 151 students (15.2% male, n = 23; 84.8% female, n = 128) were included in this study. The sociodemographic data and characteristics of the participants are summarized in Table I. Table II shows the association between smartphone addiction, depression, and level of physical activity. The relationship between smartphone addiction (as measured by the SPAI-SF), depression (as measured by the CES-D), and level of physical activity (as measured using IPAQ-SF) was investigated using the Pearson correlation coefficient. Preliminary analyses were performed to ensure non-violation of normality, linearity, and homoscedasticity assumptions. There was a slight and positive correlation between smartphone addiction and depression (r=0.313, n=151, p=0.000). Here, a higher score on the smartphone addiction scale was associated with a higher score on the depression scale. Additionally, the current data showed that prolonged use of smartphones was associated with a low level of physical activity. There was a significant negative correlation between these two variables (r=-0.167, n=151, p=0.040), with a higher score of smartphone addiction scale being associated with a lower level of physical activity. However, the results of the Pearson correlation indicated that there

was no significant association between depression and the level of physical activity (r=-0.06, n=151, p=0.461).

Table I: Characteristic of participants

Variables	N (151)		
	F(%)	Mean ± SD	Range
Age (years)		21.750 ± 1.362	19-25
Gender			
Male	23 (15.2)		
Female	128 (84.8)		
Body Mass Index (BMI)		22.107 ± 3.974	15.15-37.62
Level of smartphone addiction			
Smartphone addict	84 (55.6)		
Non-smartphone addict	67 (44.4)		
Level of depression			
Depressed	90 (59.6)		
Not depressed	61 (40.4)		
Level of physical activity			
Low	94 (62.3)		
Moderate	39 (25.8)		
High	18 (11.9)		

Note: F= frequency; SD= standard deviations

Table II: The relationship between the level of smartphone addiction with physical activity and depression

Measures	Participants (n= 151)			
	(1)		(2)	
	r	P	r	P
(1) The level of smartphone addiction (scores)	-			
(2) The level of depression (scores)	0.313**-	0.000	-	
(3) The level of physical activity (scores)	0.167**	0.040	-0.06	0.461

Note: ** = Correlation is significant at the 0.01 level (2-tailed)

DISCUSSION

This current study reported a significant relationship between the level of smartphone addiction with depression and physical activity among undergraduate students. About 55.6% of the results showed that the participants were addicted to their smartphones. This result was consistent with the previous study, which

reported that most students, particularly females, spent more time on social media and online chatting (20). Those who were highly used and attached to their smartphone usually developed low self-esteem. These individuals chose online interactions to gain acceptance and attention from others and consequently feel valued (21). However, spending more time on social media does not help to improve everyone's self-esteem.

This current finding revealed a significant association between smartphone addiction and the level of depressive symptoms. Up to 60% of the participants reported experiencing depression and mental health issues. The researcher also agreed that these depression issues came out from various predisposing factors that may include the concepts of behavioural addiction. Behavioral addictions may refer to poor tolerance, withdrawal (dysphoria when the battery dies), preoccupation, neglect of other activities, and personal loss of control (23), resulting in depressive symptoms. In line with this, the Consumer Affairs Agency of Japan (2017), also stated that more than half of the young people in Japan aged 15 to 25 who used social media or online chatting platforms via smartphones had reported bad experiences, and these included being judged and condemned (24). Another survey indicated that about 55% of undergraduates had a negative social media experience, such as bullying or hatefulness, inappropriate contact, or misunderstandings (25).

Social media can affect youths' self-view and interpersonal relationships through social comparison and negative interactions, including cyberbullying. The misuse of smartphones could also lead to bullying and harassment. Incidences of bullying and harassment at schools and colleges increase the risk of depression (26). These experiences would lead to a decline in self-esteem, depression, and mental health problems among youth. Additionally, cyberbullying is a worrisome trend that has emerged because of the increased use of technology, whereby email, SMS, and social networking sites have been used to harass online. The victims might feel sad, embarrassed, depressed, and have suicidal thoughts, while others have committed suicide (27). Moreover, social media content often involves normalization and promotes self-harm and suicidality among youth.

Next, this current study also pointed out a strong association between smartphone addiction and the level of physical activity. The majority of the participants reported low engagement in any physical activity (62.3%), which could lead to poor health outcomes. Data reported by Haripriya, Samuel, and Megha (2019), as well as Zhai et al. (2020), were consistent with this current study (28-29). This finding implies that those addicted to smartphones will spend more time on their phones and have less daily physical activity, resulting in a low MET-minute per week value. Frequent mobile phone use was associated with everyday stress, sleep disturbances, and symptoms of depression. These problems could be due to tiredness and other barriers to physical activity such as lack of time, other commitments, and lack of motivation.

Prolonged Internet or smartphone use, particularly late at night, might also have indirect negative consequences to one's sleep, such as sleep deprivation (28). According to a study conducted by Lemola et al. (2014), people who use smartphones sleep later in the night without affecting the depth and restfulness of their sleep (11). Additionally, during the COVID-19 pandemic, teenagers were confined to their homes, which limited their options for regular exercise or any engagement in physical activities. As a result, their levels of physical activity dramatically dropped. Active engagement in team sports and physical activity may boost students' well-being, increase prosocial behaviour, and reduce adolescent disaffection when they are at school. Physical education programmes may have played a significant role in ensuring that students get enough exercise during the school day. Unfortunately, due to the lengthy school closure, access to physical activity and their related advantages were impaired.

On the other hand, high school students have relatively larger academic-related workloads, and commitments thus may cause them to experience a lower engagement in physical activity than lower grade children. Previous studies have shown that physical inactivity or a sedentary lifestyle increased among undergraduates as their age and educational attainment advanced (30). Inadequate physical exercise can impair adolescents' growth and development, resulting in various adverse outcomes.

Another possible contributing factor that leads to a reduction of physical activity among the participants might be their desire to spend more time on social media. Addiction to smartphones causes an individual to choose a smartphone over another activity. Smartphone users should be adequately educated and warned about the negative health effects of excessive smartphone use. It is critical to eliminate sedentary behaviour to enhance physical activity and improve health.

This present study also had a few limitations. Firstly, the data collection was taken during the pandemic, and the Malaysian government enforced a movement control order (MCO). This might have affected the level of physical activity, as the participants were restricted from leaving the house unless for valid reasons. Secondly, the result of this study may represent the entire population as this study was a cross-sectional online survey, which was the data were self-reported and could lead to biasness.

CONCLUSION

Taken together, findings from this study revealed that smartphone addiction is associated with many physical and mental health problems. Individuals addicted to smartphones may experience a higher severity of depression, a poor level of physical activity, bodily pain, and daytime sleepiness. Finally, future studies involving longitudinal studies are warranted to investigate personal characteristics and psychosocial factors and their influence on smartphone addiction among undergraduate students.

ACKNOWLEDGEMENTS

REFERENCES

1. Zheng P, Ni L. Smart Phone and Next Generation Mobile Computing. Burlington: Elsevier Science; 2010.
2. Topic: Smartphones [Internet]. Statista. 2022 [cited 24 January 2022]. Available from: https://www.statista.com/topics/840/smartphones/
3. MCMC. Internet Users Survey 2018: Statistical Brief Number Twenty-Three, 2018, 1-39.
4. Aljomaa S, Al.Qudah M, Albursan I, Bakhiet S, Abduljabbar A. Smartphone addiction among university students in the light of some variables. Computers in Human Behavior. 2016;61:155-164.
5. Kwon M, Lee J, Won W, Park J, Min J, Hahn C et al. Development and Validation of a Smartphone Addiction Scale (SAS). PLoS ONE. 2013;8(2):e56936.
6. Jaalouk D, Boumosleh J. Is Smartphone Addiction Associated with a Younger Age at First Use in University Students?. Global Journal of Health Science. 2018;10(2):134.
7. Demirci K, Акgunьl M, Akpinar A. Relationship of smartphone use severity with sleep quality, depression, and anxiety in university students. Journal of Behavioral Addictions. 2015;4(2):85-92.
8. Suzbilir F. The Impact of Social Media Usage And Smartphone Addiction On Youngs'/Adolescents' Career Futures: A Study At High Schools. Business & Management Studies: An International Journal. 2018;6(2):466-487.
9. Ashraful Islam M, Yun Low W, Ting Tong W, Wan Yuen CC, Abdullah A. Factors Associated with Depression among University Students in Malaysia: A Cross-sectional Study. KLS. 2018 May 17;4(4):415.
10. Ko C, Yen J, Yen C, Chen C, Chen C. The association between Internet addiction and psychiatric disorder: A review of the literature. Eur psychiatr. 2012 Jan;27(1):1-8.
11. Lemola S, Perkinson-Gloor N, Brand S, Dewald-Kaufmann JF, Grob A. Adolescents' Electronic Media Use at Night, Sleep Disturbance, and Depressive Symptoms in the Smartphone Age. J Youth Adolescence. 2015 Feb;44(2):405-18.
12. Rosenberg DE, Norman GJ, Wagner N, Patrick K, Calfas KJ, Sallis JF. Reliability and Validity of the Sedentary Behavior Questionnaire (SBQ) for Adults. Journal of Physical Activity and Health. 2010 Nov;7(6):697-705.
13. Park JH, Moon JH, Kim HJ, Kong MH, Oh YH. Sedentary Lifestyle: Overview of Updated Evidence of Potential Health Risks. Korean J Fam Med. 2020 Nov 20;41(6):365-73.
14. Tremblay MS, LeBlanc AG, Kho ME, Saunders TJ, Larouche R, Colley RC, et al. Systematic review of sedentary behaviour and health indicators in school-aged children and youth. Int J Behav Nutr Phys Act. 2011;8(1):98.
15. Rajappan R, Selvaganapathy K, Liew L. Physical Activity Level Among University Students: A Cross Sectional Survey. IJPR. 2015 Dec 11;3(6):1336-43.
16. Ziaei R, Mohammadi R, Dastgiri S, Baybordi E, Rahimi VA, Sadeghi-Bazargani H, et al. The prevalence and correlates of physical activity/inactivity and sedentary behaviour among high-school adolescents in Iran: a cross-sectional study. J Public Health (Berl). 2020 Oct 14
17. Radloff. The CES-D Scale: A Self-Report Depression Scale for Research in the General Population. Appl. Psychol. Meas. 1977, 1, 385–401
18. Yang L, Jia C, Qin P. Reliability and validity of the Center for Epidemiologic Studies Depression Scale (CES-D) among suicide attempters and comparison residents in rural China. BMC Psychiatry. 2015 Dec;15(1):1-8
19. Buke M, Egesoy H, Unver F. The effect of smartphone addiction on physical activity level in sports science undergraduates. Journal of Bodywork and Movement Therapies. 2021 Oct;28:530-4.
20. Nishida T, Tamura H, Sakakibara H. The association of smartphone use and depression in Japanese adolescents. Psychiatry Research. 2019 Mar;273:523-7.
21. Li C, Liu D, Dong Y. Self-Esteem and Problematic Smartphone Use Among Adolescents: A Moderated Mediation Model of Depression and Interpersonal Trust. Front Psychol. 2019 Dec 20;10
22. 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 Dec;19(1)
23. Consumer Affairs Agency of Japan. 消費生活に関する意識調査 結果報告書 消費者庁, 2017, pp 0–21.
24. Rosenthal SR, Buka SL, Marshall BD, Carey KB,

Clark MA. Negative Experiences on Facebook and Depressive Symptoms Among Young Adults. Journal of Adolescent Health. 2016 Nov;59(5):510-6.

25. Qudah MFA, Albursan IS, Bakhiet SFA, Hassan EMAH, Alfnan AA, Aljomaa SS, et al. Smartphone Addiction and Its Relationship with Cyberbullying Among University Students. Int J Ment Health Addiction. 2019 Jun;17(3):628-43.

26. Akbulut, Y. Reflections of Preservice Information Technology Teachers Regarding Cyberbullying. Turk. Online J. Qual. Inq. 2011; 2(3):67–76–76.

27. Ratan ZA, Parrish A, Zaman SB, Alotaibi MS, Hosseinzadeh H. Smartphone Addiction and Associated Health Outcomes in Adult Populations: A Systematic Review. IJERPH. 2021 Nov 22;18(22):12257.

28. Zhai X, Wu N, Koriyama S, Wang C, Shi M, Huang T, et al. Mediating Effect of Perceived Stress on the Association between Physical Activity and Sleep Quality among Chinese College Students. IJERPH. 2021 Jan 2;18(1):289.

29. Seidu A, Ahinkorah BO, Agbaglo E, Darteh EKM, Ameyaw EK, Budu E, et al. Are senior high school students in Ghana meeting WHO's recommended level of physical activity? Evidence from the 2012 Global School-based Student Health Survey Data. PLoS ONE. 2020 Feb 12;15(2):e0229012.

30. Kleppang AL, Hartz I, Thurston M, Hagquist C. The association between physical activity and symptoms of depression in different contexts – a cross-sectional study of Norwegian adolescents. BMC Public Health. 2018 Dec;18(1)