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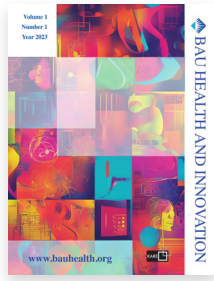

Original Article

The Effects of Aerobic Exercises on Psychiatric Symptoms and Physical Fitness in Children Exposed to Sexual Abuse

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Abstract

Objectives: Child sexual abuse is an issue that has become evident throughout the world in recent years and requires attention in its treatment. For this purpose, we investigated the effects of aerobic exercises used in physiotherapy on some findings related to post-traumatic stress such as depression and anxiety and on aerobic endurance, flexibility, and muscular endurance associated with physical fitness in the treatment of children exposed to sexual abuse.

Methods: The research was carried out at the Child Advocacy Center affiliated by the Child and Adolescent Psychiatry Clinic within Istanbul Bakırköy Prof. Dr. Mazhar Osman Mental Health and Neurological Diseases Training and Research Hospital. The study was planned in three groups and 34 cases were included. Groups were stated as control, home exercise, and physiotherapist-guided exercise for 12 weeks. Depression (Children Depression Inventory), anxiety (The Screen for Child Anxiety Related Disorders), post-traumatic stress responses (Child Post-traumatic Stress Reaction Index), cardiovascular capacity (6-min walk test-6 [MWT]), endurance (1-Minute Sit-up and Push-Up Tests), flexibility (Sit-and-Reach Test) and quality of life (Quality of Life Scale for Children-QoL-C) parameters were evaluated at before and after treatment.

Results: As a result; significant improvements were observed in 6 MWT in all groups; for anxiety, sit and push-ups, and quality of life in the exercise group; for sit and lie in exercise and home exercise groups ($p<0.05$). In comparison between groups, the exercise group was found superior to the others in anxiety and quality of life and to the control group in 6 MWT and psychosocial health ($p<0.05$).

Conclusion: Aerobic exercise can be used safely in the treatment of children victims of sexual abuse. Due to the superiority of the physiotherapist-guided group, it can be preferred first.

Keywords: Adolescent, aerobic exercise, depression, sexual abuse.

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Laying the foundations of a healthy society is possible when children complete their development in a healthy way. However, children have been abused and neglected since the past times.[1] While children are exposed to abuse in many societies, there has been a serious increase in sexual abuse cases in recent years. It is devastating impacts effect children in every country, harming families, communities, nations, and even generations.[2] According to the research

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on child abuse and domestic violence conducted by the United Nations International Children's Emergency Fund (UNICEF), it has been determined that emotional abuse is seen at a rate of 51%, physical abuse at a rate of 43%, and sexual abuse at a rate of 3% among children aged 7–18 who are living in Türkiye.[3] Although the rate of sexual abuse is lower than other forms of abuse, it is a condition that has both physical and psychological damage and is generally thought to be less reported.[4]

Treatments applied after sexual abuse typically include cognitive-behavioral and trauma-focused psychoeducation processes and sexual abuse family education.[5] In a study, it was stated that in addition to standard psychotherapy sessions, animal-assisted therapy can be applied within the scope of post-abuse treatment, thus it is possible to create an environment of trust and acceptance, which is especially important.[6] Later on, different researchers also proposed a group treatment model for sexually abused children that included play and animal-assisted therapy. Although the treatment methods show individual differences, no treatment method has been shown to be superior to the other symptoms such as chronic pain and depression.[7] This is not surprising given the many variables in abuse cases, such as the age of the victim, the abuse type, severity, and duration of abuse, the child's relationship with the perpetrator, the child's vulnerability and resilience, reaction, and family support. For these reasons, it is necessary and important to develop innovative treatment models for children who are victims of sexual abuse.

In the literature; it has been observed that body awareness training, massage therapies, correct breathing techniques, yoga, and relaxation exercises are used within the scope of physiotherapy in the treatment of abused children especially for chronic pelvic/ back pain and fibromyalgia.[8,9] In a study examined, after classical massage therapy was applied to a group of sexually abused children, saliva and urine analysis were performed and a significant increase in the levels of activating neurotransmitters (serotonin and dopamine)-an average of 28% increase for serotonin, an average of 31% for dopamine-and a significant decrease in cortisol levels were noted.[10] In another study in which body awareness therapy was applied to stress disorders after traumas such as sexual abuse, it was observed that the number and severity of physical symptoms decreased significantly and they tended to decrease in dissociation compared to the control group.[11] In addition to these studies, breathing and relaxation exercises that teach correct breathing techniques for children are explained in detail and step by step in the Care Guide for Children Victims of Sexual Abuse, published by the International Rescue Committee in 2015 with the contribution of UNICEF. On the other hand, no studies on aerobic exercises are known to have positive effects on psychiatric symptoms such as depression and anxiety in children. In light of these findings, our hypothesis was that due to the antidepressant effects of aerobic exercises used in physiotherapy, post-traumatic symptoms that resist recovery, and some parameters related to physical fitness can provide significant improvements in children who have been sexually abused.[12]

The primary aim of our study is to investigate the effects of aerobic exercises used in physiotherapy in the treatment of sexual abuse against children on post-traumatic stress-related depression and anxiety symptoms. As a secondary outcome, we explored that aerobic exercises can also provide significant improvements in children who have been sexually abused in terms of physical fitness-related aerobic endurance, flexibility, and muscular endurance.

Materials and Methods

Participants

The children consecutively enrolled in this randomized controlled clinical study. The present study was carried out at Child Advocacy Center which is affiliated by the Child and Adolescent Psychiatry Clinic within Istanbul Bakırköy Prof. Dr. Mazhar Osman Mental Health and Neurological Diseases Training and Research Hospital from October 2018 to August 2019. The protocol was approved by the Clinical Researches Ethics Committee of the Republic of Türkiye Ministry of Health Istanbul Bakırköy Prof. Dr. Mazhar Osman Mental Health and Neurological Diseases Training and Research Hospital (Approval number: 2018/234). Before being included in the study, children gave written informed consent to participate. The protocol conformed to the standards for human experiments set by the Declaration of Helsinki.

Inclusion requirements were children aged between 8 and 17 years, being a girl and victim of sexual abuse, to volunteer and participate in the study after explaining the purpose of the research and the tests to be applied to children and families. Exclusion criteria were having physical and/or psychological disability that may prevent them from exercising, any condition (inability to understand the forms, a physical disability, and illiteracy) that would prevent the child from completing the self-report scales at the time of assessment.

Children's numbers have been calculated with the "Rasoft sample size calculator" in 80% confidence interval, considering the child abuse incidence as 1.4%[13] within a population of 20,000, the sample size of our study has

been found as 10 for each group. Finally considering the possibility of children dropping out of the study, 14 children were included in each of the three groups. Children were randomly assigned to one of three groups to receive Group 1, Group 2, or Group 3 (ratio 1:1:1). "Research Randomiser" which is an online randomization web service that was used to allocate the children.[14] We determined two treatment groups to see whether doing exercises with a supervisor are more effective than doing them at home. The treatments were planned as 2 days a week for 12 weeks and applied by the same physical therapist (T.B.), and the evaluations were made by another therapist at the beginning and after the treatment (E.K.M.). Children and outcome assessors were kept blind to allocation.

Outcome Measures

The primary outcome was related with depression, anxiety, and trauma as psychiatric symptoms and the secondary outcomes were quality of life and physical parameters such as aerobic capacity, muscle endurance, and flexibility. Only the total scores of the questionnaires evaluating psychiatric symptoms were calculated. All outcome measurements were performed at baseline and after 3 months.

The severity of depression that children felt was evaluated using the "Children Depression Inventory (CDI)". The aim of the scale is to gather the information obtained from the clinical interview with the child and evaluate it by the expert, and to provide general information about depressive symptoms and the severity of depression.[15] Cutoff score for the CDI was developed to differentiate between youth with and without a depressive disorder for the purposes of early detection and determining adequate treatments. It was recommended that the cutoff score in clinical settings needs to be sensitive and is set at 13.[16,17] Meanwhile, in non-clinical samples, the cutoff score is 19 or 20, which seems to be specific enough to identify samples of potentially depressed children and adolescents. The children were asked to choose the most appropriate sentence for the past 2 weeks. Each item gets "0", "1," or "2" points depending on the severity of the symptom. The maximum score is 54. A high total score indicates a high level of depression or its severity.[18,19]

To screen anxiety "The Screen for Child Anxiety Related Disorders-SCARED" was produced to show the level of anxiety problems experienced in certain areas in children. It consists of five separate sections: Generalized anxiety (9 items), separation anxiety (8 items), social phobia (7 items), school phobia (4 items), and physical symptoms of anxiety (13 items). Each item is scored from 0 (not true or mostly true) to 2 (very true or often true). A total score of 25 or more on the scale may suggest anxiety disorder.[20,21]

Symptoms of post-traumatic stress disorder usually appear within a month after the traumatic event, but in some cases, these reactions may persist for months, may not be seen, or maybe seen with a trigger factor.[22] In our study, stress reactions in children and adolescents after various traumatic experiences were assessed with "Child Post Traumatic Stress Reaction Index-CPTS–RI". Findings of the scale regarding internal consistency, consistency between test-retest raters and construct validity show that it will be useful in monitoring post-traumatic symptoms in children. The test-retest reliability of the scale in Turkish was 0.86, and the inter-interviewer reliability was 0.98. A total score of 12–24 indicates mild, 25–39 moderate, 40–59 severe, and above 60 very severe.[23]

Aerobic capacity assessment associated with physical fitness was evaluated using the "6-min walk test-6 MWT" which is used as an indicator of many cardiovascular diseases as well as exercise capacity and can be easily applied in healthy or unhealthy individuals. It is the distance covered by the children evaluated in 6 MWT at their walking speed in 6 minutes.[24]

In the study, "1-Minute Sit-up and Push-Up Tests" were used for the purpose of abdominal and upper trunk muscles' endurance evaluations. It is determined by the number of sit-ups and push-ups the child can do per minute.[25]

In the "Sit-and-Reach Test" that is practiced for the aim of assessing flexibility, a ruler was placed on the side of a 30 cm cube. In the long sitting position, the child was asked to lie on the ruler with both hands after touching the plantar face of their feet on the cube while the knees are in extension. The edge of the cube was considered as "0", and values above it were considered positive while values below it were negative. The test was applied twice, at the beginning and at the end of the treatment, and the differences were recorded.[26]

To evaluate the quality of life for children, we used the "Quality of Life Scale for Children-QoL-C", which was conducted with a Turkish validity and reliability study.[27] The scale consists of a total of 23 items evaluating physical health (8 items), emotional functionality (5 items), social functionality (5 items), and school functionality (5 items). Scoring is done in 3 areas: First, the scale total score; second, the physical health totals score; and third, the psychosocial health total score evaluates emotional, social, and school functionality. The most important features are that it is short and can be filled in about 5–10 min and is easy to apply and score by the researcher.[28]

Procedures

In the first group consisting of 14 children, a total of 40-min sessions with a 10-min warm-up, 20-min aerobic exercise program, and a 10-min cool-down were applied twice a week with a female physiotherapist for 12 weeks. The same exercises were planned as a home program and given brochures to the second group consisting of 10 children. The first sessions were held with the physiotherapist to teach the exercises and followed by a checklist. The third group, consisting of 10 children, was determined as the control group, in which only the scales and tests were applied to be evaluated at the beginning and after 12 weeks.

Exercise Program

The exercises were planned as 2 days a week for 12 weeks. Each session was determined as 40 min a day consisting of 10 min warm-up, 20 min aerobic, and 10 min cooling (stretching) exercises under the supervision of the physiotherapist (Appendix 1).

Statistical Analysis

Software Program and Manufacturer

The Statistical Package for the Social Sciences version 20.0 for Windows software was used for all statistical analyses. This version was manufactured by John Wiley and Sons, Limited in England. The conformity of the data to the normal distribution was evaluated with the Kolmogorov–Smirnov test. Non-parametric tests were applied because many data were not suitable for normal distribution. The Chi-square test was used to compare categorical variables. The groups were compared with the "Kruskal–Wallis test" in terms of demographic and clinical characteristics. "Wilcoxon Signed-Ranks Test" was used to compare the pre-treatment and post-treatment values of the groups. Intergroup evaluations were made with the "Kruskal–Wallis test." When a significant difference was found, the "Mann–Whitney U test" was used to interpret the differences between the groups, and the "Bonferonni" correction was applied and the error level was accepted as $p<0.01$. The statistical significance level for the results was accepted as $p<0.05$.

Results

The children selection process was shown in the consort diagram in Figure 1. 42 children included in the study groups were randomized and divided into three groups equally. However, after the evaluation, five children refused to participate in the study. All three children reported that they had to stop treatment due to family and psychological reasons. As a result, a total of 34 children completed the study, including the exercise group of 14 children with the guidance of a physiotherapist (Group 1), the home exercise group of 10 children (Group 2), and the control group of 10 children (Group 3). All exercised children attended regularly their treatment programs 2 days per week for 12 weeks in the clinical setting.

The mean ages of the groups were not statistically significant (14.60±2.12 for group 1, 14.60±2.01 for Group 2, 14.86±1.51 for group 3, $p=0.83$). On the basis of the nature of sexual abuse, 15 (44.1%) of the 34 children had penetration (vaginal or anal) while the remaining 19 children reported other forms including fondling, touching, and verbal abuse. With regard to the identity of the abusers, 38.2% (n=13) were boyfriends, 2.9% (n=1) father, 2.9% (n=1) stepfathers, 32.3% (n=11) other relatives, 5.9% (n=2) strangers, and 17.6% (n=6) familiar people. There were no significant differences for the nature of sexual abuse and the identity of the perpetrators among groups ($p>0.05$). At baseline, there were no significant differences between groups for other sociodemographic and clinical variables of the patients ($p>0.05$). According to intragroup evaluations, depression, and post-traumatic stress symptoms, results were not statistically significant in the three groups while for anxiety reactions, a statistically significant decrease was observed in only group exercises under the guidance of a physiotherapist ($p<0.05$) (Table 1). When these psychiatric parameters were evaluated between the groups at 12 weeks after treatment, in terms of anxiety, a statistically significant decrease was found in Group 1 compared to other groups ($p=0.01$) (Table 1). In Groups 2 and 3, no statistical superiority was found over each other ($p>0.05$) (Table 1).

In the intragroup analyses, statistically significant increases were observed in all groups in the 6 MWT while in the 1-min sit-up and 1-min push-up tests, it was only in Group 1 that exercised under the guidance of a physiotherapist ($p<0.05$) (Table 2). When the differences between the groups were evaluated for 6MWT, it was determined that there was more improvement in Group 1 compared to the control group ($p<0.01$) (Table 2). There was no statistically significant difference between the groups in the 1-min sit-up and 1-min push-up tests ($p>0.05$) (Table 2). On the other hand, in the sit-reach test, the gains in Group 1 and Group 2 were found to be statistically significant ($p<0.05$) and when the differences between the groups were evaluated, no superiority of any group over the other was observed ($p>0.05$) (Table 2).

In intragroup analyses, statistically, significant increases were found in the total scores of the quality of life scale. In the total scores of physical and psychosocial health, only in Group 1 ($p<0.05$) (Table 3). When the differences between

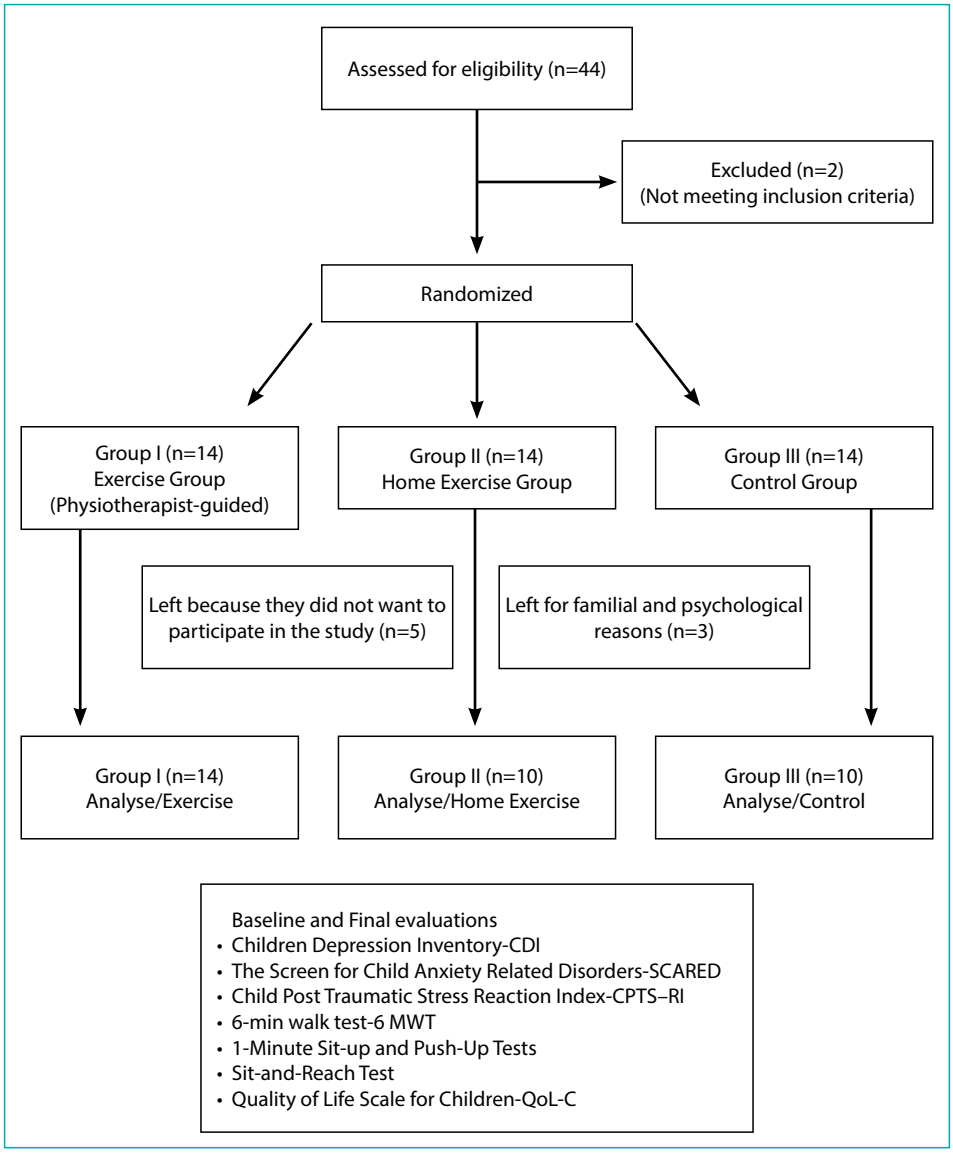

Figure 1. Design of the study.

the groups in the total scores of the quality of life scale were evaluated, the increases in Group 1 were found to be statistically more significant than in Groups 2 and 3 ($p<0.01$) (Table 3). In the analyses between groups according to the total physical health scores, no significant difference was found in any group compared to the other ($p>0.05$). In the comparison of psychosocial health total scores between groups, the improvements in Group 1 were statistically more significant than the Group 3 ($p<0.01$) (Table 3).

Discussion

The findings of this randomized controlled study which might help provide a point of view into the clinical effectiveness of aerobic exercise on psychiatric symptoms and physical fitness in children exposed to sexual abuse, showed that results in anxiety, 6 MWT, and quality of life were superior in the therapist-guided exercise groups. Although improvements were found in the exercise groups in the scales showing depression and post-traumatic stress responses, this difference was not statistically significant. Statistically significant gains were found in the therapist-guided exercise groups in the 1-min sit-up and 1-min push-up tests evaluating muscular endurance. In the sit–and-reach test results, significant improvements were recorded in the home exercise and therapist-guided exercise groups.

In a study, it is stated that sexually abused children recover significantly over time, but some symptoms such as aggression, chronic pain, and depression remain largely resistant.[29] Therefore, the aim of the treatment of children who are victims of sexual abuse should be to reduce the

Table 1. Comparison of the mean values of depression, anxiety, and post-traumatic stress responses of the cases within and between groups

	Pre-test Mean±SD	Post-test Mean±SD	Willcoxon Signed-Ranks p	Intragroup Difference Mean (%95 CI)	Kruskal–Wallis		
					p	Bonferonni	
						Group	p*
Depression							
Group 1	21.14±7.34	19.86±6.99	0.07	1.29 (−0.76–3.33)		1–3	0.14
Group 2	19.40±5.32	19.20±5.94	0.83	0.20 (−1.85–2.25)	0.30	2–3	0.30
Group 3	20.40±6.96	20.80±7.39	0.67	−0.40 (−2.37–1.57)		1–2	0.64
Anxiety							
Group 1	41.00±12.64	30.21±10.16	0.004	10.78 (4.44–17.12)		1–3	0.01
Group 2	34.30±7.97	33.90±10.15	0.76	0.40 (−3.66–4.46)	0.01	2–3	0.01
Group 3	33.60±7.75	31.90±7.26	0.15	1.70 (−1.10–4.50)		1–2	0.76
Post-traumatic stress responses							
Group 1	51.21±13.41	46.21±15.13	0.08	5.00 (−0.16–10.16)		1–3	0.36
Group 2	50.60±13.88	50.20±14.09	0.75	0.40 (−4.51–5.31)	0.21	2–3	0.21
Group 3	51.10±7.75	49.20±7.94	0.25	1.90 (−1.56–5.36)		1–2	0.79

Group 1: Exercise Group; Group 2: Home exercise group; Group 3: Control group; SD: Standard deviation; CI: Confidence interval, p<0.05.

Table 2. Comparison of the mean values of 6 MWT, sit-ups, push-ups, and sit-reach tests of the cases within and between groups

	Pre-test Mean±SD	Post-test Mean±SD	Willcoxon Signed-Ranks p	Intragroup difference Mean (%95 CI)	Kruskal–Wallis		
					p	Bonferonni	
						Group	p*
6 MWT							
Group 1	441.9±32.36	468.9±34.53	0.001	−27.07 (−33.68–[−20.47])		1–3	0.007
Group 2	445.7±50.39	461.2±46.08	0.03	−15.50 (−31.35–0.35)	0.03	2–3	0.03
Group 3	424.2±57.32	451.2±57.99	0.01	−27.00 (−47.32–[−6.67])		1–2	0.73
Sit-ups							
Group 1	17.71±4.81	20.14±4.41	0.002	−2.43 (−3.62–[−1.24])		1–3	0.03
Group 2	15.70±2.83	16.80±3.85	0.15	−1.10 (−2.93–0.73)	0.13	2–3	0.13
Group 3	14.30±3.89	15.10±4.18	0.10	−0.80 (−1.86–0.26)		1–2	0.87
Push-ups							
Group 1	20.29±5.74	23.07±6.06	0.001	−2.79 (−4.24–[−1.33])		1–3	0.02
Group 2	15.70±3.06	17.00±3.39	0.10	−1.30 (−2.85–0.25)	0.14	2–3	0.14
Group 3	16.40±4.06	17.70±5.33	0.08	−1.30 (−2.85–0.25)		1–2	1.00
Sit and reach test							
Group 1	5.14±3.61	6.50±3.92	0.002	−1.36 (−1.89–[−0.82])		1–3	0.06
Group 2	4.10±1.45	4.85±1.70	0.04	−0.75 (−1.40–[−0.09])	0.15	2–3	0.15
Group 3	4.20±1.87	4.80±2.20	0.05	−0.60 (−1.20–0.00)		1–2	0.71

Group 1: Exercise group; Group 2: Home exercise group; Group 3: Control group; SD: Standard deviation; CI: Confidence interval, p<0.05.

effects of psychiatric symptoms and physical findings and increase their quality of life. Thus, it is possible to reconstruct the concept of self-perception in the child and ensure a healthy integration into society. For this purpose, different psychotherapy approaches are mentioned in the treatment guidelines. However, there is insufficient evidence for an effective treatment approach.[30] Since we know that depression is chronically localized after such

Table 3. Comparison of the mean values of quality of life of the cases within and between groups

	Pre-test Mean±SD	Post-test Mean±SD	Willcoxon Signed-Ranks p	Intra-group difference Mean (%95 CI)	Kruskal–Wallis		
					p	Bonferonni	
						Group	p*
Quality of life							
Group 1	58.77±19.28	69.17±16.57	0.001	−10.40 (−16.91–[−3.89])		1–3	0.003
Group 2	60.32±14.56	59.56±14.86	0.95	0.76 (−8.67–10.18)	0.02	2–3	0.01
Group 3	57.93±20.13	57.82±18.08	0.75	0.11 [−4.14–4.36)		1–2	0.54
Physical health							
Group 1	62.27±20.23	70.75±18.61	0.05	−8.48 (−17.72–0.75)		1–3	0.15
Group 2	64.99±13.64	66.87±16.93	0.57	−1.87 [−14.48–10.73)	0.68	2–3	0.68
Group 3	59.37±24.47	59.06±23.86	1.00	0.31 (−6.55–7.17)		1–2	0.51
Psychosocial health							
Group 1	58.20±20.40	71.60±18.09	0.001	−13.39 (−20.13–[−6.65])		1–3	0.001
Group 2	56.83±15.80	54.83±13.75	0.79	2.00 (−7.46–11.46)	0.02	2–3	0.02
Group 3	57.16±19.43	56.66±16.46	0.88	0.50 (−3.47–4.47)		1–2	0.87

Group 1: Exercise group; Group 2: Home exercise group; Group 3: Control group; SD: Standard deviation; CI: Confidence interval, p<0.05.

traumas and is resistant to recovery with psychotherapy, we think that providing a lifestyle with exercise that extends over longer periods will make the gains meaningful. In our study, we used aerobic exercises and although improvements were observed in the exercise groups in the results of the Post-traumatic Stress Response Scale, the gains were not found to be statistically significant. While no significant difference was observed between the groups, we think that when more children are evaluated, being in social contact with the therapist will provide more effective and meaningful results in reducing stress reactions compared to home exercise and control groups.

Some researchers stated in a study they conducted that in addition to standard psychotherapy sessions, animal-assisted therapy can be applied within the scope of post-abuse treatment, thus creating an environment of trust and acceptance, which is especially important.[6] Another researcher, on the other hand, emphasized in their study, in which they compiled the psychotherapy methods used in the treatment of children who were victims of sexual abuse, and that no method was found to be superior to the other and that no method was effective alone.[7] Within the scope of physiotherapy, it has been observed that body awareness training, massage therapies, correct breathing techniques, and relaxation exercises are used in the treatment of sexually abused children. Some researchers in their study emphasized the positive effects of classical massage therapy applied to a group of children who were victims of sexual abuse.[10] However, they stated that the decrease in the depression parameter immediately after the massage could not be maintained in the long term and an increasing response to touch was observed. For this reason, possible sensitivity reactions to touch can be eliminated with aerobic exercises that do not require one-to-one contact with children. It has been observed that studies on aerobic exercises, which are known to have positive effects on psychiatric symptoms such as depression and anxiety, and on physical fitness, are not included in the treatment of children who are victims of sexual abuse in the literature. In our study, we created an aerobic exercise protocol by planning a 40-min session with warm-up and cool-down periods to be applied at home or with a therapist in addition to their ongoing psychotherapy for children who were exposed to sexual abuse. Although our results in terms of anxiety were in favor of all three groups, the improvement levels of the group exercising with the therapist were statistically more significant within and between groups. The control and home exercise groups did not show superiority over each other. For this reason, our study provides evidence for the supportive effect of socializing and exercising with a specialist in psychotherapy and medical treatment, especially in such anxiety disorders.

In a study conducted with women with a history of childhood sexual abuse using a stationary bicycle, the heart rates of the abused individuals were measured before and after the treadmill, and it was observed that they could

not achieve the expected speed from the immobile state to taking action with the sudden stimulation of the vagal pathways and then returning to the resting heart rate. This shows that people with a history of abuse have delays in their "fight or flight" reaction timings during stress.[29] In a study, it is supported that people with psychiatric dysfunction have severe social anxiety and weak vagal modulation.[31] In another study conducted with a treadmill or stationary bike for 8 weeks in individuals diagnosed with major depression, it was stated that there was an increase in reaction time and it was emphasized that aerobic exercise was effective on cognitive control.[32] These studies show that victims of sexual abuse experience not only psychiatric but also physiological changes and it is necessary to include physical interventions accordingly, such as aerobic exercises in their treatment. Contrary to our hypothesis, in our study, when the results in the depression parameter were examined, there was no superiority between the groups. We think that the main reason for this is the fact that the chronic structure of depression occurs after devastating traumas such as sexual abuse and that this cycle is not easily broken even though they give less depressive symptoms immediately after the exercise session. As a result, increasing the level of physical activity by being supported by physical education lessons and social activities in schools where children spend most of their time, and making aerobic exercise a habit under the guidance of relevant specialist therapists will provide a significant reduction in the long-term depression levels of children who are victims of sexual abuse.

It has been shown that the level of physical activity is also related to features such as exercise capacity and motor coordination.[33] In a study, the 6-min walk test was used on 30 children diagnosed with spinal muscular atrophy and supported the appropriateness of its use.[34,35] According to our results in the 6-minute walk test, it was observed that there was a significant difference in the increases in all groups after the measurements. When the differences between the groups were evaluated, it was determined that the gains in the group exercising with the therapist were higher than the control group. Moreover, in 1-minute push-ups and 1-minute sit-ups tests, the increased number of repetitions in the last evaluations compared to the first evaluations was found to be statistically significant in the group exercising with the therapist. We believe that factors such as the natural process of fading away the effects of trauma and the increase in the level of physical activity in children are effective in the significant gains in the control group.

The depression experienced by children after traumas such as sexual abuse also affects their mobility levels, causing them to lead a sedentary life by moving less and communicating less, and this may cause the muscles that do not move to shorten and harden and reduce flexibility.[36,37] For this purpose, in our study after the first and last evaluations, the gains in the sit-reach test in the groups doing home exercise and exercising with a therapist were statistically significant.

As a result of the evaluations, significant improvements were observed in all parameters of the quality of life in the group exercising under the guidance of a therapist. When the sub-parameters were examined, there was no difference between the groups in physical health total scores, but it was seen that the group exercising under the guidance of a therapist was superior to the control group in psychosocial health scores. This shows that children need to get out of the house and socialize more with people and environments they can trust, so they can be more motivated to improve their quality of life and aerobic exercises contributed to this process.

The most important limitation of our study is the inadequacy of the number of sexual abuse cases we could reach, pointing a difficulty for randomization. Furthermore, the inclusion of only female gender in the study constitutes a limitation. We were dependent on a single region and center for case flow and we were able to work with a limited population due to the fact that some cases refused to participate in the study because the situation increased their sensitivities, or they started and discontinued the treatment. Another limitation is that we conduct evaluations with the short-term results of the exercises. Furthermore, the relationship between the physiotherapist and child as well as individual severity of observed symptoms may be factors that impact outcome. The superior aspect of our study is that it is the first randomized controlled study to evaluate psychiatric and physical fitness parameters in the same study and use aerobic exercise on children exposed to sexual abuse.

Conclusion

In the light of studies conducted for these reasons, it is understood that there are no satisfactory results and consensus in the treatment processes of children exposed to sexual abuse. Although psychotherapy supported by medical treatment is frequently used, it still needs to be supported by multi-alternative treatment methods. Therefore, the idea that aerobic exercise involvement in the therapy can be effective in a short period is noteworthy. More evidence-based studies including more expansive inclusion criteria, inclusion of other abuse criteria, and observation of long-term effects of the study outcomes are needed.

Disclosures

Ethics Committee Approval: The study was approved by the Republic of Türkiye Ministry of Health Istanbul Bakırköy Prof. Dr. Mazhar Osman Mental Health and Neurological Diseases Training and Research Hospital Ethics Committee (no: 234, date: 06/11/2018).

Authorship Contributions: Concept – E.K.M., T.B.; Design – E.K.M., T.B., C.M.; Supervision – E.K.M., T.B.; Resource – H.E.A.T., C.M.; Materials – H.E.A.T., C.M., E.K.M.; Data Collection and/or Processing – T.B.; Analysis and/or Interpretation – E.K.M., T.B.; Literature Search – E.K.M., T.B., C.M., H.E.A.T.; Writing – T.B.; Critical Reviews – E.K.M., C.M., T.B., H.E.A.T.

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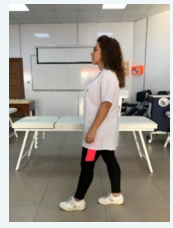
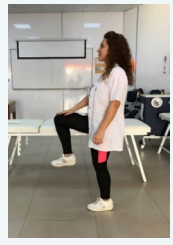
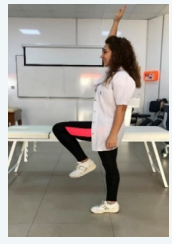
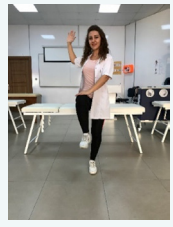
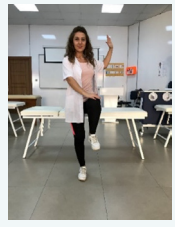
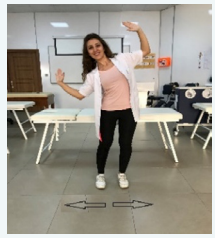
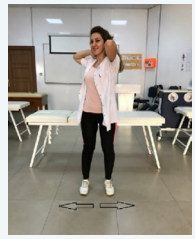
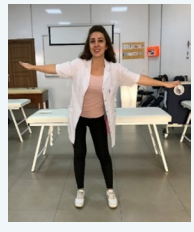
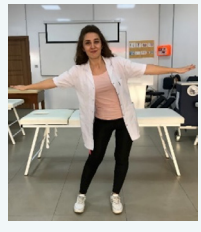
References

1. Mathews B, Pacella R, Dunne MP, Simunovic M, Marston C. Improving measurement of child abuse and neglect: A systematic review and analysis of national prevalence studies. PLoS One 2020;15(1):e0227884.
2. Hillis S, Mercy J, Amobi A, Kress H. Global prevalence of past-year violence against children: A systematic review and minimum estimates. Pediatrics 2016;137(3):e20154079.
3. Oral ÜK, Engin P, Büyükyazıcı Z. Türkiye'de Çocuk Istismarı ve Aile içi Şiddet Araştırması Özet Raporu. Ankara: UNICEF; 2010.
4. Alşen Güney S, Bağ Ö, Cevher Binici N. An overview of a hospital-based child advocacy center's experience from Turkey. J Child Sex Abus 2018;27(5):476–89.
5. Yancey CT, Hansen DJ, Naufel KZ. Heterogeneity of individuals with a history of child sexual abuse: An examination of children presenting to treatment. J Child Sex Abus 2011;20(2):111–27.
6. Dietz TJ, Davis D, Pennings J. Evaluating animal-assisted therapy in group treatment for child sexual abuse. J Child Sex Abus 2012;21(6):665–83.
7. McTavish JR, Santesso N, Amin A, Reijnders M, Ali MU, Fitzpatrick-Lewis D, et al. Psychosocial interventions for responding to child sexual abuse: A systematic review. Child Abuse Negl 2019;116:104203.
8. Dunleavy K, Kubo Slowik A. Emergence of delayed posttraumatic stress disorder symptoms related to sexual trauma: Patient-centered and trauma-cognizant management by physical therapists. Phys Ther 2012;92(2):339–51.
9. Stirling J, Chalmers KJ, Chipchase L. The role of the physiotherapist in treating survivors of sexual assault. J Physiother 2021;67(1):1–2.
10. Field T, Hernandez-Reif M, Diego M, Schanberg S, Kuhn C. Cortisol decreases and serotonin and dopamine increase following massage therapy. Int J Neurosci 2005;115(10):1397–413.
11. Price C. Body-oriented therapy in recovery from child sexual abuse: An efficacy study. Altern Ther Health Med 2005;11(5):46–57.
12. Kvam S, Kleppe CL, Nordhus IH, Hovland A. Exercise as a treatment for depression: A meta-analysis. J Affect Disord 2016;202:67–86.
13. Aktepe E. Çocukluk çağı cinsel istismarı. Psikiyatr Güncel Yaklaşımlar 2009;1(2):95–119.
14. Randomiser R. Available from: https://www.randomizer.org [Last accessed on 2019 Oct 20].
15. Sawyer GK, Hansen DJ. Heterogeneous symptom patterns of sexually abused children in treatment: Understanding the complexity of the problem. J Child Sex Abus 2014;23(8):900–17.
16. Bang YR, Park JH, Kim SH. Cut-off scores of the children's depression inventory for screening and rating severity in Korean adolescents. Psychiatry Investig 2015;12:23–8.
17. Kovacs M. Children's Depression Inventory. Toronto, Ontario: Multi-Health Systems Inc.; 1992.
18. Makay B, Emiroğlu N, Ünsal E. Depression and anxiety in children and adolescents with familial Mediterranean fever. Clin Rheumatol 2010;29(4):375–9.
19. Dallar Y, Erdeve ŞS, Çakır İ, Köstü M. Obezite, çocuklarda depresyon ve özgüven eksikliðine neden oluyor mu? Gülhane Tıp Derg 2006;48(1):1–3.
20. Bar-Haim Y, Dan O, Eshel Y, Sagi-Schwartz A. Predicting children's anxiety from early attachment relationships. J Anxiety Disord 2007;21(8):1061–8.
21. Hale WW 3rd, Crocetti E, Raaijmakers QA, Meeus WH. A meta-analysis of the cross-cultural psychometric properties of the Screen for Child Anxiety Related Emotional Disorders (SCARED). J Child Psychol Psychiatry 2011;52(1):80–90.
22. Wherry JN, Corson K, Hunsaker S. A short form of the trauma symptom checklist for young children. J Child Sex Abus 2013;22(7):796–821.
23. Erden G, Kılıç EZ, Uslu RI, Kerimoğlu E. The validity and reliability study of Turkish version of child posttraumatic stress reaction index. Cocuk Genclik Ruh Sagligi Derg 1999;6:143–9.
24. Ünver E, Cinemre ŞA. Ergenlik öncesi erkek çocuklarda fiziksel aktivite düzeyinin 6 dakika yürüme testi ile ilişkisi. Spor Bilim Derg 2014;28(4):194–204.
25. Hashim A, Ariffin A, Hashim AT, Yusof AB. Reliability and validity of the 90° push-ups test protocol. Int J Sci Res Manag 2018;6(6):1–6.
26. López-Miñarro PA, de Baranda Andújar PS, RodrÑGuez-GarcÑa PL. A comparison of the sit-and-reach test and the back-saver sit-and-reach test in university students. J Sports Sci Med 2009;8(1):116–22.
27. Çakın-Memik N, Ağaoğlu B, Coşkun A, Karakay I. Çocuklar için

yaşam kalitesi ölçeğinin 8-12 yaş çocuk formunun geçerlik ve güvenirliği. Çocuk Ergen Ruh Sağlığı Derg 2008;15:87–98.
28. Desai AD, Zhou C, Stanford S, Haaland W, Varni JW, Mangione-Smith RM. Validity and responsiveness of the pediatric quality of life inventory (PedsQL) 4.0 generic core scales in the pediatric inpatient setting. JAMA Pediatr 2014;168(12):1114–21.
29. Lampe A, Doering S, Rumpold G, Sölder E, Krismer M, Kantner-Rumplmair W, et al. Chronic pain syndromes and their relation to childhood abuse and stressful life events. J Psychosom Res 2003;54(4):361–7.
30. Murray LK, Nguyen A, Cohen JA. Child sexual abuse. Child Adolesc Psychiatr Clin N Am 2014;23(2):321–37.
31. Dale LP, Carroll LE, Galen G, Hayes JA, Webb KW, Porges SW. Abuse history is related to autonomic regulation to mild exercise and psychological wellbeing. Appl Psychophysiol Biofeedback 2009;34(4):299–308.
32. Movius HL, Allen JJ. Cardiac vagal tone, defensiveness, and motivational style. Biol Psychol 2005;68(2):147–62.
33. Olson RL, Brush CJ, Ehmann PJ, Alderman BL. A randomized trial of aerobic exercise on cognitive control in major depression. Clin Neurophysiol 2017;128(6):903–13.
34. Lopes VP, Stodden DF, Bianchi MM, Maia JA, Rodrigues LP. Correlation between BMI and motor coordination in children. J Sci Med Sport 2012;15(1):38–43.
35. Dunaway Young S, Montes J, Kramer SS, Marra J, Salazar R, Cruz R, et al. Six-minute walk test is reliable and valid in spinal muscular atrophy. Muscle Nerve 2016;54(5):836–42.
36. Lee MC. Validity of the 6-minute walk test and step test for evaluation of cardio respiratory fitness in patients with type 2 diabetes mellitus. J Exerc Nutrition Biochem 2018;22(1):49–55.
37. Mak KK, Ho SY, Lo WS, Thomas GN, McManus AM, Day JR, et al. Health-related physical fitness and weight status in Hong Kong adolescents. BMC Public Health 2010;10(1):88.

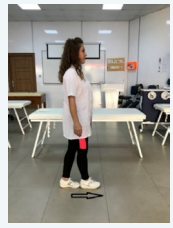
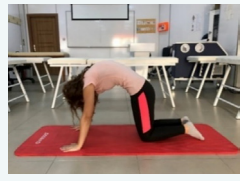
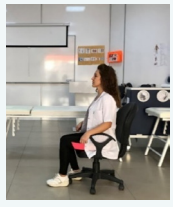
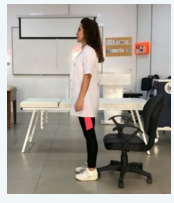
Appendix 1.

Exercise Protocol

Warm-up Exercises	**Figures**
Walks with 20 steps forward, sideways, and backwards	 
March of soldiers by lifting their knees, touching their knees with each step	 
Step Exercises	  
Counting Exercises in Reverse T Position	 
Aerobic Exercises	
Trunk lateral flexion and rotation exercises	 
Trunk and hip circulation exercises	 

Appendix 1 (Cont).

Exercise Protocol

Aerobic Exercises	**Figures**
Tandem Gait	
Above knee exercises	
Half sit-up exercises	
Bridge and Half push-up exercises	 
Cat-Camel exercises	 
Balance exercise in the crawling position	
Chair exercises	  
Cool-up Exercises	
Stretching-Relaxing Exercises