Low-Carbohydrate Eating Patterns for Health – Friend or Foe?

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Senior Scientist, Global Nutrition
Tate & Lyle

Funded by:

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A Few Reminders

CPE Credit

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• To claim credit, please take the post webinar evaluation to be emailed after the webinar.

This webinar is being recorded. Please mute your phone and/or computer microphone.
Questions & Answers

- Please use the “questions” box on your “Go To Meetings” screen to submit questions to our presenters.

- Please submit your questions at any time during today’s webinar.
Learning Objective

At the end of this program, attendees will be able to:

• Summarize consumer views on low-carbohydrate eating patterns and how the market responds to such trends.

• Discuss the latest scientific evidence on how these eating patterns impact health, particularly weight loss and glycemic management.

• Describe practical considerations of low-carb eating patterns including potential benefits and limitations.
Consumer Trends: Low-Carbohydrate Eating Patterns

Beth Nieman Hacker, MBA
## Disclosures

<table>
<thead>
<tr>
<th>AFFILIATION/FINANCIAL INTERESTS (prior 12 months)</th>
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<td>Tate &amp; Lyle Ingredients Americas</td>
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</table>
Consumers plan to limit sugar and carbs in next year

% Plan to Consumer “Much Less” or “Somewhat Less”

<table>
<thead>
<tr>
<th>Country</th>
<th>Sugar %</th>
<th>Carbohydrates %</th>
</tr>
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<tbody>
<tr>
<td>Philippines</td>
<td>72%</td>
<td>49%</td>
</tr>
<tr>
<td>Mexico</td>
<td>71%</td>
<td>46%</td>
</tr>
<tr>
<td>France</td>
<td>60%</td>
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<tr>
<td>UK</td>
<td>57%</td>
<td>38%</td>
</tr>
<tr>
<td>US</td>
<td>55%</td>
<td>29%</td>
</tr>
<tr>
<td>Germany</td>
<td>52%</td>
<td>28%</td>
</tr>
<tr>
<td>Philippines</td>
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<tr>
<td>UK</td>
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</table>

Source: Tate & Lyle Global Ingredient Tracker January 2020

Q. How much, if any, do you plan to change your consumption of the following items over the next 12 months? Would you say you plan to consume each...
US consumers believe sugars and carbs cause weight gain

Source: International Food Information Council (IFIC), 2019 Food & Health Survey
In 2020, US consumers will be trying various low-carb regimens

Eating or drinking changes started at the beginning of this year (January 2020)

- 23% Avoiding or limiting sugar
- 15% Low-carb diet
- 7% Ketogenic diet

Source: International Food Information Council (IFIC), A Consumer Survey on New Year’s Diet Resolution, February 2020
Q. What eating or drinking change or changes did you start at the beginning of this year. Please select up to two.; *IFIC 2019 Food & Health Survey
The primary reason for changing habits is to improve health

- Improve health: 41%
- Change appearance/lose weight: 35%
- Other: 24%

Source: International Food Information Council (IFIC), A Consumer Survey on New Year’s Diet Resolution, February 2020
Q. Which of the following best describes why you started this change in your eating or drinking habits?
Food and beverage companies are providing solutions to complement consumers’ health needs

Future of health & wellness product claims
Global retail value growth, forecasted CAGR 2020-2024

- +8.7% Energy Boosting
- +7.5% Immune System
- +7.3% Beauty From Within
- +6.1% General Wellbeing
- +5.3% Digestive Health
- +4.2% Weight Management

Source: Euromonitor Global Health & Wellness Positioning
Manufacturers are responding with low-carb products and related product claims

Global growth of product launches with a reduced sugar/carb claim
5YAGR 2015-2019

North America +8%
Europe +12%
Asia Pacific +11%
Middle East Africa +12%
Latin America +5%

Global growth of product launches reduced sugar/carb claims
5YAGR 2015-2019

+33%
Meal Replacement and Other Drinks

+15%
Fruit Snacks

+14%
Snack/Cereal/Energy Bars

+9%
Carbonated Soft Drinks

Source: Mintel GNPD 2015-2019; Claims matches one or more of [Diabetic; Low/Reduced Sugar; Low/No/Reduced Carb; Sugar Free; No Added Sugar; Low/No/Reduced Calorie; Low/No/Reduced Glycemic]
Products with sugar-free claims have reduced total carb grams the most

Source: Mintel GNPD 2015-2019; Claims matches one or more of [Diabetic; Low/Reduced Sugar; Low/No/Reduced Carb; Sugar Free; No Added Sugar; Low/No/Reduced Calorie; Low/No/Reduced Glycemic]; Avg Carbohydrates (g per 100g/ml) total in 2019
What are net carbs and how do we calculate them?

**Net carbs** are the amount of **carbohydrates** a food contains after subtracting the fiber, sugar alcohols* and allulose (recent FDA ruling). Because these **ingredients** are **carbohydrates** that the body can't digest, it does not affect blood sugar levels.

### Calculate Net Carbs

Total Carbohydrate (grams)
- Sugar Alcohol (½ grams)
- Fiber (grams)
- Allulose (grams)
= Net Carbs (grams)

Source: [https://tl.tateandlyle.com/allulose/calculator](https://tl.tateandlyle.com/allulose/calculator)

*Subtract ½ of the sugar alcohols. For erythritol, the full amount can be subtracted
[https://www.medicalnewstoday.com/articles/326457#how-to-calculate](https://www.medicalnewstoday.com/articles/326457#how-to-calculate)
Net carbs is most important among Keto dieters and People with Diabetes

Net Carbohydrates Influence on Purchase

- **Gen Pop (A) (n=981)**
  - Does not influence my purchase decision: 19% BC
  - Greatly influences my purchase decision (those rating 10 on a 10-point scale): 12%

- **Keto Dieters (B) (n=636)**
  - Does not influence my purchase decision: 2%
  - Greatly influences my purchase decision (those rating 10 on a 10-point scale): 28% A

- **Type 2 Diabetes (C) (n=317)**
  - Does not influence my purchase decision: 11%
  - Greatly influences my purchase decision (those rating 10 on a 10-point scale): 24% A

Source: Tate & Lyle Proprietary Carb Label Research, December 2019

Q: In your selection of food and beverage products, to what extent do net carbohydrates influence your purchasing decisions?

Stat testing – A/B/C Gen Pop (A), Keto Dieters (B), PWD (C) – significant difference at the 95% confidence level
In-market examples of net carb communication

Source: Mintel GNPD
The label with net carb calculation is easiest to understand

Q: Which of these labels make it easiest to understand what net carbs are?

Stat testing – A/B/C/D – significant difference at the 95% confidence level

Source: Tate & Lyle Proprietary Carb Label Research, December 2019

Net Carb Label Easiest to Understand

- **A**: 41% BCD
- **B**: 37% BCD
- **C**: 43% BCD
- **D**: 37% BCD

**PWD (n=316)**

**Keto Dieters (n=635)**

**Gen Pop (n=979)**
The Scientific Evidence Behind Low-Carbohydrate Eating Patterns

William S. Yancy, Jr, MD, MHS, FTOS
Director, Duke Diet and Fitness Center
Associate Professor of Medicine
Duke University
## Disclosures

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Nutritional Therapy for Obesity

Energy consumption intended to cause negative calorie balance and loss of fat mass

- **Low-calorie diets:** 1,200-1,800 kcal/day
  - Restricted fat diet
    - Low-fat diet: <30% fat calories
    - Very low-fat diet: <10% fat calories
  - Restricted carbohydrate diet
    - Low-glycemic diet:
      - Low-carbohydrate diet: 50-150 grams/day
      - Very low carbohydrate diet: <50 grams/day (with or without nutritional ketosis)

- **Very low-calorie diets:** Less than 800 kcal/day
  - Physician supervision recommended
  - Recommended for shorter durations
  - Full meal-replacement programs

Nutrition Therapy for Adults With Diabetes or Prediabetes: A Consensus Report

https://doi.org/10.2337/dc19-0014

This Consensus Report is intended to provide clinical professionals with evidence-based guidance about individualizing nutrition therapy for adults with diabetes or prediabetes. Strong evidence supports the efficacy and cost-effectiveness of nutrition therapy as a component of quality diabetes care, including its integration into the medical management of diabetes; therefore, it is important that all members of the health care team know and champion the benefits of nutrition therapy and key nutrition messages. Nutrition counseling that works toward improving or maintaining
Low-carbohydrate Defined

• Low-carbohydrate
  – 26-45% kcal from carbohydrate
  – Limits starchy and sugary foods
• Very low-carbohydrate
  – <26% kcal from carbohydrate
  – Often goal of 20-50 g of non-fiber carb
  – High fat – typically 65-80% total kcal
Low Carbohydrate Ketogenic Diet (LCKD)

- Initially, < 20 g of carbohydrates per day
  - Unrestricted amounts of meat and eggs
  - Four oz. hard cheese
  - Two cups salad vegetables
  - One cup low-carbohydrate vegetables
- Calories **not restricted**
- Carbohydrate intake slowly increased as weight goal approached
- Daily multivitamin, copious liquids, broth
Dietary carbohydrate (sugar or starch) raises serum glucose and insulin

A carbohydrate restricted (high fat) diet reduces the diet contribution to serum glucose, which then lowers insulin levels

Insulin is a potent stimulator of lipogenesis (fat storage) and a potent inhibitor of lipolysis (fat burning)

Lowering insulin levels leads to burning of stored body fat, raising serum ketones and lowering body weight
The Role of Ketones

• Ketone bodies: molecules that deliver energy
• Ketones can be used by all cells except erythrocytes, cornea, lens, retina
• Ketone levels increase when dieting
  – Fed state: $0.1 \text{ mmol/L}$
  – Overnight fast: $0.3 \text{ mmol/L}$
  – Low-carb diet—induction: $1–3 \text{ mmol/L}$
  – > 20 days fasting: $10 \text{ mmol/L}$
  – Diabetic ketoacidosis: $25 \text{ mmol/L}$

• Serum pH did not decrease below 7.37 in a study performing arterial blood gas analyses

RCTs ≥12 months: Low Carb vs Low Fat

<table>
<thead>
<tr>
<th>Study</th>
<th>Body weight (kg) Mean, sd and total</th>
<th>Mean difference (95 %CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brinkworth et al.</td>
<td>-13.1, 11.86, 55</td>
<td>-1.50 (-5.93, 2.93)</td>
</tr>
<tr>
<td>Dansinger et al.</td>
<td>-2.1, 4.8, 40</td>
<td>1.20 (-1.51, 3.91)</td>
</tr>
<tr>
<td>Davis et al.</td>
<td>-3.1, 4.8, 55</td>
<td>0.00 (-2.05, 2.05)</td>
</tr>
<tr>
<td>Dyson et al.</td>
<td>0.3, 6.96, 11</td>
<td>1.10 (-3.64, 5.84)</td>
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<tr>
<td>Foster et al.</td>
<td>-7.2, 7, 33</td>
<td>-2.80 (-6.53, 0.93)</td>
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<tr>
<td>Foster et al.</td>
<td>-6.34, 10.82, 153</td>
<td>-1.03 (-1.41, 3.47)</td>
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<tr>
<td>Lim et al.</td>
<td>-4.7, 7.16, 77</td>
<td>-2.10 (-4.13, 0.07)</td>
</tr>
<tr>
<td>Iqbal et al.</td>
<td>-1.5, 8.36, 67</td>
<td>-1.30 (-3.99, 1.39)</td>
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<tr>
<td>Lim et al.</td>
<td>-2.9, 4.9, 17</td>
<td>-0.80 (-3.98, 2.38)</td>
</tr>
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<td>McAuley et al.</td>
<td>-5.4, 12.6, 24</td>
<td>-1.00 (-8.02, 8.02)</td>
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<tr>
<td>Shai et al.</td>
<td>-4.7, 6.5, 109</td>
<td>-1.80 (-3.26, -0.34)</td>
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<tr>
<td>Stern et al.</td>
<td>-5.1, 8.7, 62</td>
<td>-2.00 (-4.99, 0.99)</td>
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<tr>
<td>Truby et al.</td>
<td>-9, 4.1, 9</td>
<td>-1.70 (-2.16, 6.56)</td>
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<tr>
<td>Total (95 % CI)</td>
<td></td>
<td>-0.91 (-1.65, -0.17)</td>
</tr>
</tbody>
</table>

-0.91 kg (-1.65, -0.17)

How Weight Loss Occurs: Calories, Calories, Calories!

Calories are Reduced b/c Hunger is Less

<table>
<thead>
<tr>
<th>Study</th>
<th>WMD (95% CI)</th>
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</thead>
<tbody>
<tr>
<td><strong>Fullness/Satiety</strong></td>
<td></td>
</tr>
<tr>
<td>Johnstone et al. (20)</td>
<td>2.40 (-14.06, 18.86)</td>
</tr>
<tr>
<td>Ratliff et al. (55)</td>
<td>7.90 (0.26, 15.54)</td>
</tr>
<tr>
<td>Subtotal (I² = 0.0%, p = 0.553)</td>
<td>6.92 (-0.01, 13.86)</td>
</tr>
<tr>
<td><strong>Hunger</strong></td>
<td></td>
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<tr>
<td>Johnstone et al. (20)</td>
<td>-9.40 (-22.34, 3.54)</td>
</tr>
<tr>
<td>Ratliff et al. (55)</td>
<td>-0.40 (-9.10, 8.30)</td>
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<tr>
<td>Martin et al. (54)</td>
<td>-5.96 (-9.29, -2.63)</td>
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<tr>
<td>Subtotal (I² = 0.0%, p = 0.418)</td>
<td>-5.48 (-8.50, -2.45)</td>
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<tr>
<td><strong>Desire to Eat</strong></td>
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<tr>
<td>Johnstone et al. (20)</td>
<td>-12.10 (-25.43, 1.23)</td>
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<tr>
<td>Ratliff et al. (55)</td>
<td>-7.60 (-16.03, 0.83)</td>
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<tr>
<td>Subtotal (I² = 0.0%, p = 0.576)</td>
<td>-8.89 (-16.01, -1.76)</td>
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How Weight Loss Occurs: A Little Bit of Water Loss

How Weight Loss Occurs: A Little Bit of Water Loss

Duration of Intervention

Mean Total Body Water, kg

-2.4 kg†
-1.8 kg†

† p = 0.05, for comparison between diet groups. Yancy WS, Ann Intern Med, 2004.
How Weight Loss Occurs: What About Metabolism?

# Symptomatic Adverse Effects

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Low fat (n = 60)</th>
<th>Low carb (n = 59)</th>
<th>P value</th>
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<tbody>
<tr>
<td>Constipation</td>
<td>35%</td>
<td>68%</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Headache</td>
<td>40%</td>
<td>60%</td>
<td>.03</td>
</tr>
<tr>
<td>Bad breath</td>
<td>8%</td>
<td>38%</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Muscle cramps</td>
<td>7%</td>
<td>35%</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>7%</td>
<td>23%</td>
<td>.02</td>
</tr>
<tr>
<td>Weakness</td>
<td>8%</td>
<td>25%</td>
<td>.01</td>
</tr>
<tr>
<td>Rash</td>
<td>0%</td>
<td>13%</td>
<td>.006</td>
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Comparison of Participant Completion Rates of Low-Fat vs Low-Carb Diet Studies

Each point represents a comparison from one of 19 studies.

## Meta-Analysis: Low Carb vs Low Fat

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. of Trials</th>
<th>Net Difference Low Carb – Low Fat</th>
<th>95% CI</th>
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</thead>
<tbody>
<tr>
<td>Weight, kg</td>
<td>22</td>
<td>-1.0</td>
<td>-2.2, 0.2</td>
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<tr>
<td>Systolic BP, mmHg</td>
<td>18</td>
<td>-1.0</td>
<td>-3.5, 1.5</td>
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<tr>
<td>Diastolic BP, mmHg</td>
<td>18</td>
<td>-0.7</td>
<td>-1.6, 0.2</td>
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<tr>
<td>HDL-C, mg/dL</td>
<td>19</td>
<td>3.3*</td>
<td>1.9, 4.7</td>
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<tr>
<td>LDL-C, mg/dL</td>
<td>19</td>
<td>3.7*</td>
<td>1.0, 6.4</td>
</tr>
<tr>
<td>TG, mg/dL</td>
<td>20</td>
<td>-14.0*</td>
<td>-19.4, -8.7</td>
</tr>
</tbody>
</table>

*p ≤0.05 for net change.

Glucose and Insulin Response to 300 kcal Meal After 10 days on Diet

*Glucose AUC lowest for low-carb diet (p = .001).

*Insulin AUC different for each diet (p = .001)

Network Meta-analysis Comparing Diet Effects on Glycemia in Type 2 DM

- 56 trials enrolling 4937 participants comparing 9 diets:
  - Low-fat, Vegetarian, Mediterranean, high-protein, moderate-carbohydrate, low-carbohydrate, control, low GI/GL, Paleolithic

- “For reducing HbA1c, the low-carbohydrate diet was ranked as the best dietary approach (SUCRA: 84%), followed by the Mediterranean diet (80%) and Paleolithic diet (76%) compared to a control diet.”

Client SB

67 yo WM with diabetes, high cholesterol, hypertension

<table>
<thead>
<tr>
<th></th>
<th>Week 0</th>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3</th>
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<tr>
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<td>LDL</td>
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<tr>
<td>Hb A1c</td>
<td>10.5</td>
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<td>8.4</td>
</tr>
</tbody>
</table>

- Week 0: Discontinue Insulin, losartan
- Week 1: Discontinue Insulin, losartan, Sitagliptan
- Week 2: Continue Metformin, Decrease atorvastatin
- Week 3: Discontinue Insulin, losartan
- Week 4: Continue Metformin, Decrease atorvastatin

- Discontinue Atenolol/chlorthalidone
Client RJT

64 yo WF with sleep apnea, diabetes, fatty liver, hypertension, mild CAD

<table>
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<th>2007</th>
<th>2010</th>
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<td>199</td>
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<td>BP meds</td>
<td>Atenolol, Clonidine, Lisinopril</td>
<td>Carvedilol, HCTZ, Lisinopril</td>
<td>Carvedilol, HCTZ, Lisinopril</td>
<td>Carvedilol, HCTZ, Lisinopril</td>
<td>Carvedilol, Lisinopril</td>
<td>Lisinopril</td>
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<td>DM meds</td>
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<td>Colesevelam, Niacin</td>
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<td>1.08</td>
<td>1.04</td>
<td>0.42</td>
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Low Carb Take Home Points

• Lowering carbohydrate intake leads to spontaneous reduction in calories and lower insulin levels
• Body fat breaks down into ketones, which are used for energy
• Because of early diuresis, adequate intake of fluid and salt is important
• Weight loss is slightly better on average compared with low fat/low calorie eating
• If carbohydrate is added back, it should be done gradually
• Blood pressure and blood triglycerides decrease, HDL increases
• LDL does not typically increase BUT it can in some people
• Blood sugar decreases profoundly such that medications must be reduced at diet start!
Questions & Answers
A Practitioner’s Perspective

Megan Rossi, PhD, RD
Research Fellow, King’s College London, UK
Founder, The Gut Health Clinic, UK
Author, Eat Yourself Healthy
## Disclosures

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<td>Danone</td>
</tr>
<tr>
<td></td>
<td>Almond board of California</td>
</tr>
<tr>
<td></td>
<td>International Nut and Dried Fruit Council</td>
</tr>
<tr>
<td>Scientific Advisory Board/Consultant/Board of Directors:</td>
<td>IBS Network</td>
</tr>
<tr>
<td></td>
<td>Bowel and Cancer Research</td>
</tr>
<tr>
<td>Speakers Bureau:</td>
<td>Ryvita (fibre event)</td>
</tr>
<tr>
<td></td>
<td>Alpro (plant-based eating event)</td>
</tr>
<tr>
<td>Stock Shareholder:</td>
<td>The Gut Health Doctor</td>
</tr>
<tr>
<td></td>
<td>The Gut Health Clinic</td>
</tr>
<tr>
<td></td>
<td>Bio&amp;Me</td>
</tr>
<tr>
<td>Employee:</td>
<td>King’s College London</td>
</tr>
</tbody>
</table>
Overview

- Variations of low carb diets
- Clinical indications and cautions
- Nutrients to watch
- Focus on foods vs. nutrients
- The full picture
Popular ways to ‘do’ low carb

- **Zero carb (carnivore diet)**
  - Animal products + spices only

- **Ketogenic diet**
  - 20-50g net carbs per day
  - Protein <20%
  - Test blood ketones daily
  - Restricts: dairy, wholegrains, starchy vege, fruit, legumes
  - Variations: modified, cyclical

- **Atkins diet**
  - 4 phases, with increasing net carb allowance
  - Protein is not restricted
  - Restricts: dairy, wholegrains, starchy vege, fruit, legumes
  - Variations: Eco (vegan-version)

- **Low sugar diet**
  - Restricts: all sources of sugars including fruit and dairy

- **Paleo**
  - No direct limit on carbs, but limits foods groups
  - Restricts: dairy, wholegrains, legumes

- **Low carb Mediterranean diet**
  - Limits wholegrains
  - More emphasis on fish and EVOO (vs. red meat and butter)
Clinical indications

NICE National Institute for Health and Care Excellence

1.12 Ketogenic diet

1.12.1 Refer children and young people with epilepsy whose seizures have not responded to appropriate AEDs to a tertiary paediatric epilepsy specialist for consideration of the use of a ketogenic diet. [new 2012]

• Clinical guidelines
  – Refractory epilepsy in children and young people
  – Rare metabolic disorders e.g. GLUT-1 deficiency
Ketogenic diet

- Strict monitoring (blood ketone 3 x daily)
- Nutrient adequacy and growth reviews
- Palatability
- Side effects
  - Keto ‘flu’
  - Bad breath (acetone)
  - Constipation
### Low carbohydrate diet

Consultation closes 29th April 2020. Email sacndiabetes@phe.gov.uk

---

#### Table 3.1: UK and international macronutrient recommendations for adults with T2D

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Macronutrient (% total dietary energy)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Carbohydrate</td>
</tr>
<tr>
<td>National Institute for Clinical Excellence (NICE)*</td>
<td>50</td>
</tr>
<tr>
<td>Scottish Intercollegiate Guidelines Network (SIGN)</td>
<td>Individualise</td>
</tr>
<tr>
<td>Diabetes UK</td>
<td>Individualise</td>
</tr>
<tr>
<td>(low carbohydrate diet** amongst other strategies, for weight loss in the short term)</td>
<td>20 to 35</td>
</tr>
<tr>
<td>American Diabetes Association (ADA)</td>
<td>Individualise</td>
</tr>
<tr>
<td>Diabetes Canada</td>
<td>45 to 60</td>
</tr>
<tr>
<td>European Association for the Study of Diabetes</td>
<td>45 to 60</td>
</tr>
<tr>
<td>Diabetes Australia</td>
<td>No specific amount</td>
</tr>
<tr>
<td>(low carbohydrate diet* amongst other strategies, for reducing blood sugar levels and weight loss in the short term (6 months))</td>
<td></td>
</tr>
</tbody>
</table>

**NICE guideline [NG28] recommendation adapted to be in line with UK government recommendations.**

**Defined as _<130g/day_ or _<26% total energy intake derived from carbohydrate._**

Clinical cautions

Are low-carbohydrate diets safe in diabetic and nondiabetic chronic kidney disease?

Nia S. Mitchell,¹,² Julia J. Sciolla,³ and William S. Yancy Jr.¹,²,⁴

Table 1. Protein content in different diets

<table>
<thead>
<tr>
<th>Diet</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western diet</td>
<td>59–72</td>
<td>73–109⁹</td>
</tr>
<tr>
<td>KDIGO recommendation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stages G1–3</td>
<td>61–107</td>
<td>71–124⁹</td>
</tr>
<tr>
<td>Stages G4/5</td>
<td>46–61</td>
<td>53–71</td>
</tr>
<tr>
<td>LC diet</td>
<td>73–130</td>
<td>60–120¹¹</td>
</tr>
<tr>
<td>Postbariatric surgery diet</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

⁹Based on NHANES.¹⁰
¹⁰Based on average weight of women and men in the United States.¹⁶
LC diet, low-carbohydrate diet; KDIGO, the Kidney Disease: Improving Global Outcomes; NHANES, the National Health and Nutrition Examination Survey.

Figure 3. Theoretical concerns about increased protein intake and kidney function.

Ketoacidosis associated with low-carbohydrate diet in a non-diabetic lactating woman: a case report


Louise von Geijer¹ and Magnus Ekelund²
# Nutrients to watch

<table>
<thead>
<tr>
<th>Food Group Name</th>
<th>Grain (cereal) foods, mostly wholegrain and/or high cereal fibre varieties</th>
<th>Vegetables and legumes/beans</th>
<th>Fruit</th>
<th>Milk, yoghurt, cheese and/or alternatives, mostly reduced fat</th>
<th>Lean meat and poultry, fish, eggs, tofu, nuts and seeds, legumes/beans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main distinguishing nutrients</td>
<td>carbohydrate, protein, iron, dietary fibre, thiamin, folate, iodine</td>
<td>beta-carotene and other carotenoids, vitamin C, folate, dietary fibre</td>
<td>vitamin C, dietary fibre</td>
<td>calcium, protein, riboflavin, vitamin B₁₂</td>
<td>protein, iron, zinc, vitamin B₁₂ (animal foods only), long chain omega 3 fatty acids</td>
</tr>
<tr>
<td>Other significant nutrients*</td>
<td>energy, magnesium, zinc, riboflavin, niacin, vitamin E</td>
<td>Carbohydrate (potato, sweet potato, sweet corn, legumes)</td>
<td>carbohydrate, folate, beta-carotene</td>
<td>energy, carbohydrate, magnesuim</td>
<td>dietary fibre (plant foods only), energy, essential fatty acids</td>
</tr>
</tbody>
</table>

*Carbohydrate, protein, fat, and other nutrients present in foods from all groups.
For every 8 grams/day of extra fiber…

- 19% ↓ RISK OF HEART DISEASE
- 15% ↓ RISK OF TYPE 2 DIABETES
- 8% ↓ RISK OF COLON CANCER

Carbohydrate quality and human health: a series of systematic reviews and meta-analyses

Lancet 2019; 393: 434-45

185 Observational studies
(n=135 million person-years)
Fiber’s mechanisms of action

- Increase bacterial fermentation metabolites e.g. short-chain fatty acids, methane
- Decrease low density lipoprotein
- Decrease blood pressure
- Increase bacterial & faecal mass
- Decrease C-reactive protein
- Decrease gut transit time
- Decrease gut lumen pH
- Increase satiation
- Decrease glucose absorption rate

Koh et al. 2016

@theguthealthdoctor
Not all fibers are created equal


Daniel So,1 Kevin Whelan,2 Megan Rossi,2 Mark Morrison,3,4 Gerald Holtmann,4,5 Jaimon T Kelly,7 Erin R Shanahan,3,5 Heidi M Staudacher,4 and Katrina L Campbell1,6

- 64 studies, n=2099 participants RCT with added food or supplement
- Fibre intervention
  - higher Bifidobacterium $p<0.001$
  - higher Lactobacillus $p=0.020$
  - higher faecal butyrate $p=0.05$
- Prebiotic fibres
  - higher Bifidobacterium $p<0.001$
  - higher Lactobacillus $p=0.002$
- Other fibres
  - nil differences in microbiota
Not all fibers are created equal

Dietary fibre, whole grains, and risk of colorectal cancer: systematic review and dose-response meta-analysis of prospective studies

25 Observational studies
2 million People (close to)

10% Reduced risk of colon cancer for every 10g increase in total fibre

10% Reduced risk of colon cancer for every 10g increase in wholegrain fibre

Not significant for fruit fibre or vegetable fibre

Dietary fibre and risk of breast cancer in the UK Women’s Cohort Study
Not just fiber

Spender et al., 2008, Br J Nutr
Manach et al. 2004, AJCN
Plant-based diet diversity

- Fibre + prebiotics + polyphenols + bioactives

Long-term Paleolithic diet is associated with lower resistant starch intake, different gut microbiota composition and increased serum TMAO concentrations. European Journal of Nutrition 2019

Mc Donald et al., 2018
Whole foods vs. nutrients

7 sessions, 12 weeks

n=67

32% 8%
The SMILES trial

A brief diet intervention can reduce symptoms of depression in young adults – A randomised controlled trial

Published: October 9, 2019

- Omega 3
- B12
- Selenium
- Folate
- Hydration

50g fibre! (36% carb, 190g)

Opie et al. 2017
Prevention of eating disorders: 2019 in review

Michael P. Levine
EATING DISORDERS
2020, VOL. 28, NO. 1, 6–20

Cell Metabolism
Short-Term Consumption of Sucralose with, but Not without, Carbohydrate Impairs Neural and Metabolic Sensitivity to Sugar in Humans

Feature Article
Improving diet sustainability through evolution of food choices: review of epidemiological studies on the environmental impact of diets
Take home messages

리본

Varying extremes of low carb
- Restricted food groups: 0 to 4

Clinical guidelines
- Indications e.g. Refractory epilepsy
- Caution e.g. Chronic kidney disease

🌞 Nutrients to watch
- Several micronutrients + fiber + phytochemicals

🥗 People eat whole foods not nutrients
- Move to a focus on food quality not isolated nutrients

⚠️ The full picture
- Eating disorders, additives, environmental
Thank you!
Thank you for joining us!

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