

The ketogenic diet's impact on health

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Abstract: The Ketogenic diet is a very low-carbohydrate diet designed to put your body into ketosis. The ketogenic diet is one of many low carb diets that have been historically used as a method to lose weight. However, low-carb diets may have multiple health benefits beyond weight loss. This paper will explain one type of low carb diet, the ketogenic diet, and discuss its use as a treatment for autism, diabetes, and epilepsy.

Keywords: Ketogenic, Keto, Low-Carb, Diet

1. Introduction

The ketogenic diet (or keto) is a very low-carb, high-fat diet. The dieter reduces carbohydrate intake and replaces it with fat. The ultimate goal is to achieve a metabolic state called ketosis. [8] The body normally produces small fuel molecules called ketones, which are made from fat, in modest amounts. On the keto diet, the body responds to the lack of glucose by producing extra ketones. The body then uses these ketones for energy rather than the typical glucose from carbohydrates. Once the body has changed its energy source from glucose to fat, the dieter has reached ketosis. This diet has recently gained popularity as a mechanism for weight loss thanks to social media and celebrity endorsements. Although there are no available statistics about the prevalence of people following this diet, Google searches for the term ketogenic are up eight times over five years [12]. The purpose of this review is to explore some of the alternative uses for the keto diet. Historically, the ketogenic diet has been used to treat diseases and is a proposed treatment for other medical conditions.

2. Methods

A comprehensive literature review was conducted by accessing PubMed using keywords "Ketogenic Diet." Two thousand eighty-four papers were identified, and I used eight of these for the information to write this research paper. The papers I ended up including in this article all have to do with either epilepsy, diabetes, autism or weight loss and were all written within the last ten years.

3. Background

In a standard healthy diet, an adult should consume sixteen hundred to twenty-four hundred (1600 – 2400) calories per day depending on age, sex and physical activity level. According to the Institute of Medicine, this standard diet should be made up of forty-five to sixty-five percent (45% - 65%) carbohydrates, twenty to thirty-five percent (20% - 35%) fat, and twelve to twenty percent (12% - 20%) protein. The American Heart Association recommends a diet that emphasizes fruits, vegetables, whole grains, low-fat dairy products, skinless poultry and fish, nuts and non-tropical vegetable oils. They further recommend that fats, sodium, red meats and sugar be limited.

In contrast, the keto diet suggests seventy-five percent (75%) fat, twenty percent (20%) protein, and only five percent (5%) carbohydrates. While both recommend non-processed, fresh foods, the keto diet strictly prohibits fruits and grains. Despite the keto diet's recent surge in popularity, it has been around for approximately 100 years as a treatment for health conditions and is not the new discovery the general

population believes. It has been a part of the treatment plan for such conditions as epilepsy, type 2 diabetes, and autism. There have been many studies researching the impact of the ketogenic diet on these conditions [12].

3.1. Epilepsy

The ketogenic diet has also been used as a treatment for epilepsy [3]. One study examined the effectiveness of the ketogenic diet in helping children with medically resistant epilepsy. This study reviewed the charts of 63 children who had been placed on a ketogenic diet as a non-pharmacological treatment for seizures. The study found that children on the ketogenic diet were able to improve seizure outcomes and seizure control. However, the outcomes were better for female patients and patients whose age of seizure onset was later. The authors were able to confirm the diet's effectiveness, but indicated that additional studies were needed to determine the predictors of successful response [3]. According to another study, there have been hundreds of previous studies that show results of children having at least a 50% reduction in seizures, and 1 in 10 children will become seizure free. This study examines many different diet therapies such as the ketogenic diet, as an alternative treatment for epilepsy. The study states that the use of and interest in the keto diet is continuing to grow worldwide and not only as a last resort type of treatment [6]. The keto has also been studied on adults. One study included 29 patients who were placed on the keto diet for two years. Only five patients completed the full term. However, fifty-two percent of the patients experienced a decrease in seizure frequency while on the diet, proving that the keto is an effective treatment for adults with epilepsy as well [11].

3.2. Type 2 Diabetes

In type 2 diabetes, the underlying cause is hyperinsulinemia and insulin resistance. By minimizing carbohydrate intake, the glycemic response is reduced, and the underlying insulin resistance improves. This can not only reduce the amount of medication needed to control type 2 diabetes, but in some cases eliminate it completely. One study examining the effect of the ketogenic diet on patients with type 2 diabetes showed a significant improvement of glycemia. This study was made up of twenty-eight patients who were put on a keto diet for sixteen weeks. Each week the patients were checked, and their medications adjusted. By the end of the sixteen-week period, twenty-one patients had completed the study with all but 4 having either reduced or eliminated their medications [2]. In contrast, research completed by Fred Brouns indicates the effectiveness of a low carbohydrate diet on type 2 diabetes is debatable. Brouns contests that although a low carb diet like the keto diet will improve insulin sensitivity and stabilize blood glucose, it is unclear whether or not these changes can be attributed to the type of diet specifically, or just from general weight loss. He also discusses some of the pitfalls of the keto diet such as unwanted side effects and the difficulty to adhere to the diet. He instead believes that the research supports a reduction of rapidly digestible carbohydrates such as sugar, syrup, potatoes and rice and that the long-term intake of high fat combined with low carbohydrate intake needs more research [4].

3.3. Autism

One potential benefit of the ketogenic diet is that it has been shown to help improve some of the behavioral aspects of autism disorder [1]. Studies conducted on mice have provided encouraging outcomes. These studies have shown that the keto diet can not only improve autism behaviors, but sometimes completely reverse them [9]. One study that examined the effects of the keto diet and autism used BTBR mice as subjects. During this study, there were no changes during phase one, but phase two and three showed positive results among the mice who were fed a ketogenic diet. During phase two of this study, the mice that were fed a ketogenic diet began to prefer spending time with other mice [1]. The mice that were examined ended up having increased levels of social interaction, decreased self-directed repetitive behavior, and increased communication [1]. In a very small study with human children the results were similar. In this study, thirty children were placed on a ketogenic diet for six months. Only eighteen children maintained the diet for the duration of the six-month

period. However, of those eighteen all showed some improvement in behavior. In addition, the children's gains did not disappear after being taken off the diet [9]. Since there is no cure for autism, this research is very exciting for the parents of autistic children. While it may not be the cure a parent hopes for; the diet poses a minimal health risk and is certainly a viable option for treatment without further research.

4. Summary and Practical Applications

There are countless studies on the ketogenic diet. While there are both proven and emerging benefits of the diet, one concern remains; the safety behind high fat, low carb diets when used for extended periods of time. The long-term effects of the ketogenic diet are still unknown and require more research to discover how the diet will affect participants as well as if the benefits outweigh any potential risks.

Keto has been a successful alternative treatment for nearly 100 years for children with epilepsy. Further research is needed to determine its efficacy in adults and what variables predict success in both adults and children. Patients on the keto diet lowered blood glucose levels and improved insulin sensitivity. However, it is unclear whether these improvements were due to the weight loss associated with the diet or if the high fat low carb diet had a direct effect on these improvements. The ketogenic diet has been shown to help improve some of the behavioral aspects of autism disorder. Studies on mice and humans indicate the diet could possibly improve social communication behaviors in subjects with autism disorders. This requires much more research, but the outcomes have been positive. [1].

The main conclusion of this research is that the benefits of the ketogenic diet look promising, but ultimately require more research. The side effects of the lifelong use of the diet as a treatment plan are unknown. In addition, the diet is very restrictive and difficult to adhere to making long term research that much more difficult.

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