

Effect Of Ketogenic Diet On Adoloscents With Epilepsy:A Review Article

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ABSTRACT

The Ketogenic Diet (KD) is a modality of treatment used since the 1920s as a treatment for intractable epilepsy. It has been proposed as a dietary treatment that would produce similar benefits to fasting, which is already recorded in the Hippocratic collection. The KD has a high fat content (90%) and low protein and carbohydrate. Evidence shows that KD and its variants are a good alternative for non-surgical pharmacoresistant patients with epilepsy of any age, taking into account that the type of diet should be designed individually and that less-restrictive and more-palatable diets are usually better options for adults and adolescents. This review discusses the KD, including the possible mechanisms of action, applicability, side effects, and evidence for its efficacy, and for the more-palatable diets such as the Modified Atkins Diet (MAD) and the Low Glycemic Index Diet (LGID) in children and adults.

KEY WORDS: Adoloscents, Epilepsy, ketogenic diet.

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I. Introduction

Epilepsy is a disabling and common neurological disease, which can be controlled successfully in most patients with one or more antiepileptic drugs. Approximately 30% of patients with epilepsy have refractory epilepsy, that is, have a failure of adequate trials of two tolerated, appropriately chosen and used antiepileptic drug schedules to achieve sustained relief of seizures. Some of these patients are not surgery candidates, so it is necessary to search for alternative treatments for epilepsy such as palliative surgery, neuromodulation, and a ketogenic diet (KD).¹

Epilepsy in the pediatric and adolescent populations is a devastating condition where individuals are prone to recurrent epileptic seizures or changes in behavior or movement that is the direct result of a primary change in the electrical activity in the brain. Although many children with epilepsy will have seizures controlled with antiseizure medications (ASMs), a large percentage of patients are refractory to drug therapy and may consider initiating a ketogenic diet. The term Ketogenic Diet or Ketogenic Diet Therapy (KDT) refers to any diet therapy in which dietary composition results in a ketogenic state of human metabolism. Currently, there are 4 major Ketogenic diet therapies—the classic ketogenic diet (cKD), the modified Atkins diet (MAD), the medium chain triglyceride ketogenic diet (MCTKD) and the low glycemic index treatment (LGIT). The compositions of the 4 main KDTs differ and limited evidence to distinguish the efficacy among different diets currently exists. Although it is apparent that more randomized controlled trials (RCTs) and long-term studies are needed to evaluate efficacy, side effects and individual response to the diet, it is imperative to study and understand the metabolic profiles of patients with epilepsy in order to isolate which dietary restrictions are necessary to maximize clinical benefit².

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The classic ketogenic diet (CKD) consists of a high-fat and low-protein and carbohydrate diet, with restricted calories and fluids. The diet mimics the fasting state, altering the metabolism to use fats as a primary fuel source; catabolism of fatty acids in the liver produces ketone bodies (KB), which induces urinary ketosis

Ketogenesis or the production of ketone bodies (KBs) primarily occurs in liver from fatty acid β -oxidation-derived acetyl-CoA and transported to the extrahepatic tissues for terminal oxidation . These KBs are involved in a variety of important metabolic pathways such as fatty acid β -oxidation (FAO), gluconeogenesis, the tricarboxylic acid (TCA) cycle, de novo lipogenesis and sterol biosynthesis . This metabolic mechanism provides an alternative source of energy, especially under a fasting state, during which the availability of carbohydrate is limited while the availability of fatty acids increases, therefore serving as the main energy source. Ketone bodies, β -hydroxybutyrate (BHB) in particular, have been traditionally considered an alternative source of energy supply and metabolism in humans provides a significant source of fuel for the brain in a carbohydrate-limited state. Brain cells are able to produce energy from glucose and ketones and are therefore considered metabolically flexible. . During periods of very low carbohydrate intake, BHB is the primary energy source for neurons

The ketogenic diet involves consuming a very low amount of carbohydrates and replacing them with fat to help your body burn fat for energy. Health benefits can include weight loss and lowering your risk for certain diseases. The ketogenic diet (or keto diet, for short) is a low carb, high fat diet that offers many health benefits. .Ketogenic diets may even have benefits against diabetes, cancer, epilepsy, and Alzheimer's disease⁴

DIFFERENT TYPES OF KETOGENIC DIETS

There are several versions of the ketogenic diet, including:

Standard ketogenic diet (SKD): This is a very low carbohydrate, moderate protein and high fat diet. It typically contains 70% fat, 20% protein, and only 10% carbohydrates .

Cyclical ketogenic diet (CKD): This diet involves periods of higher carb refeeds, such as 5 ketogenic days followed by 2 high carbohydrate days.

Targeted ketogenic diet (TKD): This diet allows you to add carbohydrates around workouts.

High protein ketogenic diet: This is similar to a standard ketogenic diet, but includes more protein. The ratio is often 60% fat, 35% protein, and 5% carbohydrates.⁵

PRINCIPLES OF KETOGENIC DIET FOR EPILEPSY

To induce ketosis, need to reduce carb intake and increase fat intake. To maintain normal body function and growth, an adequate intake of dietary protein is needed. The diet is ideally overseen and directed by a neurologist or a registered dietitian specializing in the ketogenic diet.

For people with refractory epilepsy, children especially, the diet may start in the hospital with a fasting period of 18 to 24 hours. (This is not necessary but may help induce ketosis quicker). The diet is then started by slowly increasing calories and the ratio of fat to carbohydrates and protein. By the end of day three, the person should be consuming the number of calories they normally consume per day.

Because the keto diet does not provide all of the vitamins and minerals needed for a balanced diet, vitamin and mineral supplements are typically prescribed, most especially calcium, vitamin D, B vitamins, and selenium.

A classic keto diet consists of 3 to 4 grams of fat for every 1 gram of carbohydrate and protein. That represents anywhere from 75% to 90% of calories from fat.⁶

DIET PLAN IN KETOGENIC DIET

The main fat sources for the ketogenic diet are butter, heavy whipping cream, mayonnaise, and polyunsaturated or monounsaturated oils (like canola or olive oils). Coconut oil or special medium-chain triglycerides (MCT) oil may also be used.

Building a keto diet plan almost invariably requires the input of a qualified healthcare provider who can guide you through the types and proportions of foods you need to meet the strict dietary goals.

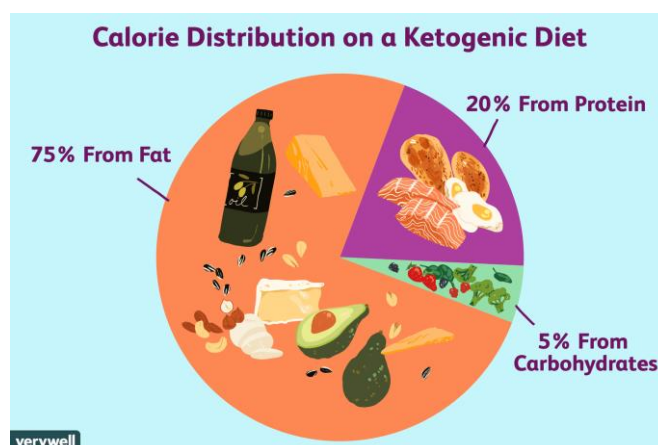
example of a daily ketogenic menu for epilepsy:

Breakfast: Eggs made with heavy cream, cheese, and butter; a small serving of strawberries, pineapple, or cantaloupe

Lunch: Hamburger patty topped with cheese; cooked broccoli, green beans, or carrots with melted butter; whipped heavy cream

Dinner: Grilled chicken breast with cheese and mayonnaise; cooked vegetables with butter; whipped heavy cream

Snacks: Whipped heavy cream, small servings of fruit, sugar-free gelatin.



EFFECT OF KETOGENIC DIET ON EPILEPSY

Keto diets work to control seizures by inducing a state of ketosis. This switches the body's metabolism from burning glucose for energy to using ketone bodies. It is thought these two fuel sources act differently on parts of the brain that trigger seizures.

Under normal circumstances, carbohydrates in food are converted into glucose, which fuels the brain and other parts of the body. If you don't consume enough carbohydrates, the body will convert fat into ketone bodies, which replace glucose as the brain's fuel source.

As ketone bodies increase in the bloodstream, a body is said to go into a state of ketosis. Ketosis appears to decrease the frequency of seizures in many—but not all—people with epilepsy

POSSIBLE SIDE EFFECTS OF KETOGENIC DIET

It is not uncommon to feel fatigued and weak after starting a ketogenic diet, but these tend to subside as your body adapts to the diet.

In children, the keto diet can impact a child's growth and development. It is often used for a year or two and then gradually traditional to a balanced diet if epilepsy is well managed.

At the same time, the long-term use of a ketogenic diet in children and adults can lead to potentially severe complications like:

- Chronic constipation
- Slowed growth
- High cholesterol
- Kidney stones
- Increased risk of bone fractures⁷

II. Conclusion

The ketogenic diet is an effective treatment for people with epilepsy. The high-fat, low-carbohydrate diet has been shown to reduce the frequency of seizures in children and adults. The diet switches the body's fuel from glucose to ketones. It puts the body into a state of ketosis, which appears to have seizure-preventive effects. These benefits sometimes last even after the diet has been stopped.

The classic ketogenic diet for epilepsy consists of 3 to 4 grams of fat for every 1 gram of carbohydrate and protein. It can be difficult to adhere to a strict keto diet, and many people are able to achieve similar benefits with a modified Atkins diet. It is important to work with your doctor and a nutritionist to ensure you are following the diet correctly. To avoid nutritional deficiencies, children and some adults on a ketogenic diet may need vitamin supplements

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