Effect of swimming on respiratory function test and lung capacity in children with asthma

Efeito da natação no teste de função respiratória e capacidade pulmonar em crianças com asma

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Abstract
The purpose of this study is to look at how swimming affects pulmonary function tests and lung capacity in children with asthma. This researcher's objective was to examine the impact of frequent swimming activities on the quality of life of children with asthma. In accordance with the stated goal, the research was carried out using an experimental design with no pretest-posttest control group. The study consisted of 20 asthmatic children aged 6-18 years. An exercise protocol encapsulating free swimming exercises for 60 minutes per session, 3 days a week for 8 weeks was applied in two groups of 10 people. The SPSS 22.0 package program was used to examine the data. The data was subjected to a normality test. For data that was

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judged to be regularly distributed, parametric tests were utilized. The paired-samples t test was used to compare the study group's pre-post test results. Significance level was accepted as p<0.05. According to the research findings, there was a statistically significant difference in the respiratory parameters pre-post test values of the research group was (p<0.05). In conclusion, swimming workouts appear to improve asthmatic children's development.


**Introduction**

Asthma is a chronic disorder that is still a severe noncommunicable disease; an estimated 339 million people worldwide suffer from asthma, and this figure is anticipated to rise by another 100 million by 2025. Asthma is the most frequent chronic medical illness in

**Resumo**

O objetivo deste estudo é observar como a natação afeta os testes de função pulmonar e a capacidade pulmonar em crianças com asma. O objetivo deste pesquisador foi examinar o impacto de atividades frequentes de natação na qualidade de vida de crianças com asma. De acordo com o objetivo declarado, a pesquisa foi realizada usando um desenho experimental sem grupo de controle pré-teste-pós-teste. O estudo consistiu em 20 crianças asmáticas com idade entre 6 e 18 anos. Um protocolo de exercícios encapsulando exercícios de natação livre por 60 minutos por sessão, 3 dias por semana durante 8 semanas foi aplicado em dois grupos de 10 pessoas. O programa do pacote SPSS 22.0 foi usado para examinar os dados. Os dados foram submetidos a um teste de normalidade. Para dados considerados regularmente distribuídos, foram utilizados testes paramétricos. O teste t de amostras pareadas foi usado para comparar os resultados pré-pós-teste do grupo de estudo. O nível de significância foi aceito como p<0,05. De acordo com os achados da pesquisa, houve diferença estatisticamente significativa nos valores dos parâmetros respiratórios pré-pós teste do grupo pesquisa foi (p<0,05). Em conclusão, exercícios de natação parecem melhorar o desenvolvimento de crianças asmáticas.

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It is described as the temporary constriction of the airways caused by exercise-induced difficulty breathing and shortness of breath in asthma and has long been known as a factor contributing to physical activity limitations and a lower level of fitness in children with asthma. As a result, asthmatics have diminished physical capability and a higher risk of co-morbidities such as cardiovascular disease, obesity, and depression, culminating in the long-term economic and illness burden of this chronic condition (2).

Asthma is one of the most common chronic disorders in children and adults globally, particularly in industrialized nations. Inadequate asthma control, despite worldwide treatment standards, is a widespread condition, leading to emergency department visits and hospitalizations. Many asthma patients report that activity is a trigger for their asthma, which may lead to avoidance of exercise as a means to reduce symptoms.

According to new study, regular exercise may assist improve several elements of asthma control. Many systematic reviews and meta-analyses have been published in recent years that firmly demonstrate the safety of routine exercise in children and adults with asthma. Exercise appears to promote improvements in aerobic fitness, asthma symptoms, and quality of life, although benefits in lung function and airway hyperresponsiveness have been less consistent. Clinicians should promote routine exercise to their asthma patients in addition to routine treatment recommendations for general health benefits and possibly improvement in asthma symptoms and quality of life. In order to maintain maximum health, vigorous physical exercise is a healthy and suggested daily component. Among the benefits of physical activity; reductions in all-cause mortality and a reduced risk of cardiovascular disease, obesity, diabetes, cancer, osteoporosis, and gallstones (3–5). Sedentary behavior has been more frequent among individuals of all ages in the industrialized world in recent years, and various studies have revealed that asthma sufferers are significantly more sedentary on average. There is evidence that children and caregivers utilize purposely limiting activity as an asthma management technique in children (6).

In the United States, current standards for children and adolescents encourage at least one hour of moderate to intense physical exercise every day. More significantly, most aerobic exercises should be done on a daily basis at a moderate intensity. In addition, regular exercise improves cognition and lowers the risk of severe anxiety and depression in both adults and children. Muscle and bone strengthening exercises are also advised (7).
Given that up to 90% of asthmatics report that exercise triggers their symptoms, avoiding exertion makes sensible but is likely to be harmful to long-term health. Asthmatic patients may avoid exercise owing to imagined breathing constraints.

Westergren et al. (2017) investigated perceptions of exercise limitation in 302 asthmatic children and discovered that baseline asthma severity and overweight status were both independently linked with perceived activity limitation. These findings imply that people with both illnesses may avoid exercise (8).

Regardless of asthma condition, exercise may provide activity-specific hazards. With a new exercise plan, patients with extremely unstable and poorly managed asthma might expect to encounter asthma symptoms. More study on the effects of water-focused exercise in asthma is needed, however no negative impacts have been observed in terms of asthma outcomes, respiratory symptoms, or the type of pool purification employed (9).

Aerobic activity increases oxygen and ventilation needs, resulting in fast and deep breathing. Sedentism, for the same reasons, can have negative mechanical effects on lung volumes and smooth muscle function, predisposing to airway hyperreactivity. More research is needed, however present data demonstrate no consistent improvement in spirometric lung function (or improvement in fundamental airflow obstruction) following exercise therapies (10).

Regular exercise increases exercise capacity, physiological functioning, and asthma management and control, as well as the socialization and quality of life (QoL) of the asthmatic kid, and removes the long-term adverse effects of inactivity. Swimming, in particular, has been recognized as the best sport for children with asthma due to its low asthmaogenicity (11).

Swimming activities have been shown to improve lung density and capacity. Swimming's protective effect is most likely connected to the warm and humid environment in indoor swimming pools, which lowers respiratory heat loss and generates less severe consequences than other forms of terrestrial activities.

Swimming is supposed to engage and strengthen the respiratory muscles as well as enhance chest wall flexibility, resulting in improved lung function. Swimming improves children with asthma in ways that go beyond the individual physiological level, with psychological and economical repercussions for both the kid and the family.

It has been shown that children with asthma who consistently engage in the swimming program have higher self-esteem and self-confidence. Furthermore, when the child's health improves, it has been found that less frequent and better-managed asthma attacks result in less symptoms and uninterrupted sleep at night (12).
Methodology

The study consisted of 20 asthmatic children aged 6-18 years. An exercise protocol encapsulating free swimming exercises for 60 minutes per session, 3 days a week for 8 weeks was applied in two groups of 10 people.

The research was conducted in a semi-olympic swimming pool linked with the Diyarbakr Provincial Directorate of Youth and Sports. The pool measures 25 meters long and 12.5 meters wide. The temperature ranged from 26 to 28 degrees. The pH level was regulated between 1 and 3. The pool area is underfloor heated and features a dedicated tribune for parents. Each session included four lifeguards and a nurse stationed around the pool. Each child's parents filled out and signed a "Informed Consent Form" freely. The quantitative research type's pretest-posttest experimental design model was employed in the study.

2.1 Statistical Analysis

The SPSS 22.0 package program was used to examine the data. The data was subjected to a normality test. For data that was judged to be regularly distributed, parametric tests were utilized. The paired samples t-test was performed to compare the study group's pre-post test results. The significance threshold was set at p0.05.

Results

<table>
<thead>
<tr>
<th>Variance</th>
<th>X</th>
<th>ss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>9.25</td>
<td>2.89</td>
</tr>
<tr>
<td>Height</td>
<td>139.50</td>
<td>17.30</td>
</tr>
<tr>
<td>Body Weight</td>
<td>38.00</td>
<td>13.64</td>
</tr>
</tbody>
</table>

Table 1: Comparison of demographic information of athletes
Source: Research Results

When Table 1 is examined, the research group; It was observed that had 9.25±2.89 of age mean, had a height of 139.50±17.30 and a body weight of 38.00±13.64.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Pre-test</th>
<th>Post-test</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVCex</td>
<td>2.22 ±78</td>
<td>3.99 ±1.40</td>
<td>-12,707</td>
<td>0,00*</td>
</tr>
<tr>
<td>FEV1</td>
<td>2.04 ±64</td>
<td>3.68 ±1.15</td>
<td>-14,213</td>
<td>0,00*</td>
</tr>
<tr>
<td>FEV1/FVC</td>
<td>93.35 ±5.56</td>
<td>149.40 ±8.92</td>
<td>-74,524</td>
<td>0,00*</td>
</tr>
<tr>
<td>PEF</td>
<td>4.15 ±1.04</td>
<td>7.37 ±1.72</td>
<td>-19,329</td>
<td>0,00*</td>
</tr>
</tbody>
</table>

Table 2: Changes in Pulmonary Parameters of Athletes Before and After Training
Source: Research Results
When Table 2 was examined, it was observed that there was a statistically significant difference between the respiratory parameters of the research group, pre-post test values (p<0.05).

Discussion

Swimming exercise has been connected to preventing or improving asthma symptoms, according to a review of the literature. However, other studies have found that swimming has no effect on asthma symptom control, and some have reported a higher prevalence of asthma exacerbations and allergic rhinitis among swimmers (13).

Swimming has long been regarded as a safe and healthful sport for children with asthma, owing to the fact that the temperature and humidity of indoor swimming pools make the exercise less asthmagenic and prone to bronchospasms (14).

Studies comparing the benefits of swimming instruction on asthmatic children with any other control group found no significant benefit in asthma symptoms. When swimming instruction was compared to an active control group, one research found no changes in quality of life, asthma control, asthma exacerbations, or asthma-related healthcare usage for children and care givers (15). There are studies showing statistically significant benefits of swimming training above 25% to 75% in FEV1, FVC, and FEF expressed as a percentage of predicted values.

FEV1 differences of 100 mL between the swimming and control groups are clinically significant and equivalent to those observed in children with asthma treated with 100 mcg of ginhalefluticasonepropionate (16). As evaluated by maximal oxygen uptake, swim training had a considerable advantage over cardio-pulmonary fitness when compared to an inactive control. The 25% difference in VO2 max for swimming compared to the control is clinically significant. Differences seen in reviews of physical activity studies in children without asthma range from 5% to 15% (Armstrong 2011) and exceed the 9% difference seen in children with asthma who receive physical education. Studies have pointed out that the result is of similar magnitude when VO2 max is encapsulated with other exercise capacity measures (17).

When the findings of eight trials with similar outcomes in the literature were examined, 262 people were initially randomized, but 42 were removed early. As a result, the remaining subjects were enrolled in the research. Seven studies looked at asthma control and lung function, whereas one looked at lung function and bronchial hyperresponsiveness. Cardiopulmonary fitness, asthma symptoms, and lung function were assessed at the start and conclusion of the intervention or control period. As a result of the measurements, no
significant difference was observed in swimming exercises in terms of these values in any of the studies (18 - 20). A new study examining the effects of swimming training on asthma symptoms in people of all ages discovered that the exercise was well tolerated and had no negative impact on asthma symptoms (21). Since the 1970s, observational studies have offered that swimming training is not hazardous to asthma control, with benefits on asthma symptoms and control in pre- and post-observation design studies (22). In a different study, they stated that the exercise improved the respiratory values of the students in a positive way (23). In another study, they reported that inspiratory muscle training applied to individuals with Down syndrome provided significant positive improvement in respiratory functions (24).

When the literature is examined through the lens of wrists, it is clear that numerous research are being conducted to investigate the effects of swimming training on asthma and lung functioning in children with asthma. When these experiments were analyzed, it was discovered that some beneficial changes occurred, while others had no impact.

**Conclusion**

Swimming is an aerobic workout that increases QoL as well as overall physical, physiological, and emotional well-being. Meta-analyses conducted on lung function showed a small statistically significant effect on FEV 1 (L) and a large effect on FVC, but not for FEV 1% and PEF. The narrative synthesis of asthma control through medication use and symptoms favored the swimming group.

Swimming had no negative effects, but did result in a reduction or negligible change in BHR and EIB in the children with asthma in this study. However, due to the abundance of low-quality material, drawing clear conclusions might be problematic.

Many studies have demonstrated that regular swimming exercise improves pulmonary function tests and lung capacity in children with asthma. In order to capture the intended advancements, it will be necessary to continually regulate the fundamental sanitary conditions of these pools, to maintain the air temperatures at the acceptable levels, and, moreover, to follow up on the swimming trainings under the supervision of professionals.

**References**


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