

Low-Carbohydrate Nutrition Approaches in Patients with Obesity, Prediabetes and Type 2 Diabetes

- Overview
- Assessment
- Description of Approaches
- Medication Management
- Maintenance and Adherence

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Prevalence of Target Diseases

- The prevalence of prediabetes and type 2 diabetes has increased dramatically over several decades in parallel with the increasing prevalence of obesity.
- Most recent estimates in 2015 state that 34% of Americans have prediabetes (hemoglobin A1c 5.7-6.4%) and 9.4% have type 2 diabetes (hemoglobin A1c $\geq 6.5\%$ or on diabetes medication).
- Obesity, prediabetes and type 2 diabetes are all risk factors for cardiovascular disease (CVD), and their increasing prevalence is now leading to an increase in the prevalence of CVD.

Key Points and Scope

- Low-carbohydrate eating patterns are recognized in scientific literature and expert treatment guidelines as effective nutritional therapies for obesity, prediabetes and type 2 diabetes.
- Because low- and very-low-carbohydrate eating patterns are effective treatments for these risk factors, plus risk factors such as hypertriglyceridemia and low high density lipoprotein (HDL) cholesterol (metabolic syndrome), their use has real potential for reducing CVD.
- Low- and very-low-carbohydrate eating patterns can have potent lowering effects on blood glucose and blood pressure, which can lead to hypoglycemia or hypotension in people taking diabetes or blood pressure medications, respectively. Therefore, medication reduction, or deprescribing, is often required at the onset of dietary change, as is ongoing monitoring and medication management.
- Numerous additional nuances to the use of these nutritional approaches have led to the production of this pocket guide, which is intended to assist practitioners in the safe and effective use of low-carbohydrate nutrition.
- This pocket guide will define and describe low-carbohydrate nutritional approaches, identify appropriate target patient populations, and summarize recommended practices for the use of such eating patterns in adults, particularly adults with obesity, prediabetes or type 2 diabetes.
- This pocket guide is not intended for treatment of children or people with type 1 diabetes, who may require adjustments to the approaches described.

Vital Sign Essentials

- Weight
- Height
- **Waist circumference**
 - ▶ Start at the top of the hip bone, then bring the tape measure all the way around the body, level with the umbilicus. The patient can hold the beginning of the tape measure at the umbilicus and rotate 360° in front of you to accomplish this.
 - ▶ Make the tape snug but not tight and record the measurement right after exhalation.
Note: if waist circumference multiplied by 2 is greater than the patient's height, then risk is higher for metabolic syndrome. Use the same unit of measurement for both (e.g., inches).
- **Blood pressure and heart rate**
 - ▶ Patient should be seated, relaxed, and rested for 5 minutes prior to measurement. Use appropriate sized cuff, as a cuff that is too small falsely elevates the reading.
Note: Many patients with diabetes have stiff arteries due to arteriosclerosis, which can cause a falsely elevated blood pressure reading.

Basic Level Tests (consider for all)

- Complete blood count (CBC)
- Fasting complete metabolic panel (CMP), including: glucose, electrolytes, kidney function, bicarb for acid/base balance, liver panel
- Fasting lipid panel, including: TC, HDL, LDL, triglycerides with attention to the TG/HDL ratio and TC/HDL ratio
- Strongly consider screening all patients with obesity and type 2 diabetes for sleep apnea (home screening options readily available)
- Strongly consider screening for food and sugar addiction
- Thyroid-stimulating hormone (TSH)
- Hemoglobin A1c (HbA1c)
- Urine microalbumin (for patients with diabetes and/or those taking ACE-inhibitors or ARBs)

Second Level Tests (consider for higher risk groups)

- 75-100 gram glucose tolerance test (GTT)
- Postprandial glucose and insulin tests
 - ▶ glucose and insulin tests one to two hours after glucose drink
- Advanced lipid profile to provide LDL particle size and number (large size and small number are desirable)
- Coronary artery calcium (CAC) score to quantify coronary artery disease
- Serum uric acid
- Serum ferritin for iron stores (especially if vegetarian, low red meat consumption, or status post gastric bypass)
- Vitamin B12 (especially if vegetarian, on long-term metformin use, or status post gastric surgery)
- Vitamin D (especially if status post gastric surgery)
- High-sensitivity C-reactive protein (hsCRP) to check systemic inflammation
- C-peptide levels (consider for patients who have been on long-term insulin to ensure that the patient is still making insulin, especially if the patient does not fit the typical pattern of hyperinsulinemia)
- Body composition scale that can accurately estimate visceral fat

Continuous Glucose Monitor (CGM)

- CGM technology has become more accessible, affordable, and user friendly over time.
- Reactive hypoglycemia and large post-meal spikes are common with standard high carbohydrate dietary patterns, both in insulin resistance and in later stage T2D with beta cell insufficiency. The CGM shows these patterns and how an individualized nutrition regimen improves them.

Patient Selection

- Patients are good candidates for some type of carbohydrate-restricted dietary intervention if they have a problem with overweight, obesity or another metabolic problem.
- Patients should be able and prepared to use a blood glucometer to check serum glucose if on insulin or insulin secretagogues (sulfonylureas and meglitinides) and to communicate with the health care team during the dietary intervention.
- In most cases, patients with an acute, unstable medical condition are not candidates for any dietary intervention.
- Co-existing conditions such as pregnancy or kidney or liver disease may require additional dietary changes or even interdict certain regimens.

Table 1. Low-Carb Eating Patterns^a

Eating Pattern	Total Carbs grams/day	Proteins/Fats						Carbohydrates					
		Meat	Poultry	Fish & Shellfish	Eggs	Tofu	Non starchy Veggies ^b	Starchy Veggies	Leafy Greens	Berries	Fruit	Grains	
Very Low-Carb Keto	≤30 ^c	No limit ^d	No limit ^d	No limit ^d	No limit ^d	No limit ^d	1 cup	-	2 cups	-	-	-	
Low-Carb Keto	30–50 ^c	No limit ^d	No limit ^d	No limit ^d	No limit ^d	No limit ^d	2 cups	1 cup	2 cups	½ cup	1 cup	-	
Mediterranean	50–150	No limit ^d	No limit ^d	No limit ^d	No limit ^d	No limit ^d	3 cups	1 cup	No limit ^d	1 cup	1 cup	2 svgs	
Paleo ^e	50–150	No limit ^d	No limit ^d	No limit ^d	No limit ^d	No limit ^d	3 cups	1 cup	No limit ^d	½ cup	½ cup	-	
Primal ^e	50–150	No limit ^d	No limit ^d	No limit ^d	No limit ^d	No limit ^d	3 cups	1 cup	No limit ^d	-	-	-	
Vegetarian	100–150				No limit ^d	No limit ^d	No limit ^d	No limit ^d	No limit ^d	1 cup	1 cup	4 svgs	

^a This table is based on the most common approaches, and some variants of each nutritional approach may differ slightly from the table.

^b Examples are potatoes, corn, peas, beans/legumes, acorn or butternut squash, carrots, parsnips.

^c Suggest a **minimum** of 15 grams net carbs daily in the form of non-starchy vegetables.

^d May be consumed to satiety. While no limit is specified for these foods, consuming them excessively or beyond satiety can adversely impact weight management.

^e Paleo/Primal food quality emphasized: grass-fed beef, grass-fed butter, limiting omega-6 fatty acids (vegetable oil, seed oil). Major difference between the two is that Primal allows dairy, nightshade vegetables and legumes.

↪ Description of Approaches

Table 2. Selected Categories of Foods

Foods with 0 carbs:

beef	fish (e.g., tuna, salmon, catfish, bass, trout)	veal
pork	shellfish (e.g., shrimp, scallops, crab and lobster)	sausage
bacon	eggs	lamb
chicken	pork rinds	ham
turkey	pepperoni slices	salami
duck (or other fowl)	hot dogs	bologna

Sweets with 0 carbs:

sugar-free gelatin

Sweets with <5 carbs/serving:

sugar-free pudding low-carb protein shakes

Foods with ≤ 2 grams carbs but high calorie, so limit for weight loss:

cheese (4 oz) oils/butter (2 tbsp)

cream (2 tbsp) mayonnaise (2 tbsp)

Leafy greens (~2 grams of carbs/cup):

arugula	endive	spinach
bok choy	greens (including beet, collards, mustard, and turnip)	radicchio
cabbage (all varieties)	kale	radishes
chard	lettuce (all varieties)	scallions
chives	parsley	watercress

Table 2. Selected Categories of Foods**Non-starchy vegetables (~5 grams of carbs/cup):**

artichokes	jicama	snow peas
asparagus	leeks	sprouts (bean & alfalfa)
broccoli	mushrooms	sugar-snap peas
Brussels sprouts	okra	summer squash
cauliflower	onions, shallots	tomatoes
celery	peppers	wax beans
cucumber	pumpkin	zucchini
eggplant	rhubarb	green beans (string beans)

Starchy vegetables/starches (~20 grams of carbs/cup):

grains (even “whole” grains)	flour	pastas
rice	cornstarch	muffins
cereals	breads	bagels
tortillas	carrots	potatoes
crackers	parsnips	French fries
slow-cooked beans (pinto, lima, black beans, etc.)	corn	potato chips
peas	tortilla chips	

Snack ideas:

hard cheeses	olives	hard boiled or deviled eggs
nuts	pepperoni or salami slices	celery with nut butter

Note: Emphasis should be placed on the starches with the lowest glycemic impact.

Comment: Low carb diets include full fat dairy products such as full fat cheeses, cream and sour cream, and full fat plain yogurts. Individuals should be aware of the total carb count in the lactose component of the product and serving size. For example, in coffee heavy cream is preferred over skim milk.

Figure 1. Reading a Nutrition Facts Label

There are two ways to count carbs:
TOTAL CARBS or **NET CARBS**

Total Carbs

- ▶ Look at the serving size and total carbohydrate sections
- ▶ In this example, 4 grams carbohydrate = 4 total grams of carbohydrate per 1 cup of cauliflower
- ▶ TOTAL CARBS is used when individuals are trying to lose weight most effectively

Net Carbs

- ▶ Look at the serving size, total carbohydrate and dietary fiber sections.
- ▶ Subtract dietary fiber from total carbohydrate to get the “net carbs.”
- ▶ In this example, 4 grams carbohydrate – 2 grams fiber = 2 grams “net carbs” per 1 cup of cauliflower.
- ▶ NET CARBS is more often used for individuals trying to lose weight more gradually or maintain body weight.
- ▶ Packaged or processed low-carbohydrate foods often contain sweeteners called sugar alcohols (e.g., erythritol, maltitol, xylitol, isomalt) that are carbohydrates. Some people think sugar alcohols can be subtracted similar to fiber when calculating “net carbs,” but most of them contain about half the calories per gram that carbohydrates contain.

Nutrition Facts	
4 servings per container	
Servings size	1 cup (85g)
Amount Per Serving	
Calories	20
%Daily Value*	
Total Fat 0g	0%
Saturated Fat 0g	0%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 25mg	1%
Total Carbohydrate 4g	1%
Dietary Fiber 2g	7%
Total Sugars 2g	
Includes 0g Added Sugars	0%
Protein 2g	
Vitamin D 0mcg	0%
Calcium 19mg	2%
Iron 0mg	0%
Potassium 250mg	6%
Vitamin A 0mcg	0%
Vitamin C 41mg	45%
*The % Daily Value tells you how much a nutrient in a serving of food contributes to a daily diet. 2000 calories a day is used for general nutrition advice.	
Calories per gram: Fat 9 • Carbohydrate 4 • Protein 4	
INGREDIENTS: CAULIFLOWER.	

Figure 1. Reading a Nutrition Facts Label (cont'd)

Individualizing Carbohydrate Intake Level

- ▶ The effective carbohydrate intake level can vary considerably from patient to patient, as can strategies for determining that level.
- ▶ The level depends on several factors including age, gender, metabolic rate, insulin sensitivity, activity level, and quality of carbohydrate (glycemic index/load).
- ▶ One effective strategy is to start at a level that is effective for most everyone, typically ~20 g of total carbohydrate per day. This level achieves weight loss and ketogenesis in most individuals.
- ▶ Then, small amounts of carbohydrate (~5 g) can be added to the daily amount each week in the following situations:
 - ▶ As the patient reaches the goal for weight or another goal such as blood glucose control
 - ▶ If cravings for carbohydrate might lead the patient to abandon the eating plan
 - ▶ If side effects of the eating pattern (e.g., constipation) cannot be managed otherwise and threaten continued adherence.
- ▶ Ideally, 5 g of carbohydrate from one type of food (e.g., ½ cup berries, 1 cup of non-starchy vegetable or 1 oz of nuts) is added daily for 1 week.
- ▶ If weight loss (or weight stability, if that is the goal) continues, then another 5 g of carbohydrate from the same or another type of food can be added.
- ▶ In this manner, the patient can identify a level of carbohydrate intake below which weight loss can be achieved and a higher level at which weight stability can be achieved.

General Eating Principles to Communicate with Patients

- A low-carbohydrate nutritional approach has a natural appetite reduction effect to ease you comfortably into the consumption of smaller and smaller quantities. Therefore, counting calories is not required.
- Eat when you are hungry and stop when you are comfortably full.
- You do not have to eat if you are not hungry. Skipping meals is acceptable as long as you do not overeat or eat high carbohydrate foods later due to delayed hunger.
- You do not have to eat everything on your plate "just because it's there."

Monitoring and Adjusting Medications

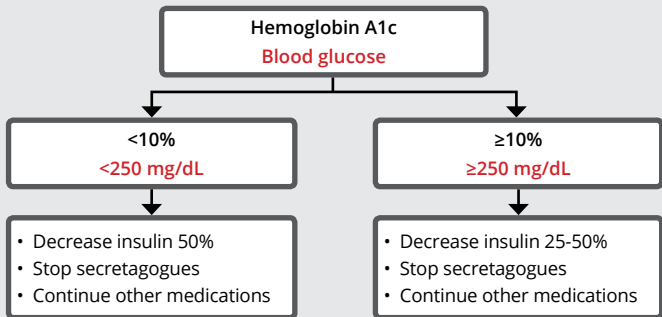
- The most important task for the clinician using low-carbohydrate nutrition therapy is to adjust medications to minimize the risk for hypoglycemia and hypotension. Note: For safety and efficacy, the authors feel it is important for the patient to have daily accessibility with the health care team when adjusting medications so daily adjustments can be made if needed.
- Reducing carbohydrate intake potentially reduces blood glucose level, which means that diabetes medications can be reduced.
 - ▶ Particularly insulin and insulin secretagogues (sulfonylureas, meglitinides) can lead to hypoglycemia and therefore usually need to be reduced at onset of dietary change.
- Reducing carbohydrate intake also leads to water loss, partly from the use of glycogen stores (glycogen is stored with water) and partly from lower insulin levels (insulin, particularly when combined with hyperglycemia, signals the kidneys to retain sodium). As a result, blood pressure can decrease and dehydration can occur if water and sodium are not replenished.
- Insulin and insulin secretagogues should be adjusted **ON THE SAME DAY** that the patient is starting the new eating plan using the algorithms as guidance.
- Frequency of monitoring thereafter should be individualized based on the patient's comorbid conditions, concomitant medications, health literacy, age and other factors.
- For patients taking larger doses of insulin or diuretic, clinic visits every 1-2 weeks may be necessary at the beginning, and avenues for communication should be made available if advice is needed between visits.
- Elevations of blood glucose in the 150-250 mg/dl range can be tolerated after medication reductions are made while patients are adapting to low-carbohydrate nutrition and losing weight—this gives a “buffer” from hypoglycemic episodes.
- As weight loss continues, blood glucose levels will decline and further medication reductions may be necessary.
- Visits can be spaced out to monthly when blood glucose or blood pressure is at goal with no or rare hypoglycemia or hypotension episodes. Visits can be spaced further, if desired, when weight loss slows to 1-2 lbs. or less per week.

Table 3. Blood Pressure Medication Adjustment

Blood pressure, mm Hg		Change in one medication
Systolic	Diastolic	
<110	NA	Decrease by 25–50%
110–149	<95	No change
150–169	95–110	Increase by 25–50%

Notes:

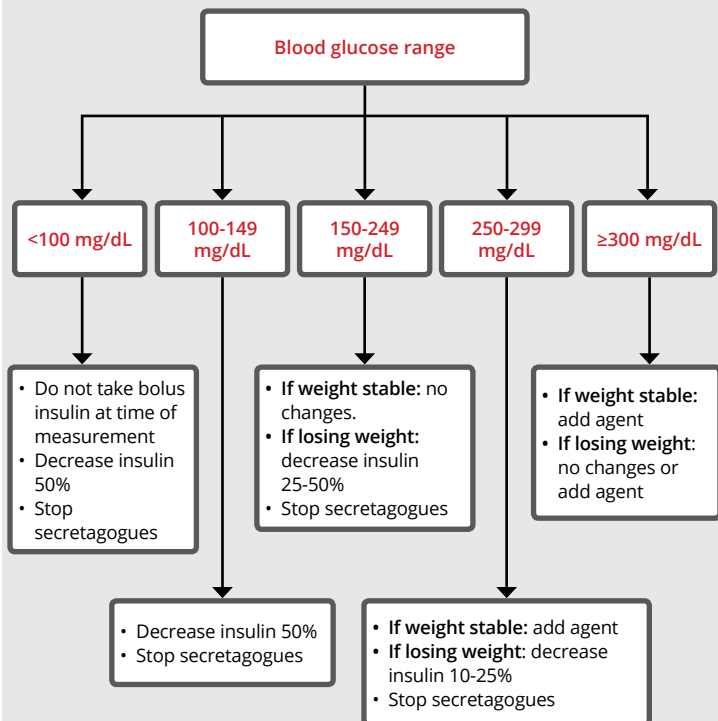
- For patients with controlled blood pressure and/or controlled edema, consider stopping low-dose or reducing high-dose diuretic medication during first 2–4 weeks to minimize risk for dehydration. Return to prior dose if BP elevates above goal and/or edema recurs.
- Treat symptomatic hypotension (extreme fatigue) or orthostatic hypotension (dizzy or lightheaded when going from lying/sitting to standing) similar to SBP <110 mm Hg.
- If reducing medication already at minimum dose, stop that medication.
- If increasing medication already at maximum dose, add one medication at starting dose.
- Follow diabetes/coronary artery disease/congestive heart failure guidelines regarding choice of agents when starting or stopping medication.

Figure 2. Initial Diabetes Medication Changes

Notes:

- When reducing insulin, typically reduce bolus and basal insulins at same time with a goal to have basal insulin as $\frac{1}{2}$ to $\frac{2}{3}$ of total daily dose.
- If no insulin or secretagogue in regimen and blood glucose <250 mg/dl, taper off thiazolidinedione (due to weight gain side effect) and try to lose weight.
- Avoid alpha-glucosidase inhibitors (due to diminished efficacy with low-carbohydrate intake) and SGLT-2 inhibitors (to minimize risk of ketoacidosis).
- Consider adding GLP-1 agonist as insulin is reduced or stopped, as this medication slows gastric emptying and can facilitate improved glucose control and appetite control.

Figure 3. Follow-Up Diabetes Medication Changes



Notes:

- When reducing insulin, typically reduce bolus and basal insulins at same time with a goal to have basal insulin as $\frac{1}{2}$ to $\frac{2}{3}$ of total daily dose.
- If no insulin or secretagogue in regimen and blood glucose <250 mg/dl, taper off thiazolidinedione (due to weight gain side effect) and try to lose weight.
- If adding an agent, choose agents that are weight neutral or lead to weight loss: metformin, GLP-1 agonists.
- Avoid alpha-glucosidase inhibitors (due to diminished efficacy with low-carbohydrate intake) and SGLT-2 inhibitors (to minimize risk of ketoacidosis).

Table 4. Adapting Diabetes Medication for Low Carbohydrate Management of Type 2 Diabetes

Drug Group	Action	Hypoglycemia risk?	Clinical suggestion
Biguanides (metformin)	Reduce hepatic gluconeogenesis. Reduce peripheral insulin.	No	Optional, consider clinical pros/cons.
GLP-1 agonists	Slow gastric emptying. Increase satiety. Increase insulin secretion.	No	Optional, consider clinical pros/cons.
Insulins	Exogenous insulin.	Yes	Reduce/Stop ^a
Sulfonylureas	Increase pancreatic insulin secretion.	Yes	Stop (if gradual carbohydrate reduction then wean by halving dose)
Meglitinides	Increase pancreatic insulin secretion.	No	Reduce/Stop (if gradual carbohydrate reduction then wean by halving)
SGLT-2 inhibitors	Reduce renal glucose reabsorption, increasing glucose excretion in the urine.	No	Consider stopping, especially with significant carbohydrate restriction. (SGLT2i's may cause ketoacidosis, including with euglycaemia)
Thiazolidinediones	Reduce peripheral insulin resistance.	No	Usually stop, concerns over long term risks usually outweigh benefit.
DPP-4 inhibitors	Inhibit DPP-4 enzyme, potentiating GLP-1 effect.	No	Usually stop, due to lack of benefit.
Alpha-glucosidase inhibitors	Delay digestion of starch and sucrose.	No	Usually stop, due to no benefit if low starch/sucrose ingestion.
Self-monitoring blood glucose	Provide feedback on blood glucose and response to food.	N/A	Important to be available for people on drugs that risk hypoglycaemia. May be useful also for helping to understand blood glucose response.

^a **Insulin reduction suggestion:** Important to tailor to individual. Usually requires close supervision with healthcare professional, and if in doubt seek expert input.

T2DM without 'beta cell failure': Usually reduce insulin dosage by approximately 50% (though a 30% initial reduction may be appropriate for those with a high HbA1c). Monitor QDS for hypoglycemia, with rescue glucose if required. Continue down-titration of insulin as insulin resistance improves (can take months in some cases). Goal for most can be to eliminate exogenous insulin.

Caution: Some people diagnosed with T2DM may have significant 'beta cell failure.' Also people with other forms of pancreatic insufficiency (e.g. LADA) may have been misdiagnosed as T2DM. Consider these possibilities if patient was not overweight at diagnosis. Inappropriate over-reduction and cessation of exogenous insulin is avoidable in these cases as they will become hyperglycemic.

Adapted from: Br J of GP July 2019 ; Murdoch C, Unwin D, Cucuzzella M, Patel M, Cavan D

How to Increase Maintenance

- Long-term sustainability may be improved by behavioral analogies like budgeting. Expectation is not avoidance of all carbohydrates but specific choices of foods low in digestible carbohydrate.
- Cravings for carbohydrate-rich foods are common, and unplanned deviations from any dietary pattern or lifestyle plan are normal and to be expected. Counseling emphasis should be placed on returning to the prescribed eating pattern and developing plans to remove, avoid or respond differently to triggers.
- Discussing in plain language “binge management strategies” and “emotional management strategies” initially and periodically is essential.
- Vegetarian dietary patterns, even vegan patterns, can be adapted to a low-carbohydrate goal with the inclusion of vegetable products which are high in protein content – e.g., soybeans, tofu, tempeh, and vegetable fats such as avocados, olives, nuts, seeds and nut butters.

Table 5. How to Manage/Prevent Potential Side Effects

Potential Negative Effects	Prevention/Management Solution
Transient symptoms such as headache, fatigue, lightheadedness or diarrhea, commonly called the “keto flu.”	If hypertension or heart failure is not present, adding fluid and sodium (e.g., bouillon 1–2 cubes/day) can prevent or reduce these symptoms. These symptoms typically resolve in 7–10 days. As with viral flu, patients should rest and avoid heavy exertion during this initial stage of the nutrition plan if symptoms occur.
Halitosis	Increase water intake, maintain good oral hygiene and use parsley, sugarless mints or chewing gum. In some cases, modification of macronutrient intake may be helpful.
Large increases in LDL	If LDL cholesterol increases more markedly, this can be managed by focusing on intake of plant-based foods (non-starchy vegetable consumption), leaner protein sources and increased unsaturated fats while reducing foods high in saturated fat (e.g., full-fat dairy products like butter, cream and cheese; processed meats; poultry skin).
Constipation	To prevent constipation, providers should emphasize non-starchy vegetables high in insoluble fiber, adequate fluid intake with the majority as water, and regular weight-bearing physical activity. If constipation occurs, stool softeners such as docusate should be the first line choice for treatment, followed by osmotic laxatives (See Table 6). Stimulant laxatives should not be used regularly due to potential risk of bowel hypotonia and dependency.
Hypoglycemia	Lowering carbohydrate intake should not cause hypoglycemia unless there is concomitant use of insulin secretagogues.

Physician-Patient Communication Topics — Dispelling Myths

- **Myth:** Low-carb nutritional approaches are a fad
Response: Over the past several decades, many randomized controlled trials, both short term and long term (up to 2 years or more), have demonstrated that a low-carbohydrate eating pattern is effective for weight loss, metabolic improvement, and weight maintenance.

- **Myth:** Low-carb is bad for your heart
Response: Carefully controlled randomized trials have demonstrated reduction in cardiometabolic risk factors and carotid intimal thickness.

- **Myth:** Low-carb is not sustainable long-term
Response: Reducing daily carbohydrate intake has the effect of decreasing appetite and increasing satiation or sense of fullness and corresponding biomarkers. This effect assists in long term maintenance. Randomized trials typically show that patients persist with low-carbohydrate eating plans similarly to comparison diets.

- **Myth:** Plant foods are reduced
Response: Non-starchy vegetables (green leafy, cruciferous, zucchini, cucumber, celery, etc.) are the foundational foods of a low-carbohydrate eating pattern and are nutrient dense with abundant amounts of folate, potassium, vitamins and phytonutrients. Proteins or fats can also be obtained from vegetable sources such as nuts, tofu, tempeh, olive oil, avocado and others.

- **Myth:** Ketosis is dangerous because the brain needs glucose
Response: Restricting dietary carbohydrates has been an established treatment option for children with hard to control epilepsy since the 1920s and has no proven deleterious effect on cognitive function.

- **Myth:** Ketone products and fats are necessary to get into nutritional ketosis
Response: The most important factor to attain nutritional ketosis is to consume a small amount of carbohydrate. Adding ketones or fats or oils is not necessary.

- **Myth:** Low-carb eating patterns negatively influence kidney function
Response: This myth stems from the confusion between low-carb eating patterns and high-protein eating patterns. Low-carb does not necessarily mean high protein. Further, for people without existing kidney disease, and for those eating to satiety, higher protein intake does not appear to be related to lower kidney function.

Table 6. Summary of Common Osmotic Laxatives

Type	Generic Name	Dosage	Side Effects/ Problems ^a	Mechanism of Action
OTC Products				
Hyperosmolar agents	Sorbitol	15–30 mL daily or <i>bid</i>	Sweet taste, transient abdominal cramps, flatulence, bloating	Nonabsorbable disaccharides metabolized by colonic bacteria into acetic and short-chain fatty acids, which accelerate colonic transit
	Lactulose	15–30 mL daily or <i>bid</i>		
	Polyethylene glycol	17 g/d	Incontinence due to potency, bloating, abdominal cramps	Osmotically ↑ intraluminal fluids
Saline laxative	Magnesium	15–30 mL daily or <i>bid</i>	Magnesium toxicity, dehydration, abdominal cramps, incontinence	Fluid osmotically drawn into small-bowel lumen, cholecystokinin stimulated, colon transit time ↓
	Magnesium citrate	5–10 fl oz (150–300 mL) once	Avoid in renal failure	

^a Potentially all laxatives and constipation treatments may cause fecal incontinence.

Abbreviations

ACE, angiotensin-converting enzyme; **ARB**, angiotensin-receptor blocker; **ASCVD**, atherosclerotic cardiovascular disease; **bid**, twice a day; **BP**, blood pressure; **CAC**, coronary artery calcium; **CBC**, complete blood count; **CGM**, continuous glucose monitor; **CMP**, fasting complete metabolic panel; **CVD**, cardiovascular disease; **GLP-1**, glucagon-like peptide-1; **GTT**, glucose tolerance test; **HbA1c**, hemoglobin A1c; **HDL**, high density lipoprotein; **hsCRP**, high-sensitivity C-reactive protein; **LADA**, latent autoimmune diabetes in adults; **LDL**, low density lipoprotein; **OTC**, over-the-counter; **SBP**, systolic blood pressure; **SGLT-2**, sodium-glucose co-transporter-2; **TC**, total cholesterol; **TG/HDL**, triglyceride to HDL

Disclaimer

This pocket guide attempts to define principles of practice that should produce high-quality patient care. It is applicable to specialists, primary care, and providers at all levels. This pocket guide should not be considered exclusive of other methods of care reasonably directed at obtaining the same results. The ultimate judgment concerning the propriety of any course of conduct must be made by the clinician after consideration of each individual patient situation.



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