

# A WhatsApp-delivered intervention to promote physical activity in young children with autism spectrum disorder

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**Objective:** The aim of this study was to examine the effects of WhatsApp-delivered physical activities on the physical activity level of children with Autism Spectrum Disorder (ASD).

**Method:** This study used the mixed-method sequential exploratory design that consisted of the quantitative stage and the qualitative stage. The 42 family (parent and child dyads) participated in the study. Families were assigned randomly to an experimental group (n: 21) and a control group (n: 21). Families in the experimental group were engaged in 6 weeks of the WhatsApp-delivered physical activities. The data were collected through Leisure Time Exercise Questionnaire (LTEQ) and Semi-Structured Interview Questions. A two-way mixed ANOVA (2 groups × 2 time points) was used to determine the effects of WhatsApp-delivered physical activities on the physical activity level of children with ASD.

**Results:** After the WhatsApp-delivered physical activities, a significant increase was observed in the physical activity level of children with ASD in the experimental group compared to the control group.

**Conclusions:** The results provided evidence that WhatsApp-delivered physical activities positively affect the physical activity level of children with ASD.

**Keywords:** autism spectrum disorder; intervention; WhatsApp; physical activity; exercise

## Introduction

Autism Spectrum Disorder (ASD) is a neurological and developmental disorder observed even in early childhood and is commonly characterized by inadequate social interaction and communication skills and limited patterns of repetitive behavior. ASD not only affects the behavioral, cognitive and mental functions of children with this diagnosis, but also negatively affects the level of physical activity (American Psychiatric Association 2013). Studies show that children with ASD have a lower level of physical activity compared to their typically developing peers (Corvey *et al.* 2016, Macdonald *et al.* 2011, McCoy *et al.* 2016, Pan *et al.* 2016). Low level of physical activity is a major concern for children with ASD (Garcia-Pastor *et al.* 2019). It is because children with ASD have fewer opportunities to participate in physical activity and exercise (Pan *et al.* 2011) and this puts them at risk of developing chronic conditions such as diabetes, obesity and heart disease

(World Health Organization 2008). Some measurement tools are used to determine the physical activity level of individuals with ASD. One of these measurement tools is the Leisure Time Exercise Questionnaire (LTEQ). LTEQ was developed by Godin and Shephard in Canada in 1985, and it is a short and practical questionnaire used to assess the leisure time physical activity level of individuals based on their own reporting (Sari and Erdoğan 2016). As an indicator of its usefulness, the questionnaire has been cited more than 1160 times in the Scopus database (Amireault and Godin 2015). LTEQ consists of 4 items that seek information about how many times mild, moderate and strenuous intensity physical activities occur for at least 15 min in a typical week (Amireault *et al.* 2015). Increasing scores are associated with increased exercise behavior. The final score provides us with references about the health contribution of physical activity (Sari and Erdoğan 2016). LTEQ has been frequently used in previous studies (Hamm and Yun 2018, Healy and Marchand 2020, Marchand and Healy 2019, Memari *et al.* 2015, Russell *et al.* 2018) to determine the leisure time physical

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activity level of individuals with ASD. Memari *et al.* (2015) showed that LTEQ has a good test-retest reliability score that can be used to determine the physical activity level of children with ASD.

Regular participation in physical activity is an effective method used in reducing the risks arising from the developmental characteristics of children with ASD (Yarımkaça *et al.* 2017). Regular physical activities positively affect the physical development, physical health, psychomotor skills and skill-related fitness of children with ASD (Dickinson and Place 2014, Healy *et al.* 2018, Lalonde *et al.* 2014, Menear and Neumeier 2015, Sowa and Meulenbroek 2012). Physical activities can improve the social interaction (Chu and Pan 2012) and communication skills (Yarımkaça *et al.* 2017) of children with ASD, reduce their self-stimulating/self-injurious (Sorensen and Zarrett 2014) and stereotypical behaviors (Oriol *et al.* 2011) and increase their self-efficacy (Lang *et al.* 2010). As is seen in the literature, studies aimed at improving physical activity in children with ASD reveal that physical activities have a significant impact on the biological and psycho-social development of children with ASD. While these results are encouraging, there are some limitations on the sustainability of existing physical activity interventions for children with ASD. Current physical activity interventions aimed at increasing the physical activity level of children with ASD often require specialist support (teacher, medical clinician, or physical therapist), costly special equipment and non-naturalist environments (school, equine, pool, or equine therapy center etc.) (Healy and Marchand 2020). In most cases, access to existing physical activity programs is limited to people living in areas where specialists serve (Marchand and Healy 2019). In addition, from spring 2020, the novel Coronavirus (COVID-19) outbreak has emerged that deeply affects the world and restricts access to existing physical activity programs for children with ASD. Children with ASD faced the risk of physical inactivity due to closed training centers during the COVID-19 crisis (Yarımkaça and Esentürk 2020a). In the face of this situation, it was reported that parents do not know what to do to increase the physical activity level of their children with ASD and they have a lack of a suitable physical activity program (Esentürk 2020, Yarımkaça and Esentürk 2020b). For this reason, there is a need for an alternative physical activity presentation that children with ASD can do with their parents in the home environment and reach wider audiences.

Social media platforms may have the potential to promote physical activity in children with ASD and create a sustainable physical activity presentation (Healy and Marchand 2020). WhatsApp (WhatsApp Inc., Mountain View, CA), which is among the social media platforms, is an application used by more than 700 million people worldwide, allowing smartphone users to send content

such as text messages or video-pictures to each other (Muntaner-Mas *et al.* 2017). WhatsApp allows multiple users to create a group and join the chat at the same time and follow the content shared in the group at the same time (Johnston *et al.* 2015). A number of studies evaluated the effectiveness of physical activities offered through social media platforms such as WhatsApp and Facebook on individuals with normal development (Muntaner-Mas *et al.* 2017, Valle *et al.* 2013, Wójcicki *et al.* 2014). The results of these studies revealed that WhatsApp and Facebook-delivered physical activities can positively affect the health problems of individuals with normal development. Specifically, only one study was found examining whether physical activities offered through social media platforms were an effective intervention for children with ASD. Healy and Marchand (2020) reported that Facebook-delivered physical activities are an effective intervention to increase the physical activity level of children with ASD. However, no research has yet been conducted to examine the effectiveness of WhatsApp-delivered physical activities for children with ASD. Considering this gap in the literature, the aim of this study is to investigate whether the WhatsApp-delivered physical activities have any effect on the physical activity level of children with ASD.

## Method

### Study design

This study used the mixed-method sequential exploratory design that consisted of the quantitative stage and the qualitative stage (Creswell 2014). In the quantitative stage, a quasi-experimental design with experimental and control groups was used to investigate the effects of WhatsApp-delivered physical activities on the physical activity level of children with ASD (see Figure 1). The quasi-experimental design is a highly applicable research model that is often used in research in the field of education, where it is not possible to control all variables. While the pre-test in the model helps determine the similarity level of the groups before the intervention program, the post-test allow to interpret the effects of the intervention on the participants (Cohen *et al.* 2007). In the qualitative stage, semi-structured interview questions were used to examine the opinions of parents about the changes in physical activity level of children with ASD and the WhatsApp-delivered physical activities. Semi-structured interview is defined as a distinctive method used to understand what, how and why participants think (Bogdan and Biklen 2007).

### Participants

Participants were recruited from four specialized education and rehabilitation centers for children with ASD in Ankara during the COVID-19 crisis. The city of Ankara is the second largest city in Turkey with a population of approximately 5.5 million. With the first

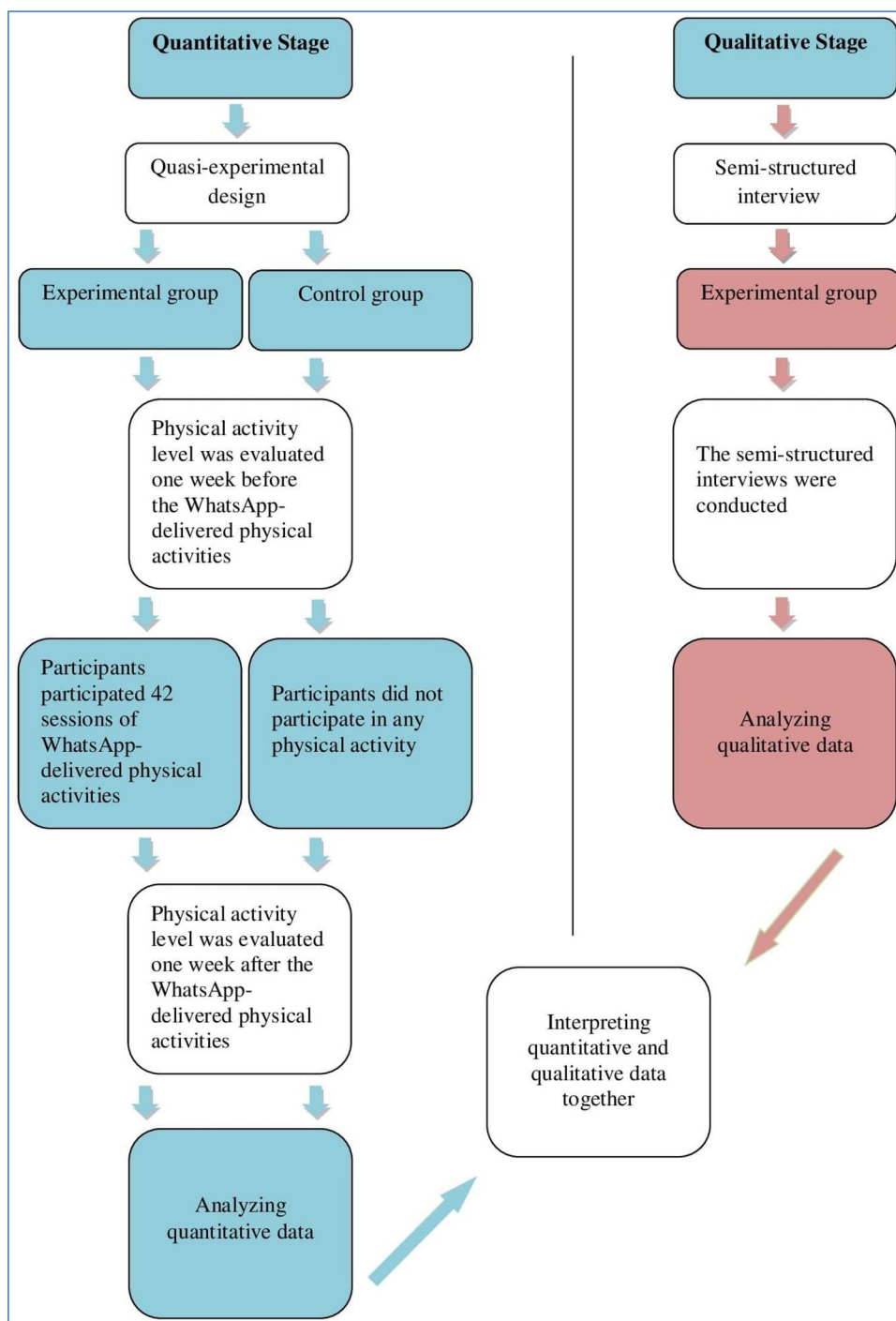


Figure 1. Flow chart for the current study.

incident of COVID-19 in Turkey on March 11, 2020, rapid and protective measures were taken by the Turkish government. Within the scope of the measures taken, public and private educational institutions were closed, except for continuous care centers for children with ASD. At the time of the current research (27 April 2020–21 June 2020), the vast majority of children with ASD stayed with their families at home during this process and could not access educational support, including physical education.

A total of 42 families (parent and child dyads) participated in the study. The families were randomly divided into two groups: an experimental group (n: 21)

and a control group (n: 21). None of the parents and their children dropped out the current study. Children with ASD in the experimental group were engaged in 6 weeks of the WhatsApp-delivered physical activities. Criteria sampling method was used to determine the participants of the study. Selection criteria for the participants included: a) having a child diagnosed with ASD according to DSM-5 criteria, b) volunteering for participation in the study, and c) having an active WhatsApp account. In line with these criteria, support was received from the directors of special education and rehabilitation centers to identify the participants. With the permission of the directors of the special

**Table 1. Examples of physical activity sent over a typical week.**

Day	Physical activity	Content
Monday	Home-based exercises	Exercises such as knee to elbow, plank, back extensions, squats, side knee lifts, superman, bridge, chair dips, chest opener, child's pose, seated meditation and legs up the wall
Tuesday	Fun educational games	In-house active games with pairs or groups that can be made using items that can be found in the home environment
Wednesday	Dancing	Fun dances with the whole family accompanied by rhythm and music (Hip hop, zumba, etc.)
Thursday	Fitness	Activities such as jumping jacks, burpees, squat, plank, synchronized step, knee bending, bending to the side, sit-ups, and push-ups
Friday	To be active during the day	Walking at home, placing food, climbing stairs, sit-up and push-up activities can also be used as inspiration to be active during the day
Saturday	Meditation	Meditation and breathing techniques for calmness (Breathing, Yoga etc.)
Sunday	Domestic chores	Domestic chores such as cleaning and gardening

education and rehabilitation centers, the primary researcher interviewed the parents of children with ASD on the phone and explained the purpose and participation process of the study to them.

### Intervention

#### WhatsApp-delivered physical activities

A private WhatsApp group was created in order to share information, strategies and videos about physical activities with parents. The parents in the experimental who met the criteria to participate in the study were included in this private WhatsApp group. In line with the recommendations of the U.S. Department of Health and Human Services (2018) and two academicians on autism and physical activity (one Professor and one Associate Professor), a 20-30 min physical activity session was held 7 days per week for 6 weeks. In order to include physical activities preferred by children with ASD and their parents in the sessions, the primary researcher conducted phone interviews with the parents. Activities that parents can easily implement at home with their children with ASD and that do not require any materials were included in the sessions. Each physical activity session consisted of: a) a warm-up period of about 10 min, b) a physical activity period of about 10 min, and c) a cooling down period of about 10 min. The warm-up period included mild gait and rotation of the joints in the extremities (knee and ankle, hip, neck and shoulder). During the physical activity period, home based exercises, fun games, daily housework, dance, meditation and fitness activities were included. The cooling down period included breathing and stretching exercises. Parents were sent 3 YouTube videos (about 10 min each) illustrating the three components of a 30-min session (warm-up-physical activity-

cooling) the day before the sessions. In other words, 3 new videos were sent to the parents each day to illustrate what they were expected to do with their children the next day. The sessions were held in small periods of 3 × 10 min, with a 2-minute break between periods. The videos were added to the WhatsApp group and parents watched the videos. Questions about video content were answered in a group chat, and parents were provided with detailed information and definitions of video content. Examples of physical activities and their contents sent to parents for a typical week can be seen in Table 1.

#### Strategies for WhatsApp-delivered physical activities

A number of strategies were determined to ensure the sustainability of physical activities and to make parents ready to practice physical activities. For 6 weeks, physical activity strategies were shared with parents via WhatsApp group. Physical activity strategies were prepared with the support of previous studies (Healy and Marchand 2020, Narzisi 2020, Menear and Neumeier 2015, Yarimkaya and Esentürk 2020a) that suggested a strategy for the effective participation of children with ASD in physical activities.

**Organizing the physical activity environment.** In order for children with ASD to participate in physical activities effectively, parents were advised to prepare the physical activity environment in advance. If the activities were to be held in a room, the parents were asked to ventilate the room (such as opening windows) before the activities and to organize the environment in a wide enough way to do the activities easily. It was reminded that attention should be paid not to sound and

light in the room that could distract children with ASD. In addition, it was stated that physical activity and sports pictures that may attract the attention of the child with ASD can be hung on the walls of the room where physical activity would be performed.

#### **Preparing the child with ASD for physical activity.**

Pre-physical activity preview helps children with ASD know what they will encounter during activities (Grenier and Yeaton 2011, Menear and Neumeier 2015). Before each physical activity session, parents were advised to preview activity videos for their children with ASD. However, parents were asked to talk about the positive effects of physical activity on people in concrete and short terms to their children with ASD and to mention that they would be given a reward at the end of each week. Information on the positive effects of physical activities on individuals was shared with parents in the WhatsApp group.

#### **Ensuring the participation of the whole family in physical activity.**

Studies show that if the active participation of the family cannot be achieved in the educational practices offered to children with ASD, the activities will not reach the stated goals for both children and family (Diken 2009, Sameroff and Fiese 2000). For this reason, suggestions were made for the participation of all family members in the activities before each physical activity session.

**Reward.** An effective reward system was established in the study in order to increase the motivation of children with ASD. The reward package consisting of a tennis racket, frisbee, volleyball ball, jumping rope, kite and car-baby was delivered to the parents. Parents were asked to give one of these rewards to their children with ASD at the end of each week. The rewarding system was reminded to parents in weekly messages.

#### **Promoting social interaction between parents, motivating them and offering them social support.**

To encourage social interaction between parents, parents were asked to share photos or videos of their children during the activities in the WhatsApp group. A message in this direction was sent to the WhatsApp group once a week. With this guidance, it was aimed for parents to share their success, to be motivated, to communicate with each other and to give them clues about physical activities. Researchers were always available to answer parents' questions, and outside of the WhatsApp group, parents were supported in physical activities via private messaging.

**Controlling physical activity.** A chat was held with the parents once a week about at what rate physical activities were performed, who participated in physical

activities and the usefulness of physical activities. Questions were sent to the parents once a week via WhatsApp. Parents reported their opinions on how often physical activities were done and the usefulness of physical activities via private WhatsApp messages. In this way, we tried to verify to what extent and how physical activities were performed.

### **Instruments**

#### **Personal information form**

Demographic information about parents (gender, age, income level and educational background) and their children (gender, age, diagnosis and additional comorbidities) were collected with the personal information form.

#### **Leisure Time Exercise Questionnaire (LTEQ)**

LTEQ was used to assess the physical activity level of the children with ASD before and after the WhatsApp-delivered physical activities. LTEQ aims to determine how many times a) Strenuous intensity physical activities, b) Moderate intensity physical activities and c) Mild physical activities have been done for at least 15 min in the last week (Godin and Shephard 1985). The total score of the questionnaire is calculated as follows: weekly leisure time activity score =  $(9 \times \text{strenuous intensity physical activities}) + (5 \times \text{moderate intensity physical activities}) + (3 \times \text{mild physical activities})$  (Godin 2011). In the adaptation of LTEQ to Turkish culture (Yerlisu-Lapa et al. 2016), as a result of the Exploratory Factor Analysis (EFA), a single factor structure that explains 55% of the total variance was obtained. Test-retest analysis was carried out within the scope of the reliability of the questionnaire. For the Turkish version of LTEQ, the test-retest reliability coefficient was calculated as .84 for the overall questionnaire and .80, .76 and .72 for the items of the questionnaire, respectively. In addition, according to the criterion validity, Spearman correlation coefficient was found as .92 as a result of the correlation analysis made with the 'International Physical Activity Questionnaire-Short Form'.

#### **Semi-structured interview questions**

With semi-structured interview questions, the perceptions of parents in the experimental group about the changes in the physical activity level of children with ASD and the WhatsApp-delivered physical activities were examined. Interview questions were reviewed in terms of content validity by three experts (1 Associate Professor, 2 Assistant Professors) experienced in the field of physical activity and qualitative study. The interview questions were finalized by taking the opinions of the experts (miswritings, clarity, and scope). All interviews with parents in the experimental group were carried out through private WhatsApp messages in

**Table 2. Participant characteristics.**

		Groups	
		Experimental (n: 21) n(%)	Control (n: 21) n(%)
Children (n: 42)	Gender		
	Female	8(38.1%)	6 (28.5%)
	Male	13(61.9%)	15 (71.5%)
	Age (M + SD)	5.52 + 0.74	5.90 + 0.79
	Diagnosis		
	ASD	21(%100)	21 (%100)
	Additional Comorbidities		
	ADHD	9(42.9%)	5 (23.9%)
	SD	3(14.2%)	1 (4.8%)
	ID	1(4.8%)	3 (14.2%)
	LD	1(4.8%)	1 (4.8%)
N	7(33.3%)	11 (52.3%)	
Parents (n: 42)	Gender		
	Female	16(76.1%)	14 (66.7%)
	Male	5(23.9%)	7 (33.3%)
	Age (M + SD)	35.95 + 4.82	36.19 + 7.35
	Education		
	Secondary School	4(19.1%)	3 (14.2%)
	High School	10(47.6%)	14 (66.7%)
	University	7(33.3%)	4 (19.1%)
	Income		
	Low	2(9.6%)	1 (4.8%)
	Middle	11(52.3%)	13 (61.9%)
High	8(38.1%)	7 (33.3%)	

ASD: Autism Spectrum Disorder; ID: Intellectual Disability; SD: Speech Delay; LD: Learning Disability; ADHD: Attention Deficit Hyperactivity Disorder; N: None.  
M: Mean, SD: Standard deviation.

accordance with the COVID-19 outbreak measures. The semi-structured interviews were not conducted with the control group. The questions were addressed to the parents after the WhatsApp-delivered physical activities and the parents answered the questions in the form of a WhatsApp message on the same day. Interview questions included: a) How would you rate your overall experience with WhatsApp-delivered physical activities? b) How beneficial did the physical activities posted in the WhatsApp group have on your child's physical activity level? and c) What can you say about the usefulness of the physical activity contents and strategies posted in the WhatsApp group?

### Analysis

Comparisons between and within the group regarding the physical activity level of children with ASD were analyzed using SPSS software (Version 20.0). The physical activity level of the experimental and control group in the baseline was examined by Independent samples t-test. A two-way mixed ANOVA (2 groups  $\times$  2 time points) was used to determine the effects of WhatsApp-delivered physical activities on the physical activity level of children with ASD. Significant interactions resulting from ANOVA were evaluated by post hoc Bonferroni test. Paired-samples t-test was used to investigate the differences between pre-test and post-test within each of the groups. Significance was tested at  $p < .05$ . The descriptive analysis method was used in the analysis of the qualitative data of the study. First, all of the messages of the participants in the WhatsApp group were translated into text. The primary and

secondary researchers then independently read and analyzed the data line by line. Then, coding was done and themes were created. In the last step, the data were interpreted. In the interpretation of the data, the feelings and thoughts of the participants were expressed descriptively by giving direct quotations in this study. With this qualitative data analysis, it was aimed to describe the opinions of parents about the physical activity level of children with ASD and the usefulness of the intervention program. Pseudonyms were used in the study to protect identities of parents and children. Children were listed as P1, P2, P3, etc.

### Results

The sample of the current study consisted of a total of the forty-two family (parent and child dyads). Families were assigned randomly to an experimental group and a control group (see Table 2 for demographic characteristics of the participants). The experimental group consisted of 21 children with ASD (8 girls and 13 boys). The mean ages of children with ASD in the experimental group were 5.22 (SD: 0.74). The control group was comprised of 21 ASD students (6 girls and 15 boys). The mean ages of children with ASD in the control group were 5.90 (SD: 0.79). The study also provided detailed information regarding the parents of the children with ASD in the experimental and control groups. The majority of parents in the experimental were female (16 female and 5 male), and were a mean age of 35.95 years (SD = 4.82). The education level of the majority of the parents (80.9%, n: 17) in the experimental group was at high school or university. The majority

**Table 3. ANOVA results related to the pretest-posttest physical activity scores.**

Source	Type III Sum of Squares	Mean Square	F	p	Partial Eta Squared ( $\eta^2$ )
<b>Between-Subjects</b>					
Group (A/C)	6840.048	128,000	37.843	.000*	.366
Error	11844.762	296.119			
<b>Within-Subjects</b>					
Time (Pretest-Posttest)	5029.762	5029.762	95.554	.000*	.705
<b>Time * Group</b>	5185.714	5185.714	98.516	.000*	.711
Error	2105.524	52.638			

\*Represented  $p < .05$ .

of parents in the control were female (14 female and 7 male), and were a mean age of 36.19 years (SD = 7.35). The education level of the majority of the parents (85.8%, n: 18) in the control group was at high school or university.

### Changes in physical activity level of the children with ASD

In pre-WhatsApp-delivered physical activities, the differences between the physical activity level of the experimental and control groups were analyzed by Independent-samples t-test. As a result of the analysis, it was revealed that there was no significant difference between the physical activity level of children with ASD in the experimental and control groups ( $t_{(40)} = .534$ ;  $p > .05$ ). This showed that the children with ASD in the experimental and control groups in the pre-WhatsApp-delivered physical activities had similar physical activity level.

Two-way mixed ANOVA (2 groups  $\times$  2 time points) test was performed to determine the impact of WhatsApp-delivered physical activities on the physical activity level of children with ASD (see Table 3). ANOVA revealed a significant group effect ( $F_{(1,40)} = 37.843$ ;  $p < .05$ ,  $\eta^2 = .366$ ), a significant time effect ( $F_{(1,40)} = 95.554$ ;  $p < 0.05$ ,  $\eta^2 = .705$ ) and a significant group  $\times$  time interaction ( $F_{(1,40)} = 98.516$ ;  $p < .05$ ,  $\eta^2 = .711$ ) on the physical activity level of the participants in the experimental and control groups.

Since ANOVA results reveal a significant group  $\times$  time interaction, post hoc Bonferroni test was used to determine whether there was a change in experimental and control groups over time. As reported Figure 2, pair-wise comparisons revealed the significant increase their pre-test physical activity scores of children with ASD in the experimental group compared to their post-test physical activity scores (adjusted Bonferroni =  $p < 0.05$ , Difference = +31.190), this was not the case in the control group (adjusted Bonferroni =  $p > .05$ , Difference: -0.23).

Differences between pre-test and post-test physical activity scores of experimental and control groups were examined with Paired-samples t-test (see Table 4). The results of the analysis showed that there was a significant difference in favor of post-test between pre-test and post-test physical activity scores of children with

ASD in the experimental group ( $t_{(40)} = -10.544$ ;  $p < .05$ ). On the other hand, no significant difference was found between pre-test and post-test physical activity scores of children with ASD in the control group ( $t_{(40)} = .211$ ;  $p > .05$ ).

### Perceptions of the parents on the WhatsApp-delivered physical activities

Two main themes were created by analyzing the data collected from the parents in the experimental group: 1) benefits of WhatsApp-delivered physical activities and 2) usefulness of WhatsApp-delivered physical activities. The first theme (*benefits of WhatsApp-delivered physical activities*) includes the sub-themes of increasing the level of physical activity, promoting family participation, improving movement skills and reducing technological tool addiction. The second theme (*usefulness of WhatsApp-delivered physical activities*) includes sub-themes of support for physical education, learning interesting and useful information about physical activity and support to create new routines (Figure 3).

#### Theme 1: benefits of WhatsApp-delivered physical activities

The following findings were obtained from the interviews with the parents about the benefits of WhatsApp-delivered physical activities. Overall, parents stated that WhatsApp-delivered physical activities improved the physical activity level of their children with ASD and contributed to their mobility. In addition, mothers demanded that such applications be used as supportive education not only during the outbreak period, but also in normal times.

P3's mother, who is an academican, said: 'During the outbreak process, we started working from home with my husband. Unfortunately, the time we spare for our son has decreased. Fortunately, we learned about your study. We act according to your schedule. Our son's physical activity level has increased. We regularly do physical activities with our son'.

P13's father stated: 'My son started to be more active during the day after the physical activities you sent via WhatsApp. It is like he walks more straight and upright'.

P16's mother, who is a housewife, said: 'I was afraid that my daughter would regress when her education was disrupted due to this pandemic. In other words, the lockdown made its effect felt immediately, we could not even go to a park. She was getting very sedentary. These activities contributed a lot to her movement'.

P7's mother stated: 'We had a hard time explaining the lockdown to my daughter. She didn't understand that we were

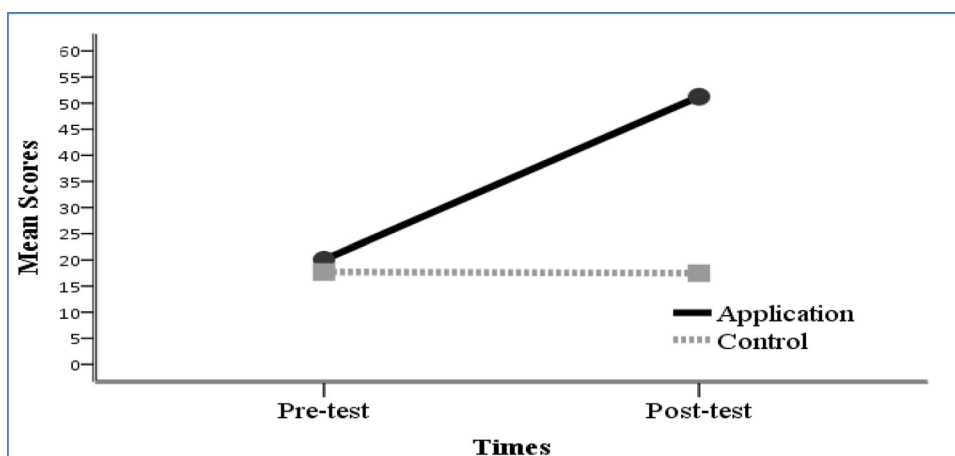


Figure 2. Mean physical activity scores of the groups in pre-intervention and post-intervention.

Table 4. Paired-samples t-test results related to the pre-test-posttest physical activity scores.

Group		N	M	SD	t	p
Experimental group	Pre-test	21	20.04	16.475	-10.544	.000*
	Post-test	21	51.23	13.54		
Control group	Pre-test	21	17.71	11.38	0.211	.835
	Post-test	21	17.46	10.62		

\*Represented  $p < .05$ .  
M: Mean, SD: Standard deviation.

always at home. She was very bored at home. It was very difficult to explain staying at home all the time. I remember walking together for an hour some days before the outbreak. That's why I wanted to participate in your work. There was a change for her. We move and have fun together'.

Parents stated that before the WhatsApp-delivered physical activities, they were worried about their children's health due to the dependence on technological tools, the constant desire to rest and the constant desire to eat, but their anxiety decreased due to the increased physical activity level and movement skills of their children who participated in the WhatsApp-delivered physical activities. A parental opinion supporting this is as follows: 'Physically, my son started to be more active. The activities contributed to my son's movement. We are always at home, everywhere is forbidden, always asking for rest and always wanting to eat. I was very worried about his health. It was a difficult situation for us, but thank you for the activities and your work. My worries disappear as he moves. It makes us very happy that he moves and has fun' (P20's mother).

P1's mother, who experienced a similar incident, said the following: 'Thank you very much. Most of our day was spent with tablets, computers and food. I was very worried about her health, her weight, her eyes. At least, we can stay away from computers and tablets with physical activities. My daughter is moving more than before, doing sports and having a good time ... of course I am very happy about this situation'.

In addition, parents stated that thanks to the WhatsApp-delivered physical activities, not only their children with ASD, but the whole family started to be

active and engaged in physical activities by having fun together.

P14's father, a university graduate, said: 'My son has a lot of fun, he always wants to win games. I want to thank you. We do the activities with the whole family, not only my son but the whole family are more active now'.

P12's mother stated: 'Your study has been very beneficial for us. My daughter participates in daily activities and moves. So glad we have you. And not only my daughter, but her siblings and sometimes the whole family we work together. We move together, we have fun, we spend time together'.

P6's father said: 'Your system is very successful. Thank you very much for me and my wife. I find it extremely useful WhatsApp physical activities. During the lockdown days, you provided us with significant support. We did the whole family together sometimes activities, and it was an opportunity to act together'.

### Theme 2: usefulness of WhatsApp-delivered physical activities

Findings from interviews with parents regarding usefulness of WhatsApp-delivered physical activities are shown below. Parents generally stated that they do not know what to do to increase the physical activity level of their children during the COVID-19 outbreak, but that WhatsApp-delivered physical activities are an important support in this process.

P17's father said: 'My son was going to private education before, and when we came from there, we were playing in the park. We were badly affected by the lockdown. We tried playing games at home a few times, but it wasn't regular. WhatsApp physical activities have been an important support for us'.

P8's mother, who is a housewife, stated: 'We were initially worried about the lockdown in the form of what our child will do and how he will do it. His other training was much disrupted and of course sports were also hampered. However, you gave us great support with your work. The activities attracted my son's attention, and we can easily apply them and very fun activities'.

P11's mother said: 'Thank you very much. WhatsApp physical activities have been a huge support to us. We also had the opportunity to act together. My daughter had a lot of fun. Thank you also for the rewards. My daughter is excitedly waiting for her weekend reward'.

P15's father stated: 'Before your work, I tried something to get my son to move, but we could not determine how and for how



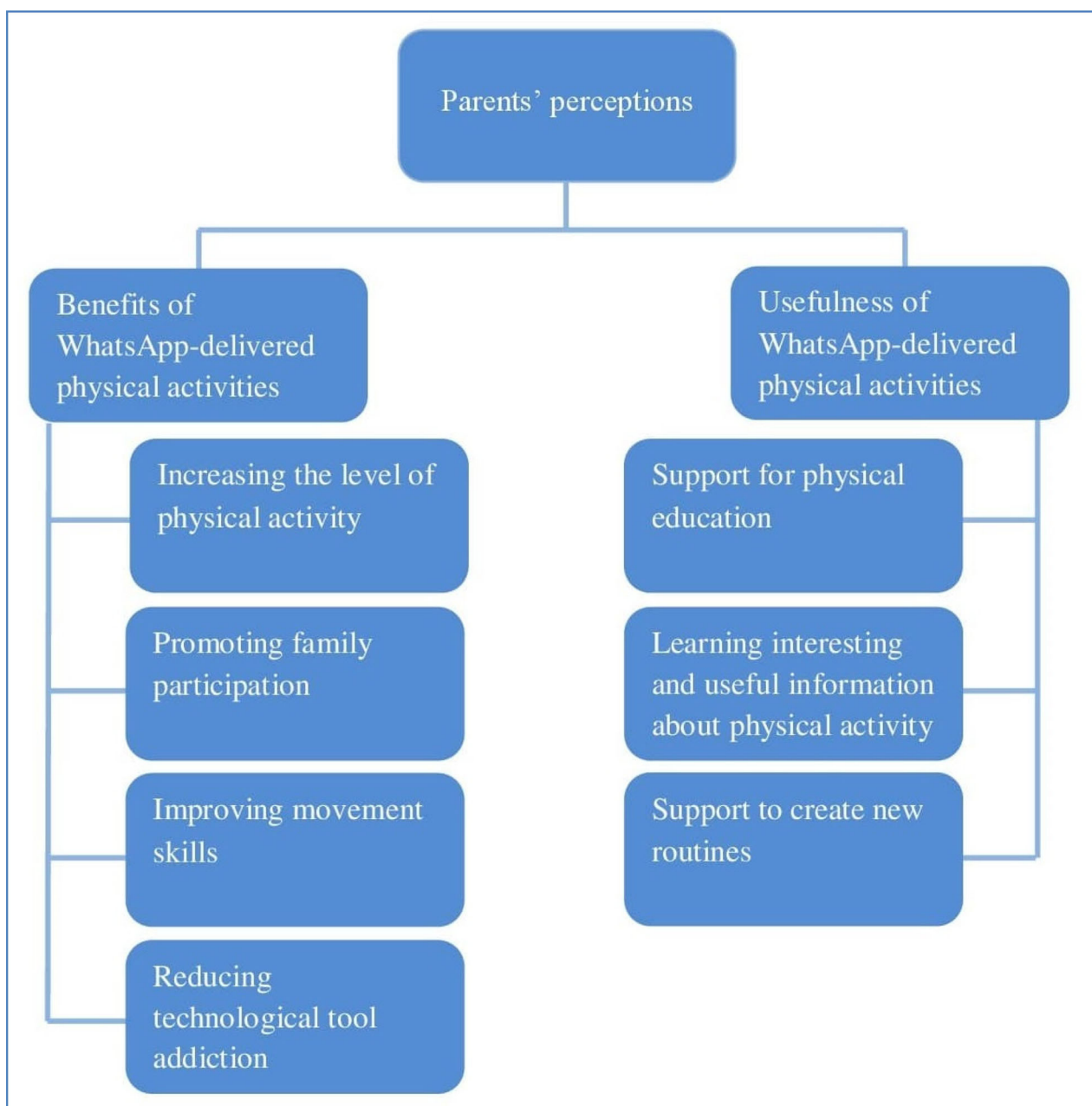


Figure 3. Summaries of the themes and sub-themes.

long to do it. Now we are doing our activities in a planned way with your guidance every day’.

Parents also stated that their children do physical activities with fun, they are pleased to participate in physical activities, and they learn extremely interesting and useful information about physical activities. Parental opinions supporting this situation are as follows:

P5’s mother said: ‘It was very useful. My child also loved it, it is also very good that we do it together. I also learned useful information about physical activities’.

P9’s mother stated: ‘The whole family had to stay home due to the coronavirus. Our father stayed at home and worked from home. Our daughter had the most difficulties in this process. Physical activities have been a good support for us. My daughter is doing exercises with fun’.

P18’s mother said: ‘We could not leave the house due to the lockdown. We also started doing some activities at home. However, no matter what activity we do, it has not been as effective as your WhatsApp physical activities. My son is doing the moves with enthusiasm and fun’.

In addition, parents said that the routines of their children with ASD were disrupted by the COVID-19 lockdown, but that WhatsApp-delivered physical activities could quickly take place in the new routine parents are trying to create for their children. A parental opinion supporting this situation is as follows: ‘Everything was cut off suddenly with the outbreak. My child had a routine day before the outbreak, but those routines were completely broken. We started to create new routines for my son with his father. With your work, our physical activity routine has also been formed, and

*physical education is not interrupted. He learns new movements and becomes more active' (P10's mother).*

P4's mother said: 'Now our new routine for physical education has become the physical activities in your study. We do activities with my daughter at the same time every day. It makes me very happy that she moves and takes new routines'.

P2's mother said: 'All of my son's routines were broken due to the lockdown. He was constantly asking for rest and eating. It was very difficult to get used to new activities. Fortunately, my manager informed me about your study. We wanted to join immediately. It made us very happy that he also participated in your activities, learned new routines and do movements along with his other trainings'.

## Discussion

The aim of this study was to examine the effects of WhatsApp-delivered physical activities on the physical activity level of children with ASD. The results showed that WhatsApp-delivered physical activities positively affected the physical activity level of children with ASD. After the WhatsApp-delivered physical activities, it was determined that children with ASD in the experimental group had a significant increase in physical activity level compared to the control group. These results were similar to previous studies that aimed to increase the physical activity level of individuals through WhatsApp and Facebook. For example, Healy and Marchand (2020) found that Facebook-delivered physical activity is an effective intervention to increase the physical activity level of children with ASD. Muntaner-Mas *et al.* (2017) showed that WhatsApp-delivered physical activities have a positive effect on the cardiovascular disease risks and health-related physical fitness components of older adults.

WhatsApp-delivered physical activities in the current study were carried out during a period of home stay precaution due to the COVID-19 outbreak. During the COVID-19 crisis, the physical education of children with ASD was interrupted due to closed schools and special education centers, and children with ASD faced the risk of physical inactivity (Yarimkaya and Esentürk 2020b). Parents participating in the current study reported that they do not know what to do with the physical activities of their children with ASD due to their suddenly changing lives, but that WhatsApp-delivered physical activities in this difficult process is a significant guide in increasing the physical activity level of their children with ASD. In addition, parents stated that their children do WhatsApp-delivered physical activities with fun, they are pleased to participate in physical activities, and they learn very interesting and useful information about physical activities. Current physical activity interventions aimed at increasing the physical activity level of children with ASD often include physical activity programs such as karate (Bahrami *et al.* 2016), swimming (Pan 2010), summer camp (Brookman *et al.* 2003), fitness (Pitetti *et al.*

2007), and therapeutic horse riding (Gabriels *et al.* 2012). Systematic reviews reveal that participation in existing physical activity programs has a positive impact on the developmental areas of children with ASD (Lalonde *et al.* 2014, Lang *et al.* 2010). Despite these promising findings, there are some limitations in the sustainability of existing physical activity interventions. Current physical activity interventions are often interrupted by dependence on professionals and unnatural environments and high cost (Healy and Marchand 2020). In most cases, access to existing physical activity programs is limited to people living in areas where professionals serve (Marchand and Healy 2019). However, barriers that prevent participation in physical activity for children with ASD can be overcome through social media platforms (Healy and Marchand 2020). Studies conducted on a large population, including individuals with ASD (Joseph *et al.* 2015, Wójcicki *et al.* 2014, Valle *et al.* 2013) have revealed that interventions delivered through social networks such as WhatsApp and Facebook can be effective in increasing the level of physical activity and solving health problems. For example, Healy and Marchand (2020) revealed in their study examining the feasibility of Facebook-delivered physical activities on the physical activity level of children with ASD that parents find Facebook-delivered physical activities extremely useful and that parents obtain interesting and useful information about physical activities through the Facebook-delivered physical activity intervention. Consequently, in line with previous studies, the current study indicated that WhatsApp-delivered physical activities effectively increased the physical activity level of children with ASD. The findings provided evidence that WhatsApp-delivered physical activities can be administered by parents to children with ASD in a home environment without expert support, high costs, or dedicated sports venues. However, it should be noted that the study is among the few studies that reveal the benefits of WhatsApp-delivered physical activities for children with ASD, additional studies should be planned to investigate the effectiveness of social networks such as WhatsApp on the physical activity level of children with ASD.

## Limitations of the study

Although the study is among the few studies examining the effectiveness of WhatsApp-delivered physical activities for children with ASD, it contains some limitations. The greatest limitation of the study was considered to be its small sample size. This may limit the generalizability of the results obtained from the physical activity questionnaire. In addition, there was no follow-up test for the physical activity level of children with ASD. Therefore, it can be difficult to interpret the persistence of the effects of WhatsApp-

delivered physical activities on the physical activity level of children with ASD. In addition, as the study was conducted during the COVID-19 crisis, one physical activity session every day could easily be administered by the parents. However, there is no prediction or data that parents can practice one physical activity session every day for children with ASD when their school is not closed.

### Implications for future research

In the present study, information, strategies and video links regarding physical activities were shared with the parents by interacting with the parents on a daily and weekly basis via WhatsApp group. However, a separate family education program has not been organized for the parents regarding physical activity. Parents' questions regarding the activities were answered instantly through the WhatsApp group, and it was ensured that the parents were able to conduct physical activity sessions with joint discussions. Pre-WhatsApp-delivered physical activities, parent training sessions can be planned to support parents to better mediate WhatsApp-delivered physical activities in future studies.

### Disclosure statement

No potential conflict of interest was reported by the authors.

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