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ARTICLE

Effectiveness of an 8-Week Game-Based Physical Activity Program in Reducing Post-Traumatic Stress among Children Affected by the 2023 Kahramanmaraş Earthquakes

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ABSTRACT: Objectives: This study examines the effectiveness of an eight-week game-based physical activity program designed to reduce post-traumatic stress levels in children affected by the Kahramanmaraş-centered earthquakes that occurred in Turkey on 06 February 2023. Following the earthquake, millions of children experienced significant changes in their education and living conditions, adversely affecting their psychological health. **Methods:** The therapeutic effects of physical activity on post-traumatic stress disorder (PTSD) are frequently emphasized in the literature, and this study specifically focuses on the impact of game-based exercises. The research employed an experimental design, involving 80 earthquake-affected children aged 10 to 13, who were randomly assigned to either an experimental group (n = 40) or a control group (n = 40). The experimental group participated in game-based physical activities three times per week for eight weeks, with each session lasting 60 min. Data were collected using the Child Post-Traumatic Stress Reaction Index (CPTS-RI), and pre-test and post-test comparisons were conducted. **Results:** Children in the experimental group showed a marked reduction in PTSD symptoms, with mean CPTS-RI scores decreasing from 2.60 at pre-test to 1.91 at post-test. In contrast, the control group's scores remained virtually unchanged (2.59 at pre-test vs. 2.57 at post-test). Two-way ANOVA demonstrated significant main effects of group and time, as well as a significant group × time interaction ($F = 114.88$, $p < 0.001$, $\eta^2 = 0.42$), indicating that the reduction was attributable to participation in the game-based physical activity program. These findings highlight not only the statistical significance but also the practical relevance of structured, culturally adapted physical activity interventions for trauma-exposed children. **Conclusion:** These findings suggest that regular, structured game-based physical activities can support the mental health of children following traumatic events such as earthquakes and reduce their stress levels. The study recommends integrating physical activity into post-disaster psychosocial support programs and highlights it as an effective, accessible, and enjoyable method to enhance children's trauma coping skills. Accordingly, it advocates for the wider implementation of physical activity-based interventions in similar crisis situations.

KEYWORDS: Earthquake-affected children; post-traumatic stress; game-based physical activity; child post-traumatic stress reaction index (CPTS-RI); psychological well-being

1 Introduction

Natural disasters such as earthquakes are not only associated with widespread physical destruction but are also recognized as some of the most psychologically distressing life events [1]. Due to their sudden and

unpredictable nature, such disasters often trigger intense emotional responses including fear, helplessness, and uncertainty, which may lead to long-term psychological consequences [2]. Previous studies have shown that earthquakes can lead to a variety of mental health problems, including depression, among large segments of the population [3]. On 06 February 2023, at 04:17 and 13:24 local time, two major earthquakes with magnitudes of 7.7 and 7.6 struck Türkiye, with epicenters in the Pazarcık and Elbistan districts of Kahramanmaraş. These earthquakes were recorded as the most destructive in the country's history, affecting an area of 108,812 square kilometers and impacting 11 provinces across the Eastern and Southeastern Anatolia regions. The province of Malatya, where the present study was conducted, experienced a significant loss of life and property as a result of the disaster [4].

Following the earthquakes, it was found that adult survivors experienced varying levels of depression—ranging from mild to severe [5]. However, the psychological effects of the disaster were not limited to adults. Approximately four million children were affected by the February 6 earthquakes, and the destruction or damage of around 576 schools across the 11 provinces severely disrupted children's access to education [6]. This disruption, combined with the sudden changes in daily life and the experience of loss, increased children's and adolescents' vulnerability to various mental health issues [7]. Furthermore, a post-disaster report emphasized the scarcity of psychosocial support programs to help children and adolescents in the affected regions cope with the traumatic experience of the earthquake, highlighting a significant need for specialized professionals and interventions in these areas [8]. Additionally, an information bulletin published by the Turkish Psychiatric Association after the earthquake noted that children aged 2–5, 6–11, and adolescents aged 12–17 may exhibit different trauma-related symptoms [9].

Disaster psychology is a field that examines the psychosocial impacts of disasters such as earthquakes, floods, mining accidents, and acts of terrorism [10], and it is stated that post-disaster social work was initiated in the twentieth century by sociologists [11]. In Türkiye, studies on the psychological consequences of disasters began following the 1992 Erzincan earthquake [12] and gained momentum after the 1999 Marmara earthquake [13]. This is because individuals' reactions following a disaster vary depending on the nature of the disaster and personal characteristics, and are generally categorized into different phases: the initial hours, the early days, and the end of the first week [14]. Based on these phases, psychological assistance to disaster survivors has been framed within the context of disaster psychology as both psychological first aid, recommended by the World Health Organization [15], and as individualized mid- and long-term treatment approaches involving psychosocial support interventions [14]. Within this context, the current study was conducted approximately one year after the earthquakes of February 6, 2023, during the months of March, April, and May. Although this timing might be considered a limitation of the study, it is important to acknowledge that earthquakes are natural disasters known to cause long-term psychological effects [16–19].

Regular physical activity and exercise can play a significant role in improving the physical and mental health of children following trauma. Research has demonstrated that physical activity is effective in reducing post-traumatic stress disorder (PTSD) and other psychological symptoms. Specifically, physical activity has been shown to enhance mental well-being in traumatized children by reducing symptoms of anxiety, depression, and PTSD [20–22]. Moreover, the combination of resistance and aerobic exercises appears to be particularly effective in alleviating PTSD symptoms [23]. Beyond natural disasters, regular exercise has also been found to reduce depressive symptoms and improve overall mood in individuals who have experienced other forms of trauma [21,22]. Additionally, exercise is known to contribute to cognitive recovery after traumatic brain injuries. [24,25]. It has also been reported that physical activity can reduce social anxiety and boost individuals' self-confidence [26], and that engaging in physical activities integrated with nature can foster post-traumatic growth while lowering stress levels [27]. Finally, given the significant disruptions in sleep patterns observed among individuals affected by earthquakes [28,29], it is important to

note that regular exercise has been shown to improve sleep quality and enhance general physical health in children [20,30].

Game-Based Physical Activity (GBPA) and Psychological Well-Being

Game-based approaches have become increasingly popular in educational settings [31]. In recent years, they have been increasingly employed as an active methodology to address issues related to social behavior and motivation among children and adolescents [32–34]. In this context, implementing physical activities in a gamified format for children was a crucial parameter in ensuring the sustainability of the intervention and in achieving the desired outcomes.

The impact of game-based physical activity (GBPA) on psychological well-being has been the subject of extensive research in recent years. Studies have shown that GBPA can significantly enhance psychological well-being in children, adolescents, and adults alike [35–37]. GBPA—such as exergames, augmented reality (AR) games, and traditional physical games—has been associated with substantial improvements in participants' happiness, subjective well-being, and overall mental health [35–41]. These types of activities are linked to reductions in stress, anxiety, and depression. Notably, active video games (exergames) and AR-based games have demonstrated such effects, particularly among university students and young adults [37,38,40,41]. Furthermore, game-based activities have been found to improve self-esteem and promote positive emotional states in children and adolescents, while simultaneously reducing negative emotions such as tension, anger, and confusion [35,37,39]. GBPA has also been shown to enhance social interaction, attention, and memory [35,40].

The effectiveness of game-based physical activity in reducing PTSD symptoms can be theoretically explained by several mechanisms. Meta-analyses and randomized controlled trials indicate that GBPA significantly reduces PTSD symptoms in children. Specifically, children receiving group-based interventions experienced significant reductions in PTSD symptoms compared to controls, with a moderate effect size ($g = -0.55$). This effect was also observed across different types of trauma (natural disaster, war, abuse) and across various socioeconomic settings [42–45]. Game-based group therapies have been found effective in a variety of forms, including traditional games and cognitive-behavioral approaches [46–48].

The positive psychological and social effects of game-based physical activities for children are supported not only by research findings [42,46] but also by some positive psychology [49] and health behavior theories [50]. Indeed, as theorists such as Piaget, Vygotsky, and Erikson, who have pioneered approaches to children from past to present, have suggested, game supports multidimensional development for children, playing a fundamental role in cognitive, social, emotional, and physical domains [51–53]. Modern approaches, on the other hand, emphasize the effects of play on coping with uncertainty, learning motivation, and psychosocial resilience [54–56].

Within this framework, it is evident that earthquakes are natural disasters that leave profound physical and psychological effects on children, and that they can have particularly significant impacts in terms of post-traumatic stress. Interventions aimed at reducing post-traumatic stress levels are of great importance in facilitating children's adaptation to life following such traumatic events. While physical activity is well known for its positive effects on individuals' overall health, it also plays a crucial role in psychological recovery processes. In this context, the central research question of the present study is whether regular physical activity is effective in reducing post-traumatic stress levels among children affected by the earthquake. Accordingly, the study was conducted using an experimental design involving both an intervention and a control group.

2 Methods

This study was conducted to examine the effect of regular physical activity on the Child Post-Traumatic Stress Reaction Index (CPTS-RI) levels in children affected by the earthquake. The research employed an experimental design, one of the quantitative research methods. A pretest-posttest control group model was adopted within the scope of the study.

2.1 Participants

A total of 80 students (Experimental: 10.75 ± 0.74 years; Control: 11.1 ± 0.93 years), aged between 10 and 13, living in the same region affected by the earthquake, participated in the study. Participants were randomly assigned to either the experimental group (n = 40; 21 females, 19 males) or the control group (n = 40; 19 females, 21 males). The children were homogeneously distributed in terms of age, gender, and trauma level. Participants in the experimental group received a regular physical activity program, while participants in the control group did not receive any intervention. As of June 2025, all participants in both the intervention and control groups continue to reside in safe container settlement areas established for earthquake survivors.

The rationale for selecting children aged 10–13 is based on both developmental and methodological considerations [57–60]. This age group corresponds to late childhood and early adolescence, a critical period for psychosocial development during which trauma symptoms are quite evident but also responsive to structured interventions [58,59,61,62]. Additionally, the CPTS-RI scale has been shown to be reliable and valid in assessing PTSD symptoms in children at this developmental stage.

The study was approved by the Scientific Research Publications and Ethics Committee of the İnönü University with decision number 2/6 dated 08 February 2024. Participation was voluntary, and ethical guidelines were strictly followed throughout all phases of the study. Informed consent was obtained from the families, and participants' personal information was kept confidential.

2.2 Child Posttraumatic Stress Reaction Index (CPTS-RI)

To assess participants' post-traumatic stress levels, the CPTS-RI, originally developed by Pynoos and colleagues in 1987, was employed [63]. The validity and reliability of the scale in Türkiye were established by Erden and colleagues [64]. This instrument is designed to measure the intensity of post-traumatic stress reactions experienced by children and adolescents who have been exposed to trauma. The scale consists of 20 items, each rated by the participant on a 5-point Likert scale ranging from 0 to 4, where 0 indicates "never experienced" and 4 indicates "experienced very often". As a result, total scores range from 0 to 80, with higher scores reflecting more severe post-traumatic stress symptoms. The CPTS-RI evaluates trauma-related symptoms across emotional, cognitive, and behavioral dimensions, providing a comprehensive assessment of the negative effects experienced by children. Items on the scale assess symptoms such as intrusive memories related to the traumatic event, fear, avoidance behaviors, hyperarousal, and emotional responses. Due to its ability to capture a wide range of trauma symptoms, the CPTS-RI is widely used as a valid and reliable tool in both the diagnostic assessment of PTSD in children and in monitoring treatment outcomes. In this study, the CPTS-RI was administered to each participant twice: once before the intervention (pre-test) and once after the intervention (post-test). This pre-post evaluation enabled the researchers to assess changes in post-traumatic stress levels and determine the effectiveness of the intervention.

2.3 8 Week Game Based Physical Activity Program

The children in the experimental group participated in a structured physical activity program conducted over eight weeks, with sessions held three times per week, each lasting 60 min. The program was

designed by the researchers involved in this study, consisting of game-based exercises tailored to be age-appropriate for the children. Given the lack of access to necessary equipment and transportation among the earthquake-affected children, the program—comprising educational, game-based physical activities as outlined in Table 1—was implemented in a manner that ensured consistent and regular participation.

Table 1: GBPA program applied for 8 weeks.

Week	Day 1	Day 2	Day 3
1	Introduction, trust and group games	Balance and coordination games	Educational games based on teamwork
2	Sensory-motor skill games	Target-based games	Story-supported movement activities
3	Crawling, jumping, and catching games	Ball games and cooperation activities	Station-based activities
4	Movement with imitation and role-play	Rhythm and music-integrated games	Educational competitive games
5	Obstacle course and climbing activities	Attention and memory-enhancing games	Balance beam, rope jumping activities
6	Emotional expression games	Body awareness activities	Group problem-solving games
7	Outdoor orientation and exploration games	Team competitions	Game creation and leadership skills
8	Free and creative movement games	Mini tournaments and group evaluation	Symbolic ceremony and closing activities

The program design, consisting of 24 sessions over eight weeks, each lasting 60 min, is based on evidence from physical activity and play therapy interventions that typically last between 6 and 12 weeks [26,65,66]. A frequency of three sessions per week was deemed optimal to establish routine and ensure consistent exposure while preventing participant fatigue. The 60-min duration was deemed appropriate to balance the children's attention span with the need to include warm-ups, basic play-based activities, and cool-down phases. The program's conceptual framework was informed by international literature on play-based interventions and was implemented in a format appropriate to the region's culture, integrating traditional games and physical activities into educational practices and psychosocial support programs.

Conducted in a controlled environment by trained specialists, this program aimed to evaluate the effects of physical activity on trauma-related stress. In this context, children in the control group continued their normal daily routines and did not receive any structured interventions during the study. Due to logistical and ethical concerns in the post-disaster period, an alternative active control condition, such as participation in standard physical education or non-physical group activities, was not implemented. In particular, the lack of trained personnel and the need to prioritize immediate psychosocial interventions for the affected children made it impossible to organize parallel structured sessions for the control group. Therefore, a passive control design, consistent with similar post-disaster intervention studies, was adopted.

Table 1 summarizes the weekly and daily overall structure of the eight-week game-based physical activity program planned for the earthquake-affected children. The program consisted of three weekly sessions, each 60 min long, featuring enjoyable and interactive activities appropriate for the developmental stage of the participants. The first weeks focused primarily on fostering social bonds, group cohesion, and the development of basic motor skills among children. In subsequent weeks, games were added to the program, which fostered skills such as balance, coordination, rhythm, problem-solving, and leadership. The final week was dedicated to free-form activities that strengthened children's self-confidence, such as mini-tournaments and closing ceremonies.

The program was designed to promote both physical development and psychosocial recovery following trauma.

2.4 Data Collection and Analysis

Data were analyzed using IBM SPSS Statistics version XX (IBM Corp., Armonk, NY, USA). Prior to conducting inferential analyses, the normality of the data was examined using the Kolmogorov-Smirnov

and Shapiro-Wilk tests, along with an evaluation of skewness and kurtosis values. The assumption of homogeneity of variances was tested with Levene's test.

To assess baseline equivalence between the experimental and control groups, independent samples *t*-tests were applied to pre-test scores. To evaluate the main effects of group (experimental vs. control), time (pre-test vs. post-test), and the group × time interaction, a two-way mixed ANOVA was conducted. When the assumption of equal variances was violated, corrections based on the "equal variances not assumed" approach were used.

Effect sizes were reported alongside significance values: Cohen's d was calculated for *t*-test comparisons, while partial eta squared (η^2) was provided for ANOVA results. Effect size interpretation followed conventional thresholds (small = 0.01, medium = 0.06, large = 0.14).

All statistical tests were two-tailed, and the level of significance was set at $p < 0.05$.

2.5 Use of Artificial Intelligence

Artificial intelligence (AI)-assisted tools (ChatGPT, OpenAI, San Francisco, CA, USA) were used exclusively for language polishing and improving grammar/fluency in the preparation of this manuscript. No AI tools were used for data collection, statistical analysis, or interpretation of results. The authors take full responsibility for the scientific content of the article.

3 Results

According to the results of the Kolmogorov-Smirnov and Shapiro-Wilk normality tests presented in Table 2, all variables were found to conform to a normal distribution. Given that the sample size was below 50, the Shapiro-Wilk test was considered more reliable, and its results indicated that the significance values for all variables exceeded the 0.05 threshold. Although the Kolmogorov-Smirnov test showed a significant result for the post-test data of the experimental group ($p = 0.024$), the Shapiro-Wilk test yielded a borderline but acceptable significance value of 0.055. Therefore, it was concluded that this variable also followed a normal distribution.

Table 2: Normality test.

Group	Test	Kolmogorov-Smirnov			Shapiro-Wilk			Skewness	Kurtosis
		Statistic	df	Sig.	Statistic	df	Sig.		
Experimental	Pre-Test	0.097	40	0.200#	0.966	40	0.272#	0.450	0.086
	Post-Test	0.150		0.024	0.946		0.055#	0.045	−1.164
Control	Pre-Test	0.099		0.200#	0.978		0.617#	0.459	0.182
	Post-Test	0.105		0.200#	0.981		0.731#	−0.016	−0.278

Note: df, degrees of freedom; Sig, significance. #$p > 0.05$.

Furthermore, an examination of skewness and kurtosis values revealed that all variables fell within the range of −1 to +1, indicating symmetric distributions resembling a bell curve. These findings support the assumption of normality and justify the use of parametric tests for data analysis.

Table 3 and Fig. 1 present the mean scores and standard deviations of CPTS-RI (Child Post-Traumatic Stress Reaction Index) pre-test and post-test results for participants in the experimental and control groups. In the experimental group, the mean pre-test score for male participants was 2.6289, which decreased to 1.8816 in the post-test. Similarly, female participants had a pre-test mean of 2.5714 and a post-test mean of 1.9452. Considering the overall experimental group, the mean score declined from 2.5988 in the pre-test to 1.9150 in the post-test. These data indicate a significant reduction in post-traumatic stress levels among both male and female children in the experimental group. In the control group, the mean pre-test score for

males was 2.6079, slightly decreasing to 2.5684 at post-test, while females showed a slight increase from a pre-test mean of 2.5667 to 2.5786 post-test. The overall mean for the control group was 2.5863 in the pre-test and 2.5738 in the post-test. While no notable changes were observed in the control group, the significant decrease in scores within the experimental group demonstrates the effectiveness of the intervention in reducing post-traumatic stress symptoms in children.

Table 3: Means and standard deviations of pre-test and post-test CPTS-RI scores of experimental and control groups.

Group	Gender	Pre-Test		Post-Test	
		M	SD	M	SD
Experimental (n = 40)	Male	2.6289	0.2417	1.8816	0.1857
	Female	2.5714	0.1479	1.9452	0.2048
	Total	2.5988	0.1975	1.9150	0.1961
Control (n = 40)	Male	2.6079	0.2534	2.5684	0.2180
	Female	2.5667	0.1653	2.5786	0.1609
	Total	2.5863	2.5863	2.5738	2.5738

Note: n, number; M, mean; SD, standard deviation.

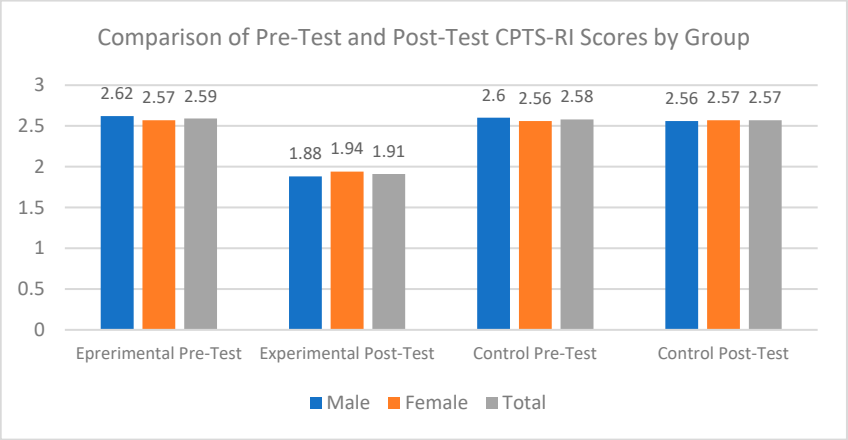

Figure 1: Pre-test and post-test CPTS-RI scores averages of experimental and control groups. (Note: Scores represent total PTSD symptom scale values; no units are applicable).

Table 4 presents the comparison of pre-test CPTS-RI scores and the differences in post-test scores between the experimental and control groups using an independent samples t-test. The Levene's test for equality of variances indicated that variances were equal for the pre-test scores (p = 0.835). The t-test results showed no significant difference between the groups at pre-test (t (78) = 0.274, p = 0.785), indicating that the experimental and control groups had similar CPTS-RI scores prior to the intervention. For the difference in post-test scores, Levene's test indicated unequal variances (p < 0.001), thus the t-test was evaluated using the "equal variances not assumed" row. The results revealed a statistically significant difference between the experimental and control groups at post-test (t (50.159) = −17.771, p < 0.001), with the experimental group demonstrating a significantly lower mean score compared to the control group (mean difference = −0.67125). These findings suggest that the intervention effectively reduced post-traumatic stress levels among the children in the experimental group.

Table 4: Independent samples *t*-test for pre-test and post-test-first test differences of control and experimental groups.

Test		Levene's Test for Equality of Variances		*t*-Test for Equality of Means						
		F	Sig.	*t*	df	Sig. (2-Tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Pre-Test	Equal variances assumed	0.044	0.835	0.274	78	0.785	0.0125	0.0455	−0.0782	0.1032
	Equal variances not assumed	/	/	0.274	77.712	0.785	0.0125	0.0455	−0.0782	0.1032
Post Test—Pre Test Difference Average	Equal variances assumed	16.306	<0.001	−17.771	78	<0.001*	−0.6712	0.0377	−0.7464	−0.5960
	Equal variances not assumed	/	/	−17.771	50.159	<0.001*	−0.6712	0.0377	−0.7471	−0.5953

Note: F, Levene's test statistic for equality of variances; Sig, significance; *t*, *t*-test statistic; df, degrees of freedom; 95% CI, 95% confidence Interval. *represents statistical significance, which means the *p*-value < 0.05.

As shown in Table 5, the evaluation of the group factor revealed a significant difference between the experimental and control groups (F = 106.486, $p < 0.05$). This indicates that the decrease in CPTS-RI scores in the experimental group, which received regular GBPA, was statistically significant compared to the control group. The difference between pre-test and post-test scores was also significant (F = 123.601, $p < 0.05$), demonstrating a marked reduction in CPTS-RI scores during the period of GBPA intervention. The interaction effect between group and test was found to be significant as well (F = 114.885, $p < 0.05$), indicating that the impact of GBPA on reducing CPTS-RI scores differed between the experimental and control groups. Partial eta squared values suggest a moderate effect size for group ($\eta^2 = 0.406$), test ($\eta^2 = 0.442$), and group * test interaction ($\eta^2 = 0.424$). These results show that the combined effect of the test and group variables on participants' post-traumatic stress reaction scores was significant, $F(1156) = 114.885$, $p < 0.05$, partial $\eta^2 = 0.42$. In other words, being in the experimental or control group had a different impact on reducing post-test scores. Thus, the change in CPTS-RI pre-test and post-test scores between the experimental and control groups was significantly different.

Table 5: Two-factor ANOVA on the effect of group and test variables on CPTS-RI scores.

Source	Type III Sum of Squares (SS)	df	Mean Square (MS)	*F*	Sig.	Partial Eta Squared (η^2)
Intercept	935.814	1	935.814	23,860.672	<0.001*	0.994
Group	4.176	1	4.176	106.486	<0.001*	0.406
Test	4.848	1	4.848	123.601	<0.001*	0.442
Group × Test	4.506	1	4.506	114.885	<0.001*	0.424
Error	6.118	156	0.039			
Total	955.462	160				

Note: df, degrees of freedom; Sig., significance. *represents statistical significance, which means the *p*-value < 0.05.

4 Discussion

In our study, using the CPTS-RI, it was concluded that eight weeks of regular exercise led to a significant improvement in the experimental group compared to the control group. Other studies that examined post-traumatic stress reaction levels in children following the Kahramanmaraş-centered earthquakes using the same scale have reported similar findings. Düken et al. found that 100% of children exhibited symptoms

of depression, 23% experienced severe trauma, and 77% showed very severe post-traumatic stress symptoms following the Kahramanmaraş earthquake [67]. Another study using the same scale reported high rates of depression and anxiety disorders among children [68], and similar emotional responses were observed in children affected by a 2011 earthquake in Van [69]. Research conducted after that earthquake also indicated that children suffered from severe trauma and sleep disturbances. It was noted that children experiencing trauma due to the earthquake had increased rates of sleep disorders [70]. In a study involving 292 children aged 8 to 15 affected by the earthquake, it was found that higher levels of earthquake exposure corresponded with increased stress responses, which in turn heightened anxiety sensitivity. Various recommendations were made to reduce this anxiety [71]. In light of these recommendations, it can be inferred that physical activity and sports may have a positive impact on the physical health that is often diminished due to trauma [72].

Research on the effects of regular physical activity on trauma levels in children indicates that physical activity provides positive social, emotional, and behavioral outcomes for children and adolescents following trauma [20,65,73]. Trauma-informed physical activity programs promote social, emotional, and academic improvements among youth [65]. These programs offer positive experiences, such as post-traumatic social bonding and psychological escape [74].

Physical activity enhances psychological resilience in individuals after trauma and reduces adverse psychological conditions, including anxiety, depression, and PTSD [20]. Additionally, physical activity may facilitate post-traumatic growth and stress reduction [27]. It can improve behavioral and emotional problems in children and support overall mental health [73,75]. Among children who have experienced trauma, physical activity has been linked to better working memory performance and fewer depressive symptoms [76]. Trauma-informed physical education aims to create safe and supportive environments, which can help children better understand challenges related to learning, relationship building, and behavior management [77]. Nature-integrated physical activities promote post-traumatic growth and assist in stress reduction [27].

While the positive effects of physical activity on traumatized children are emphasized, potential risks should also be considered. During physical activity, trauma-affected children may feel vulnerable, and instructors who lack full awareness of the deep fragility experienced by these children may inadvertently contribute to difficulties in learning, relationship formation, and behavior management [65,77]. This may lead to the re-experiencing of trauma.

In children affected by earthquakes, play therapy has been found to reduce post-traumatic stress disorder, anxiety, and negative behaviors [78]. To cope with the traumatic effects that may arise following an earthquake, encouraging children to return to their daily routines and participate in play, cultural, and art-based activities can support their stress management [79]. It has been observed that children affected by earthquakes experience declines in motor skill levels and physical activity [80]. Addressing these adverse effects requires early diagnosis, psychosocial support, and physical activity, which play crucial roles [81].

Following the Wenchuan earthquake in China, a sand play therapy intervention was conducted with children and adolescents. Trauma scores recorded at 1 and 6 months post-intervention were significantly lower compared to those obtained at 12, 18, and 24 months [82]. Similarly, Valenti and colleagues concluded that amateur sports activities can alleviate psychological and behavioral problems caused by natural disasters [83]. In addition to amateur sports, both team and individual sports have been reported to reduce the negative and traumatic effects of earthquakes [84].

From this perspective, numerous studies indicate that applying physical activity alone or as an adjunct to existing treatments in CPTS-RI management is associated with symptom reduction [23,85–91].

Limitations

This study has several limitations. First, due to the limited sample size, the generalizability of the findings to larger and more diverse populations is restricted. Additionally, since the CPTS-RI is a self-report measure, there is a risk of bias arising from social desirability or differences in participants' understanding of the items. The effects of the intervention were assessed only in the short term, and the lack of investigation into its long-term impact and sustainability constitutes another limitation.

The absence of any intervention for the control group may have made it difficult to fully control for external factors. Furthermore, the non-standardized environment and conditions under which the intervention was delivered could have introduced variability in the implementation process. Considering cultural and social factors, the validity of the scale and the intervention might differ across cultures, which limits the comparability of the results obtained in the Turkish context with those from other countries.

Finally, factors such as participants' momentary mood, external influences, and motivation levels during data collection may have also affected the results.

Therefore, it is recommended that future research employ larger samples, include long-term follow-ups, and be conducted in diverse cultural settings to address these limitations.

5 Conclusions

This study demonstrated that regular physical activity is effective in reducing post-traumatic stress levels in earthquake-stricken children. The eight-week physical activity program significantly reduced CPTS-RI scores in the experimental group. This decrease was not statistically significant in the control group. This study also demonstrated that regular physical activity is effective in reducing post-traumatic stress levels among children affected by earthquakes. The eight-week physical activity program significantly decreased CPTS-RI scores in the experimental group, whereas no statistically significant reduction was observed in the control group.

The findings suggest that physical activity may serve as a supportive factor for children's mental health and contribute to psychological recovery following a disaster. Specifically, aerobic exercises and game-based activities were found to play a crucial role in lowering stress levels in children. Moreover, regular physical activity was observed to enhance social interaction, thereby improving individuals' coping skills with trauma.

Accordingly, it is recommended that physical activity be incorporated into post-disaster psychosocial support programs. Designing structured physical activity interventions after large-scale traumatic events, such as earthquakes, should be considered an important approach to maintaining children's well-being and strengthening their mental health. Future research should explore different age groups and examine the long-term effects of physical activity to gain deeper insights into its role in the psychological recovery process following trauma.

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