



P-ISSN: 2394-1685
E-ISSN: 2394-1693
Impact Factor (ISRA): 5.38
IJPESH 2022; 9(2): 433-436
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www.kheljournal.com
Received: 03-11-2021
Accepted: 10-12-2021

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International Journal of Physical Education, Sports and Health

The association of mobile screen time and elevated blood pressure during the COVID-19 pandemic

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DOI: <https://doi.org/10.22271/kheljournal.2022.v9.i1g.2367>

Abstract

Excessive mobile screen time (MST) is more pronounced in youth. Excessive MST can increase sedentary lifestyle and detrimental health consequences such as elevated blood pressure (EBP), evolving rapidly into worse cardiovascular disturbances. This study examined the association between mobile screen time and high blood pressure in medical college students. This study was cross-sectional, involving 102 undergraduate medical students. Mobile screen time was obtained from Screen Time Monitor for iOS and Screen Time – Restrain Yourself & Parental Control Ver. 2.1.1. MST was considered low if <7hours/day and high if ≥ 7 hours/day. Subjects were encouraged to perform self-measure blood pressure. Blood pressure was measured using a digital blood pressure monitor (oscillometric) according to the current guideline from the American College of Cardiology/American Heart Association. Chi-square or independent t-test was applied to compare variables between groups. Significance was set at $p < 0.05$. Statistical analysis was computed with Statistical Package for the Social Sciences (SPSS) version 19. A high mobile screen time (≥ 7 hours/day) was identified in 56 students (54.9%). Elevated blood pressure was found in 11,8% of students. Systolic blood pressure was higher in high MST (110.87 mmHg \pm 6.84 vs. 115.02 mmHg \pm 9.28, $p=0.011$). Association between mobile screen time and elevated blood pressure was significant (OR 4.78, 95% CI 3.21-6.36, $p=0.035$). Mobile screen time had an association with elevated blood pressure in medical students. Students with high mobile screen time were 4.78 times more likely to have an elevated blood pressure than low mobile screen time.

Keywords: Elevated blood pressure, screen time, medical students, mobile gadget

1. Introduction

Rapid technological advances make the world seem to be in the palm of its hand. Gadgets make many things possible to be done. Communication runs fast and in real-time even though a very long distance separates people. Information can be obtained just in seconds. Gadgets make the distance and people seem close and negate the time difference between places in the world. Many providers provide various types of entertainment that can be accessed on mobile handphones or tablets. The film, songs, albums, television, art show or concert, music show or concert, and others can be enjoyed anytime and anywhere.

The ease of getting information and accessing entertainment and gadgets makes people immerse in excessive use or addiction. People prefer to spend more time on-screen devices instead of doing something else. Screen time is a term used to describe time allocated to gadgets use or activities are done in front of a screen. One of the most harmful effects of excessive screen time is reduced physical activity. A study conducted on adolescents in Spain reported that total screen time negatively correlated with moderate or vigorous physical activity in boys [1]. A study on young adolescents in Ireland also demonstrated that long screen time was associated with low moderate to vigorous physical activity [2].

Studies have shown a significant relationship between gadget screen time and non-communicable diseases such as elevated blood pressure, insulin resistance, and decreased triglyceride metabolism [3]. Studies in Canada and Korea reported that screen time was independently correlated with metabolic syndrome in children adolescents [4, 5]. Nightingale *et al.* (2017) documented that screen time was independently associated with insulin resistance in children [6]. At the same time, a study conducted in Poland investigated the effect of screen time on hypertension in children and adolescents with intellectual disabilities [7].

The results found that low-level physical activity and long screen time increased the risk of hypertension [7].

Hypertension is a serious health problem and one of the major causes of death globally. Hypertension is called the silent killer because sufferers often do not feel any symptoms. Thus, hypertension is often undiagnosed. Hypertension is diagnosed when the patient has a routine medical check-up or is examined by a medical officer because of other suspected diseases. A study in China addressed the increasing prevalence of hypertension at a young age [8]. Hypertension in young boosts stroke incidence at a younger age. Gerber *et al.* (2021) reported that stage 2 hypertension increased stroke incidence at 30 and 40 years [9].

Undergoing medical school education is arduous. The class schedule is hectic from morning until afternoon. Lecture material is very much and, for most students, burdensome. Campus assignments are so overwhelming that the students have very little time to relax and play. Also, they must search for course references on the internet. This results in reduced time for physical activity and increased screen time. Bednarz *et al.* (2019) reported that medical students have a nearly 2.4 times higher prevalence of hypertension than the general population [10]. Their findings said that a higher prevalence of hypertension in medical students was linked to sex, waist size, and sleep [10]. A study by Al Wabel *et al.* (2018) [11] reported risk factors of hypertension in medical students in Saudi Arabia [11]. They identified gender, BMI, history of diabetes, and hypertension associated with hypertension [11]. However, screen time has not been reported yet as a risk factor or contributing factor for hypertension. Our study investigated the association between screen time and hypertension in medical students at the Atma Jaya Catholic University of Indonesia.

2. Methods

The design of this study was cross-sectional with observational analytics. One hundred and two medical students in years 1-3 participated in this study. Participants must use gadgets. Participants with a history of hypertension, hypertension medication use or medication affecting blood pressure, family history of hypertension, history of kidney disorders, consumed caffeine within six hours before blood pressure measurement, no blood pressure measuring device were excluded. This study was conducted from July to October 2020. The Research Ethics Board, School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia approved the study (25/01/KEP-FKUAJ/2020).

2.1 Data Retrieval

Screen time data was obtained using two applications, Built-in Screen Time Monitor for iOs and Screen Time – Restrain Yourself & Parental Control Ver. 2.1.1 (Iridium Dust Limited) for android. Both applications can compile screen-based activities and present what online activities are accessed within 24 hours per day. Subjects were requested to submit a daily screen time report by sending a screenshot. Daily average screen time was categorized into low if less than <7 hours/day and high screen time if seven hours or more/day.

2.2 Measurements

Blood pressure was obtained by self-measurement. Before measurements, we conduct virtual training on applying the blood pressure measuring device. The most measurement device used was a digital blood pressure monitor or validated electronic (oscillometric) upper-arm cuff device. Participants were encouraged to use certain brands but could use other

brands they already owned. The blood pressure measurement was conducted according to the current guideline from the American College of Cardiology/American Heart Association (ACC/AHA), measured three times in the morning (08.00-10.00) with a 1-minute interval between measurements [12]. Subjects took a photograph of measurement results on the monitor device and submitted it to researchers. The blood pressure was determined from the average of two measurements. Blood pressure was classified into two categories; normal if systolic blood pressure (SBP)<120 and or diastolic blood pressure (DBP)<80 mmHg, and elevated if systolic blood pressure ≥ 120 and or diastolic blood pressure ≥ 80 mmHg [13].

2.3 Statistical Analysis

Data analysis was analyzed using IBM SPSS Statistics for Windows Version 23 (SPSS Inc., Chicago, IL, USA). Numerical data were presented as mean \pm standard deviation, whereas categorical data as frequency (percentage). The comparison of numeric data between groups was assessed using the dependent sample T-test or Wilcoxon signed-rank test based on the normality of the data distribution. The association between variables was evaluated using a chi-square test. The results were considered statistically significant if $p < 0.05$.

3. Results

One hundred and two students participated in this study (71 female, 31 male). Characteristics of the subjects are described in table 1. The average daily screen time was less than 7 hours/day. The mean SBP and DBP were within normal.

Table 1: Characteristics of subjects

| Variables | Mean \pm SD or n (%) |
|-----------------------------------|------------------------|
| Age | 19.57 \pm 1.07 |
| Sex | |
| Female | 71 (69.6%) |
| Male | 31 (30.4%) |
| Mobile screen time (hours) | |
| Weekly screen time | 48.98 \pm 15.90 |
| Daily screen time | 6.99 \pm 2.27 |
| SBP (mmHg) | 113.15 \pm 8.50 |
| DBP (mmHg) | 76.76 \pm 5.22 |

Abbreviation. SBP-systolic blood pressure; DBP-diastolic blood pressure

Table 2 demonstrated the comparison between participants with low and high screen time. Independent T-test indicated that age and DBP were not significant between groups. Systolic blood pressure was significantly higher in participants with increased screen time than low screen time (110.87 \pm 6.84 vs. 115.02 \pm 9.28, $p=0.011$). Fifty-six (54.9%) participants (38 female, 18 male) had high daily screen time. However, the Chi-square test did not reveal an association between gender and screen time ($p=0.419$).

Table 2: Comparison between low vs. high mobile ST

| Variables | Low ST | High ST | <i>p</i> |
|------------|-------------------|-------------------|----------|
| Age | 19.67 \pm 1.01 | 19.48 \pm 1.11 | 0.369 |
| Sex | | | |
| Female | 33 | 38 | 0.419 |
| Male | 13 | 18 | |
| SBP (mmHg) | 110.87 \pm 6.84 | 115.02 \pm 9.28 | 0.011* |
| DBP (mmHg) | 76.17 \pm 5.09 | 77.25 \pm 5.33 | 0.301 |

Abbreviation. ST-screen time; SBP-systolic blood pressure; DBP-diastolic blood pressure

Table 3 describes the Chi-square test between screen time and blood pressure. Twelve participants (11.76%) had elevated blood pressure (2 low screen time, ten high screen time). The result showed that screen time was correlated with elevated blood pressure ($p=0.035$). Increased screen time had a 4.78 times higher possibility to experience elevated blood pressure (95% CI 3.21 – 6.36).

Table 3: Association between blood pressure and mobile screen time

| Variable | Low ST | High ST | <i>p</i> | OR |
|-------------|--------|---------|----------|------|
| Normal BP | 44 | 46 | 0.035 | 4.78 |
| Elevated BP | 2 | 10 | | |

Abbreviation. ST-screen time; BP-blood pressure

4. Discussion

Investigations on the association between screen time and elevated blood pressure have been performed. Several previous studies reported an association between screen time and hypertension in children and adolescents [4-7]. The recent study attempted to examine the association between mobile screen time and elevated blood pressure in medical students. Our findings showed that 54.9% of participants had high daily screen time. Systolic blood pressure was elevated in participants with increased screen time. Participants with increased screen time had a 4.78 greater risk of experiencing elevated blood pressure.

Our study revealed that elevated blood pressure was found in 11.76% of medical students. A greater prevalence was reported in Egypt [14]. Moussa *et al.* (2016) compared the prevalence of hypertension in two universities using direct blood pressure measurements. The prevalence of hypertension was 26.5% in Damietta University and 18.1% in Port-Said University [14]. Pengpid *et al.* (2014) reported that the prevalence of prehypertension among students in the University of the Philippines-Visayas was 13.9% [15]. When added to the prevalence of hypertension of 2.4%, the prevalence of elevated blood pressure becomes 16.3% [15]. Peltzer *et al.* (2017) reported high blood pressure among university students in ASEAN countries [16]. The prevalence of prehypertension and hypertension was 19% and 6.7% [16]. Differences in results between studies could be caused by several factors, including blood pressure measurement methods (by researchers or self-measurements), devices, number of measurements, and measurements time.

Our study's main findings showing screen time associated with elevated blood pressure were by several previous studies [4-7]. There have been studies investigating the relationship between screen time and metabolic disorders, including hypertension. Several studies found that screen time and metabolic syndrome were independent. Martinez-Gomez D *et al.* (2009) found that screen time was associated with hypertension in children, independent of body composition [17]. Mark and Janssen (2008) demonstrated that screen time was associated with metabolic syndrome, independent of physical activity [5]. However, opposite results were also reported. Findings by Nightingale *et al.* (2017) demonstrated that children with higher screen time had higher anthropometric measures, fatness, leptin, and insulin resistance [6]. At the same time, Wyszynska *et al.* (2017) reported that the risk of hypertension was more remarkable in low physical activity than in longer screen time [7]. Conflicting results between studies may be due to differences in the age of the subjects, cut-off of increased screen time and blood pressure, and blood pressure measurement method.

The mechanism of elevated blood pressure due to excessive screen time is still unknown. Nevertheless, from previous studies, increased blood pressure might be influenced by reduced physical activity, increased fatness, and insulin resistance. Physical activity is thought to diminish sympathetic nerve activity and decrease peripheral vascular resistance by stimulating nitric oxide (NO) secretion by vascular endothelium and neurohormonal responses [18]. Nitric oxide is a potent vasodilator that increases during exercise. Fatness and high-calorie intake are associated with increased sympathetic nerve stimulation due to increased resting plasma norepinephrine [19]. High fat and carbohydrate intake also stimulate α -1 and β -adrenergic receptors leading to elevation of sympathetic activity and blood pressure [20]. Insulin raises blood pressure via several mechanisms; elevating renal sodium reabsorption, activating the sympathetic nervous system, influencing transmembrane ion transport, and hypertrophy of resistance vessels [21].

Our study has some limitations. First, to comply with physical distancing during the COVID-19 pandemic, blood pressure was taken by self-measurements. To minimize bias, we conduct training to self-measurements blood pressure using a digital device for participants before the study. However, bias might still occur due to differences in devices brands. Second, other risk factors for elevated blood pressure (physical activity, body size, and fatness) were not observed. Taking into account risk factors would establish the association between screen time and elevated blood pressure in this study.

5. Conclusion

Due to limitations, part of the study's findings should be interpreted carefully. However, our results could support several previous investigations that reported screen time associated with elevated blood pressure. Participants with high screen time had almost five times greater risk of developing hypertension. More significantly higher systolic blood pressure was more pronounced than diastolic blood pressure between low and high screen time.

6. Acknowledgment

The author would like thanks to Felicia, Ghea Mangkuliguna, Abigail Tania, and Ratna Cornellya for managing the subjects and collecting the data.

7. Conflict interest

Authors have no conflict of interest.

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