

REVIEW ARTICLE

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## THE EFFECTIVENESS OF KETOGENIC DIET IN TREATMENT OF EPILEPSY PATIENTS: A LITERATURE REVIEW

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### Abstract

The ketogenic diet is one of the alternative treatment management of epilepsy patients. The study aimed to examine the effect of the ketogenic diet for managing epilepsy patients. A literature review used by databases to find the relevant articles included Science Direct, Scopus, and Pro-Quest from 2011 to 2018. Metabolic therapy with the ketogenic diet can improve mitochondrial function, increase inhibition, and reduce nerve stimulation, which can cause seizures in epilepsy patients. Also, other factors need to be considered to produce an optimal impact on the use of the ketogenic diet, such as patient compliance and age. The ketogenic diet is one of the non-pharmacological alternatives that can be done to prevent recurrence in epilepsy patients.

**Keywords:** ketogenic diet, epilepsy, literature review

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### 1. Introduction

Epilepsy is a transient event caused by excessive neuronal activity or inconsistency in the brain (1). That is a chronic neurological disease that can be experienced by all ages in both men and women (2). Based on data from the World Health Organization (WHO), the number of people living with epilepsy currently reaches 60 million peoples with an average prevalence of active epilepsy was 8.2 per 1000 population (2). Epilepsy has an impact on the quality of life. A previous study stated that the several effects of epilepsy included medical, psychological, social, and education (3). Schachter (2016) explained that the ketogenic diet significantly impacts for epilepsy management (4). The ketogenic diet used since 1921 is a diet high in fat, moderate protein, and low in carbohydrates. This combination of energy can cause ketosis, which serves to relieve seizures (5). The ketogenic diet has attracted the attention of researchers in the last 30 years (6).

A study also showed the positive effect of the ketogenic diet for treating all types of epilepsy syndrome (7). Furthermore, the ketogenic diet showed a positive impact and safety for childhood and adolescent with epilepsy (8). Although the ketogenic diet was effective for long term care for epilepsy, however determining the efficacy of the ketogenic needed (9). This paper aims to analyze potential ketogenic diet as alternative treatment management of epilepsy patients.

## 2. Method

This paper is a literature review. The author used several databases included Webmail, Science Direct, Scopus, and Pro-Quest. The inclusion criteria of this study were 1) articles published from January 2010 to December 2018, 2) discuss management of epilepsy with the ketogenic diet. An exclusion criterion does not use language literature other than English. The keywords used in this study including; "ketogenic diet and epilepsy," "ketogenic diet," "epilepsy management." Twenty-eight articles selected including two cross-sectional methods, nine retrospective studies, four prospective observational methods, 1 case studies, one meta-analysis, nine quantitative true experiment method, one particular report, and one literature reviews.

## 3. Results

### a. Theoretical Concept

The epilepsy is a common neurological disorder caused by abnormalities in the brain's electrical activity (3,10). Schachter explains that there are several epilepsy management skills, which are long-term management; one of them is the consumption of ketogenic diets (4). The ketogenic diet is a high-fat, low protein, and low carbohydrates which induces the production of body ketones through fat metabolism, changing the primary calorie source of carbohydrates to fat (11). Whereas according to the Epilepsy Foundation, the ketogenic diet is a diet high in fat, moderate protein, and low in carbohydrates, which aims to make the body in a state of ketosis (12).

### b. The ketogenic diet as alternative treatment management of epilepsy patients

Several studies have explained the clinical use of the ketogenic diet in metabolic processes in epilepsy patients (13). Previous studies showed the epigenetic effects on reducing the risk of permanent seizures due to a shift in the threshold in the process of seizures in epilepsy patients (11,14). Besides, the ketogenic diet has caused DNA changes in gene expression seen in experimental models of epilepsy in the temporal lobe (15). Also, there is a definite therapeutic relationship between metabolism and neuron activity in the brain. Metabolic therapy with the ketogenic diet can improve mitochondrial function, increase inhibition, and reduce nerve stimulation, which can cause seizures in epilepsy patients (16).

### c. The ketogenic diet as alternative treatment management of children, adolescents and adults patients with epilepsy

A ketogenic diet is a form of alternative medicine in patients with epilepsy who experience drug resistance. In children with epilepsy, the ketogenic diet is active and safe in preventing epileptic seizures (6,17-19). In adults with epilepsy, the ketogenic diet still needs further research. According to Aninditha & Wiratman, the ketogenic diet is not

effective in adult patients who have epilepsy. However, different from those reported by Maromi et al. in their study, which explains the ketogenic diet is an effective and beneficial alternative treatment in symptomatic epilepsy (9). Another study reveals that the ketogenic diet in adults with epilepsy is feasible, effective, and safe for the long term (20).

Providing the ketogenic diet to people with epilepsy can affect the digestive system, weight loss, and increased lipids in adults. Several side effects from the digestive system include constipation, diarrhea, and vomiting and can be solved by increasing the fiber intake, and sodium. Weight loss is a positive effect on overweight epilepsy patients. Increased serum fat is healthy with long-term ketogenic diet therapy (21-22). Some patients who discontinue diet therapy are not due to side effects caused by the ketogenic diet (24,25).

d. The ketogenic diet as alternative treatment management during pregnancy in epilepsy patients

Care for epilepsy in pregnant women needs to be done carefully (26). Concerning this issue, antiepilepsy drugs (AED) was non-pharmaceutical alternatives during pregnancy in epilepsy patients (27). The ketogenic diet in pregnant women with epilepsy has been shown to reduce blood ketone levels to moderate levels (26). A study mentioned that non-pharmacological epilepsy therapy such as the ketogenic diet could be useful during gestational age, although health care provider needs to monitor the side effects (27). Several studies explain the consideration of the benefits and potential losses to the fetus due to hyperketonemia conditions in epilepsy pregnant women. Thus, the ketogenic diet during pregnancy can be used as a non-pharmacological alternative (27).

e. Application of ketogenic diet as alternative treatment management in epilepsy patients

Some literature shows that the ketogenic diet in adults with epilepsy is comparable to children (8,21). One prospective study showed the effectiveness of the ketogenic diet on reducing the frequency of seizures by 47% in the first and third months, and 33% in the next six months (13). So the Epilepsy Diet Center (AEDC) was formed in 2010 at Johns Hopkins Hospital to provide a ketogenic diet center for adults with epilepsy. The majority of patients attending AEDC are women, with ages ranging from 18 to 86 years. Overall, more than half of the participants who started the ketogenic diet continued to diet during the study. Of the 139 participants who began or continued diet therapy after the first visit, 41% (57 of 139) responded to diet therapy, and 27% (37 of 139) became free of seizures (28).

The ketogenic diet provides long-term benefits that are effective in the treatment of epilepsy in adulthood and are a promising adjunct therapy for patients with drug-resistant epilepsy (28). The establishment of the Epilepsy Diet Center has proven beneficial for the epilepsy group and helps improve their diet. They need and access dietitians and neurologists in their care so that they can help improve compliance with the ketogenic diet (28).

#### 4. Discussion

The management of the ketogenic diet can be used as a non-pharmacological alternative in the treatment of epilepsy patients (21). However, adequate information about the ketogenic diet and their side effects should be consent (5). In general, the side

effects of the ketogenic diet are gastrointestinal and lipid complaints. However, the reported side effects are usually transient and are not the most common reason for patients to stop taking the ketogenic diet (29).

The ketogenic diet can be clinically significant by considering patient compliance. For increasing the effect of ketogenic diet therapy, several strategies carried out, such as evaluating health education, monitoring compliance, and awareness of epilepsy treatment, monitoring side effects, and developing friendly methods. The ketogenic diet is commonly used for children who have treated with antiepilepsy (28).

## 5. Conclusions And Recommendations

The ketogenic diet is one of the non-pharmacological alternatives that can be done to prevent recurrence in epilepsy patients. Metabolic therapy with the ketogenic diet can improve mitochondrial function, increase inhibition, and reduce nerve stimulation, which can cause seizures in epilepsy patients. Although it has benefits to prevent the recurrence of epilepsy, the ketogenic diet requires special attention to side effects that can occur in patients such as digestive problems. Also, other factors need to be considered to produce an optimal impact on the use of the ketogenic diet, such as patient compliance and age.

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