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Psychiatric disorders among children and adolescents suffered from COVID-19 infection

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Abstract

Background It was aimed to investigate the psychological effects of the Coronavirus disease 2019 (COVID-19) pandemic on children and adolescents. The effects of disease process on development of psychiatric disorders, the course of pre-existing disorders, and peer relationships of children who have had COVID-19 infection were evaluated. Fifty three patients (28 girls and 25 boys) who were aged 12 ± 2.64 years and diagnosed with COVID-19 infection within the last 3–9 months, were randomly selected and included. Sociodemographic form, Beck Depression Inventory/Children's Depression Scale, Symptom Checklist 90-Revised were given to the participants, and a semi-structured interview was used to establish psychiatric disorders before and after COVID-19 infection. Parents were asked to fill in Conner's Rating Scale-Parents and Behavioral Rating Inventory of Executive Function.

Results Compared to pre-pandemic, duration of physical activity and time spent with peers were decreased, while screen exposure was found to be increased. Subclinical psychiatric symptoms were exacerbated after infection and most affected area was eating problems with loss of appetite and weight.

Conclusions In conclusion, our data showed that COVID-19 is associated with an increase in psychiatric disorders among children and adolescents, and further studies are needed in a larger population to investigate the causes and consequences of these effects.

Keywords COVID-19, Pandemic, Child, Adolescent, Psychiatric disorders

Introduction

Severe acute respiratory syndrome coronavirus-2 (Severe Acute Respiratory Syndrome—SARS-CoV-2) was identified in December 2019 in Wuhan, China. Coronavirus disease 2019 (COVID-19) which was caused by SARS-CoV-2, has been recognized as a major global public health emergency, and SARS-CoV-2 pandemic was

declared on March 11, 2020. The COVID-19 pandemic has affected more than 610 million people, including 6,510,139 deaths, as of September 22, 2022 and continues to spread [1]. The devastating consequences of this virus on health systems, society and economies around the world are still continuing. Following a viral infection, different types of damage may occur in many systems and tissues like brain [2]. In addition, infection may trigger peripheral and central inflammatory responses (neuroinflammation) and cause long-term musculoskeletal problems, cognitive impairment, and psychological distress [3]. SARS-CoV-2 that causes COVID-19 also affects multiple systems [4]. Due to its influence on a wide variety of systems, COVID-19 can be devastating and life-threatening in the acute period. While the inflammation

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associated with cognitive deficits and psychiatric symptoms emerging in COVID-19 was reported; long-term effects on brain have documented by follow-up studies [5, 6]. Data on mental effects of other coronaviruses including the Middle Eastern Respiratory Syndrome (MERS-induced by MERS-CoV) and Severe Acute Respiratory Syndrome (Severe Acute Respiratory Syndrome-SARS-induced by SARS-CoV-1), indicate long-term persistent psychiatric impairment among the patients recovering from acute infection [7]. A follow-up study of up to 12 years have shown lasting effects, including anxiety, depression, trauma, and sleep disturbance [8]. More than half of patients affected by SARS, MERS or Ebola have at least one psychiatric disorder. The main factors responsible for an increased negative burden are; perception of threat, mortality, food insecurity, stigma and discrimination [9, 10]. The lack of a specific therapeutic agent for COVID-19 may cause the feeling of uncertainty, anxiety and adverse mental states especially in susceptible individuals, and this shows that supporting mental health should be an essential part of the rehabilitation for patients [11].

Morbidity of COVID-19 is the focus of a great deal of research, and persistent symptoms including psychiatric and cognitive impairment after infection are increasingly being reported [12, 13].

Various combinations of biological, psychosocial and environmental factors may cause psychiatric disorders. Early findings of COVID-19 are consistent with the existing literature on patients with severe and unexpected illness, medical illness, functional inadequacy, psychosocial stressors and psychiatric symptoms [14]. There is evidence of negative consequences of the epidemic on psychological distress of both general population and individuals who have had COVID-19. Emotional symptoms may be associated with COVID-19 through the interaction with major life events and psychosocial stressors, or may result from impaired brain function and neural damage [15].

A study published in 2020 showed that there was about half of the general population had a significant psychological impact due to the COVID-19 and that the most common problem people faced was impaired sleep quality (40%), followed by stress (34%) and psychological distress (34%). In addition, the burden of psychological morbidity was highest among people who had COVID-19, healthcare professionals and the general population, respectively [11].

It is difficult to distinguish whether this high prevalence of psychiatric comorbidity is directly due to SARS-CoV-2 infection or whether negative psychological effects of other social and environmental factors such as social distance and quarantine, self-isolation,

changes in sleep and lifestyle behaviors, fear of death, and economic burden [16].

Given that most of psychiatric disorders begin at early ages, earlier recognition and treatment of potential effects of COVID-19 pandemic provide us to protect the current and future mental health, development, learning and well-being of children and adolescents [17].

In the light of these information, this study aimed to investigate the psychological effects of the COVID-19 pandemic on children and adolescents. The effects of disease process on development of psychiatric disorders, the course of pre-existing disorders, and the relationships with peers of children who have had COVID-19 infection. It is assumed that there will be exacerbation of pre-existing psychiatric disorders in children and adolescents who have had COVID-19 infection, and that psychiatric symptoms will develop in the patient group who did not show psychiatric disorders before.

Material and methods

Procedure

Fifty three patients who were aged 6–18 years and applied to the Pediatric Emergency Department of our university and were diagnosed with COVID-19 infection with a positive PCR test within the last 3–9 months, were randomly selected and included in the study. The number of participants previously assessed in psychiatry clinic was 6. The others were evaluated by psychiatrists for the first time. The information recorded about physical activity, time spent with family or peers, participating in online education was obtained from interviews with parents and children. The effects of pandemic process on those features and changes in psychiatric symptoms before and after infection were investigated. Written consent was obtained from parents and verbal assent was requested from children and adolescents to participate. Sociodemographic form, Beck Depression Inventory (BDI) (for children older than 13) or Children's Depression Scale (CDS) (for children aged 6–12), were given to the participants, and Schedule for Affective Disorders and Schizophrenia for School-Age Children, Present and Lifetime Version (K-SADS-PL) was used by clinician to establish psychiatric disorders of participants before and after COVID-19 infection. Parents were asked to fill in Conner's Rating Scale-Parents and Behavioral Rating Inventory of Executive Function (BRIEF). Statistical analyzes were performed using the SPSS Package program. The participants with neurological problems, entellectuel disabilities and autism spectrum disorders were excluded. This study was approved by the local ethical committee of our university (2022000235–4).

Measures

Sociodemographic form

The data form prepared by the researchers includes questions about the patient's age, gender, academic level, participation in online education, screen exposure, duration of physical activity, time spent with peers, changes in appetite and weight during the pandemic, parental age, education level. It was completed by the clinicians in the interviews with parents.

Schedule for Affective Disorders and Schizophrenia for School-Age Children, Present and Lifetime Version (K-SADS-PL)

The KSADS-PL was developed by Kaufman [18] and the validity and reliability study of Turkish version was conducted by Gökler [19]. It is a semi-structured diagnostic interview that aims to diagnose psychiatric disorders in children.

Children's Depression Scale (CDS)

It is a self-reported scale to assess depression symptoms among the children aged 6–12 years. Turkish validity and reliability was conducted by Oy [20]. The highest score is 54 and the cut-off point is 19.

Beck Depression Inventory (BDI)

It is a self-reported scale consisting of 21 items and is conducted by the individuals after the age of 13–14. The highest score is 63. The high score was found to be associated with the level and severity of depression. It was developed by Beck in 1961 and validity and reliability studies were carried out by Tegin [21]. According to a study in which the reliability of the scale was published in 2022, the reliability coefficient was updated as 0.8 instead of 0.65 [22].

Behavioral Rating Inventory of Executive Function (BRIEF)

It evaluates the behaviors of 5–18 years healthy children and adolescents with neurodevelopmental disorders, taking into account executive functions. It consists of 86 questions divided into 8 sub-headings filled by parents or teachers. Higher scores indicate more severe executive dysfunctions. Its validity and reliability were performed by Batan et al. [23].

Conners' Parent Rating Scales-Revised (CPRS-R)

This is one of the most frequently used behavioural scales in clinical and research settings in children with neurodevelopmental disorders, particularly children with ADHD. It was developed by Conners [24] and the was conducted by Kaner et al. [25]. The parents of

the enrolled children responded to the questions on a 4-point Likert scale.

Statistical analysis

Pearson Chi-Square test and descriptive statistical methods (frequency, percentage, mean, standard deviation) were used to compare qualitative data. Independent sample T-test was used for the comparison of parameters between groups. Pearson correlation analysis was used to examine the relationship between scale scores. The results were evaluated at the 95% confidence interval and the significance level of $p < 0.05$. Statistical analyzes were performed using the SPSS Package program.

Results

Among all participants 53% ($n = 28$) were girls and 47% ($n = 25$) were boys. The mean age was 12 ± 2.64 years. According to the parents' reports, the average time of children participated in online education during the pandemic was found to be 4.5 h (± 1.8) per day.

Participation in online education was asked and 67% of participants stated that they regularly participated while 37% did not. The parameter that most negatively affected participation in online education was "reluctance to participate" (66%), and the parameter that had the least negative impact on participation was "inadequate equipment and internet access" (26.4%). The parameters affected participation in online education are indicated in Table 1. Table 2 shows the evolution of times of physical activity, screen exposure and peer interaction before and after the pandemic.

The percentage of problems experienced in participation in online education is as follows; reluctance to participate 66%, inability to wake up early 52.8%, inability to focus 56.6%, interested in something else 52.8%, reluctance to open the camera 43.4% and, inadequate equipment or internet access 26.4%.

While the physical activity of the participants was 4 h/day before the pandemic, it decreased to 1.6 h/day afterward ($p = 0.000$). Screen time was 2.6 h/day before

Table 1 The parameters affected participation of children in online education

	Frequency (%)
Reluctance to participate	66
Inability to wake up early	52,8
Inability to focus	56,6
Interested in something else	52,8
Reluctance to open the camera	43,4
Inadequent equipment or internet access	26,4

Table 2 Comparison of physical activity, screen duration and time spent with peers before and after the pandemic

	Before the pandemic	After the pandemic	<i>p</i>
Physical activity (hour/day)	4 (sd:2,1)	1,6 (sd:1,4)	,000
Screen duration (hour/day)	2,6 (sd:1,8)	5,4 (sd:1,7)	,000
Interaction with peers (hour/week)	13,2 (sd:1,2)	4,4 (sd:1,7)	,000

Sd Standard deviation

Table 3 Frequencies of psychiatric disorders among participants before and after COVID-19 infection

Psychiatric Disorder N(%)	Before COVID-19 infection	After COVID-19 infection	<i>p</i>
Subthreshold PAD	5(9)	11 (21)	0,15
PAD	15 (28)	17 (32)	0,01
Subthreshold MDD	3 (6)	6 (11)	0,32
MDD	10 (19)	11 (21)	0,08
Subthreshold ED	1 (2)	7 (14)	0,15
ED	1 (2)	3 (6)	0,01
Subthreshold OCD	2 (2)	9 (16)	0,012
OCD	4 (7)	10 (18)	0,00
Subthreshold ADHD	11 (20)	20 (39)	0,00
ADHD	6 (11)	8 (15)	0,15
Somatic symptoms	1 (2)	6 (11)	0,02
Sleep problems	2 (4)	4 (8)	0,15

PAD Pervasive Anxiety Disorder, *MDD* Major Depressive Disorder, *ED* Eating Disorder, *OCD* Obsessive Compulsive Disorder, *ADHD* Attention Deficit Hyperactivity Disorder, *p* < 0,05

the pandemic and increased to 5.4 h/day after the pandemic ($p = 0.000$). While the interaction with peers was 13.2 h/week before the pandemic, it decreased to 4.4 h/week after the pandemic, and this difference was statistically significant ($p = 0.000$).

The relationship between interaction with peers and screen time during the pandemic process and the psychiatric symptoms after the illness was not statistically significant.

The frequencies of psychiatric disorders before and after the infection were shown in Table 3.

According to psychiatric interviews, 41% ($n = 22$) of participants had at least one clinical psychiatric disorder and 22% ($n = 12$) had at least one subthreshold disorder prior to COVID-19 infection. While 45.4% ($n = 15$) of the participants who had psychiatric disorders before the COVID-19 infection reported an exacerbation of their symptoms, 54.5% ($n = 18$) stated that their symptom severity did not change after the infection period. Among the participants who had psychiatric disorder before the infection and stated an increase in symptom severity, 27% ($n = 5$) were diagnosed with a

pervasive anxiety disorder, 55% ($n = 5$) were with major depressive disorder, and 26% ($n = 6$) were with ADHD.

As shown in Fig. 1, the frequency of clinical diagnosis was 54% ($n = 29$), whereas that of subthreshold diagnosis was 45% ($n = 24$) after the infection. In addition, 32% of participants reported that they experienced disgust with food during the infection, and 22% of these participants stated that the feeling of disgust with food and smell continued for weeks after the infection.

The changes in appetite of participants who had COVID-19 were analyzed and an increase in appetite was observed in 13%, a decrease in appetite in 37%, and no change was observed in 50%. Accordingly, weight gain was seen in 4%, weight loss was 28% of participants, and 68% of participants did not experience any change in weight.

The frequencies of psychiatric disorders among the participants who had applied to the psychiatry clinic before the COVID-19 infection were shown in Table 4.

Discussion

In our study, it was aimed to investigate psychological effects of previous COVID-19 infection and the COVID-19 pandemic on children and adolescents. The parameters related with daily life, such as duration of screen exposure, interaction with peers, physical activity before and after the pandemic, and psychiatric symptoms of children before and after the infection were questioned. Subclinical symptoms were exacerbated after infection.

Worsening of symptoms after infection in the presence of a pre-existing psychiatric disorder is consistent with literature [26]. Cross-sectional studies have reported that the prevalence of stress-related psychiatric symptoms, depression, anxiety symptoms, and sleep problems increased in the general population after the pandemic [26]. The results of the current study also showed an increase in depression and anxiety symptoms and sleep problems. A systematic review reported that the frequency of depressive symptoms was 21–45% after COVID-19, but the preceding frequency was unknown [27]. In another study, it was reported that after COVID-19 infection, the frequency of depression and anxiety was approximately 40% and the frequency of sleep disorders were higher than 30% [28]. The divergence between

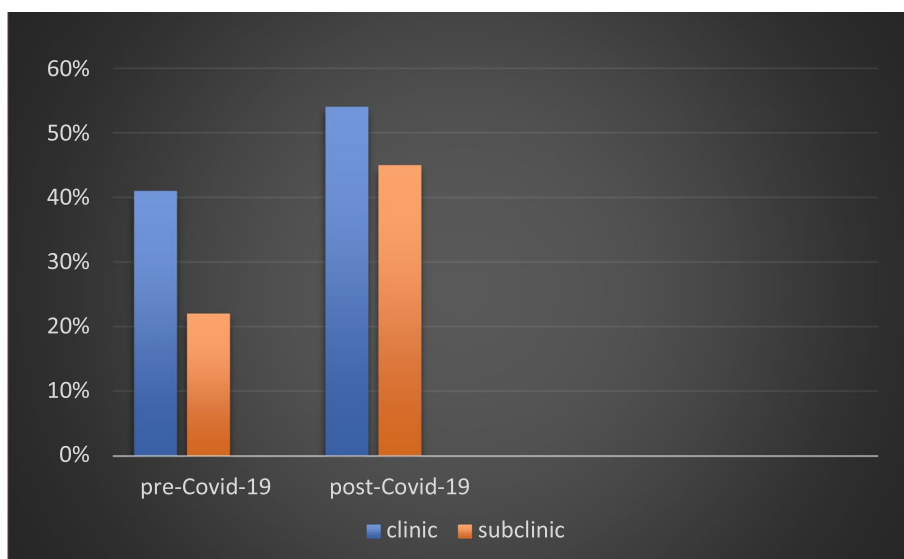


Fig. 1 Distribution of clinic and subthreshold disorders before and after COVID-19 infection

studies may be associated with methodological differences. The current study was not carried out in the acute period of pandemic, but in the progressive stage at which the temporary symptoms may disappeared, while more persistent or severe ones may became clear. On the other hand, we have emerged the sample by contacting the parents of children suffered from COVID-19 infection and the ones who accepted to participate were selected. These participants volunteered for psychiatric evaluation may be the ones experienced more psychiatric symptoms. Another important point supporting the reliability of our results may be the semi-structured psychiatric interviews applied to each participant to detect the symptoms.

Table 4 Pre and post-COVID-19 psychiatric disorder rates of participants who had previously applied to psychiatry clinic

Psychiatric Disorder N (%)	Before COVID-19 infection	After COVID-19 infection
Subthreshold PAD	0	1 (16)
PAD	2 (33)	2 (33)
Subthreshold MDD	0 (0)	1 (16)
MDD	1 (16)	2 (33)
Subthreshold OCD	0 (0)	0 (0)
OCD	1 (16)	3 (50)
Subthreshold ADHD	0 (0)	3 (50)
ADHD	2 (33)	2 (33)
Subthreshold ED	0 (0)	0 (0)
ED	0 (0)	0 (0)

PAD Pervasive Anxiety Disorder, MDD Major Depressive Disorder, ED Eating Disorder, OCD Obsessive Compulsive Disorder, ADHD Attention Deficit Hyperactivity Disorder

Considering that social communication skills develop inversely with screen exposure of the child, it is seen that decreasing peer interactions, restricting social life and increasing screen time pose a risk for mental well-being [29]. In current study, it was found that CDS scores and the time spent with peers were negatively correlated. In addition, there was found no statistically significant relationship between BDI scores and the time spent with peers. The difference observed here may be related to the fact that relatively older patients who were administered BDI, maintained their peer relationships online.

The results of current study showed that, unlike the studies showing an increase in risk for emotional eating and weight gain in adults, eating problems with weight and appetite loss were more pronounced [30]. In addition, these results are similar with a study evaluating appetite in the preschool age group in our country [31]. These findings support the differences in appetite regulation in adult and pediatric age groups during the pandemic period. It is thought that the COVID-19 pandemic may have disrupted the nutritional habits of individuals and that interventions aimed at eating habits may be beneficial in order to prevent eating disorders that may also continue after the epidemic. Although the results of the study contribute to the effects of the pandemic process on children and adolescents, studies including larger sample are warranted to better understand the effects on social and academic skills and psychiatric symptoms before and after COVID-19 infection.

Çocuklarla psikiyatrik görüşme yapılmış olması.

Gönüllülerin gelmesi.

Akut dönemde yapılmamış olması.

Strengths and limitations

The cross-sectional nature of the study is one of the limitations. In addition, the retrospective questioning may have led to recall bias of participants. A further limitation of this study is the relatively small sample size. In the literature, there are extensive studies on the effects of the pandemic process on children and adolescents, but studies on psychiatric disorders of children and adolescents who have had the disease are limited. Including patients infected with COVID-19 and exposed to the effects of the disease can be an important aspect of this study. On the other hand, the presence of psychiatric symptoms and possible diagnosis were assessed by questioning the clinical variables through a semi-structured psychiatric interview and scales.

Conclusions

The results of the study suggest that COVID-19 has increased psychiatric disorders in children and adolescents. The study shows that eating problems are the most affected area and suggests that a broader perspective may be useful for the population presenting with these symptoms. In this respect, it is important to evaluate the effects of COVID-19 infection in a larger sample, taking into account the severity of the disease and the spectrum of symptoms, and to determine the changes in the group in which the psychiatric evaluation was made beforehand. In conclusion, our data showed that COVID-19 is associated with an increase in psychiatric disorders in children and adolescents, and further studies are needed in a larger population to investigate the causes and consequences of these effects.

Abbreviations

COVID-19	Coronavirus disease 2019
Severe Acute Respiratory Syndrome—SARS-CoV-2	Severe acute respiratory syndrome coronavirus-2
MERS	Middle Eastern Respiratory Syndrome
BDI	Beck Depression Inventory
CDS	Children's Depression Scale
K-SADS-PL	Schedule for Affective Disorders and Schizophrenia for School-Age Children, Present and Lifetime Version
BRIEF	Behavioral Rating Inventory of Executive Function
CPRS-R	Conners' Parent Rating Scales-Revised
PAD	Pervasive Anxiety Disorder
MDD	Major Depressive Disorder
ED	Eating Disorder
OCD	Obsessive Compulsive Disorder
ADHD	Attention Deficit Hyperactivity Disorder

Acknowledgements

The authors thank to all clinic team involved with data collection.

Authors' contributions

EY, GV, DBO, MCU, BGK developed the research idea, EY, MCU, OC, AA and HHO assessed the data of patients with ADHD. OC, AA and HHO entered the data. MCU completed the statistical analyses. EY, OC, AA and HHO wrote the article and revised it. All authors have read and approved the manuscript.

Authors' information

EY, OC, AA, HHO, DBO, MCU, BGK are child and adolescent psychiatrist and GV is a pediatrician who assessed the participants diagnosed with COVID-19 infection.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Written consent was obtained from parents and verbal assent was requested from children and adolescents to participate. This investigation was approved by the Ethical Committee of Ankara University, Turkey (2022000235–4).

Consent for publication

Not applicable. The manuscript does not contain any individual person's data in any form (including individual details, images or videos).

Competing interests

None to declare.

Received: 15 February 2023 Accepted: 26 April 2023

Published online: 23 June 2023

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