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Indira Gandhi Government Post Graduate College,

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Ketogenic Diet: A View on Benefits and Risks

Dr. Mishu Singh

Assistant Professor-Chemistry

M. P. Govt. P. G College, Hardoi

Email id: mishusingh17@gmail.com

Abstract:

A keto- diet refers to a ketogenic diet, which is a high-fat; adequate-protein; low-carbohydrate content with the goal is to get more calories from protein and fat than from carbohydrates. It works by depleting the body of its store of sugar, so it will start to break down protein and fat for energy, causing ketosis. There has been a remarkable resurrection of attention in the ketogenic diet in the last few years. However, the ketogenic diet (KD) is not a very new treatment option. It was first reported in the year 1921 when Geyelin made the first scientific annotations about the association of fasting and seizures when he noticed that some of his patients were seizures free during fasting. Wilder suggested that that ketonemia has a sedative effect on the brain, mimicking anesthesia if the body is deprived of glucose and is forced to metabolize fats that produce ketones. The use of ketogenic diets in weight management has gained marvelous fame in the last couple of years, but at the same time, it has also created several controversies. Some researchers advocate that keto-diet has no metabolic advantages and the weight loss during the process results simply from reduced caloric intake, probably due to the increased satiety effect of protein on the brain. There are several other adverse effects of ketogenic diet also, which include muscle cramps, bad breath, changes in bowel habits, keto-flu and loss of energy. It is noticeable that the ketogenic diet is proving to be an effective treatment but it is not entirely benevolent and benign. It must be prescribed thoughtfully, implemented carefully, and monitored closely. It is also notable that we need to learn new information about the mechanisms of action, effectiveness, indications, and most importantly the side effects of the Ketogenic Diet.

Keywords: Keto-Diet, Ketosis, Protein, Carbohydrates, Intermittent Fasting.

INTRODUCTION:

It's all the frenzy and has hit the mainstream. The internet is overflowing with stories of how everyone from celebrities to ordinary people has shed off the most stubborn fat deposited with the help ketogenic diet. Some suggest that this eating prototype is very helpful in managing chronic diseases which are usually a product of unhealthy lifestyle such as hypertension, heart diseases, diabetes, Alzheimer's and curing many other [1]. So, is it a miracle diet or just the latest craze? Despite continuous advances, obesity is still a major worldwide health hazard with a mortality rate of about 2.8 million per year. Properly modified diet regimen for weight reduction can help administer the obesity outbreak to some level. One diet regimen that has proven to be very effective for rapid weight loss is a very-low-carbohydrate and high-fat ketogenic diet [2, 3]. Russell Wilder first used the ketogenic diet and also coined the term "ketogenic diet" to treat epilepsy in 1921. For almost a decade, the ketogenic diet was used as a therapeutic diet for the treatment of pediatric epilepsy until the introduction of antiepileptic drugs. The resurrection of the ketogenic diet as a speedy weight loss formula is a fairly new idea the has shown to be quite successful, at least in the small run.

Carbohydrates are the chief source of energy for living organism including humans. When restricted with carbohydrates, our body breaks down fat content deposited in muscles into ketones which become the source of energy for the body. These ketones now provide energy to the brain, muscles and other body organs to work. A ketogenic diet is a kind of fasting. When the body is on the starvation state it breaks down lean muscle mass for energy, but with full fast on keto diet the fat provides energy and lean muscle mass is maintained. The keto diet was initially designed not for weight loss, but the treatment of epilepsy. In the early 1920s, the doctors apprehended that the low carb forces the body to use fat for energy than usual glucose. Thus, converting the body fat into ketones, this was taken up by the body cells as fuel [4]. However, with the development of anti-seizure medications, now doctors

or researchers don't rely much on a ketogenic diet for the treatment of epilepsy. However, people who don't respond to medications can still benefit [5].

HOW THE KETO DIET WORKS; PHYSIOLOGY AND BIOCHEMISTRY:

The ketogenic diet is a high fat, moderate protein, low carbohydrate eating prototype, which differs from the normal healthful eating proposal. When on a keto diet, carbohydrates from all sources are strictly controlled and restricted. Intending to maintain carbohydrates below 50 grams a day, keto dieters often put away bread, grains, and cereals. Even the use of most healthy fruits and vegetables is also narrowed because they contain fructose, a form of carbohydrate. In a way, the keto diet makes big shifts in how people usually eat. Fundamentally, carbohydrates are the chief source of energy for the body cells. When the body is rundown with carbohydrates in blood, insulin secretion is drastically reduced and the body enters a catabolic state where the Glycogen stored in muscle depletes. Here, two metabolic processes Gluconeogenesis and Ketogenesis come into action [6].

Gluconeogenesis is the process of formation of Glucose in the liver from lactic acid, glycerol, and amino acids like alanine and glutamine. When the glucose level drops in the body due to its unavailability, ketogenesis starts to give energy in the form of ketones. These ketones replace glucose now and act as a primary source of energy. During ketogenesis due to less glucose level in the blood, insulin secretion becomes less and the stimulation of deposition of fat and glucose reduces sharply. Fatty acids present in body cells and tissues also metabolize to acetoacetate which converts to beta-hydroxybutyrate and acetone. These are the vital ketones that collect in the body when a ketogenic diet is sustained for a longer period. As long as the body is deprived of carbs, the body remains in keto state. This metabolic state is often referred to as "nutritional ketosis" as ketones produced in small concentrations don't alter the pH of the blood. It significantly differs from 'Ketoacidosis', a life-threatening state, where ketones are produced in enormously larger concentrations, altering the blood pH to acidic [7].

Production of ketones depends on various factors such as basal metabolic rate (BMR), body mass index (BMI), and body fat percentage. The ketones produced in the body are consumed for energy by various organs such as heart, muscle tissue, and kidneys. Ketones can cross the blood-brain barrier to supply energy to the brain as an alternative source. However, RBCs and the liver do not utilize ketones as they lack mitochondria and enzyme Diaphorase respectively. Ketones are called super fuel also as they produce more ATP (adenosine triphosphate) in contrast to glucose which in turn helps the body to maintain sufficient fuel even during a caloric deficit. These have the advantage of decreasing the damage caused by free radicals and enhance antioxidant capacity[8].

TYPES OF KETOGENIC DIET: Depending upon the food there are several types of adaptations for the ketogenic diet [9], which include:

1. The standard ketogenic diet (SKD) is high-fat (75%), moderate- protein (20%) and very low-carbohydrates (5%).
2. The cyclical ketogenic diet (CKD) that provides stages of higher-carbohydrate food. For example; continuous days of ketogenic (less than 50 grams of carbohydrates per day) followed by 2 days of high carbohydrate diet. On day seven, they will have a carbohydrate day with approximately 150 grams of it.
3. Targeted ketogenic diet (TKD) diet allows the addition of more carbohydrates around workouts.
4. The high-protein ketogenic diet, similar to a standard ketogenic diet it includes more protein than it having 60% fat 35% protein and 5% carbohydrates. However, Cyclical or targeted ketogenic diets being more advanced methods are used by bodybuilders or athletes only.
5. Dirty keto diet that follows the same ratio of fats, proteins, and carbohydrates as the regular SKD but with a twirl. Where it doesn't bother about the macronutrients come from.

HEALTH BENEFITS OF KETO: Ketogenic diets can cause enormous reductions in blood sugar levels, shifts the body's metabolism from carbs and to ketones. This along with the increased ketones has numerous health benefits[10]. Some of those are listed below:

1. **Help Lose Weight:** It is an effective way to lose weight and lower risk factors for diseases such as hypertension and other heart-related problems. It is reported that the ketogenic diet loses 2.2 times more weight than any other low-fat diet.
2. **Diabetes:** Diabetes is exemplified by changes in metabolism, high blood sugar level and weakens insulin functions. A ketogenic diet helps in improving insulin sensitivity and cause fat loss, leading to considerable health reimbursement for people with type- 2 diabetes.

3. **Epilepsy:** *The ketogenic diet originated as a tool for treating neurological diseases such as epilepsy.*
 4. **Heart disease:** *It improves risk factors like HDL cholesterol levels and blood pressure.*
 4. **Cancer:** *The diet is presently being used to cure several types of cancer.*
 5. **Alzheimer's disease:** *The keto diet may reduce symptoms of Alzheimer's disease and slows down its progression.*
 6. **Parkinson's disease:** *It is found that the diet helps in Parkinson's disease also.*
 7. **Polycystic ovary syndrome:** *By reducing the insulin levels keto diet can play a key role in polycystic ovarian syndrome.*
 8. **Brain injuries:** *It is found that the ketogenic diet can reduce concussions and fasten the recovery of brain cells.*
- In a way, it can be concluded a ketogenic diet offers many health benefits, particularly with metabolic, neurological or insulin-related issues.*

THE BOTTOM LINE: IS THE KETO DIET SAFE?

This eating pattern of the ketogenic diet is not recommended for individuals suffering from pancreatic disease, hypo, and hyperthyroidism, liver and gall bladder problems or with a history of eating disorders. This also involves short-term and long-term health threats for those who are associated with the keto diet. Short term health risks include keto flu, upset stomach, headache, fatigue, and dizziness. Some report trouble sleeping, cramps in muscle, dehydration, and diarrhea also. Restricting the high-fiber vegetables, fruits, and whole grains increases the risk for constipation which most of the keto dieters often suffer from. The long term health risks include kidney stones, deficiency diseases of vitamins A, C, K & folic acid and minerals. As to limit carb intake, most of the nutrient-rich vegetables and fruits are removed from the ketogenic diet [11]. The nature of high fat intake in the keto diet is very controversial and divisive to high grade. Researchers have reported that the presence of saturated fat in the diet increases the risk of cardiac diseases and other chronic health issues.

KETO SIDE EFFECTS:

The ketogenic diet is pretty off-putting. Researches have reported that this eating pattern for epilepsy makes it very complex. Using this keto diet as a means for weight loss and other health reimbursements, the adjudicators are still out. Usually, a ketogenic diet is safe and sound for many people but there are a few side effects to watch out for [12].

1. **Dehydration and Muscle Cramps:** Carbs require water for storage. Fat does not. On a keto diet body stores less water and the kidney starts expelling sodium. With dehydration and low electrolytes, your muscles can start cramping [13].
2. **Decreased Metabolic Flexibility:** Lot many people struggle for metabolic flexibility when on strict keto regime.
3. **Insomnia:** There isn't research on keto and sleep problems but these issues are common on strict keto and are a big part of the reason why the Bulletproof Diet includes some quality carbs[14].
4. **Constipation:** Fiber intake that's lower than the recommended amount can contribute to constipation and irritable bowel syndrome (IBS).[15]
5. **Diarrhea:** On the opposite end of the scale, some experience diarrhea on ketosis, especially if they aren't used to higher-fat intake [16]
6. **Keto Rash:** Few people suffer from itchiness, red rash on the back, chest, and other body parts also known as Prurigo pigmentosa. This condition is not life-threatening or dangerous but to some extent related to change in the hormonal level in the body that triggers allergens due to ketosis [17]
7. **Keto Flu:** The keto flu is a normal reaction body undergoes as it switches from burning glucose to fat. It affects some people more. Symptoms of keto flu include sugar cravings, brain fog, headache, insomnia, irritability, muscle

soreness, and poor concentration. This condition arises due to water and sodium flush causing dizziness, nausea, muscle cramping, headaches, and gastrointestinal issues. Along with this, T3 and T4 thyroid hormone levels decrease disturbing the metabolism, heart rate, and body temperature. Change in Cortisol level increases irritability and insomnia [18].

Long-term implementation is low and can be a serious issue with a ketogenic diet. Even though the ketogenic diet is considerably better in the stimulation of weight loss with obese people and the induced weight loss is rapid, intense, and sustainable, there is dire need to understand the clinical impacts, safety, tolerability, and duration as the diet is challenging and requires to understand the disease-specific mechanisms. It may be followed for a minimum of 2 to 3 weeks up to maximum 6 to 12 months. Close supervision and observation of renal functions while on a ketogenic diet is a very crucial imperative, and the transition from a normal carb diet to keto and vice-versa should be gradual and well-controlled.

HOW TO MINIMIZE THE SIDE EFFECTS:



Although the ketogenic diet is not harmful to healthy people, there may be some initial side effects while your body adapts the ketones in the initial days of ketosis. Side effects of the keto diet can be minimized by taking mineral supplements and easing out the diet. The addition of vegetables and minerals, extra salt and excess of water intake can help in reducing the toxic effect of ketones in the body [19].

CONCLUSION; PROCEED WITH CARE WITH THE KETO DIET:

Sadly, keto food and the diet regime are more prone to end with weight regain as one can not be on a keto diet for long for health reasons. Having fat as the chief food there is always a concern about the increase of cholesterol in the blood. Ketogenic dieters tend to lose more calcium in the urine which can lead to a decrease in bone density over time and increase the risk of osteoporosis. Another concerning issue is that while following a ketogenic diet, there are chances of mineral and vitamin deficiency as one is not getting fruits and vegetables as a heart-healthy diet pattern would have. The American Health Association recommends having fruits, vegetables, grains, low-fat dairy products, fish, nuts and legumes, sweets for a heart-healthy diet [20]

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