



CHRONIC DISEASES AND KETOGENIC DIET – AN OVERVIEW

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Abstract:

The ketogenic diet is a high-fat, adequate-protein, low-carbohydrate diet. Normally, the carbohydrates contained in food are transformed into glucose, which is then transported around the body. The low carbohydrates intake forces the body to burn fats rather than carbohydrates. The ketogenic diet has been shown to generate beneficial metabolic changes in the short-term. Along with weight loss, health parameters associated with carrying excess weight have improved, such as insulin resistance, high blood pressure, and elevated cholesterol and triglycerides.

Keywords: chronic diseases, ketogenic diet

1. Introduction

Physicians of ancient Greece cured illnesses, including epilepsy, by modifying their patients' eating habits. The ketogenic diet is a conventional dietary treatment that was created to reproduce the success and remove the limitations of the non-mainstream use of fasting to treat epilepsy. During the 1920s and 1930s, when the only anticonvulsant medication was limited to sedative [bromides](#) (discovered 1857) and [phenobarbital](#) (discovered 1912), the ketogenic diet was widely applied and investigated.

The therapy has been abandoned following the new anticonvulsant drugs discovery. Phenytoin (PHT), sold under the brand name Dilantin and Valproate (VPA), sold as Convulex, Depakote, etc. contributed to make the dietary restriction approach of convulsive disorders to become obsolete. Following of the 1994 successful treatment with a ketogenic based diet of a two-year patient with epileptic seizures unresponsive to anticonvulsants drugs, the low carbohydrate diets gained wide interest.

The ketogenic diet was also under investigation for the treatment of a wide variety of disorders other than epilepsy:

- development of age-related cognitive decline and pathological neurodegeneration like Alzheimer's disease;
- Parkinson's disease;
- psychotic and autism spectrum disorders;
- metabolic syndrome;
- glycogen storage disease (GSD);
- diabetes;
- polycystic ovary syndrome (PCOS);
- some types of cancers;
- obesity;
- GLUT1 deficiency syndrome;
- traumatic brain injury (TBI);
- multiple sclerosis;
- nonalcoholic fatty liver disease;
- migraine headaches, etc.

2. How it Works

The ketogenic diet is a very low-carb, high-fat diet that shares many similarities with the Atkins and low-carb diets. A low-carb diet is a diet that restricts carbohydrates, such as those found in sugary foods, pasta and bread. It is high in protein, fat and healthy vegetables. (source: [healthline.com](https://www.healthline.com)).

For achieving good results, the source of calories should be like:

- 60 to 75 percent of your calories from fat;
- 15 to 30 percent of your calories from protein;
- 5 to 10 percent of your calories from carbs.

2.1 Foods to Avoid

- sugar: soft drinks, fruit juices, agave, candy, ice cream, products that contain added sugar;
- refined grains: wheat, rice, barley and rye, bread, cereal and pasta;
- trans fats: hydrogenated or partially hydrogenated oils;
- diet and low-fat products: many dairy products, cereals or crackers;
- highly processed foods;
- starchy vegetables.

2.2 Foods to Eat

- meat: beef, lamb, pork, chicken, etc.
- fish: salmon, trout, haddock and many others; wild-caught fish.
- eggs;
- vegetables: spinach, broccoli, cauliflower, carrots, etc.
- fruits: apples, oranges, pears, blueberries, strawberries.
- nuts and seeds: almonds, walnuts, sunflower seeds, etc.

- high-fat dairy: cheese, butter, heavy cream, yogurt.
- fats and oils: coconut oil, butter, lard, olive oil and fish oil. (source: [healthline.com](https://www.healthline.com))

Ketogenic diet is not recommended for individuals with pancreatic disease, liver conditions, thyroid problems, eating disorders or a history of eating disorders, gallbladder disease or those who have had their gallbladders removed.

3. Literature Review

Many health experts now suppose that a low-carb nutrition (higher in fat and protein) is a much better option to treat obesity and other chronic diseases.

F. Lefevre et al. (2010)'s study regarding ketogenic diet for the treatment of refractory epilepsy in children concluded that *"the evidence is sufficient to determine that the ketogenic diet is efficacious in reducing seizure frequency in children with refractory epilepsy"*.

The conclusion of the Keene, Daniel L. (2006) study on the use of the ketogenic diet in childhood epilepsy was *"there is evidence to support the cautious use of ketogenic diet in children with refractory epilepsy"*.

Elizabeth G. Neal et al. (2008) concluded their study regarding ketogenic diet for the treatment of childhood epilepsy with *"the results from this trial of the ketogenic diet support its use in children with treatment-intractable epilepsy"*. As side effects of the ketogenic diet: *"the most frequent side-effects reported at 3-month review were constipation, vomiting, lack of energy, and hunger"*.

Paoli, A. et al. (2020)'s study regarding the effects of a ketogenic diet in overweight women with polycystic ovary syndrome concluded that *"Our results suggest that a ketogenic diet may be considered as a valuable non-pharmacological treatment for polycystic ovary syndrome. Longer treatment periods should be tested to verify the effect of a KD on the dermatological aspects of polycystic ovary syndrome"*.

Hayden White et al. (2020) investigated the effects of inducing ketogenesis via an enteral formulation in patients with acute brain injury. The results of the study revealed that *"In patients with acute brain injury, an enterally administered ketogenic formulation increased plasma ketone concentrations, was well tolerated, did not impact on cerebral hemodynamics and can be safely administered"*

The conclusions of a study which investigated the role for ketogenic diets in epilepsy and status epilepticus in adults were *"ketogenic diets offer an increasingly needed adjunct to anti-epileptic drugs for management of chronic epilepsy and refractory status epilepticus in adults. Studies support feasibility, tolerability, and efficacy of the classic ketogenic diet and its variants in adults, although randomized control trials are needed. Potential complications and side effects of diet therapy are often preventable and manageable, nevertheless strategies are needed to improve adherence."* (J. Williams Mackenzie, C. Cervenka, 2017)

On a study investigating the efficacy of a modified ketogenic diet for patients with McArdle disease recommends *"the use of the ketogenic diet in a large-scale, placebo-controlled study in glycogen storage disease type V"*. (Løkken, N. et al., 2020)

A Brucci, A. et al. (2020) investigating the role of a Very Low-Calorie Ketogenic Diet on Weight Loss in Patients with Obesity and Mild Kidney Failure concluded that *"when*

conducted under the supervision of healthcare professionals, a VLCKD is an effective and safe treatment for weight loss in patients with obesity, including those affected by mild kidney failure."

Davis, J. J. et al. (2020) on a study regarding the role of ketogenic diet on treatment and prevention of dementia concluded that *"the ketogenic diet has shown promise in regard to delay or mitigation of symptoms of cognitive decline."*

A study on the effects of very low-calorie ketogenic diet on the orexinergic system, visceral adipose tissue, and ROS production (Valenzano, A. et al., 2019) observed *"an effect of the VLCKD upon the orexinergic system, supporting the usefulness of such a therapeutic intervention in promoting obesity reduction in the individual burden of this disease."*

Di Lorenzo, C. et al. (2019) on a study regarding the effect of very low-calorie diet in overweight migraine patients concluded that *"has a preventive effect in overweight episodic migraine patients that appears within 1 month, suggesting that ketogenesis may be a useful therapeutic strategy for migraines."*

From an endocrinologist perspective consider that *"ketogenic dietary strategies may play a role in short-term improvement of important metabolic parameters with potential for long-term benefit. However, response may vary due to inter-individual ability to maintain long-term carbohydrate restriction"* (Kuchkuntla, A. R., et al. 2019).

Castellana, M., et al. (2019) studied the efficacy and safety of the very low ketogenic diets in patients with overweight and obesity. The results suggested *"the use of VLCKD as an effective strategy for the management of overweight and obesity"*.

Włodarek, D. (2019). Investigated the role of ketogenic diets in neurodegenerative diseases (Alzheimer's and Parkinson's disease). The conclusion was that: *"The available results of research projects dealing with the use of the KD and ketone bodies in neurodegenerative diseases are fairly promising. At the same time, the majority of these studies were employed in vitro or by using animal models. The number of studies with human participation is rather small, and those that exist feature relatively short therapy duration periods. It is rather difficult to say how significant this therapeutic approach may be in the future, especially because the use of the diet alone is difficult and concerns elderly people with possible concomitant diseases which may impose certain constraints on the possibility of KD application. Further studies are necessary, especially for research of long-term KD effects on the symptoms and course of neurodegenerative diseases, as well as on the general well-being of affected patients."*

4. Possible Risks of the Keto Diet

Although the diet is generally safe, it can still initiate problems when used short-term or long-term. These include:

- the imbalance of sodium, potassium, and magnesium levels;
- dehydration;
- constipation, indigestion, nausea, vomiting, diarrhea, and dysbiosis;
- low blood sugar;
- high triglycerides;
- increased uric acid;
- kidney stones;

- hormone imbalances;
- growth disturbances;
- osteopenia.

5. Conclusions

The ketogenic diet can be an efficient therapeutic nutritional regime. It is currently being researched for its usefulness and efficiency in controlling, preventing and treating a variety of health ailments. But, applying the diet inaccurately can have severe health effects and may not be the best option for completing and preserving general health. It involves a significant dedication and regular laboratory examination. It takes a minimum of two weeks and often four or more to acclimatize to the severe decrease in carbohydrates. And, in order to preserve the advantages of the low-fat diet, the macronutrient ratio must persist for a long-term.

References

- Bruci, A.; Tuccinardi, D.; Tozzi, R.; Balena, A.; Santucci, S.; Frontani, R.; Mariani, S.; Basciani, S.; Spera, G.; Gnessi, L.; Lubrano, C.; Watanabe, M. Very Low-Calorie Ketogenic Diet: A Safe and Effective Tool for Weight Loss in Patients with Obesity and Mild Kidney Failure. *Nutrients* 2020, 12, 333.
- Castellana, M., Conte, E., Cignarelli, A. et al. Efficacy and safety of very low-calorie ketogenic diet (VLCKD) in patients with overweight and obesity: A systematic review and meta-analysis. *Rev Endocr Metab Disord* (2019). <https://doi.org/10.1007/s11154-019-09514-y>.
- Davis, J. J., Fournakis, N., & Ellison, J. (2020). Ketogenic Diet for the Treatment and Prevention of Dementia: A Review. *Journal of Geriatric Psychiatry and Neurology*. <https://doi.org/10.1177/0891988720901785>.
- Di Lorenzo, C.; Pinto, A.; Ienca, R.; Coppola, G.; Sirianni, G.; Di Lorenzo, G.; Parisi, V.; Serrao, M.; Spagnoli, A.; Vestri, A.; Schoenen, J.; Donini, L.M.; Pierelli, F. A Randomized Double-Blind, Cross-Over Trial of very Low-Calorie Diet in Overweight Migraine Patients: A Possible Role for Ketones? *Nutrients* 2019, 11, 1742.
- Diet Review: Ketogenic Diet for Weight Loss. (2019, May 22). Retrieved from <https://www.hsph.harvard.edu/nutritionsource/healthy-weight/diet-reviews/ketogenic-diet/>.
- Elizabeth G. Neal, Hannah Chaffe, Ruby H. Schwartz, Margaret S. Lawson, Nicole Edwards, Georgianna Fitzsimmons, Andrea Whitney, J. Helen Cross (2008). The ketogenic diet for the treatment of childhood epilepsy: a randomised controlled trial. *The Lancet Neurology*, Jun;7(6):500-6. doi: 10.1016/S1474-4422(08)70092-9.

- Frank Lefevre and Naomi Aronson (2000). Ketogenic Diet for the Treatment of Refractory Epilepsy in Children: A Systematic Review of Efficacy. *Pediatrics* April 2000, 105 (4) e46; DOI: <https://doi.org/10.1542/peds.105.4.e46>.
- Gordon, B. (n.d.). What is the Ketogenic Diet. Retrieved from <https://www.eatright.org/health/weight-loss/fad-diets/what-is-the-ketogenic-diet>
- Hayden White, Balasubramanian Venkatesh, Mark Jones, Peter S. Kruger, James Walsham & Hesly Fuentes (2020). Inducing ketogenesis via an enteral formulation in patients with acute brain injury: a phase II study, *Neurological Research*, DOI: 10.1080/01616412.2019.1709743.
- J. Williams Mackenzie, C. Cervenka (2017). The role for ketogenic diets in epilepsy and status epilepticus in adults. *Clinical Neurophysiology Practice*, Volume 2, 2017, Pages 154-160.
- Keene, Daniel L. (2006). A Systematic Review of the Use of the Ketogenic Diet in Childhood Epilepsy, *Pediatric Neurology*, Volume 35, Issue 1, 1 – 5.
- Ketogenic diet. (2020, March 12). Retrieved from https://en.wikipedia.org/wiki/Ketogenic_diet.
- Kuchkuntla, A.R., Shah, M., Velapati, S. et al. Ketogenic Diet: an Endocrinologist Perspective. *Curr Nutr Rep* 8, 402–410 (2019). <https://doi.org/10.1007/s13668-019-00297-x>.
- Løkken, N, Hansen, KK, Storgaard, JH, Ørngreen, MC, Quinlivan, R, Vissing, J. Titrating a modified ketogenic diet for patients with McArdle disease: A pilot study. *J Inherit Metab Dis*. 2020; 1– 9. <https://doi.org/10.1002/jimd.12223>.
- Paoli, A., Mancin, L., Giacona, M.C. et al. Effects of a ketogenic diet in overweight women with polycystic ovary syndrome. *J Transl Med* 18, 104 (2020). <https://doi.org/10.1186/s12967-020-02277-0>.
- Phenytoin. (2020, February 6). Retrieved from <https://en.wikipedia.org/wiki/Phenytoin>.
- The Ketogenic Diet: Pros and Cons According to NUNM. (2019, August 12). Retrieved from <https://nunm.edu/2019/02/ketogenic-diet/>.
- Valenzano, A.; Polito, R.; Trimigno, V.; Di Palma, A.; Moscatelli, F.; Corso, G.; Sessa, F.; Salerno, M.; Montana, A.; Di Nunno, N.; Astuto, M.; Daniele, A.; Carotenuto, M.; Messina, G.; Cibelli, G.; Monda, V. Effects of Very Low Calorie Ketogenic Diet on the Orexinergic System, Visceral Adipose Tissue, and ROS Production. *Antioxidants* 2019, 8, 643. <https://doi.org/10.3390/antiox8120643>.
- Valproate. (2020, March 4). Retrieved from <https://en.wikipedia.org/wiki/Valproate>.
- Włodarek, D. (2019). Role of Ketogenic Diets in Neurodegenerative Diseases (Alzheimer's Disease and Parkinson's Disease). *Nutrients* 2019, 11, 169.

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