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Original Research

Home participation, support and barriers among children with attention-deficit/hyperactivity disorder before and during the COVID-19 pandemic



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ABSTRACT

Objectives: Few studies have focused on the participation of children with attention-deficit/hyperactivity disorder (ADHD) in daily routine and leisure activities. This study aimed to compare the participation, support and barriers for children with ADHD at home pre-COVID-19 and during the COVID-19 outbreak. **Methods:** The study included 55 children with ADHD aged 6–11 years. Participation frequency, involvement, desire for change, supports and barriers at home were assessed using the Participation and Environment Measure for Children and Youth (PEM-CY).

Results: During the COVID-19 pandemic compared with the pre-COVID-19 period, the mean frequency of participation of children with ADHD in computer and video games (5.8% vs 5%, respectively), socialising with other people (7% vs 6.2%) and household chores (5.5% vs 4.6%) was shown to be significantly higher ($p < 0.05$). Mothers of children with ADHD reported higher levels of involvement during the COVID-19 pandemic compared with the pre-COVID-19 period across four areas of home participation, including computer and video games (4.1% vs 3.2%, respectively), arts, crafts, music and hobbies (3.7% vs 3%), household chores (3.6% vs 2.8%) and personal care management (4.2% vs 3.5%) $p < 0.05$. Mothers of children with ADHD reported that during the pandemic the following two features of the environment made participation easier than pre-COVID-19 ($p < 0.05$): cognitive demands (36.4% vs 60%, respectively) and social demands (5.5% vs 34.5%). More mothers reported that services (92.7%), supplies (87.3%) and information (85.5%) were available and/or adequate in the COVID-19 period than pre-COVID-19 ($p < 0.05$).

Conclusions: Mothers of children with ADHD reported that their children were participating more frequently in some of the home-related activities during the COVID-19 pandemic compared to pre-COVID-19. Reduced cognitive and social demands, and more readily available resources in the home environment during the COVID-19 period resulted in increased home participation compared to pre-COVID-19.

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Introduction

It is estimated that attention-deficit/hyperactivity disorder (ADHD) affects 5.3% of children worldwide.¹ ADHD is characterised by persistent symptoms of inattention and/or hyperactivity and

impulsivity.¹ This common neurodevelopmental disorder results in many serious functional impairments in activities of daily living, including reduced academic performance, learning disabilities, motor disorders and negative impacts on interpersonal relationships, emotions and well-being.^{2–4} Therefore, compared to their peers, children with ADHD have more functional difficulties in modulating sensorial feedback when participating in daily living activities.^{2,5}

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Participating in activities of daily living is an essential part of human development and life experiences, and is necessary to achieve new abilities and skills.^{6,7} Based on the International Classification of Functioning, Disability and Health (ICF) framework, participation is involvement in life situations among nine life areas, which include mobility, self-care, social interactions and life in different environmental settings.⁸

There is a growing recognition of the importance of participation for children with disabilities.^{9,10} In addition to the symptoms of ADHD, social isolation and exclusion from interpersonal relationships can lead to social difficulties, and unexpected social changes might affect the participation of children with ADHD.⁵ Few studies have focused on the participation of children with ADHD in daily routine and leisure activities.^{2,5,7} The authors of these studies report that children with ADHD have lower daily function and participation intensity, and the preference for physical and social activities, activities requiring ability and formal activities is significantly lower than in typically developing children.^{2,5,7} Moreover, children with ADHD have significant difficulties participating in daily activities at home, school and in community settings, especially in respect to self-care, home activities, spare time activities with their family and relationships with others.^{11,12}

During the COVID-19 pandemic, children and adults all over the world have encountered serious difficulties. Governments declared lockdowns and schools were closed. Children with ADHD had to stay at home for at least 2 months; thus, losing their daily routines, school and community relationships and routine medical follow-ups. These factors created an increased risk of worsening of the ADHD symptoms.¹³ Zhang et al.¹³ reported that the behaviours of children with ADHD significantly worsened relative to the pre-COVID-19 period, especially noting worsening of anxiety, attention, routine and listening to information. As children with ADHD had to stay at home during the COVID-19 pandemic, it was considered important to investigate the in-home participation, supports and barriers. Thus, the in-home participation of children with ADHD was investigated during the COVID-19 pandemic compared to the pre-COVID-19 period. The secondary aim of the study was to describe the in-home supports and barriers to participation during the COVID-19 pandemic. To the best of our knowledge, no study has reported the in-home participation of children with ADHD during the COVID-19 pandemic compared to a pre-COVID-19 period.

Methods

Participants

The study included 55 children with ADHD, aged 6–11 years, and their mothers, who received services from the Child and Adolescent Psychiatry Clinic in Antalya, Turkey, between September 2019 and June 2020. The inclusion criteria of this study were: (1) being diagnosed with ADHD (inattentive, hyperactive-impulsive or combined type) by a child and adolescent psychiatrist based on the criteria of the Diagnostic and Statistical Manual of Mental Disorders (5th ed.);¹ and (2) being aged between 6 and 11 years. The study exclusion criteria were: (1) having a psychiatric condition, including psychotic symptoms, autism spectrum disorders and depression; (2) having an orthopaedic/neurological disorder, including head trauma, cerebral palsy, seizures, vision and speech impairment; and (3) parents not agreeing to participate in the study.

Measures

Participation and Environment Measure for Children and Youth

The Participation and Environment Measure for Children and Youth (PEM-CY) is a parent-report questionnaire used to assess

participation and environmental factors in the home, school and community settings.¹⁴ The participation section includes 10 items in home settings, five items in school settings and 10 items in community settings. For each activity, parents are asked to determine the participation frequency (i.e. how frequently has the child participated, with eight options ranging from daily to never), participation involvement (i.e. how involved the child is while participating in the activity, with a five-point scale ranging from very involved to minimally involved) and change desired (i.e. do the parents want to see a change in the participation of the child in this type of activity: yes or no). After answering the participation section, environmental features are evaluated to identify supports and barriers (i.e. do the features of the environment help or make it more difficult for the child to participate in activities in home/school/community setting). There are 12 items in the home setting, 17 items in the school setting and 16 items in the community setting. The PEM-CY has been shown to be valid and reliable for children.⁹ According to a psychometric analysis study of the PEM-CY that included 178 children without disability and 210 children with a disability, the PEM-CY had moderate to very strong internal consistency and test–retest reliability (Cronbach's alpha = 0.67–0.93; intraclass correlation coefficients = 0.67–0.80).⁹

Sociodemographic questionnaire

Participants completed a questionnaire addressing family sociodemographic status, including family income, mother's education, child's age, gender, height, weight and medical history.

Procedure

Approval for the present study was obtained from the Local Ethics Committee of the university. Based on the principles stated in the Declaration of Helsinki, written informed consent was obtained from all participants. Mothers who agreed to participate in the study completed the PEM-CY and the sociodemographic form. The child and adolescent psychiatry department in Antalya, Turkey, is one of the reference centres of the city, and almost 100 families and their children present at the clinic every week. The majority of children attending the clinic have been diagnosed with ADHD. Before the COVID-19 pandemic, we routinely evaluated the children with ADHD using PEM-CY. The 'pre-COVID-19' evaluations were for the period between September 2019 and March 2020, as the first case of COVID-19 in Turkey was reported on 11 March 2020. We continued our routine evaluations until 20 March 2020, at which time the government declared a lockdown for the whole country and the children and their families had to stay at home for 2 months, from 4 April 2020 to 9 June 2020. During this period, the health of our patients was of great concern because they could not attend their routine follow-ups and we suspected some of them did not take their medicine. Therefore, between 2 and 5 June 2020, the mothers of children with ADHD were telephoned and asked about their child's health, retrospectively, and the PEM-CY was completed for the period defined as 'COVID-19 pandemic'. A total of five participants could not be reached, two had changed telephone number and three did not answer. Finally, 55 children with ADHD and their mothers completed the PEM-CY after 2 months of lockdown.

Statistical analyses

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 23 for Macintosh (IBM SPSS Statistics; IBM Corporation, Armonk, NY, USA). The Shapiro–Wilk test, histograms and Q–Q-plot were used to evaluate the distribution of variables before test selection, and data were not normally distributed. To achieve 80% power to detect a difference with 95%

Table 1
Sociodemographic characteristics of participants (n = 55).

Characteristic	Mean (SD)		
Child age (y)	8.6 (1.6)		
Age at diagnosis (y)	8.1 (1.6)		
Child height (cm)	132.4 (11.05)		
Child weight (kg)	30.2 (7.8)		
Mother's age (y)	36.7 (6.4)		
	n	%	
Child gender			
Male	47	85.5	
Female	8	14.5	
Drug use for ADHD			
Yes	27	49.1	
No	28	50.9	
Number of siblings			
0	8	14.5	
1	29	52.7	
2	14	25.5	
3	3	5.5	
4	1	1.8	
Type of school			
Elementary	45	81.8	
Secondary	10	18.2	
Distance education during COVID-19 pandemic			
None	3	5.5	
Internet	8	14.5	
Television	44	80	
Daily homework	24	43.6	
Marital status, mother			
Married	42	76.4	
Divorced	13	23.6	
Level of education, mother			
Elementary school	14	25.5	
Secondary school	12	21.8	
High School	19	34.5	
University/Graduate degree	10	18.2	
Type of community			
Urban	41	74.5	
Rural	14	25.5	
Family Income (monthly)			
Below average	13	23.6	
Average	24	43.7	
Above average	18	32.7	

ADHD, attention-deficit/hyperactivity disorder.

confidence using a paired *t*-test, a sample size of 47 participants was required, not including loss to follow-up. Analyses were performed to compare each home participation and home environment item for children with ADHD in the pre-COVID-19 and COVID-19 pandemic periods. The McNemar test was used to compare categorical responses, such as never participates, desire for change, environmental supports and barriers, between the two periods. The Wilcoxon test was used to compare the measurements at the two time points for frequency and involvement. A value of *p* < 0.05 was considered to be statistically significant.

Results

The sociodemographic characteristics of all participants are presented in Table 1. The mean age of children with ADHD was 8.6 years and they were predominantly male. Just less than half of the children (49.1%) with ADHD were taking medication. Most of the children (85.5%) had one or more siblings and were educated in elementary school (81.8%). Three children had no opportunity for distance education during the COVID-19 pandemic. More than half of the mothers (52.7%) were educated for more than 10 years. Many families lived in urban areas (74.5%) and had incomes in the 'average' to 'high' categories (76.4%).

Participation

For children with ADHD, the mean frequencies of participation and never participation for the 10 different home activity items during the pre-COVID-19 and COVID-19 pandemic periods are presented in Table 2. The mean frequency of participation in computer and video games, socialising with other people and household chores was statistically significantly higher during the COVID-19 pandemic compared to pre-COVID-19 (*p* < 0.05). The mean frequency of participation was significantly lower for socialising using technology and school preparation during the COVID-19 pandemic (*p* < 0.05). The percentage of children with ADHD who reported to never participate in the home activity of socialising using technology was consistently higher during the COVID-19 period.

Parents of children with ADHD reported higher levels of involvement in the COVID-19 period across the following four areas of home participation: computer and video games; arts, crafts, music and hobbies; household chores; and personal care management (Table 3). Lower levels of involvement than pre-COVID-19 were reported in the areas of socialising using technology and school preparation. During the COVID-19 pandemic, mothers reported less desire to change in their child's participation in the home-related activities of indoor play and games, socialising using technology, household chores and personal care management compared to the pre-COVID-19 period (*p* < 0.05). However, mothers more frequently indicated that they wanted some type of change in terms of school preparation during the COVID-19 period.

Environment

The support and resources available for the home environment of children with ADHD are shown in Tables 4 and 5. During the COVID-19 pandemic period, the mothers of children with ADHD less frequently reported that cognitive and social demands made participation more difficult than in the pre-COVID-19 period (*p* < 0.05). Fewer mothers of children with ADHD reported that the physical layout and physical demands of the environment were either 'sometimes helps/sometimes makes harder' during the COVID-19 period. However, during the same period, the majority of mothers of children with ADHD reported that sensory qualities and attitudes were either 'sometimes helps/sometimes makes harder'. During the COVID-19 pandemic, mothers more often reported that physical layout, sensory qualities, physical demands, cognitive demands, social demands and relationship with family members were either 'helpful or not an issue'. When asked whether certain resources in the home were sufficient and/or available to assist their child's participation, significantly more mothers of children with ADHD reported 'usually, yes' during the COVID-19 pandemic compared to pre-COVID-19 for services, supplies and information (Table 5).

Discussion

Many previous studies have focused on school activities and academic performance in children with ADHD and have shown ADHD to be associated with poor school performance.^{15,16} However, children with ADHD aged 6–11 years spend a lot of their time at home. Based on ADHD symptoms, participation of children in activities in the home environment could be negatively impacted. A few studies have investigated the participation of children with ADHD in leisure activities, daily activity function and household tasks through comparisons with typically developing peers.^{2,5,7,11} and it has been reported that children with ADHD participate less in leisure activities.^{2,5} The COVID-19 pandemic is global and is

Table 2
Frequencies of home participation and never participation of children with ADHD between the pre-COVID-19 and COVID-19 pandemic periods.

Participation item	Participates				Never participates				
	Pre-COVID-19		z	P-value ^a	Pre-COVID-19		COVID-19		P-value ^b
	[mean (SD)]	[mean (SD)]			n	%	n	%	
Computer and video games	5 (2.8)	5.8 (2.35)	-2.16	0.03*	13	23.6	7	12.7	0.1
Indoor play and games	5.1 (2.3)	5.05 (2.74)	-0.16	0.86	7	12.7	11	20	0.38
Arts, crafts, music and hobbies	4.5 (2.7)	5.2 (2.34)	-1.73	0.08	13	23.6	7	12.7	0.18
Watching TV, videos and DVDs	6.5 (1.3)	6.2 (1.74)	-1.25	0.21	2	3.6	3	5.5	1.00
Getting together with other people	6.2 (1.3)	7 (0.01)	-3.78	<0.0001*	1	1.8	55	0	1.00
Socialising using technology	4.1 (3.1)	2.4 (3.14)	-2.79	0.005*	19	34.5	33	60	0.004*
Household chores	4.6 (2.4)	5.5 (2.42)	-2.87	0.004*	9	16.4	8	14.5	1.00
Personal care management	6.6 (0.8)	6.5 (1.6)	-0.95	0.34	55	100	3	5.5	0.25
School preparation (not homework)	5.1 (2.5)	1.5 (0.87)	-5.79	<0.0001*	9	16.4	4	7.3	0.26
Homework	5.8 (2.01)	5.8 (1.84)	-1.09	0.27	4	7.3	4	7.3	1.00

ADHD, attention-deficit/hyperactivity disorder.

*p < 0.05.

^a Wilcoxon test.

^b McNemar test.

Table 3
Involvement of home participation and change desired of children with ADHD between the pre-COVID-19 and COVID-19 pandemic periods.

Participation item	Involvement				Mother Desires Change				
	Pre-COVID-19		z	P-value ^a	Pre-COVID-19		COVID-19		P-value ^b
	[mean (SD)]	[mean (SD)]			n	%	n	%	
Computer and video games	3.2 (2.1)	4.1 (1.7)	-2.87	0.004*	39	70.9	36	65.5	0.6
Indoor play and games	3.4 (1.7)	3.3 (2.1)	-0.42	0.67	38	69.1	25	45.5	0.02*
Arts, crafts, music and hobbies	3 (2.01)	3.7 (1.8)	-2.42	0.01*	40	72.7	30	54.5	0.08
Watching TV, videos and DVDs	4.07 (1.3)	4.4 (1.3)	-1.41	0.15	43	78.2	33	60	0.07
Getting together with other people	3.8 (1.5)	4.2 (1.2)	-1.60	0.09	27	49.1	21	38.2	0.32
Socialising using technology	2.8 (2.2)	1.7 (2.2)	-2.44	0.01*	30	54.5	13	23.6	<0.0001*
Household chores	2.8 (1.7)	3.6 (1.8)	-2.66	0.008*	41	74.5	25	45.5	0.002*
Personal care management	3.5 (1.4)	4.2 (1.4)	-2.98	0.003*	34	61.8	15	27.3	<0.0001*
School preparation (not homework)	2.7 (1.8)	1.3 (0.8)	-4.7	<0.0001*	38	69.1	52	94.5	0.003*
Homework	2.6 (1.6)	2.9 (1.6)	-1.46	0.14	48	87.3	41	74.5	0.11

ADHD, attention-deficit/hyperactivity disorder.

*p < 0.05.

^a Wilcoxon test.

^b McNemar test.

Table 4
Perceived supportiveness of the home environment in children with ADHD between the pre-COVID-19 and COVID-19 pandemic.

Environmental item	Usually makes harder					Sometimes helps/sometimes makes harder					Usually helps/not an issue				
	Pre-COVID-19		P-value ^a	Pre-COVID-19		P-value ^a	Pre-COVID-19		COVID-19		P-value ^a	Pre-COVID-19		COVID-19	
	n	%		n	%		n	%	n	%		n	%	n	%
Physical layout	7	12.7	2	3.6	0.12	11	20	2	3.6	0.004*	37	67.3	51	92.7	<0.0001*
Sensory qualities	5	9.1	1	1.8	0.12	6	10.9	55	100	0.03*	44	80	54	98.2	0.002*
Physical demands	3	5.5	2	3.6	1.00	14	25.5	2	3.6	0.002*	38	69.1	51	92.7	0.004*
Cognitive demands	33	60	20	36.4	0.01*	12	21.8	11	20	1.00	10	18.2	24	43.6	0.01*
Social demands	19	34.5	3	5.5	0.0001*	9	16.4	12	21.8	0.66	27	49.1	40	72.7	0.01*
Relationship with family members	11	20	5	9.1	0.1	11	20	15	27.3	0.48	33	60	35	63.6	0.82
Attitudes	21	38.2	26	47.3	0.4	8	14.5	28	50.9	0.001*	26	47.3	1	1.8	<0.0001*

ADHD, attention-deficit/hyperactivity disorder.

*p < 0.05.

^a McNemar test.

continuing with no known end in sight. A controlled social life with new rules has replaced the previous 'normal life' situation. Therefore, investigating the impact of the COVID-19 pandemic on the participation of children with ADHD is crucial. To the best of our knowledge, no study has investigated the participation of children with ADHD in home activities, and their supports and barriers in the home environment, both during the COVID-19 pandemic and the pre-COVID-19 period. The aim of this study was to investigate the home participation of children with ADHD, and their supports

and barriers in the home environment, during the COVID-19 pandemic compared to the pre-COVID-19 period.

As a result of the COVID-19 pandemic, children with ADHD and their families have had to endure the difficult situation of school closures and lockdowns. The children had to stay at home for at least 2 months. Zhang et al.¹³ reported that attention, anger frequency, listening to interactions and routines were significantly worsened in children with ADHD during the periods of lockdown in the COVID-19 pandemic. Results of the present study show an

Table 5
The resources of the home environment in children with ADHD between the pre-COVID-19 and the COVID-19 pandemic.

Resource item	Usually no					Sometimes yes/sometimes no					Usually yes				
	Pre-COVID-19		COVID-19		P-value ^a	Pre-COVID-19		COVID-19		P-value ^a	Pre-COVID-19		COVID-19		P-value ^a
	n	%	n	%		n	%	n	%		n	%	n	%	
Services	5	9.1	0	0	0.06	7	12.7	4	7.3	0.54	43	78.2	51	92.7	0.03*
Supplies	8	14.5	4	7.3	0.28	8	14.5	3	5.5	0.12	39	70.9	48	87.3	0.03*
Information	8	14.5	3	5.5	0.12	14	25.5	5	9.1	0.04*	33	60	47	85.5	0.001*
Time	8	14.5	5	9.1	0.5	17	30.9	14	25.5	0.64	30	54.5	36	65.5	0.26
Money	13	23.6	6	10.9	0.06	16	29.1	21	38.2	0.26	26	47.3	28	50.9	0.77

ADHD, attention-deficit/hyperactivity disorder.

*p < 0.05.

^a McNemar test.

increase of 16% in the mean frequency of participation in computer and video games, 11.2% in socialising with other people and 20.6% in household chores during the COVID-19 pandemic. The possible reason for this is that children with ADHD had to stay at home, and they spent more time in the home using a computer and interacting with other family members. Also, many participants had one or more siblings and they spent lots of time with them. In parallel with this, there was a 41.1% decrease in the mean frequency of participation in socialising using technology during the COVID-19 pandemic. There was a 73.9% increase in the percentage of children with ADHD who reported to never participate in socialising using technology during the lockdown compared to pre-COVID-19. Children with ADHD were with their family members during the COVID-19 lockdown period, and therefore did not need to use mobile phones or other devices to communicate with each other.

Involvement is key in understanding the extent to which a child is able to or prefers to actively participate in activities.¹⁷ In this way, involvement dimensions provide an opportunity to see different aspects of the child's participation.¹⁷ The findings of this study demonstrate that there were greater differences in the involvement of activities than in frequency during the COVID-19 pandemic than the pre-COVID-19 period. Mothers of children with ADHD reported a 25.8% increase in involvement in computer and video games, a 25.3% increase in arts, crafts, music and hobbies, a 29.4% increase in household chores and a 20.5% increase in personal care management during the COVID-19 period.

In addition, the results showed that mothers wanted their children to spend less time on screens, both pre-COVID-19 and during the COVID-19 pandemic. More precisely, 70.9% of mothers reported that they wanted some type of change in their child's participation in computer and video games pre-COVID-19, and this rate was 65.5% during the COVID-19 lockdown. Mothers also less frequently reported that they wanted some type of change in their child's participation in four home-related activities; there was a 34.1% increase in satisfaction in activities of indoor play and games, 56.6% in socialising using technology, 38.9% in household chores and 55.8% in personal care management. These results suggest that the mothers were satisfied with the mean frequency of participation and the levels of involvement of their children with ADHD across the home activities during the COVID-19 pandemic, especially the decrease in the mean participation frequency in socialising using technology and the increase in the level of involvement in personal care management. However, almost all the mothers (94.5%) answered that they wanted to reopen the schools. The results of this study show that children with ADHD were more interactive with people or in household activities in the COVID-19 period. As the family were together for the duration of lockdown, children with ADHD had access to family members who could support them and respond to their cognitive and social demands in home activities. In addition, half of the mothers were educated to

high school or university level, which could positively impact the cognitive and social demands of children with ADHD.

During the COVID-19 pandemic, support and resources of the home environment were improved relative to the pre-COVID-19 period for children with ADHD. Based on these findings, cognitive and social demands were more likely to hinder children with ADHD in the pre-COVID-19 period than during the pandemic. During the COVID-19 pandemic, the mothers of children with ADHD did not often select the 'usually makes harder' response when asked about the impact of cognitive demands of activities. The cognitive demands of activities were reported to be 39.3% less of a barrier in this study, compared to the findings of Zhang et al.¹³ This might be because children and their families had spent quality time together, and this was reflected positively in the child's ADHD symptoms in the acute period of the COVID-19 pandemic. The other important factors that might act on the cognitive demands of children with ADHD were marital status of mothers, family income and living region (urban or rural). In the present study, most of the mothers were married, had an 'average' to 'high' income and were living in urban areas. In the pre-COVID-19 period, one of the biggest barriers for children with ADHD was reported to be the social demands of activities. Similar to these results, many studies in the literature have described the difficulties of children with ADHD in social areas.^{7,18} However, the barrier of the social demands of activities were reduced by 83.8% during the COVID-19 period. The possible reason for this is that the children with ADHD spent more time with their siblings, parents and other family members during lockdown, and this reflected positively in their social and cognitive requirements in the acute period of the COVID-19 pandemic. However, the COVID-19 pandemic could be prolonged and could affect the social and cognitive demands of activities negatively in the long term. Future studies should investigate the long-term impact of the COVID-19 pandemic on children with ADHD.

Based on the results of this study, the resources in the home, including services, supplies and information, were sufficient and available to enable the participation of children with ADHD in activities during the COVID-19 lockdown. However, mothers of children with ADHD were more likely to report that the attitudes of teachers affected the participation of children with ADHD in online learning during the COVID-19 pandemic. These findings show that children with ADHD need access to a face-to-face education system.

A strength of this study was the investigation of the findings of home participation of children with ADHD as well as the supports and barriers of environmental features in the acute period of the COVID-19 pandemic through comparisons with the pre-COVID-19 period. Future studies should focus on school and community participation of children with ADHD during the COVID-19 pandemic by comparisons with typically developing peers. A limitation of this study was that there was a higher ratio of boys with ADHD.

The study findings suggest that children with ADHD need to spend more quality time with their parents and siblings in the

home to increase participation frequency, involvement and to prevent barriers.

In conclusion, mothers of children with ADHD reported that their children were participating more in some of the home-related activities during the COVID-19 pandemic than in the pre-COVID-19 period. The features of cognitive and social demands and the resources of the home environment did not constitute barriers to home participation during the COVID-19 pandemic as much as in the pre-COVID-19 period.

Author statements

Ethical approval

This study was approved by the Ethics Committee of Health Sciences University (2020-271).

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Competing interests

The authors have no conflict of interests to declare.

Author contributions

Ozgun Kaya Kara: writing - original draft preparation, conceptualisation, methodology; Hasan Atacan Tonak: visualisation, investigation; Koray Kara: supervision, reviewing and editing; Hazal Sonbahar Ulu: data curation, software; Barkin Kose: visualisation, investigation; Sedef Sahin: supervision, reviewing and editing; Mahmut Zabit Kara: supervision, reviewing and editing.

References

1. American Psychiatric Association AP. *Diagnostic and statistical manual of mental disorders*. 5th ed. Washington, DC: American Psychiatric Association; 2013. DSM-5. 5th edition.
2. Mimouni-Bloch A, Offek H, Rosenblum S, Posener I, Silman Z, Engel-Yeger B. Association between sensory modulation and daily activity function of children with attention deficit/hyperactivity disorder and children with typical development. *Res Dev Disabil* 2018;**83**:69–76.
3. Subcommittee on Attention-Deficit/Hyperactivity D, Steering Committee on Quality I, Management, et al. ADHD: clinical practice guideline for the diagnosis, evaluation, and treatment of attention-deficit/hyperactivity disorder in children and adolescents. *Pediatrics* 2011;**128**:1007–22.
4. Miller LJ, Nielsen DM, Schoen SA. Attention deficit hyperactivity disorder and sensory modulation disorder: a comparison of behavior and physiology. *Res Dev Disabil* 2012;**33**:804–18.
5. Shimoni M, Engel-Yeger B, Tirosh E. Participation in leisure activities among boys with attention deficit hyperactivity disorder. *Res Dev Disabil* 2010;**31**:1234–9.
6. Law M. Participation in the occupations of everyday life. *Am J Occup Ther* 2002;**56**:640–9.
7. Engel-Yeger B, Ziv-On D. The relationship between sensory processing difficulties and leisure activity preference of children with different types of ADHD. *Res Dev Disabil* 2011;**32**:1154–62.
8. World Health Organization. *International classification of functioning, disability and health*. Geneva: World Health Organization; 2001.
9. Kaya Kara O, Turker D, Kara K, Yardimci-Lokmanoglu BN. Psychometric properties of the Turkish version of participation and environment measure for children and Youth. *Child Care Health Dev* 2020 Nov;**46**(6):711–22.
10. Sahin S, Kaya Kara O, Kose B, Kara K. Investigation on participation, supports and barriers of children with specific learning disabilities. *Res Dev Disabil* 2020;**101**:103639.
11. Dunn L, Coster WJ, Cohn ES, Orsmond GI. Factors associated with participation of children with and without ADHD in household tasks. *Phys Occup Ther Pediatr* 2009;**29**:274–94.
12. Whalen CK, Henker B, Jamner LD, Ishikawa SS, Floro JN, Swindle R, et al. Toward mapping daily challenges of living with ADHD: maternal and child perspectives using electronic diaries. *J Abnorm Child Psychol* 2006;**34**:115–30.
13. Zhang J, Shuai L, Yu H, Wang Z, Qiu M, Lu L, et al. Acute stress, behavioural symptoms and mood states among school-age children with attention-deficit/hyperactive disorder during the COVID-19 outbreak. *Asian J Psychiatr* 2020;**51**:102077.
14. Coster W, Bedell G, Law M, Khetani MA, Teplicky R, Liljenquist K, et al. Psychometric evaluation of the participation and environment measure for children and Youth. *Dev Med Child Neurol* 2011;**53**:1030–7.
15. Jangmo A, Stalhandske A, Chang Z, Chen Q, Almqvist C, Feldman I, et al. Attention-deficit/hyperactivity disorder, school performance, and effect of medication. *J Am Acad Child Adolesc Psychiatry* 2019;**58**:423–32.
16. Polderman TJ, Boomsma DI, Bartels M, Verhulst FC, Huizink AC. A systematic review of prospective studies on attention problems and academic achievement. *Acta Psychiatr Scand* 2010;**122**:271–84.
17. Coster W, Law M, Bedell G, Liljenquist K, Kao Y-C, Khetani M, et al. School participation, supports and barriers of students with and without disabilities. *Child Care Health Dev* 2013;**39**:535–43.
18. Hurt EA, Hoza B, Pelham Jr WE. Parenting, family loneliness, and peer functioning in boys with attention-deficit/hyperactivity disorder. *J Abnorm Child Psychol* 2007;**35**:543–55.