Clinical Use of Low Carbohydrate Diets

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Presenter Disclosure

- Faculty: Dr. Annelise Gallien

- Relationships with commercial interests:

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  Consulting Fees: None

  Other: None

DISCLOSURES/BIASES

- I don't believe there is one diet that is appropriate for everyone
- Any healthy way of eating should limit processed food and trans fats
- I follow a low carbohydrate way of eating
- The information presented is my professional opinion (not Diabetes Canada)
- I also use a LCHF diet for management of type 1 diabetes, obesity and fatty liver disease (few cases chronic pain)
- I enjoy taking patients off medications

Personal Experience

- Offering low carb counseling for 2 years
- Compliance rates:
  - highest for DM2 previously on insulin or on maximal oral therapy
  - lowest for young obese patients without metabolic complications
- Following patients from across the province
- Receive consultation requests from bariatric clinic and orthopedic surgeons
- 8 colleagues now following this way of eating

More on Compliance: Virta Health

- Virta Health is an online diabetes reversal treatment in the U.S
- https://www.virtahealth.com/
- 1 year retention rate of 90%
- 94% eliminated or reduced insulin
- 63% non-metformin hypoglycemic medications stopped
- 12% weight loss
- Average A1c reduction 1.3%
- 60% had an A1c <6.5% without medications

Professional Challenges

- Time consuming
- Resistance from a minority of physicians, majority of dieticians

2018 Clinical Practice Guidelines Diabetes Canada

Nutrition Therapy

Chapter 11

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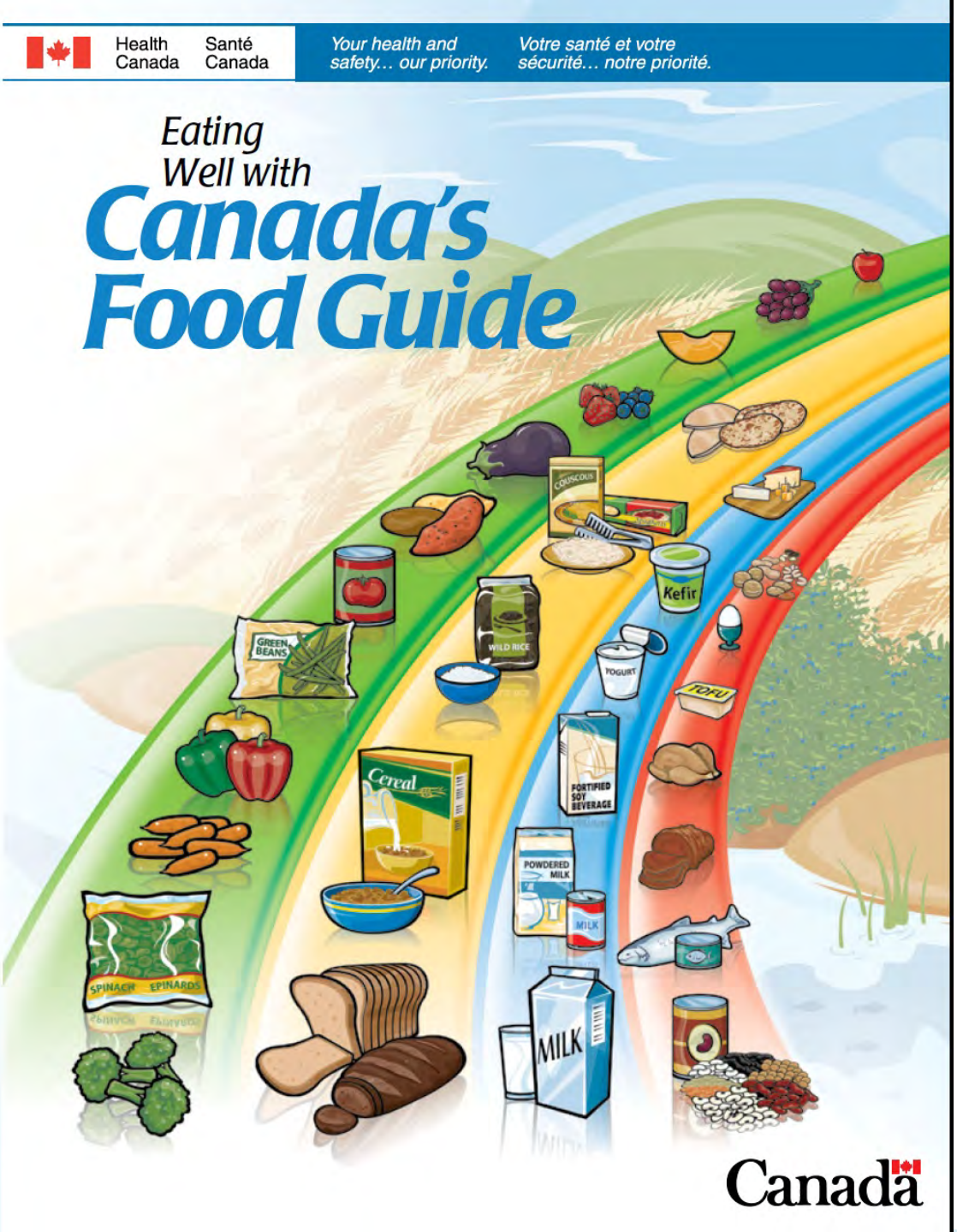

Encourage patients to follow Eating Well with Canada's Food Guide in order to meet their nutritional needs

http://www.hc-sc.gc.ca/fn-an/food-guide-aliment/index-eng.php

Macronutrient Distribution (% Total Energy)

	Carbohydrates	Protein	Fat
% of total energy	**45-60%**	**15-20%** (or 1-1.5g /kg BW)	**20-35%**
Calories per gram	**4**	**4**	**9**
Grams for 2000 calorie/day	**225-300**	**75-100**	**44-78**

BW = body weight

Table 1. Properties of dietary interventions

Properties of dietary interventions (listed in the order they are presented in the text)

Dietary interventions	A1C	CV benefit	Other advantages	Disadvantages
Macronutrient-based approaches				
Low-glycemic-index diets	↓	↓CVD	↓LDL-C, ↓CRP, ↓hypoglycemia, ↓diabetes Rx	None
High fibre diets	↓ (viscous fibre)	↓CVD	↓LDL-C, ↓non-HDL-C, ↓apo B (viscous fibre)	GI side effects (transient)
High MUFA diets	↔	↓CVD	↓Weight, ↓TG, ↓BP	None
Low-carbohydrate diets	↔	-	↓TG	↓Micronutrients, ↑renal load
High-protein diets	↓	-	↓TG, ↓BP, preserve lean mass	↓Micronutrients, ↑renal load
Mediterranean dietary pattern	↓	↓CVD	↓retinopathy, ↓BP, ↓CRP, ↑HDL-C	None
Alternate dietary patterns				
Vegetarian	↓ (144,249)	↓CHD (151)	↓Weight (147), ↓LDL-C (148)	↓vitamin B12
DASH	↓ (250)	↓CHD (159)	↓Weight, ↓LDL-C (157,250), ↓BP (28,157), ↓CRP	None
Portfolio	-	↓CVD (160,161)	↓LDL-C (160,161), ↓CRP, ↓BP	None
Nordic	-	-	↓LDL-C+↓non-HDL-C (167–169)	None
Popular weight loss diets				
Atkins	↔	-	↓Weight, ↓TG, ↑HDL-C, ↓CRP	↑LDL-C, ↓micronutrients, ↓adherence
Protein Power Plan	↓	-	↓Weight, ↓TG, ↑HDL-C	↓Micronutrients, ↓adherence, ↑renal load
Ornish	-	-	↓Weight, ↓LDL-C, ↓CRP	↔ FPG, ↓adherence
Weight Watchers	-	-	↓Weight, ↓LDL-C, ↑HDL-C, ↓CRP	↔ FPG, ↓adherence
Zone	-	-	↓Weight, ↓LDL-C, ↓TG, ↑HDL-C	↔ FPG, ↓adherence
Dietary patterns of specific foods				
Dietary pulses/legumes	↓ (174)	↓CVD	↓Weight (177), ↓LDL-C (175), ↓BP (176)	GI side effects (transient)
Fruit and vegetables	↓ (181,182)	↓CVD (78)	↓BP	None
Nuts	↓ (186)	↓CVD (142)	↓LDL-C (187,251), ↓TG, ↓FPG	Nut allergies (some individuals)
Whole grains	↓ (oats)	↓CHD (98)	↓LDL-C, FPG (oats, barley)	GI side effects (transient)
Dairy	↔	↓CVD (147,196)	↓BP, ↓TG (when replacing SSBs)	Lactose intolerance (some individuals)
Meal replacements	↓	-	↓Weight	Temporary intervention

* ↓ t = <1% decrease in A1C.

† Adjusted for medication changes.

A1C, glycated hemoglobin; *apo B*, apolipoprotein B; *BMI*, body mass index; *BP*, blood pressure; *CHD*, coronary heart disease; *CHO*, carbohydrate; *CRP*, C reactive protein; *CV*, cardiovascular; *CVD*, cardiovascular disease; *DASH*, dietary approaches to stop hypertension; *FPG*, fasting plasma glucose; *GI*, gastrointestinal; *HDL-C*, high-density lipoprotein cholesterol; *LDL-C*, low-density lipoprotein cholesterol; *MUFA*, monounsaturated fatty acid; *SSBs*, sugar-sweetened beverages; *TC*, total cholesterol; *TG*, triglycerides.

Recommendation 12

2018

12. The following dietary patterns may be considered in people with type 2 diabetes incorporating patient preferences including:
    - **Mediterranean**-style dietary pattern to reduce major CV events [Grade A, Level 1A] and improve glycemic control [Grade B, Level 2]
    - **Vegan** or **vegetarian** dietary pattern to improve glycemic control [Grade B, Level 2], body weight [Grade C, Level 3], and blood lipids including LDL-C [Grade B, Level 2], and reduce myocardial infarction [Grade B, Level 2]
    - **Dietary Approaches to Stop Hypertension (DASH)** dietary pattern to improve glycemic control [Grade C, Level 2], BP [Grade D, Level 4], and LDL-C [Grade B, Level 2], and reduce major CV events [Grade B, Level 3]
    - Dietary patterns emphasizing **dietary pulses** (e.g., beans, peas, chickpeas, lentils) to improve glycemic control [Grade B, Level 2], systolic BP [Grade C, Level 2] and body weight [Grade B, Level 2]
    - Dietary patterns emphasizing **fruit** and **vegetables** to improve glycemic control [Grade B, Level 2] and reduce CV mortality [Grade C, Level 3]
    - Dietary patterns emphasizing **nuts** to improve glycemic control [Grade B, Level 2], and LDL-C [Grade B, Level 2]

CV, cardiovascular

diabetes australia

Position Statement

Low carbohydrate eating for people with diabetes

August 2018

Key points

1. For people with type 2 diabetes, there is reliable evidence that lower carb eating can be safe and useful in lowering average blood glucose levels in the short term (up to 6 months). It can also help reduce body weight and help manage heart disease risk factors such as raised cholesterol and raised blood pressure.

March 15, 2019

Dr. Laura Saslow, PhD serves on the nutrition review committee for the American Diabetes Association

"…The American Diabetes Association (ADA) reviewed all of the clinical trial evidence for the new 2019 ADA clinical guidelines and has noted that a very low carbohydrate diet (VLCD) of 20-35g carbohydrate per day (not low in fat or salt) is the most powerful eating approach for treating type 2 diabetes, leading to a 40-50% remission rate.

Current standard of care leads to less than a 5% remission rate.

VLCD can also be helpful for patients with type 1 diabetes, pre-diabetes, hypertension, nonalcoholic fatty liver disease, polycystic ovarian syndrome and Alzheimer's disease, and there is now more clinical trial evidence for VLCD than for any other eating pattern…"

CASE- My first patient

April 2017

- 71 year old man with a 10 year history of Type 2 Diabetes
- HgA1c 8.5%
- On Humulin 30/70 24 units bid
- Metformin 1 g bid
- Has previously seen a dietician in the diabetes clinic
- He wants to know if he can do anything else
- Given education, handouts, websites on LCHF way of eating
- Advised to cut his insulin by half

What is a LCHF Diet?

Strict low carb (keto): < 20 grams carbs/day
Moderate low carb : < 50 grams carbs/day
Liberal low carb: < 100 grams carbs/day

Moderate protein intake ~ 1gram/kg
Higher fat intake ~ 100 grams/day

- Roughly 60% fat, 30% protein, 10% carbohydrates
- Not calorie restricted

- Russel Wilder first used the ketogenic diet to treat epilepsy in 1921

Eat This!


Fewer carbs
More carbs
Cheese 1
Fish and seafood 0
Natural fats 0
(butter, olive oil etc.)
Meat 0
Eggs 1
Vegetables that grow above ground 1-5

AVOID THIS!


Fruit 7 - 20
Potatoes 17
Pasta, cooked 29
Soda / Juice 52
(per 16 oz - 50 cl)
Chocolate bar 60
Bread 46
Fewer carbs
More carbs
Beer 13
(per 12 oz - 33 cl)
Rice, cooked 28
Donut 49
Candy 70

AND THIS
(Low carb junk food)

EAT REAL FOOD

PRACTICAL TIPS

WHAT I DO:

- With every new patient consult, offer option of escalating pharmacotherapy or modifying diet
- In interested/motivated patients, spend ~45 minutes explaining concept, give written handouts and online resources
- Give instructions on what to do with medications when they start to avoid hypoglycemia
- Goal in first month or so is to keep blood glucose <10
- Follow-up within 2 weeks for patients on insulin, at 1 month mark for patients on oral agents (with food diary). I check their weight, blood pressure and review glucose log book
- Recheck A1C at 3 months, lipid profile at 6 months or once weight loss has stabilized
- Once A1C at target, offer ongoing follow-up to keep patients motivated

Advantages of a LCHF Diet

- Weight loss without decrease in basal metabolic rate or muscle mass
- No hunger
- Reverses insulin resistance and type 2 Diabetes (also improves other metabolic problems such as fatty liver disease, PCOS, hypertension)
- Increases energy levels
- Controls IBS symptoms/bloating/GERD
- Improves mood, fibromyalgia symptoms
- No need to subscribe to a plan or purchase products

Disadvantages of a LCHF Diet

- Requires more planning and more time consuming
- Can be more expensive (but not necessarily)
- Some patients may feel “deprived” although not hungry
- Short term effects (up to 2 years) well described and established, need longer term studies
- No studies in pregnancy except case series

Cautions and Contraindications

- Patients taking insulin or oral hypoglycemics need an adjustment of their medications to avoid hypoglycemia
- Caution with SGLT2 inhibitors
- Contraindicated in pancreatitis, liver failure, carnitine deficiency, disorders of fat metabolism, porphyria, pyruvate kinase deficiency
- ? Pregnancy

*Can rarely cause of false positive alcohol breath test

Diabetic Medications on a Low Carbohydrate Diet

There are 3 considerations with the use of diabetic medications in type 2 diabetes when on a low carbohydrate diet:

1- Is there a risk of hypoglycemia?
2- What is the degree of carbohydrate restriction?
3- Does the medication provide any benefit, and if so, do any potential benefits outweigh any side effects and potential risks?

Drug Group	Action	Hypo Risk?	Suggested Action
Sulfonylurea	↑ pancreatic insulin secretion	YES	STOP (or half dose successively)
Insulin	Exogenous insulin	YES	REDUCE/STOP (see below)
Meglitinides	↑ pancreatic insulin secretion	YES	STOP (or half dose successively)
Biguanides	↓ insulin resistance	No	Optional, consider clinical pros/cons
GLP-1 agonists	Slow gastric emptying. Glucose-dependent insulin secretion	No	Optional, consider clinical pros/cons (expensive)
SGLT-2 inhibitors	↑ renal glucose secretion	No	Usually stop. Concern over possible risk of DKA (probably LADA misdiagnosed as DM2)
TZDs	↓ peripheral insulin resistance	No	Usually stop. Concern over risks usually outweigh benefits
DPP-4 inhibitors	Inhibit DPP-4 enzyme	No	Optional, consider clinical pros/cons
alpha-glucosidase inhibitors	Delay digestion of starch and sucrose	No	Stop. No benefit on a low carb diet
Glucose test strips	Provide feedback on blood glucose response to food		Can be helpful to show how food affects blood glucose. This can support behaviour change.

Insulin Reduction Suggestions

- Taylor to individual
- On starting low carb diet, reduce insulin by 30-50% to avoid hypoglycemia
- Monitor blood glucose
- Continue down titration of insulin as insulin resistance improves (can take months)
- If using basal-bolus regimen, consider converting to basal insulin alone
- Goal for most patients is to discontinue insulin

What about Cholesterol?

- Most people have a favorable response in their lipid profile:
  - ↓↓↓ Triglycerides
  - ↑ HDL-C
  - Same or ↓ LDL-C
- Small percentage of patients experience a significant rise in their LDL-C (LDL >6.5)
- Unknown clinical significance

LDL as a marker for CVD

- For the last several decades, science has focused LDL-C as the primary cause of CVD
- This focus remains controversial
  - measurement is inaccurate (calculated)
  - simplistic view (to keep it simple)
  - we have ignored the rest of the "forest" of other risk factors
- In the keto-adapted state, blood lipids and ketones provide 75-85% of energy

CVD risk factor	% Change	Risk
Calculated LDL-C	+ 9.9%	↑
Total LDL particle #	- 4.9%	↓
Small LDL particle #	- 21%	↓
Apo-B	- 1.6%	↓
Apo-B/Apo-A1 ratio	- 9.5%	↓
Triglycerides	- 24%	↓
HDL-C	+ 14%	↓
TG-HDL-C	- 28%	↓
CRP	- 39%	↓
WBC count	- 10%	↓
Systolic BP	- 5%	↓
Diastolic BP	- 5%	↓
HgA1c %	- 17%	↓
Weight	- 12%	↓

Summary on Cholesterol

- We need to avoid the reductionist temptation to focus on a single tree (LDL-C) over the contribution of the entire forest
- Need RCTs on CVD and mortality risk pitting a well-formulated ketogenic diet against usual care
- The increase in LDL-C appears to be limited to the large LDL sub-fraction, inflammation and blood pressure decreased

Back to Case

Case :

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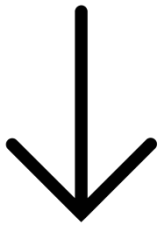
- HgA1c 8.5%
- On Humulin 30/70 24 units bid
- Metformin 1 g bid
- Has previously seen a dietician in the diabetes clinic
- Introduced to LCHF way of eating



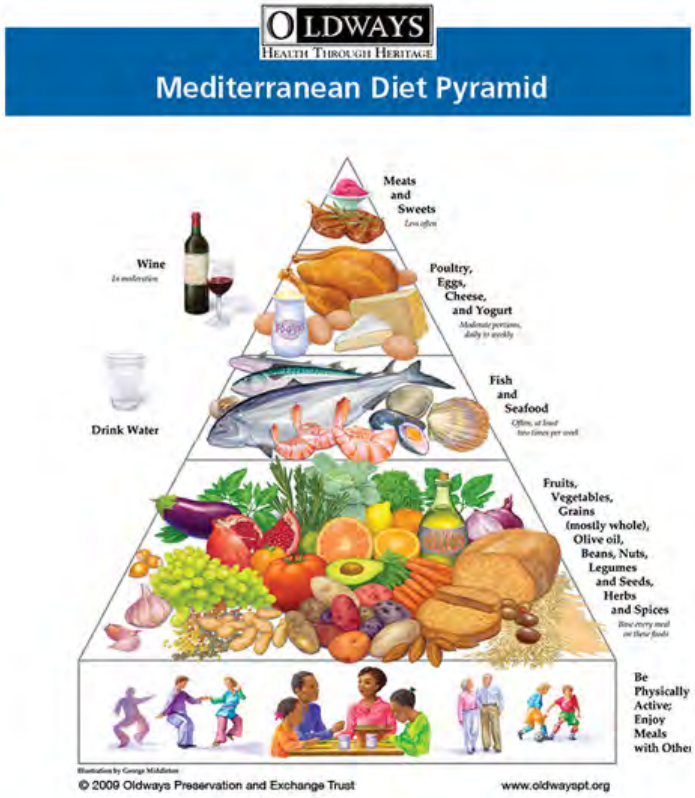
- Off insulin within 1 month
- At 3 month mark, had lost 27 lbs, A1c 5.8%, dose of antihypertensives cut by half, lipid profile unchanged (was already on statin)

As a bonus, he feels fantastic and has more energy
His partner who does not have diabetes has lost 25 lbs and feels fantastic

- At 2 years, A1c 6.5% on Janumet

Clinical Conundrum- Patients with established CVD

- Do I stop their SGLT-2 which has established CV benefit?
- Can continue or switch to GLP-1 receptor agonist
- Mediterranean Diet typically recommended
- Can modify to make low carbohydrate



Summary LCHF

- Increasing evidence for use in diabetes and other metabolic problems
- Endorsed by the American, European and Australian diabetes associations
- Medical Nutrition Therapy in the form a well formulated low carb diet should at least be offered as a therapeutic option in the right patients
- Patients with diabetes on pharmacotherapy who adopt a low carbohydrate diet should do so under medical supervision
- Has been life changing for many of my patients (and professionally rewarding for me)

QUESTIONS?