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Children's Physical Activity Behaviors During the COVID-19 Pandemic: A Mixed Methods Research

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ABSTRACT

This study aimed to examine the impact of the COVID-19 pandemic on children's physical activity behaviors. Furthermore, children's indoor and outdoor physical activity opportunities and daily habits including screen time and sleep patterns were investigated. A mixed methods approach was used in which survey methodology was combined with semi-structured interviews. The convenience sampling method was used. A sample of parents (n = 205, 165 mothers) of children (5-12 years) participated in the survey. Semi-structured interviews were used to assess changes in children's physical activity behaviors and daily habits (screen time and sleep patterns) in detail. Descriptive statistics (frequencies, standard deviations, and means) and thematic analysis were used for data analysis. The results showed that the COVID-19 pandemic and related restrictions caused a decline in children's physical activity participation, particularly a dramatic decrease in outdoor time. However, outdoor time was associated with better mental health, more active time, and less sedentary behaviors. The screen time also increased and parents had local and temporal solutions to control screen time. Although the sleep hours were sufficient for children, delays occurred in the sleep/wake schedule of children, and sleep-related problems were reported by parents. Based on the study results, professionals could help families to regulate children's daily habits. These findings could also guide efforts to promote outdoor physical activity places to prevent the negative influence of long-term homestay periods for future extreme cases.

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INTRODUCTION

The World Health Organization declared COVID-19 a global pandemic on 11 March 2020 (WHO, 2020). In order to prevent the rapid spread of the disease, the government took several national and local measures, mainly including home confinement, which forced people to stay at home for a long period. Also, the closure of public spaces, parks, sports facilities, and schools was one of the significant precautions taken by a large majority of countries to control the contagion of COVID-19 (Sallis et al., 2020; WHO, 2020).

As a vulnerable group, children were negatively impacted by the COVID-19 pandemic by disrupting their daily habits including movement behaviors, screen time, and sleep patterns, and restricted physical activity (PA) participation mainly due to quarantine measures (McCormack et al., 2020; Oliveira et al., 2022). A longitudinal study conducted in China revealed that sedentary behaviors among Chinese children and adolescents (6-17 years) increased during the COVID-19 pandemic, and the average time spent in PA decreased significantly from 540 min/week to 105 min/week (Xiang et al., 2020). Also, another study conducted in Canada confirmed the previous research's results with children's reduced physical activity participation during the COVID-19 pandemic (Riazi et al., 2021). Similar results were enriched by Ten Velde et al., with decreased movement behaviors during the pandemic among children in the Netherlands (2021). The related literature also found that children were less engaged in outdoor physical activities during the COVID-19 pandemic (Mitra et al., 2020; Nyström et al., 2020).

As a part of daily habits, screen time also changed during the COVID-19 pandemic, and a variety of studies from the literature reported a substantial increase in screen time among children in this period (Kolota & Glabska, 2021; Schmidt et al., 2020). Even though excessive screen time was associated with poor sleep quality (Pacheco et al., 2017), during the COVID-19 pandemic, due to excessive screen time, children experienced sleep-related problems such as insomnia, nightmares, and sleep terrors (Bruni et al., 2022). Sleep bedtime and risetime delays were also other negative consequences of home confinement (Knowland et al., 2022).

The literature provides strong evidence regarding the decrease in physical activity participation of children during the COVID-19 pandemic based on parents' opinions (Clarke et al., 2021; Pelletier et al., 2021). A qualitative study in Canada revealed that the pandemic-related closures limited physical activity opportunities and directly affected children's mental and physical health (Petersen et al., 2021). Moreover, this study pointed out that children tend

to spend more time on screen, engage less in physical activities, and consequently feel less connected to others. Another qualitative study from the USA examined how the shelter-in-place mandates affected children's physical activity behaviors from parents' perspectives and figured out that children faced challenges regarding access to outdoor space and exercise and play equipment (Perez et al., 2021). Similar results were found in mixed methods studies concluding that physical activity level and health-related quality of life, and sports participation drastically decreased (López-Aymes et al., 2021; O'Kane et al., 2021).

Bronfenbrenner's ecological systems theory could best explain the relationship between access to physical activity opportunities and children's physical activity level during the pandemic (Bronfenbrenner, 1979). Bronfenbrenner suggested a model consisting of four main layers, and the developing child is the model's center (Bronfenbrenner, 1979). These four layers are the microsystem, mesosystem, exosystem, and macrosystem, in which the changes directly or indirectly affect the child's development (Bronfenbrenner, 1992). For example, during the pandemic, children experienced a drastic disruption in their daily routines due to social isolation (Spinelli et al., 2020) which also caused depression and anxiety symptoms among children (India, 2020). However, the physical environmental conditions could help children maintain physical activity patterns associated with better mental health and less sedentary behaviors (Mitra et al., 2021).

Given the compatible findings of the current literature and disparities in methodologies, there is a need for more research to provide greater clarity on the influence of the COVID-19 pandemic on children's movement behaviors. To the best of our knowledge, there is no study examining children's physical activity behaviors and daily routines during the COVID-19 pandemic from a holistic view. Thus, this study aimed to examine the pandemic's effect on the physical activity behaviors of children aged 5-12 years. Further, children's daily routines were examined regarding screen time and sleep patterns. To address this issue, three different specific research questions were established:

1. How does the COVID-19 pandemic change the physical activity behaviors of children?
2. How does the COVID-19 pandemic change children's use of outdoor/indoor physical activity opportunities in the neighborhood?
3. Does the COVID-19 pandemic change children's daily habits, including sleep patterns and screen-based behaviors?

METHODS

Research Design

The study applied a mixed methods approach consisting of two phases: a survey and a semi-structured interview. The explanatory sequential design aimed to offer a general frame about the research questions with a survey, followed by the explanation and understanding of survey results with semi-structured interviews (Creswell, 2012).

Study Group

The participants were 205 parents (mothers = 165, fathers = 40) from seven different regions and 30 different cities of Türkiye and mainly reported their residential area as metropolis (n = 165, 80.5 %) with a dominant rate of living in an apartment building as household type (n = 173, 84.4%). The majority of the parents had a bachelor's degree (n = 102, 50.2 %). Participants were eligible to participate in the study if they had a child aged between 5–12 years. Moreover, the other inclusion criteria were children with typical development and living in Türkiye at the time of data collection. If a family had more than one child meeting the study criteria, the parents were instructed to consider only one for the study. The sample selection procedure was a convenience snowball sampling method (Crouse & Lowe, 2018). Table 1 presents the data regarding children's demographic characteristics and education information at the time of data collection.

Table 1
Children's sociodemographic characteristics and education information

Variables	n	%
Gender		
Girl	89	43.4
Boy	116	56.6
Age group		
Early childhood period (5-6 ages)	62	30.3
Primary age group (7-8-9-10 ages)	103	50.2
Secondary school age (11-12 ages)	34	16.6
Non-defined	6	2.9
Does your child attend online education?		
Yes	123	60
No	82	40
Does your child have online physical education and sports courses?		
Yes	86	41.9
No	119	58.1
Total	205	100

Data Collection Tools

Online Physical Activity Survey

The physical activity survey was designed to gather data from the sample to find answers to the research questions (Check & Schutt, 2012). At this stage, the survey development steps were followed (Büyüköztürk, 2005). First, the research problem was identified, and the related literature was reviewed to prepare a set of sample questions. Experts were consulted for the content validity of this exemplary survey. Based on expert opinions, the pilot study was applied and the final version of the survey was formed to apply the primary sample.

The survey consists of 61 questions distributed in the following categories: demographic information of parents and children (33 items regarding age, gender, and residential area), physical activity behaviors specified as leisure time PA and sports club attendance (8 items), outdoor physical activity opportunities (4 items), indoor physical activity opportunities (4 items) and daily habits of children that were described as sleep time and screen time (12 items). The terms 'before the COVID-19 pandemic' and 'during the COVID-19 pandemic' were highlighted in the questions to call participants' attention. All questions were marked as compulsory in the survey platform to prevent data loss. In addition, the phone calls were made with nine participants who had no internet connection. The time needed to fill out the questionnaire was approximately 15 minutes.

Semi-structured Interviews

Parent interviews were designed to address the issues in the questionnaire and explain children's physical activity changes in detail. Based on this purpose, open-ended questions were subsequently asked to the parents to compare children's PA behaviors before and during the COVID-19 pandemic. The interview approach also offers the researchers to go beyond the script and ask further questions to the participant to clarify the unclear points during the interview (Savin-Baden & Howell-Major, 2013).

Two experts from physical activity field were consulted to check to understandability and clarity of the interview questions. Moreover, cognitive interviews were conducted with three parents. Based on expert opinions and cognitive interview feedback, the interview questions were revised and completed. Eight questions in the interview were detailly prepared to investigate physical activity behaviors of children, outdoor and indoor physical activity opportunities, screen-based behaviors and sleep patterns of children, and school support for physical activity. The average time of all interviews was 21 minutes (min = 14, max = 31 minutes). The example interview questions are as follows:

1. What changes did you observe in your child's sleep pattern during the pandemic? How did these changes affect your child's mental health?

2. How much did your child benefit from physical activity opportunities placed in the environment during the pandemic? (Playgrounds, public courts, sports equipment, etc.)

3. What did the school do to support your child's physical activity during the pandemic?

Data Collection Procedure

Approval from the Human Subjects Ethics Committee of Middle East Technical University (046-ODTU-2021) was received for the data collection procedures. Also, the participants' consent was taken, and they were ensured the confidentiality of personal information throughout whole data collection process.

The survey data were collected through an online platform, Google Forms. The online questionnaire was open for one year, beginning on March 12th, 2021, and ending on March 12th, 2022. After collecting quantitative data, the qualitative data were collected through interviews, both face-to-face and video calls. The interview process lasted for one week, between May 31st and June 3rd, 2022.

Data Analysis

Quantitative Analysis

A total of 208 participants completed the online survey and three of them were excluded from data analysis as they did not meet the inclusion criteria of living in Türkiye. The survey responses were analyzed by using Microsoft Office /Excel (2021). The descriptive statistics were presented as tables and figures to reflect the impact of the COVID-19 pandemic on children's physical activity behaviors.

Qualitative Analysis

A thematic analysis was used for the qualitative data which the purpose was to define, analyze and report the themes within the dataset (Braun & Clarke, 2006). First, the interviews were transcribed and anonymized to keep the participants' identities anonymous. Then, the transcripts were conveyed to MAXQDA (2022) to identify the themes. After the leading researchers determined the themes, two experts checked them for accuracy. Then, they were reported as a qualitative analysis of this study. To assess the trustworthiness of the qualitative results and verify the confirmation and modification of the qualitative data, the member checking was used, also known as respondent validation (Birt et al., 2016).

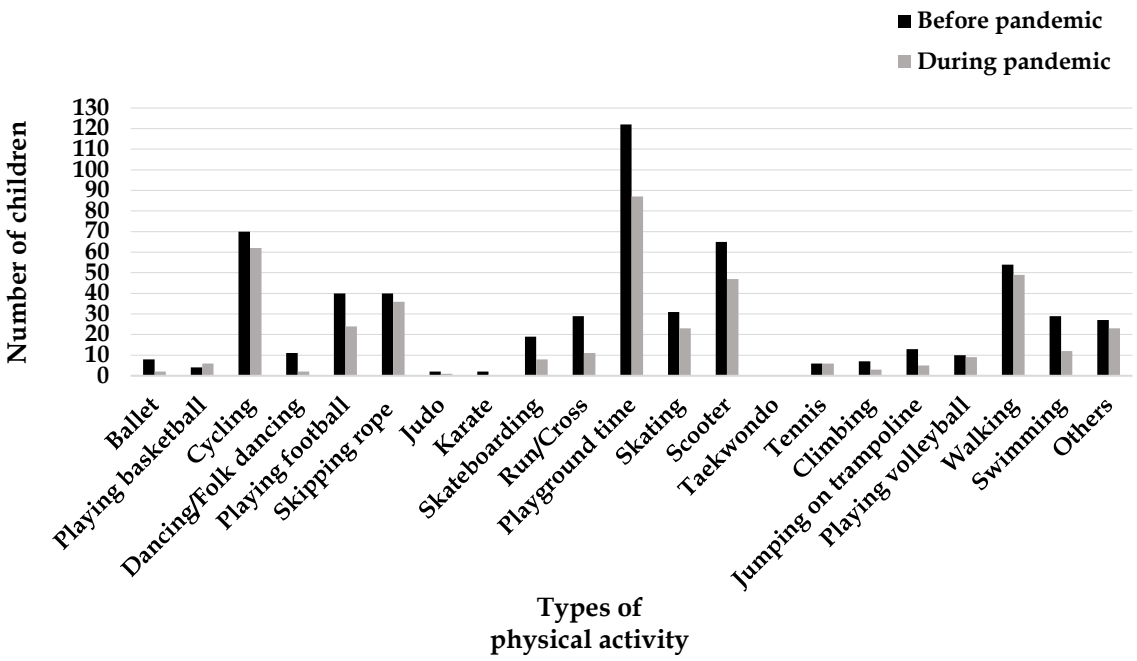
RESULTS

Quantitative Results

Physical Activity Behaviors

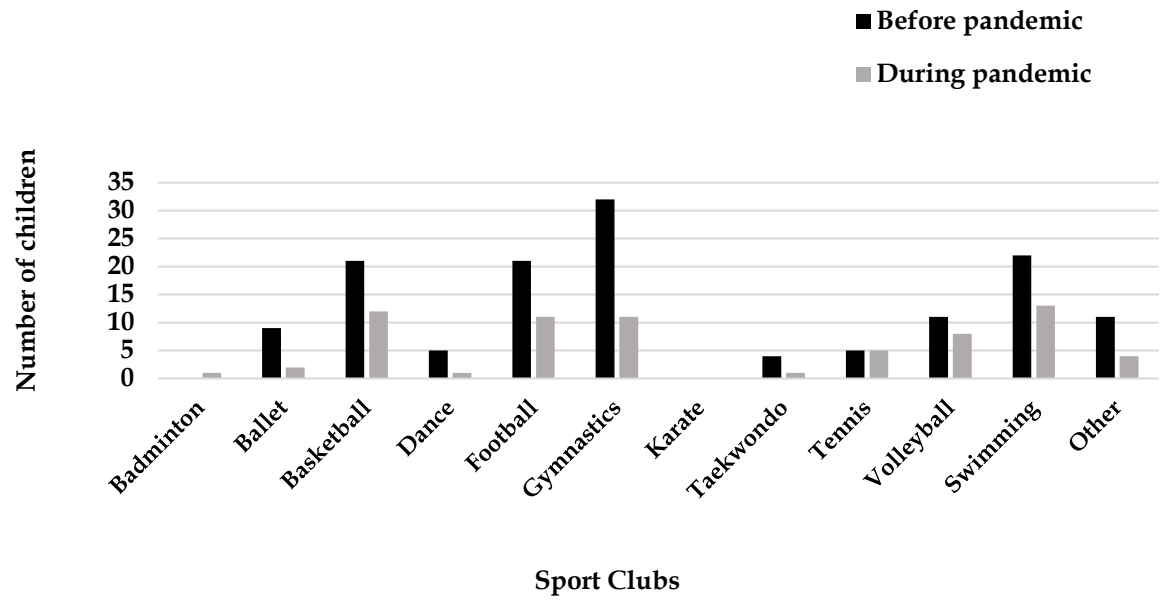
The physical activity behaviors of children during the pandemic were determined by examining their participation in recreational physical activities and sports club attendance. Figure 1 displays the number of children attending recreational physical activities both before and during the COVID-19 pandemic. Compared to the pre-pandemic period, there was a decrease in all types of physical activity specified in the survey during the pandemic except playing basketball category. Only the number of children playing basketball increased from four to six during the COVID-19 pandemic.

Figure 1
The comparison of children's recreational physical activities



As a physical activity participation, children's sports club attendance was asked in the questionnaire. Figure 2 displays the number of children who attend sport club before and during pandemic. While the number of children who went to the gymnastics club was 32 before the pandemic, this number decreased to 11 during the pandemic. Similarly, there were decreases in other sports branches as follows: ballet (from 9 to 2), basketball (from 21 to 11), and swimming (from 22 to 13).

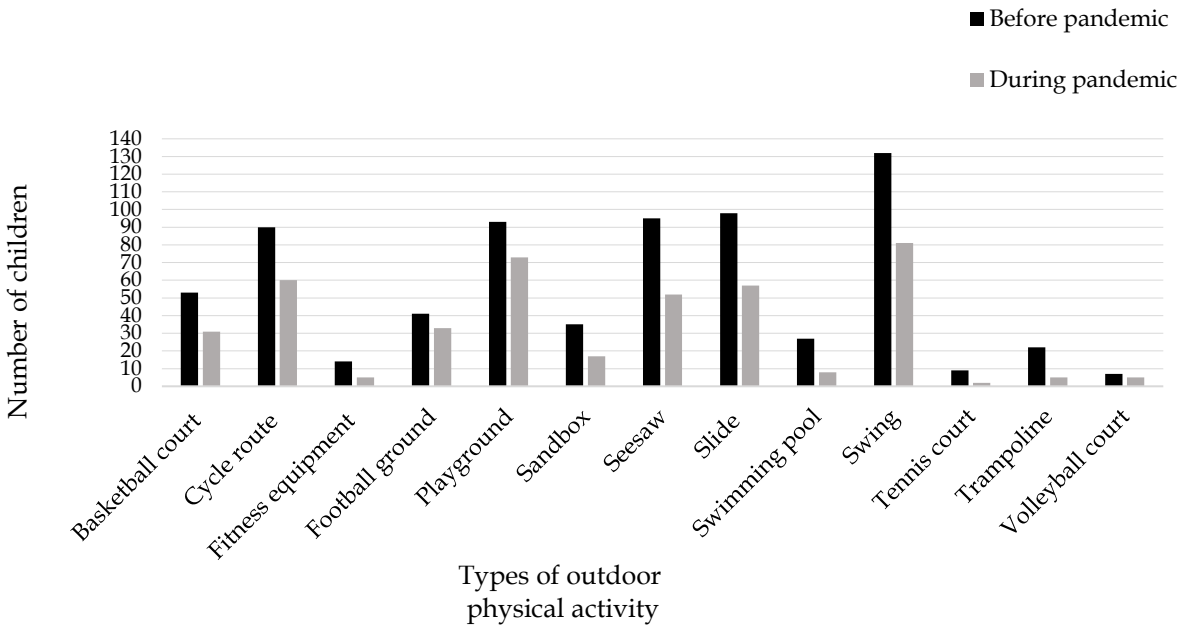
Figure 2
Children's sports club information



Outdoor Physical Activity Opportunities

The outdoor physical activity opportunities were displayed in figure 3, in which there were decreases in all outdoor PA categories. The number of children who benefited from outdoor facilities decreased in the following categories: cycle route (from 90 to 60), sandbox (from 35 to 17), seesaw (from 95 to 52), swing (from 132 to 81), and trampoline (from 22 to 5).

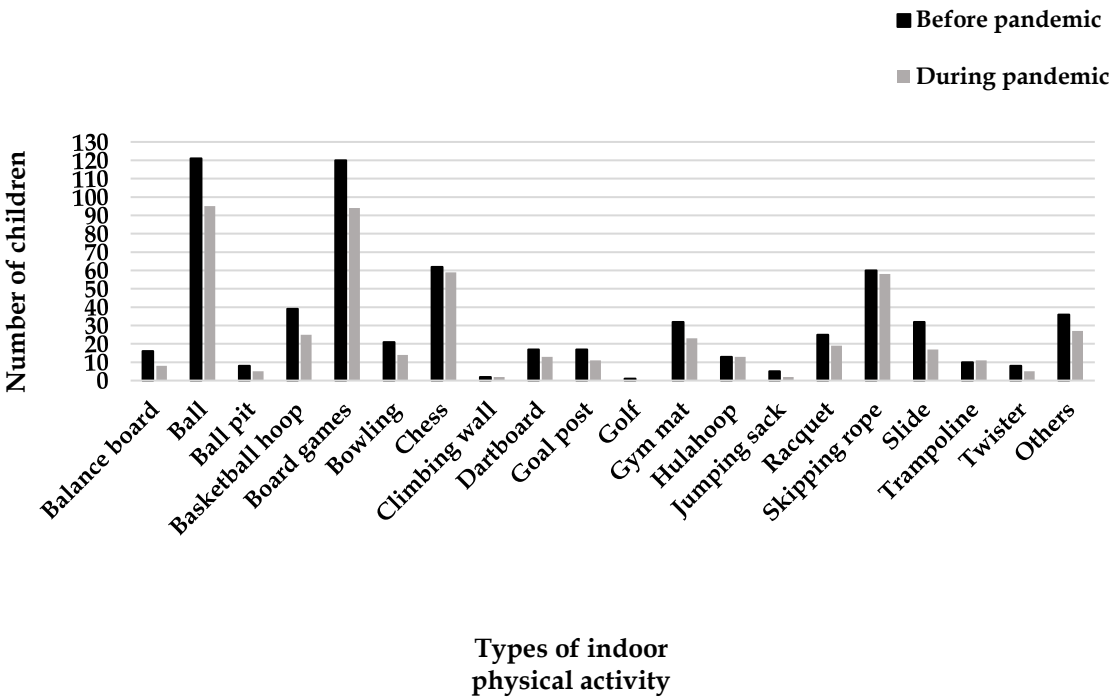
Figure 3
Children's use of outdoor physical activity opportunities



Indoor Physical Activity Opportunities

The number of children participating indoor activities before and during the pandemic is shown in figure 4. There were decreases in all indoor physical activity categories except for the children attending climbing wall activities and playing with a hula-hoop. The most significant gap between pre-pandemic and during the pandemic occurred in the following indoor PA categories: ball (from 121 to 95), board games (from 120 to 94), and slide (from 32 to 17).

Figure 4
Children's use of indoor physical activity opportunities



Daily Habits (Screen Time, Sleep Time)

Descriptive statistics of screen time and children' sleep patterns were illustrated in Table 2 based on the quantitative data of 205 children. To describe children's screen-based behaviors, the time spent in front TV, the total hours played in computer games, and the time used of telephone/tablet were displayed in the detail Table 1. The most dramatic change has been in the number of children watching TV for 6-8 hours. This number, which was 0 before the pandemic, increased to 4 in the pandemic. Except for the lowest category, 0-2, the duration of children playing computer games increased in the remaining three categories. Similar results were found for telephone/tablet use, with the highest increase in categories 6-8 and 8+. The sleep hours of children before and during the pandemic are also presented comparatively in Table 2.

Table 2
A comparison of children's screen and sleep time

Variables	Before pandemic		During pandemic	
Hours	**n**	**%**	**n**	**%**
TV hours				
0-2	107	52.2	81	39.5
2-4	81	39.5	97	47.3
4-6	17	8.3	23	11.2
6-8	0	0.0	4	2.0
Non defined	0	0.0	0	0.0
Computer games				
0-2	166	81.0	139	67.8
2-4	27	13.2	48	23.4
4-6	8	3.8	12	5.9
6-8	4	2.0	6	2.9
Non defined	0	0.0	0	0.0
Telephone/Tablet				
0-2	147	71.7	114	55.6
2-4	46	22.4	64	31.2
4-6	12	5.9	13	6.3
6-8	0	0.0	9	4.4
8+	0	0.0	1	0.5
Non defined	0	0.0	4	2.0
Sleeping hours				
7-9	63	30.7	69	33.7
9-11	115	56.1	112	54.6
11-13	22	10.7	16	7.8
13+	1	0.5	1	0.5
Non defined	4	2.0	7	3.4
Total	205	100	205	100

Qualitative Results

The volunteer eight parents from the primary sample participated in the interviews. More mothers (n = 7) were included than the father. Table 3 displays the main and sub-themes of the qualitative dataset.

Table 3
Themes and Sub-themes

Themes	Sub-themes
Physical activity challenges during the COVID-19 pandemic	Access to outdoor physical activity facilities Creating space for movement in the house Parental solutions to physical activity obstacles Children's demands School support for physical activity
Screen-based behaviors of children during the COVID-19 pandemic	Parental control on screen time Positive & negative impact of the screen context Screen devices usage during the COVID-19 pandemic

Table 3 (Continued)

Themes	Sub-themes
Screen-based behaviors of children during the COVID-19 pandemic	Parental control on screen time Positive & negative impact of the screen context Screen devices usage during the COVID-19 pandemic
Sleep patterns during the COVID-19 pandemic	Sleep duration Sleep pattern Sleep quality
Behavioral and health consequences of the COVID-19 pandemic	Fear of infection Lack of social interaction Negative impact of the pandemic on physical health Emotional intensity in children

1. Physical activity challenges during the COVID-19 pandemic

The interview results presented an overall decrease in children's physical activity levels. Parents reported how much they were affected by the long-term home confinement period. The quarantine measures forcing families to stay at home, limiting their access to outdoor space, and the closure of structured and unstructured outdoor facilities adversely affected both families and children, resulting in decreased physical activity participation of children. However, all parents were not influenced by the pandemic restrictions in the same way. Families living in a detached house could offer more ways for children to engage in outdoor activities than others. The interviews also clarified that if children had enough outdoor time, they had better mental well-being.

Another challenging situation for families was the lack of suitable space for movement at home and the inability of children to discharge their energy sufficiently. Children's demands for active play directed families to solve this problem by arranging the furniture in the house to create space and turning the attic into a playground. Moreover, some parents mentioned purchasing new materials for their children in to increase their engagement in physical activities and spend quality time. Balls, Legos, skateboard, puzzles, and coloring books were supporting materials supplied to the children during the pandemic.

The other issue discussed in the interviews was how much the schools integrated sportive activities into the online curriculum and how the teachers managed the online physical education and sports courses. Except for one parent who stated that there was no physical education and sports lessons in online education, the rest of them stated that the school provided physical education and sports lessons, albeit a little. Because it was difficult to control children from the screen and keep the focus on the course, these courses generally

included easy-to-apply activities such as stretching activities, games with simple instructions, and dances with music.

Despite the challenges and uncontrollable issues during the lockdown, parents expressed the attempts to support children's independent mobility as they were aware of the importance of PA for children's development. They engaged in physical activities with their children, including jumping rope, walking around the neighborhood, and riding a bike. In addition, parents were happy to have more family time and had the opportunity to spend more time with their children. For example, parents turned home confinement into an advantage to help their children gain new skills such as playing chess. This unexpected and favorable outcome was the only positive side of the pandemic mentioned in the interviews.

2. Screen-based behaviors of children during the COVID-19 pandemic

A consensus statement stated by many parents was the development of screen addiction and excessive screen time. One of the main arguments for increased screen time was the obligatory use of phones, tablets, and computers in distance education, Moreover, restricting children's access to recreational activities also led them to spend more time on screens. The increased screen time influenced children's behaviors; some children exhibited more vicious, aggressive, and combative behaviors than ever before. Apart from quarantine measures and online education, adverse weather conditions also increased screen time. In the interviews, many parents stated that they allowed their children to use technological devices because they avoid taking their children out, especially during the winter season.

In addition to excessive screen time, screen content also changed during the pandemic resulting in negative impacts on children's behaviors. Some parents stated that inappropriate content manipulated children to act differently from their age especially after watching makeup videos or some popular dance groups. Moreover, some online games presented scary pop-up commercials. Some requested children for their photos, locations, and videos, which was a total violation of remarkable life and needed to be controlled by authorities, as claimed by many parents.

As a typical result of quarantine measures, children lost the excellent opportunity to socialize during breathing times during school periods and interact with their peers and play games. Therefore, they tend to become socialize through online applications and meet their friends in a virtual environment, directly affecting screen time.

Since families were aware of such consequences and banning screen use ultimately would not be a solution in this process, they needed to regulate screen time in constructive

ways. While some parents controlled screen time by setting alarms, others tried to support their children with other activities to keep them away from the screen.

Besides the negative effects of the screen, some parents talked about the positive effects. For example, one mother kept her child from technological devices except for online education due the child's eye disease and directed her to dance. Thus, she improved her dancing skills. Another example was that a seven years old girl watched cartoons with appropriate content and gained exemplary behaviors such as respect for elders.

3. Sleep patterns of children during the COVID-19 pandemic

In the interviews, many parents stated that their children had sleep problems during the pandemic. As stated by many parents, children who sleep regularly and get enough sleep during the school period had to struggle with sleep problems during the pandemic. Also, children who were inactive at home for a long time had difficulty falling asleep because they did not discharge their energy sufficiently, disturbing their sleep quality.

As shared by many parents, the delay in bedtime and relatedly wake time caused children to become unproductive for the rest of the day. Thus, children had difficulty in concentrating on lessons due to the slowdown in their cognitive functions. For example, the single father in the study stated that his daughter was sleepy and could not fully listen to the lessons because she often attended the lessons in her bed. Further to the academic success, the children's diet was deteriorated, and the number of meals a day decreased from three to two. Although a decrease in sleep quality was something that many children experienced during the home confinement, some parents stated that their children did not experience sleep-related problems, and the sleep routines were the same as before the pandemic.

Despite the different impacts of the pandemic on children's sleep patterns, the most prominent issue among parents was that children's sleep duration was appropriate for their age. Most parents were sure their children were sleeping enough during the pandemic by taking extra precautions. For example, a mother said that she restricted screen use before sleep and made her child do activities that would make him more tired.

4. Emotional and health consequences of the COVID-19 pandemic

The dominant feeling among parents was the fear of infection which directly limited the children's behaviors and daily routines. Because of the anxiety of getting infected, all parents set rigid rules, including wearing masks, using antibacterial wipes, and keeping distance from others in outdoor settings. Parents' persistent and slightly oppressive attitudes made children anxious about getting used to everyday life even after the pandemic rules were

softened. For example, eight-year-old girl's mother explained her daughter's concerns about touching the surfaces in the playground and did not want to get in contact with others.

Children experienced fatigue even after low intense physical activities such as bicycling or walking. Parents explained that the lack and loss of physical activity changes mainly due to the closure of schools. As phrased by the father of the eight-year-old girl, she could walk to school even for a short distance before the pandemic, but she lost this opportunity during the pandemic. Besides physical tiredness, the weight gain was also impressed as an adverse health outcome of the pandemic by parents. Because of increased sedentary behaviors and the lack of physical activity participation, children tend to gain weight during the pandemic.

It was a mutual point stated by families that the longer the children stay at home and the less peer communication, the more aggressive behaviors they exhibit. Additionally, children had to cope with strong and intense emotions such as boredom, obstinacy, and pettishness which forced families to help their children to cope with these challenging emotions.

DISCUSSION

The purpose of this study was to examine the impact of the COVID-19 pandemic on physical activity and daily routines of children aged 5-12. The main findings included the decline in children's physical activity participation generally due to quarantine measures. Similar results to those found by Moore et al. reporting lower physical activity levels in children and drastic changes in children's outdoor play (2021). This study concluded that outdoor time was a significant determinant of children's physical activity engagement and performing less sedentary behaviors. The study's findings provided evidence of the relationship between the house type and the mental well-being of children. This is in line with the study of Hazlehurst et al., supporting the strong relationship between outdoor access and the mental health of children with clear evidence (2022). The other finding of this study was the decrease in sports club participation which hindered children's physical activity participation (Ng et al., 2020). To maintain a healthy lifestyle for children, sports clubs could continue their functions by carrying safety rules (Constantini et al., 2021). The parents' interviews emphasized the decrease in recreational activity participation by arguing the lack of recreational activity opportunities and pandemic-related safety issues (Mutz & Gerke, 2021). The limited access to physical activity places allowed families to find creative solutions to meet children's movement needs. Engaging in home-based activities, spending more time

with children and supplying different types of materials to their children were the temporal but efficient solutions during the pandemic (Lee et al., 2021). The parents' interviews also argued insufficient school support for physical activity and its quality during online courses. The effectuality of online physical education courses could be studied by policymakers (Apriyanto & Adi, 2021). The study findings, in general, could be discussed in terms of Bronfenbrenner's ecological systems theory arguing the interaction between the child and the environment., the study findings highlighted the influence of a child's closest environmental opportunities on his/her development as also clarified in the literature (Haleemunnissa et al., 2021).

The study indicated the details about indoor time with a decrease in children's indoor play/physical activity opportunities. Despite the increased indoor time, children's physical activity did not increase, possibly due to course load. Because of limited activity options, children spent more time participating in indoor activities such as reading books, painting and artworks, and playing with toys. These results are corroborated by those previously found by Barron et al. (2021), arguing the change in home-based play behaviors of children due to the lockdowns. Moreover, the quarantine measures forced children to stay at home for a long time, and the absence of social relations could cause deficiencies in children's social skills that should be considered by health professionals (Araújo et al., 2021). Because the indoor time increased during the pandemic, the interaction among family members and the children gained importance regarding their attitudes, treatment methods, and crisis management skills in the microsystem of Bronfenbrenner's ecological systems theory (Haleemunnissa et al., 2021). These results could have short- and long-term implications for public health professions suggesting contemplating over the strict pandemic measures and producing practicable solutions such as designing educative PA programs (Kutlay et al., 2018). The governments could use media effectively by publishing public messages to facilitate children to become more active in daily life and to break up extended sitting periods (Guan et al., 2020). Parents were also recommended to stimulate their children to gain new hobbies like dancing or taking responsibility for a pet to increase physical activity (Moore et al., 2021).

The study results presented the excessive screen time among children during the pandemic, as stated by many studies in the literature (Pietrobelli et al., 2020; Xiang et al., 2020). Although pandemic-related restrictions such as the closure of schools necessitate screen use for long hours (Liu et al., 2020), the amount of screen exposure could be a potential risk for detrimental effects on children's mental health (Twenge et al., 2019).

The study highlighted a general worsening in children's sleep quality during the pandemic. Although there were no vital disruptions in sleep quality, some children experienced sleep-related problems as figured out by other studies in the literature (Guerrero et al., 2020; Zhao et al., 2022). Poor sleep habits were reported by parents as such sleep latency due to prolonged screen time, which is consistent with previous studies (Hysing et al., 2013; Gellis et al., 2014; Schlieber & Han, 2021). Moreover, the literature provides strong evidence of the severe impact of home confinement on children's sleep patterns were including a significant delay in the sleep/wake schedule of children of all age groups and an increase in sleep disturbances (Bruni et al., 2022; Zhao et al., 2022).

The limitations of this study should be acknowledged. First, the sample size is small and limited to young children. The relatively small sample size produces claims about the generalization of the findings. In this sense, it is suggested to increase sample size for future studies. Second, a methodological limitation of this study is the use of subjective measurement. Subjective assessment tools could create bias and misperceptions which could cause misinterpretation of the dataset. Although the survey results were confirmed and triangulated by interview results, it would be desirable for future studies to adopt objective measurement tools to assess the study variables to prevent misunderstandings.

Future studies are recommended to conduct qualitative studies with children to analyze their experiences during the lockdown periods deeply. The impact of socioeconomic status and children's physical activity level could be studied to identify the needs of different populations. Moreover, the long-term effects of the pandemic could be a subject matter of future studies regarding children's general health conditions and adaptations to daily life. Policy makers should be aware of the importance of environmental settings on children's movement behaviors, so city planning should be based on such needs for future studies. Finally, teachers are recommended to include more physical activities into the daily routines of children in case of future extreme cases.

CONCLUSION

This study provides evidence for the decreased physical activity level of children during the COVID-19 pandemic, which mainly demonstrated the decline in outdoor play and changes in movement behaviors. Additionally, the pandemic-related restrictions negatively influenced sleep and screen behaviors. Using the Bronfenbrenner Ecological Theory as the focus of this study, it was possible to conclude that children's overall physical activity level was affected by factors beginning from the inner layer of Bronfenbrenner's ecological systems

theory. Physical environment, family settings, school facilities, and close relatives play an essential role in the development of the child at the microsystem level. At the mesosystem level, the interaction among microsystems was discussed regarding indirect relationship between the children's development and school administrators, the local organizations, and social services. At the exosystem level, the mass media could be supportive of promoting health-related behaviors and supporting more activity for children during pandemic crises. The outer layer of Bronfenbrenner's ecological systems theory, the macrosystem, and the public health emergency responses to the COVID-19 pandemic affected children's lifestyles by imposing mandatory home closures. To alleviate the impact of a pandemic on children's development, the study findings would be a guide to inform public health professionals, parents, and school administrators to become aware of the importance of PA, play, and outdoor facilities to create dealing strategies in case of future crises.

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Authors' contributions

Both authors contributed conception and design of the study; the first author collected, analyzed, and interpretation of the data; the first and second authors contributed to drafting the article, its critical revisions, and reviewing the results, then both of them approved the final version of the manuscript.

Conflict of interest declaration

The authors declare that they have no conflict of interest**.**

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