



# KETOGENIC AND LOW CARBOHYDRATE DIET TRENDS AND SCIENCE: HYPE OR HOPE?

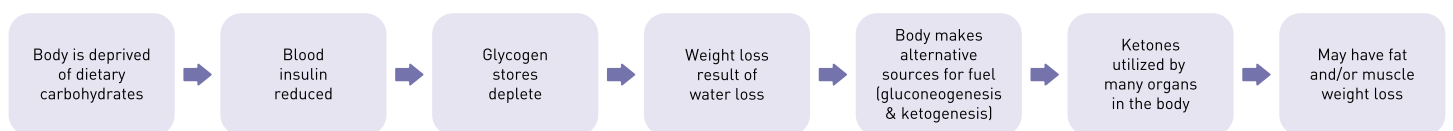
There is recent growing interest in the ketogenic (keto) diet by consumers<sup>1-3</sup>. The very low carbohydrate ketogenic diet (VLCKD) involves reducing carbohydrate intake significantly, to less than 20-50 g a day, and increasing the percentage of calories from fat (Table 1). This reduction in carbohydrates puts the body into a metabolic state called ketosis (Figure 1) which differs from diabetic ketoacidosis that has higher serum levels of ketone bodies, glucose, and an absence of insulin<sup>4</sup>. When ketosis occurs, the body utilizes alternate sources for energy, turning fat into ketone bodies in the liver, which can supply energy for the heart, muscle, kidneys, and brain<sup>5</sup>.

**Table 1. Comparison of low carbohydrate diets to recommended standard dietary patterns**

Macronutrient*	Dietary Pattern			
	Keto (VLCKD)	Atkins	Dietary Guidelines for Americans <sup>6</sup>	WHO and FAO <sup>7,8</sup>
<b>Carbohydrate</b>	5%	Depends on the phase: 10% or more	45 - 65%	50%**
<b>Protein</b>	20%	25%	10 - 35%	20%
<b>Fat</b>	75%	65%	20 - 35%	Less than 30%

\*Represents the percentage of calories suggested from each macronutrient

\*\*The WHO recommends detail should be given in regards to the type of carbohydrate. Of this 50% free sugars should make up less than 10% or reduce to less than 5% for additional health benefits.



**Figure 1. The Process of a VLCKD causing Ketosis<sup>5</sup>**

## Scientific Evidence for the Ketogenic Diet

Historically, the ketogenic diet has been utilized for epilepsy management<sup>9</sup>. A meta-analysis of thirteen studies lasting longer than a year showed the VLCKD was associated with 0.91 kg more weight loss over a high-carbohydrate, low-fat diet<sup>10</sup>. In contrast, a recent meta-analysis of thirty two studies<sup>11</sup> concluded that fat loss and energy expenditure were larger with low-fat diets compared with ketogenic diets<sup>12</sup>. More research is needed to quantify the impact of the keto diet on body weight. The most impactful way to lose weight is negative energy balance<sup>13</sup>. For those with type 2 diabetes,

reducing carbohydrate intake is important. The optimum levels of carbohydrate reduction in this population, including recommendations to achieve level of VLCKD, needs further research and supervision by a healthcare provider. The main markers to look out for are improvement in HbA1C scores (a marker of long term glucose control), glycaemic control and diet adherence<sup>10,14-19</sup>. In summary, the VLCKD and other low-carbohydrate diets can be useful to individuals, but should be discussed with a health care provider to consider other disease risk factors, such as serum lipid levels and to determine ideal dietary plan for individual circumstances<sup>20,21</sup>.

## Side effects of very low carbohydrate diets

- Various adverse effects are reported by those on a VLCKD such as constipation, halitosis (bad breath), headaches, muscle cramps, and weakness<sup>13</sup>.
- Research shows that eliminating food groups unnecessarily from the diet can lead to nutrient deficiencies (fibre and folate), and create a negative relationship with food, which in extreme cases can lead to eating disorders. It's important to remember that balance, variety and portion control are key.

**Currently, there is a lack of certification process by regulatory authorities for 'keto' products. Global dietary guidelines have no provision for recommending a keto diet for the general population.**

**Low carbohydrate diets may work in the short term. It is important to note that the "best" diet for weight reduction is a diet which results in negative calorie balance, can be sustained long-term, and contains all of the essential nutrients and food groups recommended<sup>13</sup>.**

## Ingredients for calorie reduction

To curb the worldwide obesity and diabetes epidemics calories need to be decreased in the food supply. A variety of soluble fibres and non- and low-calorie sweeteners can be utilized to reformulate commonly consumed foods and beverages to decrease calories and sugar while still enabling these products to be delicious and enjoyable. PROMITOR® Soluble Fibre has a low glycaemic response, is a well-tolerated, prebiotic which provides 2 calories per gram according to the FDA. Ingredients from the PROMITOR® Soluble Fibre family can also be used to reduce constipation, which is commonly associated with adherence to keto diets. Choosing sweeteners such as stevia, PUREFRUIT™ Select monk fruit, or DOLCIA PRIMA® Allulose can also be helpful in moderating fully caloric carbohydrate intake, which is important for blood glucose management and would align with a keto or low-carbohydrate diet plan.

**Contact the Global Nutrition team to learn more about quality of carbohydrates and reach out to your sales representative or technical application scientist to learn more about how Tate & Lyle ingredients can be utilized to reduce carbohydrates or calories in your product formulation.**

1. IFIC Foundation. Food and Health Survey 2019. 2. New Nutrition Business. 10 Key Trends in Food, Nutrition & Health 2020. 3. Walji A. A year of innovation in meal replacement drinks, 2020. Mintel 2020. 4. Paoli A. Ketogenic diet for obesity: friend or foe? Int J Environ Res Public Health. Feb 19 2014;11(2):2092-2107. 5. Masood W, Uppaluri KR. Ketogenic Diet. StatPearls. Treasure Island (FL): Available from: <https://www.ncbi.nlm.nih.gov/books/NBK499830/>; 2020. 6. DGAC. Table A7-1. Daily Nutritional Goals for Age-Sex Groups Based on Dietary Reference Intakes and Dietary Guidelines Recommendations 2015-2020. 7. Mann J, et al. FAO/WHO scientific update on carbohydrates in human nutrition: conclusions. Eur J Clin Nutr. Dec 2007;61 Suppl 1:S132-137. 8. World Health Organization. Healthy diet. Fact sheet No. 3942018. 9. Martin K, et al. diet and other dietary treatments for epilepsy. Cochrane Database Syst Rev. Feb 9 2016;2:CD001903. 10. Bueno NB, et al. Very-low-carbohydrate ketogenic diet v. low-fat diet for long-term weight loss: a meta-analysis of randomised controlled trials. Br J Nutr. Oct 2013;110(7):1178-1187. 11. Joshi S, Ostfeld RJ, McMacken M. The Ketogenic Diet for Obesity and Diabetes-Enthusiasm Outpaces Evidence. JAMA Intern Med. Jul 15 2019. 12. Hall KD, Guo J. Obesity Energetics: Body Weight Regulation and the Effects of Diet Composition. Gastroenterology. May 2017;152(7):1718-1727 e1713. 13. Freire R. Scientific evidence of diets for weight loss: Different macronutrient composition, intermittent fasting, and popular diets. Nutrition. Jan 2020;69:110549. 14. Schwingshackl L, et al. A network meta-analysis on the comparative efficacy of different dietary approaches on glycaemic control in patients with type 2 diabetes mellitus. Eur J Epidemiol. Feb 2018;33(2):157-170. 15. Sainsbury E, et al. Effect of dietary carbohydrate restriction on glycemic control in adults with diabetes: A systematic review and meta-analysis. Diabetes Res Clin Pract. May 2018;139:239-252. 16. Snorgaard O, et al. Systematic review and meta-analysis of dietary carbohydrate restriction in patients with type 2 diabetes. BMJ Open Diabetes Res Care. 2017;5(1):e000354. 17. Bolla AM, et al. Low-Carb and Ketogenic Diets in Type 1 and Type 2 Diabetes. Nutrients. Apr 26 2019;11(5). 18. Brouns F. Overweight and diabetes prevention: is a low-carbohydrate-high-fat diet recommendable? Eur J Nutr. Jun 2018;57(4):1301-1312. 19. Meng Y, et al. Efficacy of low carbohydrate diet for type 2 diabetes mellitus management: A systematic review and meta-analysis of randomized controlled trials. Diabetes Res Clin Pract. Sep 2017;131:124-131. 20. Kosinski C, Jornayvaz FR. Effects of Ketogenic Diets on Cardiovascular Risk Factors: Evidence from Animal and Human Studies. Nutrients. May 19 2017;9(5). 21. Mansoor N, et al. Effects of low-carbohydrate diets v. low-fat diets on body weight and cardiovascular risk factors: a meta-analysis of randomised controlled trials. Br J Nutr. Feb 14 2016;115(3):466-479.

**Disclaimer:** The contents of this document are strictly for general informational and education purposes. This is not intended to be an endorsement or in any way a promotion of the Ketogenic Diet, nor is it intended to be a substitute for professional medical advice, diagnosis, or treatment. Always seek the advice of your physician or other qualified health provider with any questions you may have regarding a medical condition.