



# Effect of Screen Time on Physical and Mental Health and Eating Habits During COVID-19 Lockdown in Lebanon

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**Objective** This study aimed to explore whether screen time and the screen type impacted various health aspects of children, including physical activity (PA), sleep quality, and eating habits. Additionally, we investigated whether children's eating behavior while using electronic devices affects their physical and mental health.

**Methods** We conducted an online survey asking for screen use (duration, type, and purpose), PA, eating habits, sleep problems, and level of depression. The participants were children between the ages of 3 and 7 years, and the survey was answered by the participants' parents from March 3 to March 20, 2021.

**Results** A screen time of  $\geq 2$  h in children was associated with various clinical characteristics, such as body mass index (BMI), sleep problems, depression, decreased PA, and unusual eating habits. Children's food eating behavior while using electronic devices was predicted by a total screen time  $\geq 2$  h, smartphone screen time  $\geq 2$  h, sleep problems, owning electronic devices, and eating unhealthy food.

**Conclusion** There was an interplay among children's PAs, eating behaviors, depression, sleep problems, and screen time in this pandemic era. Therefore, guiding children on the correct use of electronic devices and helping them eat healthy are paramount during this COVID-19 pandemic.

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**Keywords** COVID-19; Screen time; Eating; Sleep; Depression.

## INTRODUCTION

Over recent years, due to technological development, screen time has become a complex issue; with an ever-expanding variety of electronic media devices available worldwide,<sup>1</sup> time spent by children and adolescents in screen-based activities is continuously increasing, and coinciding with a decline in

outdoor activities.<sup>2,3</sup> This worldwide sedentary behavior has been negatively associated with the development of physical and cognitive abilities and positively associated with obesity, sleep problems, and behavioral problems.<sup>4</sup> Furthermore, this excessive screen use has been worsened by the emerging viral pandemic of coronavirus disease (COVID-19).<sup>5</sup>

Lebanon is a developing country fighting the COVID-19 outbreaks like the rest of the globe and trying to overcome the frightening impact. The first case of COVID-19 was reported in February 2020 by local authorities, and the WHO's preventive protocols were adopted by the Lebanese public health ministry policy<sup>6</sup> to control the infectious pandemic. The Lebanese government imposed a lockdown from March 1, 2020, and consequently, all educational and working institutions were closed, forcing the people to be at home.<sup>7</sup> Adults and children relied on technology to study, work, socialize, and spend long hours indoors, mainly in front of their screens.<sup>8</sup> For adults, the benefits of technological progress in enabling work and so-

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cial engagement should be acknowledged. However, for children, some effects are worrisome. The concern that children spend an extended period of time on screen is not without basis, as excessive screen time means reduced physical activity (PA) and a prolonged sedentary lifestyle, which is associated with a negative impact on physical and mental health.<sup>9</sup>

Long hours of screen time are associated with a short sleep duration, long sleep onset latency, and increased sleep deficiency.<sup>10</sup> Screen time longer than 2 h is related to poor PA.<sup>11</sup> Displacement hypothesis has been suggested, in which PAs are substituted for time spent in front of a screen.<sup>12</sup> Screen time is also associated with unhealthy eating habits, including lower vegetable and fruit consumption, higher energy intake, and higher fast food and snack intake.<sup>13,14</sup> Especially, eating while using electronic devices needs to be monitored with care in children. Screen viewing can distract children away from feeling physiologic satiety, leading to mindless eating and becoming overweight.<sup>11,15</sup> The COVID-19 lockdowns have negatively influenced children's eating pattern and PA.<sup>16</sup> Given the importance of sleep, eating, and PA in the development of children,<sup>17</sup> these aspects need attention during the pandemic.

Most studies on screen time of children have been conducted in well-developed countries.<sup>18</sup> However, similar studies in developing countries, such as Lebanon, are minimal; particularly, the effect of lockdown on various health aspects requires investigation. Therefore, it is essential to determine the changes in screen time after lockdown to identify the predominant type of screen-based activity among children, and to study children's lifestyle changes. This study aimed to explore whether eating food while using electronic devices during the pandemic affected children's physical and mental health. To this end, we investigated the impact of digital screen time on various health aspects of children, assessing the effect of screen time and type (TV, cellphone, iPad, etc.) on PA, eating habits, sleep quality, and behavior. Furthermore, we examined which clinical characteristics were associated with eating behavior while using electronic devices during the lockdown.

## METHODS

### Ethical aspect

We provided the information of study objectives, confidentiality, or risk/benefits of participating in this study in the survey form, and the participants answered after providing written informed consent. The participants agreed and voluntarily participated in this study. The study protocol was approved by the Institutional Review Board of Rafik Hariri University Hospital - Clinical Research Unit (2021-0206).

### Design and data collection tool

The link of the questionnaire was shared using a snowball technique, reaching many parents who had children between the ages of 3 and 7 years. The data were collected through convenience sampling through an online questionnaire using Google forms. The participants were asked to also send the questionnaire to parents who had similar age group children. The survey was distributed from March 3 to March 20, 2021, and responses were collected for 403 children across Lebanon.

In the first part of the questionnaire, sociodemographic data on sex, age, weight, height, residence area, private or public school, order of the child among siblings, and ownership of a device were assessed. In the second part, the screen time and sleep problems were assessed, and eating habits, PA, and mental health status were evaluated.

### Assessment

#### Measuring screen time

To measure the screen time of the children on different types of screens, direct questions were asked to indicate the amount of time spent per day on each device and the type of device used, including a computer, phone, iPad, or tablet. Participants were also asked to specify whether the main purpose of screen use was education (studying or watching school lectures) or entertainment (social media or entertainment videos).

#### Measuring eating habits and physical activity

The quality of food eaten by the child was assessed based on questions that divided eating habits into healthy (vegetables, fruits, milk, beans, etc.), sometimes healthy, and unhealthy (chips, desserts, fast food, etc.). Two additional questions about eating habits were asked to assess the degree of eating unhealthy food (does not consume, consume with moderation, or consumes excessively) and to determine whether the child ate the food while using a screen or not (never, sometimes, often, or always). Additionally, PA was assessed by asking a single question on how many days per week the child was active for at least 60 min (none, 1 day a week, less than half a week, more than half a week).

#### Children Sleep Habit Questionnaire-Abbreviated

In this study, we used the Children Sleep Habit Questionnaire-Abbreviated (CSHQ-A) (NICHD SECCYD-Wisconsin) to assess sleep problems in children by reviewing their sleep performance within a week (e.g., bedtime, sleep behavior, waking during the night, morning wake up). This scale is a modified version of the CSHQ. The questionnaire includes 22 questions ranging from "always" to "never," with a score of 1 to 5, respectively. "Always" is referred if the abnormal sleep behav-

ior occurs seven times in the past week, “usually” if the behavior occurs 5–6 times in the past week, “sometimes” for 2–4 times that week, “rarely” for once a week, and “never” for zero times a week. An abnormal sleep behavior is indicated by a total score of more than 30 on the CSHQ.<sup>19</sup>

### Preschool Feeling Checklist

To identify the mental health status of the children, we used the Preschool Feelings Checklist (PFC), which consists of 16 items that measure depressive symptoms in young children.<sup>20</sup> This scale is a yes/no checklist that includes symptoms, such as “frequently appears sad or says he/she feels sad,” “excited about play or activities as other kids,” and “often seems to be very tired and has low energy” ( $\alpha=0.68$  for this sample). If the score is 3 or higher, it indicates clinically relevant symptoms, with a sensitivity of 0.92 and specificity of 0.84 for clinically diagnosed major depressive disorder.

### Statistical analysis

The SPSS version 21.0 for Windows (IBM Corp., Armonk, NY, USA) was used for statistical analyses. The responses were divided into two groups based on sex, 2 h of screen time in each device, or sleep problems. For between-group comparisons, the demographic characteristics and clinical data were summarized as mean±standard deviation. The Student’s t-test was used for continuous variables and the chi-square test for categorical variables. Logistic regression analysis with the forward method was conducted. The dependent variable was eating foods while using electronic devices (Yes/No), and the independent variables were screen time ( $\geq 2$  h), smartphone use ( $\geq 2$  h), TV/PlayStation/Xbox use ( $\geq 2$  h), laptop use ( $\geq 2$  h), tablet/iPad use ( $\geq 2$  h), preschool feeling checklist score ( $\geq 3$ ), sleep problems (CSHQ-A  $\geq 30$ ), owning electronic devices, PA, and eating unhealthy food excessively. The level of significance for all analyses was defined as two-tailed ( $p < 0.05$ ).

## RESULTS

### Description and sex comparison

Among the 403 respondents, responses of 383 children whose parents agreed to use the responses for this study were finally included. The proportion of boys and girls was even. There was no significant difference in the age, screen time per day, physical status, the main purposes of using electronic devices, PA, and food consumption between boys and girls (Table 1). Furthermore, the sleep problem measured using the CSHQ-A was not significantly different between the two groups.

### Comparison according to screen time

We divided the participants into two groups: children with

screen time  $< 2$  h and those with screen time  $\geq 2$  h in each electronic device. There was no significant difference in the age and sex between the two groups, except for the age for children with laptop screen time (Table 2). The body mass index (BMI) was significantly higher among children with  $\geq 2$  h of screen time than in those with  $< 2$  h of screen time for only smartphone use. Among smartphone users, children with screen time  $\geq 2$  h used their device mainly for entertainment purposes, whereas among laptop users, children with screen time  $\geq 2$  h used their device mainly for education purposes. The total CSHQ-A score was significantly higher among children with  $\geq 2$  h of screen time than in those with  $< 2$  h of screen time in smartphone and TV/PlayStation/Xbox use. The proportion of PA was significantly different between the two groups for all devices, except TV/PlayStation/Xbox. The proportion of children who excessively ate unhealthy food was significantly higher among children with  $\geq 2$  h of screen time on a smartphone. The proportion of children eating food while using digital devices was significantly higher among those with  $\geq 2$  h of screen time on smartphones and tablet/iPad.

### Eating behavior while using electronic devices

When exploring the differences in clinical characteristics of children with and without eating food while using electronic devices (Table 3), we observed significant differences in the proportion of children with total screen time  $< 2$  h per day, smartphone or tablet/iPad screen time  $\geq 2$  h per day, children’s depression measured with PFC total score, sleep problems measured with CSHQ-A total score, the proportion of children having their own electronic devices, using electronic devices for entertainment, food constitution, and eating unhealthy foods excessively.

### Multivariable analysis

A logistic regression analysis with the forward method was conducted. The dependent variable was eating foods while using electronic devices (Yes/No), and age, sex and BMI were adjusted. Total screen time  $\geq 2$  h (adjusted odds ratio [aOR], 1.87; 95% confidence interval [CI], 1.09–3.21), smartphone screen time  $\geq 2$  h (aOR, 2.40; 95% CI, 1.30–4.43), sleep problems (aOR, 2.50; 95% CI, 1.50–4.16), having own electronic devices (aOR, 2.81; 95% CI, 1.72–4.61), and not eating unhealthy foods (aOR, 0.23; 95% CI, 0.07–0.81) were the significant independent variables that predicted children’s habit of eating foods while using electronic devices (Table 4).

## DISCUSSION

This study was the first in Lebanon to examine the effect of screen time use during the lockdown on PA, BMI, sleep quality, and eating behaviors among Lebanese children aged 37

**Table 1.** Demographic characteristics of responders (N=383)

Variables	Male (N=191)	Female (N=192)	p-value
Age (yr)	5.3±1.4	5.4±1.4	0.56
How much time per day does your child spend using a smartphone during this pandemic?			0.37
Never	0 (0.0)	1 (0.5)	
<1 h	15 (7.9)	15 (7.8)	
1 h	14 (7.3)	14 (7.3)	
2 h	24 (12.6)	22 (11.5)	
3 h	28 (14.7)	34 (17.7)	
4 h	32 (16.8)	23 (12.0)	
5 h	24 (12.6)	38 (19.8)	
6 h	26 (13.6)	16 (8.3)	
>7 h	28 (14.7)	29 (15.1)	
Physical status			
Body mass index (kg/m <sup>2</sup> )	17.5±3.8	17.6±4.5	0.84
Overweight	55 (28.8)	48 (25.0)	0.42
Obesity	30 (15.7)	24 (12.5)	0.38
Your child spends most of their time on electronic screens for			0.41
Education	73 (38.2)	82 (42.7)	
Entertainment	118 (61.8)	109 (56.8)	
Usually, how many days of the week was your child active for at least 60 min?			0.50
None	8 (4.2)	11 (5.7)	
1 day	25 (13.1)	18 (9.4)	
Less than half	30 (15.7)	37 (19.3)	
More than half	128 (67.0)	126 (65.6)	
During this month, your child's food mainly constituted of			0.62
Healthy food	82 (42.9)	92 (47.9)	
Sometimes healthy food	91 (47.6)	83 (43.2)	
Unhealthy food	18 (9.4)	17 (8.9)	
Does your child eat unhealthy food excessively?			0.77
Does not consume	10 (5.2)	13 (6.8)	
Consume with moderation	164 (85.9)	164 (85.4)	
Consume excessively	17 (8.9)	15 (7.8)	
Do your child eat food while using digital devices?			0.67
Never	60 (31.4)	71 (37.0)	
Sometimes	83 (43.5)	80 (41.7)	
Often	27 (14.1)	24 (12.5)	
Always	21 (11.0)	17 (8.9)	
Preschool Feeling Checklist			
Total score	2.9±2.2	3.1±2.8	0.52
Total score ≥3	90 (47.1)	85 (44.3)	0.61

**Table 1.** Demographic characteristics of responders (N=383) (continued)

Variables	Male (N=191)	Female (N=192)	p-value
Child Sleep Habit Questionnaire			
Bedtime	12.4±5.2	13.3±5.5	0.10
Sleep behavior	6.2±3.9	6.7±3.9	0.20
Waking during the night	1.8±1.6	1.9±1.6	0.71
Morning wake up	6.0±2.4	5.8±2.3	0.37
Total score	26.4±9.4	27.7±9.5	0.19

Data are presented as mean±standard deviation or N (%)

years. In this study, we observed that children with screen time  $\geq 2$  h had various clinical characteristics, such as high BMI, sleep problems, depression, poor PA, and poor eating habits. Eating food while using electronic devices was associated with total screen time  $\geq 2$  h, smartphone screen time  $\geq 2$  h, sleep problems, owning electronic devices, and eating unhealthy food.

Recent guidelines updated by the American Academy of Child and Adolescent Psychiatry in February 2020<sup>21</sup> suggest that children between 2–5 years of age can start to have an entertaining non-educational screen time outside of education, but it should be limited to approximately 1 h per weekday and 3 h on weekends. As for children aged  $\geq 6$  years, there are no strict guidelines on how much screen time they should get; however, parents should be careful that it does not interfere with their social relationships and responsibilities, and that they encourage healthy habits and limit activities that include a screen.<sup>21</sup> In this study, we found that too much smartphone screen time ( $\geq 2$  h) was associated with a significant increase in the consumption of unhealthy food ( $p=0.037$ ) and a high BMI ( $p=0.048$ ). However, BMI showed no variation when other electronic devices were used. This is consistent with a study conducted in 2012, wherein excessive use of social media among preschool children was associated with a significant increase in BMI.<sup>22</sup> Moreover, there were sleep problems among children with  $\geq 2$  h of screen time, as their total CSHQ-A score was significantly higher than that of children with  $< 2$  h of screen time on smartphones ( $p=0.008$ ) and TV/PlayStation/Xbox ( $p=0.021$ ). This result also aligns with literature reviews where children with excessive screen use during the daytime or before bedtime experienced more sleep disturbances and had poor sleep quality.<sup>23,24</sup>

This study indicates that Lebanese children, with an excessive use of digital devices during the COVID-19 pandemic ( $\geq 2$  h per day), reported lower levels of total PA (except for TV/PlayStation/Xbox) for more than half of the days (Table 2). The present data are in line with a previous cohort study among Dutch children, which revealed decreased PA levels in school-aged children during the COVID-19 pandemic, while screen

**Table 2.** Differences in clinical variables based on 2 h of screen time

Variables	Smartphone		TV/play station/Xbox		Laptop		Tablet/iPad		p-value			
	<2 h (N=272)	≥2 h (N=111)	p-value	<2 h (N=304)	≥2 h (N=79)	p-value	<2 h (N=299)	≥2 h (N=84)				
Age (yr)	5.3±1.4	5.6±1.3	0.067	5.3±1.4	5.6±1.4	0.091	5.2±1.4	6.2±1.0	<0.001	5.3±1.4	5.6±1.3	0.092
Sex (female)	48.9	53.2	0.500	50.3	49.4	0.900	49.7	52.2	0.791	49.2	53.6	0.537
Physical status												
Body mass index (kg/m <sup>2</sup> )	17.3±3.9	18.2±4.6	0.048	17.3±4.1	18.3±4.2	0.065	17.5±3.9	17.3±5.2	0.994	17.5±4.1	17.7±4.2	0.710
Overweight	24.8	34.6	0.073	26.0	33.8	0.198	28.5	23.5	0.456	28.7	23.8	0.408
Obesity	12.4	19.6	0.076	12.8	20.8	0.100	15.1	11.8	0.571	14.5	14.3	>0.999
Your child spends most of their time on electronic screens for			0.016			0.615			<0.001			0.211
Education	44.5	30.9		41.4	37.2		35.5	63.8		42.3	34.5	
Entertainment	55.5	69.1		58.6	62.8		64.5	36.2		57.7	65.5	
Preschool Feeling Checklist												
Total score	2.7±2.2	3.7±3.1	0.002	2.7±2.2	4.1±3.4	0.001	2.8±2.3	3.8±3.3	0.021	2.8±2.3	3.7±3.2	0.017
Total score ≥3	116 (42.6)	59 (53.2)	0.070	126 (41.4)	49 (62.0)	0.001	135 (43.0)	40 (58.0)	0.032	127 (42.5)	48 (57.1)	0.019
Children's Sleep Habit Questionnaire												
Bedtime	12.2±5.1	14.3±5.9	0.001	12.4±5.2	14.3±5.8	0.005	12.7±5.4	13.2±5.3	0.541	12.9±5.4	12.7±5.5	0.769
Sleep behavior	6.3±3.7	6.9±4.2	0.205	6.3±3.7	7.2±4.4	0.068	6.6±3.8	5.8±4.3	0.130	6.5±3.7	6.6±4.3	0.783
Waking during the night	1.8±1.6	2.0±1.7	0.232	1.8±1.6	2.2±1.9	0.050	1.9±1.7	1.4±1.3	0.008	2.0±1.7	1.4±1.5	0.013
Morning wake up	5.9±2.2	5.9±2.6	0.875	5.9±2.2	5.8±2.7	0.691	5.9±2.3	5.9±2.4	0.850	6.0±2.3	5.5±2.6	0.172
Total score	26.2±9.1	29.1±10.0	0.008	26.4±9.0	29.5±10.9	0.021	27.2±9.5	26.3±9.5	0.472	27.3±9.2	26.3±10.5	0.412
Usually, how many days of the week was your child active for at least 60 min?			0.010			0.160			0.003			0.004
None	4.8	5.4		4.6	6.3		3.2	13.0		3.3	10.7	
1 day	8.1	18.9		10.5	13.9		10.5	14.5		11.4	10.7	
Less than half	16.5	19.8		15.8	24.1		18.8	11.6		15.4	25.0	
More than half	70.6	55.9		69.1	55.7		67.5	60.9		69.9	53.6	
During this month, your child's food mainly constituted of			0.072			0.310			0.305			0.360
Healthy food	46.7	42.3		47.0	39.2		43.6	53.6		46.2	42.9	
Sometimes healthy food	46.3	43.2		44.7	48.1		47.1	37.7		45.8	44.0	
Unhealthy food	7.0	14.4		8.2	12.7		9.2	8.7		8.0	13.1	
Does your child eat unhealthy food excessively?			0.037			0.289			0.261			0.220
Does not consume	7.0	3.6		6.3	5.1		6.4	4.3		5.4	8.3	
Consume with moderation	86.8	82.9		86.5	82.3		86.3	82.6		87.3	79.8	
Consume excessively	6.3	13.5		7.2	12.7		7.3	13.0		7.4	11.9	
Do your children eat their food while using digital devices?			<0.001			0.916			0.319			<0.001
Never	40.8	18.0		34.9	31.6		36.0	26.1		39.5	15.5	
Sometimes	40.8	46.8		42.1	44.3		42.4	43.5		42.8	41.7	
Often	11.8	17.1		13.5	12.7		12.4	17.4		10.7	22.6	
Always	6.6	18.0		9.5	11.4		9.2	13.0		7.0	20.2	

Data are presented as mean±standard deviation, %, or N (%)

**Table 3.** Differences in clinical characteristics between children with and without eating food while using electronic devices (N=383)

Variables	Eating food while using electronic devices		p-value
	No (N=131)	Yes (N=252)	
Age (yr)	5.4±1.4	5.3±1.3	0.683
Sex (female)	71 (54.2)	121 (48.0)	0.282
Total screen time ≥2 h	75 (57.3)	203 (80.6)	<0.001
Smartphone ≥2 h	20 (15.3)	91 (36.1)	<0.001
TV/PlayStation/Xbox ≥2 h	25 (19.1)	54 (21.4)	0.690
Laptop ≥2 h	18 (13.7)	51 (20.2)	0.125
Tablet/iPad ≥2 h	13 (9.9)	71 (28.2)	<0.001
Physical status			
Body mass index (kg/m <sup>2</sup> )	17.4±3.6	17.6±4.4	0.654
Overweight	36 (27.5)	67 (26.6)	0.852
Obesity	17 (13.0)	37 (14.7)	0.649
Preschool Feeling Checklist			
Total score	2.5±2.3	3.3±2.6	0.004
Total score ≥3	47 (35.9)	128 (50.8)	0.007
Children's Sleep Habit Questionnaire			
Total score	24.8±9.0	28.2±9.5	0.001
Total score ≥30	34 (26.0)	108 (42.9)	0.001
Does your child have their own electronic devices? (Yes)	42 (32.1)	142 (56.3)	<0.001
Your child spends most of his time on electronic screens for			0.001
Education	69 (52.7)	86 (34.1)	
Entertainment	62 (47.3)	165 (65.5)	
Usually, how many days of the week was your child active for at least 60 min?			0.084
None	3 (2.3)	16 (6.3)	
1 day	11 (8.4)	32 (12.7)	
Less than half	20 (15.3)	47 (18.7)	
More than half	97 (74.0)	157 (62.3)	
During this month, your child's food mainly constituted of			<0.001
Healthy food	74 (56.5)	100 (39.7)	
Sometimes healthy food	54 (41.2)	120 (47.6)	
Unhealthy food	3 (2.3)	32 (12.7)	
Does your child eat unhealthy food excessively?			0.001
Does not consume	14 (10.7)	9 (3.6)	
Consume with moderation	113 (86.3)	215 (85.3)	
Consume excessively	4 (3.1)	28 (11.1)	

Data are presented as mean±standard deviation or N (%)

time and sedentary lifestyle increased.<sup>25</sup> Another cross-sectional study showed similar results in Tunisian children.<sup>26</sup> Furthermore, the results of this study correlate with the scientific literature findings, where a reduction in PA was associated with a greater screen time.<sup>27</sup> However, a recent systematic review among adolescents found that digital interventions, including education, goal-setting, self-monitoring, and parental involvement, increased PA significantly.

The widespread and extensive use of various screen-based electronic media in this pandemic seems to have influenced several behavioral models, such as dietary habits and the consumption of healthy foods, as recent literature highlights that the excessive use of screen time is linked with unhealthy everyday eating behaviors and patterns such as low fruit and vegetable consumption;<sup>28</sup> children are more prone to have an increased BMI. In contrast, using screens diverts attention away

**Table 4.** Logistic regression analysis with the forward method\* for expecting 'eating foods while using electronic devices' among children during the COVID-19 pandemic

Variables	cOR	95% CI	p-value	aOR	95% CI	p-value
Screen time $\geq 2$ h	3.09	1.94–4.93	<0.001	1.87	1.09–3.21	<0.001
Phone screen time $\geq 2$ h	3.14	1.83–5.39	<0.001	2.40	1.30–4.43	0.005
Sleep problems (CSHQ-A $\geq 30$ )	1.65	1.09–2.51	0.019	2.50	1.50–4.16	<0.001
Having own electronic device (Yes)	1.59	1.04–2.41	0.030	2.81	1.72–4.61	0.011
Eating unhealthy food (No)	0.16	0.05–0.54	0.003	0.23	0.07–0.81	0.023

\*adjusted for age, sex, body mass index, screen time; TV/PlayStation/Xbox ( $\geq 2$  h), laptop ( $\geq 2$  h), tablet/iPad ( $\geq 2$  h), physical activity, eating unhealthy food excessively, and preschool feeling checklist score. CSHQ-A, Children Sleep Habit Questionnaire-Abbreviated; cOR, crude odds ratio; aOR, adjusted odds ratio; CI, confidence interval

from food, leading to a less accurate amount of food ingestion and nutritional composition, thus promoting caloric intake.<sup>29</sup> In this study, we found that the proportion of children eating food while using digital devices was significantly higher among those with  $\geq 2$  h of screen time on smartphones and tablet/iPad. Moreover, among smartphone users, children with a screen time  $\geq 2$  h were prone to consume higher amounts of unhealthy food than children with screen time  $< 2$  h (13.5% vs. 6.3%). However, the effect of eating while using a screen is not limited to the unfavorable influences on the BMI, waist circumference, and not chewing properly; a key concern is that the action turns into a habit. It slowly grows into an addiction as the child finds himself/herself unable to let it go, and with time, developing the "electronic screen syndrome," as named by Dr. Victoria Dunckley, author of "Rest your child's brain."<sup>30</sup> As described by the writer, typical symptoms of this syndrome mimic psychological disorders such as stress, anxiety, sleep problems, irritability, and mood swings, and lead to behavioral changes and cognitive problems such as learning difficulties, poor memory, and concentration.

Concerning sleep behavior, children using smartphones and TV/PlayStation/Xbox for more than 2 h were more prone to sleep problems. The present findings are in accordance with many studies; a recent one conducted among Tunisian children showed the negative effect of confinement on their sleep and that they experiences sleep disturbances.<sup>27</sup> Another study among children in Iran noticed that children had a longer sleep duration when they had increased use of digital media.<sup>31</sup> Furthermore, the relationships between sleep and mental health have been addressed in numerous publications. For example, sleep problems and insomnia have been associated with psychiatric depressive behaviors.<sup>32,33</sup> Little is known about this topic among children, but one could predict that the same consequences would be seen. Our study found a significant correlation between sleep problems and depression in children, and about 40% of children with sleep problems suffered from depressive symptoms. Similarly, a recent study during the COVID-19 pandemic reported that adequate sleep in children resulted in fewer psychosocial problems.<sup>34</sup> Therefore, previous

studies have highlighted the importance of healthy sleep on behavioral development<sup>35</sup> and the quality of life in children.

In this study, we observed sleep problems in younger children similar to those in other studies among young children in Italy<sup>36</sup> and Switzerland,<sup>37</sup> where children's sleep was more harmed by the implementation of confinement compared to adults. In addition to the age impact on sleep patterns, our findings showed that girls had more sleep problems, which corresponds with a recent study that confirmed the relationship between human sleep behavior and sex differences, mostly near puberty. Another study showed similar findings among Tunisian children where girls had more sleep problems and poor sleep quality.<sup>27</sup> Indeed, we can explain these sex differences considering the hormonal changes that affect the sleep architecture across the lifespan, including childhood. In our study, sleep disturbance in children was significantly correlated with the possession of their own electronic devices; approximately 60% of children with sleep problems had their own electronic devices (data not shown). Our results are consistent with those of another study on touchscreen usage and changes in sleep patterns.<sup>38</sup> Other studies showed the association of having a TV in the bedroom with nonoptimal sleep, and confirmed previous findings on the negative impact of video devices on sleep.<sup>39</sup> However, a study among children in Italy did not reveal an association between media availability, usage with changes in nighttime waking, and latency to fall asleep.<sup>40</sup> Since children are experiencing a change in their daily habits, sleep problems have been reported in children with less PA. A study revealed associations between sleep and lifestyle factors, including diet quality and PA levels. However, there is either moderate or insufficient evidence that daily habits, such as PAs, are associated with sleep disturbances. Therefore, further studies are needed to obtain more insights on the social and environmental determinants of healthy sleep among children.

Regression analysis indicated that eating food while using electronic devices was associated with total screen time  $\geq 2$  h, smartphone screen time  $\geq 2$  h, sleep problems, owning electronic devices, and eating unhealthy food. From this study, we can infer that children's eating habits while using a screen are

related to excessive screen time, especially with smartphones, sleep problems, and eating unhealthy food. Although we could not determine the causal relationship, we speculate that guiding children not to eat while using screen time is vital to keep them healthy during this pandemic. As the ownership of electronic devices can influence their behavior, parents need to set the policy of owning, using, and controlling the electronic device's screen time for children's mental and physical health during this pandemic.

There are some limitations to this study. First, the study was conducted via an anonymous online survey, which may have resulted in a bias. Furthermore, parents answered the questions, and the reported answers might lack some accuracy. The screen time estimated by the parents may differ from the exact screen time of their children. Second, parenting styles or parenting practices were not measured, which can affect screen time and eating habits of children. Third, only a single item question with dichotomous activity time was used for assessing PA, which may be insufficient. Fourth, 2 h of screen time was defined as a critical screen time in this study based on the guideline.<sup>21</sup> Defining the appropriate screen time for children was not the objective of this study. However, 278 of 383 (72.6%) participants spent more than 2 h on screen time in this study. In this modern era, where online and digital education is gaining popularity, the appropriate screen time needs to be further discussed. Finally, this study was conducted during the peak of the pandemic in Lebanon, where the changes in symptoms (sleep problems and depression) and behaviors (eating behaviors and PA) may be affected by social distancing rather than screen time. In addition, economic crises and the Beirut explosion in August 2020 were also stressful for the Lebanese population, affecting their psychological health.

Despite the limitations, we observed an interplay among children's PAs, eating behaviors, depression, sleep problems, and screen time, in this pandemic era. Primarily, children's behavior of eating food while using electronic devices was significantly related to sleep problems, smartphone screen time, and consumption of unhealthy foods. Therefore, guiding children with their use of electronic devices and helping them eat healthily are important during the COVID-19 pandemic.

#### Availability of Data and Material

The datasets generated or analyzed during the study are available from the corresponding author on reasonable request.

#### Conflicts of Interest

Seockhoon Chung, a contributing editor of the *Psychiatry Investigation*, was not involved in the editorial evaluation or decision to publish this article. All remaining authors have declared no conflicts of interest.

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