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The Role of Physical Activity in Managing Epilepsy in Children and Adolescents: A Systematic Review

Authors:

Wiktoria Pysiewicz

ORCID https://orcid.org/0009-0002-3245-8609

Mail wiktoria.pysiewicz@gmail.com

Norbert Barlicki Memorial Teaching Hospital No. 1 of the Medical University of Lodz, Lodz, Poland

ul. dr. Stefana Kopcińskiego 22, 90-153; Łódź; Poland

Wiktor Garbarczyk

ORCID https://orcid.org/0009-0001-4107-6795

wgarbarczyk@gmail.com

University Clinical Hospital No. 2 of Medical University of Łódź

ul. Żeromskiego 113; 90-549 Łódź; Poland

Agnieszka Napieralska
ORCID https://orcid.org/0009-0001-1163-8283
napieralskaa@gmail.com
University Clinical Hospital No. 2 of Medical University of Łódź
ul. Żeromskiego 113; 90-549 Łódź; Poland

Daria Bednarczyk
ORCID https://orcid.org/0009-0007-1006-4955
Mail daria.bednarczyk99@gmail.com
Central Clinical Hospital of Medical University of Warsaw
ul. Banacha 1A, 02-097; Warsaw; Poland

Albert Kapla
https://orcid.org/0009-0004-0887-0825
albertkapla@wp.pl
NZOZ Gajda-Med Medical Group;
ul. Teofila Kwiatkowskiego 19; 06-102; Pułtusk; Poland

Michalina Jurkiewicz
ORCID https://orcid.org/0009-0005-3318-121X
mail m.jurkiewicz86@gmail.com
Central Teaching Hospital of Medical University of Łódź
ul. Pomorska 25; 192-213 Łódź; Poland
Julia Białeta
ORCID: https://orcid.org/0009-0009-3140-4060
mail: bialetajulia@gmail.com
Central Teaching Hospital of Medical University of Łódź
ul. Pomorska 251; 92-213 Łódź; Poland
Katarzyna Rowińska
ORCID https://orcid.org/0009-0002-7921-7167
mail rowinska98@gmail.com
University Clinical Hospital No. 2 of Medical University of Łódź
ul. Żeromskiego 113; 90-549 Łódź; Poland

Karolina Siembab
https://orcid.org/0009-0000-9934-8741
kkaarolina75@gmail.com
Maria Skłodowska-Curie Regional Specialist Hospital in Zgierz
ul. Parzęczewska 35, 95-100 Zgierz; Poland

Alicja Černohorská
ORCID https://orcid.org/0009-0001-8230-2891
mail a.cernohor@gmail.com
Central Teaching Hospital of Medical University of Łódź
ul. Pomorska 251; 92-213 Łódź; Poland

Abstract

Epilepsy is one of the most predominant neurological disorders in children and adolescents. It is characterized by recurrent, unprovoked seizures. While pharmacological treatments remain the primary approach for seizure control, non-pharmacological interventions like physical activity (PA) appear as potential complementary strategies for improving health outcomes in pediatric population. This systematic review evaluates the role of physical activity in the management of epilepsy in children and adolescents, focusing on its impact on seizure control, cognitive function, psychological well-being, and overall quality of life. Although the evidence regarding the impact of PA on seizure frequency is limited, regular physical activity has been shown to improve cognitive outcomes, mental health, and general quality of life in children with epilepsy. Safety concerns regarding PA of children with epilepsy are discussed. Further research among the pediatric population is needed, since PA might play an important role alongside conventional therapies in managing epilepsy in children and adolescents.

Key words: epilepsy; physical activity; children and adolescents; systematic review

Introduction

Epilepsy is known to be the most common chronic neurologic condition in childhood, affecting approximately 1% of children and adolescents globally [1,2] . It is characterized by recurrent, unprovoked seizures and therefore has a profound effect on physical, emotional, and social development of children. Conventional treatment, which includes antiepileptic drugs, dietary therapies, and in some cases, surgical interventions, intend to control seizures and reduce their frequency. However, these approaches do not completely address the broader quality of life and children with this condition are often at higher risk of developing secondary health issues such as depression, anxiety, and physical deconditioning. Comprehensive management of pediatric epilepsy extends beyond seizure control and aims to integrate strategies that improve overall health and quality of life.

Physical activity, promoted by health professionals as a condition of general health, is an important element in holistic approach to various chronic diseases. It is widely recognized for its positive effects on overall health, including improvements in cardiovascular system, strength, coordination, and psychological well-being. However, participating in sport activities have not always been recommended in neurological diseases like epilepsy. Historically, children suffering from epilepsy have been discouraged from physical activities due to limited knowledge, overprotection and fear of seizures [3,4] . Medical associations for years used to contraindicate many sports disciplines because of high risk of injury or the fear of exercise-induced seizures[5–7]. However, as the understanding of epilepsy expand and raised the need for exploring complementary interventions in epilepsy treatment, there was a shift in medical recommendations towards encouraging to participate in physical activity.

Nevertheless, the stigma remains and children with epilepsy continue to be less active than their healthy peers. For example, Wong at al. [8] reported that teens with epilepsy participated in fewer sports activities than their healthy siblings without epilepsy and were more likely to be overweight. Another, more recent study, found that children with epilepsy adopted a more sedentary lifestyle than their healthy peers and have a greater risk of poor physical activity [9]. Furthermore, Pohl et al. found that children with epilepsy had significantly lower total physical literacy scores, lower agility and movement skills, and higher screen time in comparison to their healthy peers[10].

Besides the fact that children with epilepsy remain less physically active, there are still concerns about the safety of their sports activity, especially regarding the supposed exercise-

induced seizures, which lead to uncertainty regarding its widespread recommendation. For example, some surveys have reported that physical activity is restricted by the parents and caregivers of children with epilepsy in contradiction to medical suggestions due to fear of perceived risk of injury[11].

This systematic review aims to summarize available evidence regarding the role of physical activity in managing epilepsy in pediatric populations as well as to examine the role of physical activity within the broader context of pediatric epilepsy care, exploring its impact on seizure frequency, psychological well-being, cognitive function and quality of life.

Methods

Search Strategy

A systematic literature search was conducted using key databases including PubMed, ScienceDirect and Google Scholar. The search terms included combinations of "epilepsy," "children," "adolescents," "physical activity," "exercise," "seizure frequency," "quality of life," "cognitive function," and "psychological health." Priority was given to articles published over the last 20 years (2004-2024). The search was limited to peer-reviewed articles in English, and references from identified studies were also screened to find additional relevant publications.

Inclusion and Exclusion Criteria

Inclusion criteria were: studies involving children and adolescents (aged 0-18 years) diagnosed with epilepsy, studies evaluating the effects of physical activity on seizure frequency, cognitive function, quality of life, mood, or psychological health, studies that apply physical exercise intervention, studies with original data.

Exclusion criteria were: studies focused on the role of physical activity among adults with epilepsy, children with other neurological conditions or chronic disorders, studies with no control group, articles not published in peer-reviewed journals.

Results

This systematic review identified 7 studies that met all the inclusion criteria. The sample sizes ranged from 9 to 122 participants. The physical activity interventions varied widely, including aerobic exercises (like walking, jogging, cycling), team sports and yoga. The duration of

exercise programs ranged from 5 weeks to 6 months, with most studies involving moderate-intensity physical activity.

Effects of Physical Activity on Seizure Frequency

There exist rather few studies that examine the impact of physical activity on seizure frequency in the pediatric population with description of the exact percentage or number of reduced seizures. Several studies investigating that issue reported no quantitative data regarding the seizure frequency reduction following exercise interventions. For example, Willis et al. reported a reduction in seizure frequency in some participants of their exercise programme, but with no specific percentage or number of decreased seizures, focusing more on other positive aspects like improvement in attitude and confidence of children[12]. Similarly, Do et al. conducted a physical activity programme in children with epilepsy, but did not describe the seizure frequency after the intervention, focusing on sleep objectives in physically active children with epilepsy [13].

There were only two studies that reported the exact seizure frequency following the exercise programme. Zang et al. described a significant reduction in seizure frequency - from 25% to 50% reduction in children participating in a structured home-based 6-months-long exercise programme[14]. However, the physical activity was supplemented by a combination of low glycaemic diet, which is a limitation when analyzing the impact of physical activity only. Another study that have taken the seizure frequency into account reported no significant reduction in seizure frequency compared to a control group, since the result was not statistically significant [15]. The authors conducted a 2-month yoga exercise programme among children with epilepsy and monitored the seizure frequency and EEG of the participants and controls prior and following the intervention. Although the difference regarding seizure frequency was not statistically significant and cannot be considered, the EEG in the yoga group improved and the findings were statistically significant.

Effects of Physical Activity on Quality of Life

Physical activity is known to have several benefits on individuals other than on physical health including improvements in mood and general quality of life. Several studies reported improvements in mood, anxiety, and depression level in children with epilepsy

following exercise interventions. For example, after a structured home-based exercise in the period of 6 months Zhang et al. described a significant improvement in the quality-of-life scores in the Quality of Life in Childhood Epilepsy Questionnaire (QOLCE-55)[14]. Thirty-six participants were advised to perform moderate-intensity aerobic exercise consisting of walking, jogging or cycling for 30 minutes/day, 5 days a week, for 6 months. After that not only improvement of quality of life was reported, but also reduction of anxiety, fear and depression levels. Furthermore, children and their parents reported an improvement in confidence and functional independence of the children.

Another study conducted by Eom et al. found an improvement in general quality of life of children with benign epilepsy with centrotemporal spikes who completed a 35-week long exercise programme, which consisted of supervised sport activities for 5 weeks and home-based exercise program for 30 weeks[16,17]. Additionally, the authors observed significant improvements in neurocognitive domains such as psychomotor speed along with sustained and divided attention.

Willis et al. conducted a motivated walking programme among youth with epilepsy and also reported an improvement in the quality of life of some of the children after 6 or 12 months of exercise [12] . Other benefits were reported as well, such as improved attitude and confidence of children. Additionally, the study described that parents of the participants experienced some personal benefits as well as a consequence of their child engaging in the program.

Conversely, Brown et al. conducted a 12-month-long study with behavioral counseling sessions on a large sample of 122 children with epilepsy and reported no change in quality of life nor depression scores [18]. The intervention consisted of regular behavior counseling and the participants wore a pedometer to track their daily physical activity level. However, the intervention did not increase physical activity compared to the control group. Children in both groups demonstrated declines in physical activity over one year, despite regular counseling sessions, which suggests low adherence to physical activity.

Similarly, Do et al. conducted a 12-week exercise intervention that included weekly meetings with exercise counsellors and did not report any change in quality of life. Children participating in the study measured the daily number of steps using a pedometer for three months in order to increase their physical activity. Participants were individually motivated in regular weekly meetings to increase daily steps by at least 3% each week and by 25% at the end of the intervention period. Although some of them who were older or less active at

baseline managed to increase their physical activity with exercise counseling, no change in quality of life, fatigue, depression and anxiety was observed.

Safety Considerations

Although the available evidence suggests that physical activity and participating in sports is an important factor in an optimal epilepsy management, some studies report a parental reluctance to allow their children suffering from epilepsy to participate in various sports[11]. Parents and caregivers are often confused and unsure due to fear of potential risk of injury or death should a seizure occur. Furthermore, not only parents, but also teachers raise their concerns about children's safety during sport activities. Some surveys in a Canadian study reported that schools had concerns about whether the children with epilepsy can safely participate in physical education classes, not allowing them to be involved in activities, which is another barrier for the children to physical activity engagement[19].

Consequently, when recommending physical activity for children with epilepsy it is crucial to understand parental and caregivers' concerns about children's safety and take into the account the factors in different sports activities that might affect their children's condition. Therefore, ILAE Task Force on Sports and Epilepsy have published a consensus paper that divides sports into three categories based on potential risk to people with epilepsy and describes few restrictions when considering diverse activities[4].

Discussion

This systematic review provides a summary of available evidence of possible positive impact on physical exercise for children and adolescents suffering from epileptic disorder. Those include potential improvements in seizure control as well as cognitive function, psychological health and general quality of life. However, the heterogeneity of study designs, physical activity and participant characteristics makes it challenging to establish the most effective type or intensity of exercise for managing epilepsy and optimal seizure control.

Drug resistance is considered to be one of the most serious problems in pediatric epilepsy and therefore there is a great need for finding complementary treatments other than antiepileptic drugs. Dietary intervention is playing an increasingly important role, and as one of the discussed studies found, a combination of diet and regular exercise might bring quite good results in seizure control and improvement of life quality[14]. Therefore, more clinical

studies are needed in order to investigate further the role of physical exercise as a method of treatment in drug-resistant epileptic disorder.

The effect of physical activity on seizure frequency cannot be established due to very limited date. Most of the studies describe the qualitative effect as “seizure reduction”, except one study that investigated the exact seizure frequency following the exercise programme with consistent and statistically significant results[14]. Consequently, there is a need for further high-quality trials investigating this correlation.

Another important issue prevalent in several of the discussed studies is poor adherence to physical activity among the pediatric population with epilepsy[13,18]. This might be because most of the studies used motivational exercise counselling programmes, which seems to have low efficiency among children and adolescents. Only one study applied a supervised exercise programme for 5 weeks prior to encouraging participants to continue at home[16,17]. Another possible factor that might be affecting poor adherence to physical exercises among children with epilepsy could be low confidence and poor social interaction related to epilepsy stigma. In a study that researched the adherence to exercise in people with epilepsy only one-fourth of the participants reported adherence to physical exercise[20]. The most reported challenges were fear of seizures, low self-esteem and lack of support from friends and family. However, a cross-sectional study provided promising evidence reporting that adolescents with epilepsy were the most active when involved in organized sports[21]. This suggests that children and youth with epilepsy might benefit the most from team sports and attending sports clubs. Further investigation on that matter might lead to better outcomes regarding adherence to sport exercises.

Additionally, an important aspect in the discussion about physical activity in pediatric epilepsy are safety considerations. Parents and caregivers worried about safety of children with epilepsy tend to limit their physical activity[11,19]. These concerns are raised particularly regarding sports with a risk of head trauma (soccer, hockey, boxing) and with the risk of hypoxia (climbing, diving). Although, there do exist some recommendation regarding appropriate exercises for children[4], there is a need for further information and clear guidelines including exercise programs individualized based on the child’s seizure type, frequency and medication regimen. Furthermore, we observed a lack of supervision by healthcare professionals. We emphasize the need of professional education and instruction for example by monitoring children and adolescents with epilepsy during practice, particularly of children with poorly controlled seizures.

Despite these challenges, physical activity appears to offer significant benefits for children suffering from epilepsy, particularly in terms of enhancing psychological well-being, mood and cognitive function, which are often impaired in this group of patients. Moreover, regular physical activity can improve also overall physical health, reducing the risk of obesity, which together with an increase in self-confidence and social interaction, can improve the overall quality of life for children and adolescents with epilepsy. Furthermore, this very correlation between physical activity and health-related quality of life was investigated by several studies and found to be positive[22,23].

Conclusion

Physical activity plays a valuable role in managing epilepsy in children and adolescents. The evidence suggests that regular physical activity can improve cognitive function, mental health, and quality of life. The evidence of positive impact of exercise on seizure frequency remain limited and require more investigation. Further high-quality, large-scale clinical trials are needed to establish clear guidelines for exercise interventions in pediatric epilepsy, including optimal types, intensities, and durations of activity, as well as safety considerations.

Disclosure

Author's contribution

Conceptualization: Wiktoria Pysiewicz

Methodology: Daria Bednarczyk

Software: Michalina Jurkiewicz

Check: Julia Białeta, Michalina Jurkiewicz and Albert Kapla

Formal analysis: Katarzyna Rowińska and Albert Kapla

Investigation: Wiktor Garbarczyk

Resources: Kariolina Siembab and Agnieszka Napieralska

Data curation: Alicja Černohorská and Karolina Siembab

Writing - rough preparation: Wiktor Garbarczyk and Agnieszka Napieralska

Writing - review and editing: Julia Białeta and Daria Bednarczyk

Visualization: Wiktoria Pysiewicz

Supervision: Alicja Černohorská

Project administration: Katarzyna Rowińska

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