

Ketogenic Diet and Metabolic Syndrome

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Metabolic syndrome is a cluster of conditions that occur together, including high blood pressure, high blood sugar, excess body fat, and abnormal cholesterol levels. It is a serious health condition that can increase the risk of heart disease, stroke, and diabetes. While lifestyle changes such as exercise and diet are the primary treatments for metabolic syndrome, the ketogenic diet has been used as a therapy, investigating its efficacy in managing the various components of metabolic syndrome.

Relevant research studies:

1. Effect of a Free-Living Ketogenic Diet on Feasibility, Satiety, Body Composition, and Metabolic Health in Women: The Grading Level of Optimal Carbohydrate for Women (GLOW) Study

A study published in the Journal of the American College of Nutrition found that the ketogenic diet after 21 days improved body composition, reduced blood pressure, and improved lipid profiles in obese adults with metabolic syndrome.

Briefly, in this study, the researchers aimed to investigate the effects of a free-living ketogenic diet on various aspects of health and well-being in women. They conducted a 21-day dietary intervention involving 22 women and collected data on several parameters before and after the intervention. At the end of the 21-day period here are some of the results reported:

- The Caloric intake was maintained throughout the study (1938 kcal before vs. 1836 kcal after), but there were significant changes in macronutrient composition:

- Carbohydrate intake decreased from 36% before to 13% after.
- Protein intake increased from 17% before to 20% after.
- Fat intake increased from 45% before to 65% after.
- Daily self-reports showed no significant changes in satiety or food cravings during the study.
- Body weight decreased from 73.9 kg before to 72.3 kg after, and body fat also decreased.
- No significant differences were observed in total cholesterol (TC), high-density lipoprotein (HDL), and triglycerides (TG). However, the TC/HDL ratio decreased, and low-density lipoprotein (LDL) increased after the intervention.

The study concluded that women were able to maintain calorie intake while improving various aspects of their health and metabolic markers after following a free-living ketogenic diet for 21 days. These improvements included better body composition, blood pressure, blood glucose levels, and increased ketone production. However, not all cholesterol markers showed improvement in this short-term study.

2. Ketogenic Diets and Cardio-Metabolic Diseases

This current review article aims to explore the existing evidence regarding the use of the ketogenic diet (KD) in treating cardio-metabolic diseases (CMD) and its potential clinical implications.

Overall, the review suggests that a KD can

have a significant impact on the treatment of various CMDs, particularly in terms of their effects on outcomes. KD therapy shows promise in addressing obesity, heart failure, and hypertension. However, there are differing opinions within the scientific community.

In the case of diabetes and dyslipidemia (abnormal lipid levels), the effectiveness of KD remains a subject of debate. When it comes to cardiovascular complications associated with metabolic diseases, the current evidence indicates that KD may offer protection against cardiovascular diseases related to obesity, but its effects on those related to diabetes and other metabolic disorders are still uncertain.

Several factors contribute to these controversies, including genetic variations among individuals, the duration of KD therapy, the composition, quality, and sources of ketogenic diets. To address these uncertainties, it is essential to conduct more rigorous research that focuses on ensuring the clinical safety of KDs, determining appropriate treatment durations, and devising well-structured KD plans.

In summary, while there is promising evidence supporting the use of ketogenic diets in managing certain cardio-metabolic diseases, further research is needed to better understand their effectiveness, safety, and optimal application in clinical practice.

3. **A ketogenic diet combined with exercise alters mitochondrial function in human skeletal muscle while improving metabolic health.**

This study investigated the effects of a ketogenic diet (KD) combined with exercise on mitochondrial function in human skeletal

muscle and its impact on metabolic health. The research was conducted on 29 physically active adults who participated in a 12-week supervised exercise program. Participants were divided into two groups: one following a ketogenic diet (KD group, n=15) and the other maintaining their usual mixed diet (MD group, n=14). Various measurements and muscle biopsies were taken before and after the intervention.

Key findings of the study:

- I. **Metabolic Health Improvement:** The KD group experienced improvements in metabolic health, including increased whole-body resting fat oxidation and reduced fasting insulin, insulin resistance (HOMA-IR), and visceral fat.
- II. **Mitochondrial Function Changes:** Mitochondria, the energy-producing structures in cells, were isolated from muscle tissue and studied using different substrates (carbohydrate, fat, and ketone). The KD led to changes in mitochondrial function, including:
 - Increased mitochondrial respiratory control ratio (indicating improved efficiency) by 19%.
 - Increased ATP production (energy production) by 36%.
 - Increased ATP/H₂O₂ (indicating reduced oxidative stress) by 36% with fat-based substrate.
- III. **Minimal Oxidation with Ketone-Based Substrate:** ATP production with ketone-based substrate was much lower compared to other substrates, suggesting that ketones were not extensively oxidized for energy.
- IV. **Changes in Muscle Glycogen and Triglyceride:** The KD group showed a small decrease in muscle glycogen levels (indicating reduced carbohydrate storage) by 14% and an increase in

muscle triglyceride levels (indicating increased fat storage) by 81%.

In summary, the study found that a ketogenic diet combined with exercise led to improved metabolic health and alterations in skeletal muscle mitochondrial function and efficiency. These changes could have therapeutic implications, especially in conditions associated with insulin resistance. However, it's important to note that further research is needed to fully understand the long-term effects and clinical applications of ketogenic diets in various health conditions.

Following a ketogenic diet can provide many benefits and it is important to check with your healthcare practitioner prior to initiating any new health care regime or practice.

Practitioners trained by the Metabolic Terrain Institute of Health take a scientific approach to working with patients who wish to implement the ketogenic diet as a treatment option. It is essential to consult with a MATC Certified™ Practitioner to properly test, assess and address each patient before and during implementing a ketogenic diet intervention, or at the very least consult with a practitioner or health care provider familiar with your specific state of metabolic health.

References

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