e-ISSN: 0975-1556, p-ISSN:2820-2643
Available online on www.ijpcr.com
International Journal of Pharmaceutical and Clinical Research 2024; 16(6); 2467-2470

Original Research Article

Effectiveness of Dietary Therapy in the Management of Pediatric Epilepsy

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Received: 25-03-2024 / Revised: 23-04-2024 / Accepted: 25-05-2024
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Conflict of interest: Nil

Abstract:
This study evaluates the efficacy of three dietary therapies—the ketogenic diet, modified Atkins diet, and low glycemic index treatment—in managing pediatric epilepsy. Conducted over one year at Darbhanga Medical College and Hospital, the randomized controlled trial involved 100 children diagnosed with epilepsy. Results demonstrated that the ketogenic diet significantly reduced seizure frequency by 75%, though it posed adherence challenges. The modified Atkins and low glycemic index diets, while less effective in controlling seizures, offered greater sustainability. Cognitive assessments revealed improvements in the ketogenic and modified Atkins groups, with a slight decline observed in the low glycemic index group. These findings suggest that dietary therapy serves as a viable adjunct or alternative to pharmacological treatment, emphasizing the need for individualized management plans to enhance adherence and effectiveness.
Keywords: Pediatric Epilepsy, Ketogenic Diet, Seizure Reduction, Dietary Therapy.

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Introduction

Epilepsy is a prevalent neurological condition that significantly impacts pediatric populations, manifesting as an array of recurrent, unprovoked seizures [1]. These seizures are the result of excessive electrical discharges in a group of brain cells. Different types of seizures may occur in children, ranging from convulsions and loss of consciousness to subtle staring spells or temporary confusion, which can pose severe disruptions to a child's development and daily life [2]. Traditional treatment modalities for pediatric epilepsy have predominantly revolved around antiepileptic drugs (AEDs), which, although effective in reducing seizure frequency for many, are not without drawbacks. Side effects such as fatigue, dizziness, and weight gain, along with the risk of drug resistance, prompt the need for alternative treatments [3,4].

Dietary therapy has surfaced as a promising adjunct or alternative to pharmacotherapy in managing pediatric epilepsy. Among these dietary interventions, the ketogenic diet—a high-fat, low-carbohydrate regimen—has been the most studied, showing efficacy in reducing or even eliminating seizures in some cases. The modified Atkins diet and the low glycemic index treatment, which are less restrictive than the ketogenic diet, also offer potential benefits for seizure control, providing more flexibility and ease of adherence, which are crucial factors in pediatric treatment plans [5,6].

The biochemical premise behind these dietary therapies is to induce ketosis, a metabolic state in which the body utilizes fat as its primary energy source instead of glucose. This metabolic shift is believed to confer neuroprotective effects and stabilize neuronal function, thereby reducing the frequency and intensity of seizures [7].

This study aims to systematically evaluate and compare the effectiveness of these dietary therapies in managing pediatric epilepsy, with a dual focus on seizure control and cognitive outcomes. Specifically, the study will assess the reduction in seizure frequency, examine the sustainability of dietary adherence over time, and evaluate cognitive and developmental outcomes, which are critically important in this young population. By exploring these aspects, the study hopes to provide a comprehensive understanding of the role of dietary therapy in pediatric epilepsy, potentially offering a viable alternative or complement to traditional drug therapy, thereby improving the overall management and quality of life for affected children.

Methodology

Study Design: The study was designed as a randomized controlled trial to compare the

effectiveness of three dietary therapies for managing pediatric epilepsy. This study was conducted over one year at Darbhanga Medical College and Hospital (DMCH), Darbhanga.

Participants: A total of 100 pediatric patients diagnosed with epilepsy were enrolled in the study. Inclusion criteria were children aged between 2 and 12 years diagnosed with epilepsy resistant to at least two antiepileptic drugs. Exclusion criteria included metabolic diseases, prior dietary therapy interventions, and other severe neurological disorders that could interfere with dietary treatment adherence.

Randomization and Interventions: Participants were randomly assigned to one of three groups: the ketogenic diet, modified Atkins diet, or the low glycemic index treatment. Randomization was performed using a computer-generated sequence to ensure equal distribution across the groups.

Dietary Protocols

1. Ketogenic Diet: Participants followed a strict ratio of fats to a combination of proteins and carbohydrates, typically around 4:1, overseen by trained dietitians.

2. Modified Atkins Diet: This diet included a low carbohydrate intake but was less restrictive in calories and fluid intake compared to the ketogenic diet.

3. Low Glycemic Index Treatment: Participants consumed foods that have a low glycemic index, aiming to maintain glucose levels and induce mild ketosis.

Monitoring and Follow-up: Participants were monitored for one year with monthly follow-up visits. These visits included assessments of seizure frequency, dietary adherence, and any side effects. A registered dietitian performed dietary assessments and adjustments during each visit.

Outcome Measures: The primary outcome measure was the reduction in seizure frequency from baseline to the end of the study. Secondary outcomes included changes in cognitive function and dietary adherence rates.

Statistical Analysis: Data were analyzed using SPSS software. Changes in seizure frequency and cognitive scores were assessed using paired t-tests or ANOVA as appropriate. Adherence rates were analyzed using chi-squared tests. A p-value of less than 0.05 was considered statistically significant.

Results

The group following the ketogenic diet experienced a remarkable decrease in seizure frequency, with a 75% reduction compared to the initial level. The modified Atkins diet and the low glycaemic index treatment groups also demonstrated significant reductions, although their effectiveness was slightly lower compared to the ketogenic diet. The study period revealed a modest enhancement in cognitive scores for both the ketogenic and modified Atkins diet groups. On the other hand, the group with a low glycaemic index demonstrated a slight decrease in cognitive performance.

Consistency in following the prescribed diet was observed to be the highest among participants in the low glycaemic index group, and this trend continued consistently throughout the entire duration of the study. Nevertheless, every group encountered a decrease in adherence as time went on, with the ketogenic diet displaying the most significant decline, likely because of its more stringent requirements. Based on the findings, it appears that the ketogenic diet provides the greatest advantage in terms of reducing seizures. However, its more rigid requirements may present difficulties for individuals to follow in the long run, in contrast to the less strict diets. The potential benefits of dietary therapy in managing paediatric epilepsy are encouraging, especially when tailored to meet the unique needs of each patient and supported by ongoing nutritional assistance.

Discussion

The findings from this study highlight the potential of dietary interventions as effective management strategies for pediatric epilepsy. The ketogenic diet, with the highest percentage reduction in seizure frequency, underscores its efficacy, aligning with previous research that supports its use in reducing seizures in children who are resistant to conventional antiepileptic drugs. However, the significant challenge associated with its strict regimen is adherence, as evidenced by the lower adherence rates after one year compared to the other diets [8].

The Modified Atkins Diet and the Low Glycemic Index treatment, while less effective in seizure reduction compared to the ketogenic diet, offered a more manageable alternative with relatively higher adherence rates [9]. This suggests that less restrictive diets might be more suitable for long-term management, particularly in contexts where the ketogenic diet's strictness is impractical. Cognitive outcomes varied across the diets, with the ketogenic and Modified Atkins diets showing some improvements [10]. This could suggest that beyond controlling seizures, dietary therapy might have ancillary benefits for brain function, possibly due to improved metabolic control or decreased fluctuation in neuronal excitability. However, the slight decline in cognitive scores within the Low Glycemic Index group prompts further investigation into the diet's long-term neurological impacts [11].

Table 1: Reduction in Seizure Frequency

Group	Baseline Mean Seizure Frequency	Mean Seizure Frequency at 1 Year	Percentage Reduction
Ketogenic Diet	12.8	3.2	75%
Modified Atkins Diet	12.5	5.4	57%
Low Glycemic Index	12.7	8.1	36%

Table 2: Cognitive Outcomes

Group	Baseline Cognitive Score	Cognitive Score at 1 Year	Change in Score
Ketogenic Diet	85	92	+7
Modified Atkins Diet	86	88	+2
Low Glycemic Index	87	86	-1

Table 3: Dietary Adherence Rates

Group	Adherence Rate at 6 Months	Adherence Rate at 1 Year
Ketogenic Diet	80%	65%
Modified Atkins Diet	85%	75%
Low Glycemic Index	90%	82%

Importantly, dietary adherence emerged as a critical factor influencing the success of dietary therapy. The decline in adherence over time, particularly with the ketogenic diet, points to the need for comprehensive support systems, including regular follow-ups with dietitians, educational support for families, and possibly integrating technological tools like mobile apps for diet management to improve long-term compliance [12,13]. Overall, the study reinforces the role of dietary therapy in pediatric epilepsy management but also highlights the need for individualized approaches based on dietary preferences, feasibility, family support, and healthcare infrastructure to optimize outcomes and sustain long-term benefits. Further studies could explore the comparative impacts of these diets in diverse populations and refine strategies to enhance adherence and minimize cognitive risks [14,15].

Conclusion

The study conclusively demonstrates that dietary therapies, specifically the ketogenic diet, modified Atkins diet, and low glycemic index treatment, are effective in managing pediatric epilepsy by significantly reducing seizure frequency. The ketogenic diet showed the highest efficacy in seizure reduction but also faced challenges with long-term adherence due to its restrictive nature. The modified Atkins and low glycemic index diets, while slightly less effective in seizure control, presented more sustainable options for families, indicating the importance of flexibility and individual suitability in dietary choices for long-term management. These findings underscore the necessity for tailored dietary management plans that consider both the clinical effectiveness and the practical aspects of dietary adherence, highlighting a pivotal role for dietary therapy alongside traditional pharmacological approaches in the comprehensive management of pediatric epilepsy.

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