

Applicable to: Health Professionals

Summary of Key Recommendations

Nutrition Recommendations to Manage Diabetes

Meal Timing

- Individualize timing and spacing of meals based on lifestyle preference and treatment goals.
 - Generally, eating 3 meals/day, including breakfast, is recommended.

Carbohydrate

- Space carbohydrate intake over the day to support blood glucose (glycemic) management.
 - Major food sources of carbohydrate include starchy vegetables, fruits, grains and grain products, milk, yogurt, legumes (beans, lentils, and peas), and added sugars.

Fibre

- Choose foods high in fibre to achieve an intake of 30–50 g fibre/day from a variety of sources.
 - High fibre foods include whole grains, products made from whole grains, vegetables, fruits, legumes (beans, lentils, and peas), nuts and seeds.

Glycemic Index

- Glycemic index (GI) is a tool to help guide carbohydrate food choices but is an advanced concept, and individuals will require additional education to use it successfully.
- For individuals interested and ready for education about the GI, support them to replace high GI carbohydrate foods (GI score of ≥ 70) with low GI carbohydrate foods (GI score ≤ 55).
 - Examples of low GI foods are whole grains, yams, legumes, milk, and berries.

Sugars

- Limit intake of foods with added (free) sugars to <5% or up to 10% total daily energy intake.
Example: No more than 50 g or 12.5 tsp (63 mL) added sugars in a 2000 kcal diet.

Fats

- Choose food sources of unsaturated fats (e.g. nuts) in place of foods high in saturated fats (e.g. high-fat processed meat).
 - Restrict saturated fats to less than 9% total daily calorie intake and minimize trans-fat intake.



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Sodium

- Limit sodium intake to less than 2300 mg per day.

Alcohol

- Limit alcohol intake to two standard drinks or less per day for females and three standard drinks per day or less for males (no more than 10 standard drinks per week for females and no more than 15 standard drinks per week for males).

Vitamins

- Monitor for vitamin B₁₂ deficiency in individuals on long-term (>4 years) metformin treatment.

Introduction

The purpose of the Adult Diabetes Nutrition Guideline (NG) is to provide health professionals with an overview of the evidence-based nutrition recommendations for adults with type 1 diabetes or type 2 diabetes and provide answers to commonly asked questions (See [Key Questions List](#)).

Following the recommendations in the (NG) can help to manage diabetes and:^{1,2}

- reduce A1c up to 1.9% in people with type 1 diabetes.³ [Grade D, Consensus]¹
- reduce A1c up to 2.0% in people with type 2 diabetes.³ [Grade C, Level 3 Evidence]¹
- prevent complications associated with diabetes.
- manage co-morbidities.
- reduce hospitalization rates.

The NG was developed by the Adult Diabetes Nutrition Practice Working Group and is based on scientific evidence or best practice as recommended by national and international diabetes organizations (e.g. Diabetes Canada and American Diabetes Association). It was reviewed by health professionals across the province and members of the Diabetes, Obesity, and Nutrition Strategic Clinical Networks. If you have questions about this Nutrition Guideline, please contact Nutrition_Resources@ahs.ca.

This information is intended as a general resource only and is not meant to replace the medical counsel of a physician or individual consultation with a registered dietitian (RD). It is the responsibility of health professionals to evaluate the situation of each patient in their care, and apply the NG appropriately. Individuals who are at high risk of malnutrition or who have a medical condition that is impacted by nutrition should be referred to an RD.

Note: For purposes of this NG, the single term patient will be used to refer to clients, patients, and residents.

Referral to a Registered Dietitian

For more information on referral to an RD and RD services available in Alberta Health Services (AHS):

- See Nutrition Guideline: [Referral to a Registered Dietitian](#)
- Visit [Referring Patients for Nutrition Services](#)

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Key Questions List

Key nutrition questions related to adult diabetes care addressed in this NG are listed below.

Definition

- What is diabetes?

Eating to Manage Diabetes

- Why is healthy eating important for diabetes management?
- Can type 2 diabetes be managed with lifestyle alone?

Meals and Snacks

- Are regular meals recommended to manage diabetes?
- What does a balanced meal look like?
- How can individuals with diabetes estimate recommended portion sizes?
- Are snacks recommended to manage diabetes?
- What types of snacks are recommended for people with diabetes?
- What is the evidence to support intermittent fasting for type 2 diabetes treatment?

Carbohydrates

- What are carbohydrates?
- Why is it important to spread carbohydrates over the day?
- What is carbohydrate counting?
- What is the recommended carbohydrate intake for an individual with diabetes?
- What are restricted carbohydrate and ketogenic diets?
- Are restricted carbohydrate (including ketogenic) diets effective and safe for adults with diabetes?

Fibre

- How does a high fibre diet benefit people with diabetes?
- How much daily fibre is recommended for people with diabetes?

Glycemic Index

- What is the glycemic index?
- How can people with diabetes use the glycemic index to make food choices?

Sugar and Sugar Substitutes

- Can individuals with diabetes consume sugar and sugar-sweetened foods and beverages?
- Are sugar substitutes safe for individuals with diabetes?

Fat and Protein

- How do fat and protein affect blood glucose levels?
- What is the recommended intake of protein for an individual with diabetes?
- What is the recommended intake of fat for an individual with diabetes?
- Do individuals with diabetes need to worry about LDL blood cholesterol?

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Dietary Patterns

- What dietary patterns are recommended for people with diabetes?
- What is a Mediterranean diet and its benefits for people with diabetes?
- What are the benefits of following a vegetarian diet for people with diabetes?
- What diet helps manage blood pressure in people with diabetes?

Eating Out

- How can restaurant meals fit into a healthy eating pattern for someone with diabetes?

Vitamin, Minerals, and Natural Health Products

- Do people with diabetes require vitamin and mineral supplements?
- Are there Natural Health Products (NHPs) recommended for the management of diabetes?

Alcohol

- Can an individual with diabetes drink alcohol?
- How much carbohydrate and calories are in alcohol?

Weight

- How does body weight affect diabetes management and health risks?
- How can an individual with diabetes achieve their 'best' weight?

Physical Activity

- What benefits do people with diabetes get from physical activity?
- What type of physical activity is recommended?

Hypoglycemia (Low Blood Glucose)

- What is hypoglycemia (low blood glucose)?
- How does a person with diabetes prevent hypoglycemia?
- How should a person with diabetes treat hypoglycemia?

Sick Day Management

- How can individuals manage their diabetes during illness?

Additional Considerations

- How can I support people with diabetes wanting to fast for spiritual or religious reasons?
- How can I support a person with diabetes facing financial strain and household food insecurity?

Resources

- What resources are available for patients?
- What resources are available for health professionals caring for patients with diabetes?

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Answers to Key Questions

Definition

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What is diabetes?

Diabetes is a metabolic disorder characterized by hyperglycemia (high blood sugar) due to insufficient insulin secretion, insufficient insulin action, or both.⁴ **Type 1 diabetes** is a result of pancreatic beta-cell destruction, usually caused by an autoimmune process. The body stops producing insulin and, therefore, exogenous insulin is required. **Type 2 diabetes** is a progressive chronic disease, with varying degrees of insulin resistance and insulin deficiency. The pancreas produces some insulin, but the cells in the body do not respond to the insulin properly (insulin resistance). The pancreas often cannot produce enough insulin to overcome this resistance without treatment.

Individuals with diabetes are at an increased risk for macro and microvascular complications associated with chronic hyperglycemia. These include coronary heart disease, stroke, nephropathy, retinopathy, foot ulceration and infection, erectile dysfunction, and neuropathy.⁴ Lifestyle interventions, including eating a healthy diet, can help manage diabetes and reduce the risk of associated complications.

For information about screening for and diagnosing diabetes refer to [Diabetes Canada's Clinical Practice Guidelines](#).

Eating to Manage Diabetes

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Why is healthy eating important for diabetes management?

Choosing nutritious foods as a part of a healthy lifestyle can help to prevent or manage hyperglycemia, hypertension, and dyslipidemia, thus reducing hospitalization rates.¹ Nutrition education to manage diabetes shortly after the diagnosis is important to ensure that the desired lifestyle interventions and individualized nutrition treatment plans are implemented.¹⁻³ Periodic and ongoing nutrition and diabetes self-management education and support are important to sustain improvements in clinical outcomes and behaviours.^{2,5} When possible, people with diabetes should receive nutrition counselling by an RD.¹

Can type 2 diabetes be managed with lifestyle alone?

Type 2 diabetes can be managed through diet and lifestyle changes as discussed in this guideline. According to the Diabetes Canada Clinical Practice Guidelines, if blood glucose and/or A1c targets are not achieved within three months of lifestyle and nutrition management, antihyperglycemic medication should be initiated. [Grade A, Level 1A Evidence]⁶

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Meals and Snacks

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Are regular meals recommended to manage diabetes?

Eating three meals per day, including breakfast, is recommended for people with diabetes. This helps with spacing and regularity in meal consumption to support good glycemic management.¹ In general, the timing and spacing of meals is individualized and based on the patient's lifestyle preferences and treatment goals. For individualized meal planning recommendations and education, consider referring to an RD.

Considerations

Some individuals may choose intermittent fasting to improve their health or fast for spiritual reasons. Refer to the following sections for additional information:

- [What is the evidence to support intermittent fasting for type 2 diabetes treatment?](#)
- [How can I support people with diabetes wanting to fast for spiritual reasons?](#)

What does a balanced meal look like?

A nutritionally balanced meal includes a variety of vegetables, fruits, whole grains, and protein-rich foods.⁷ Diabetes Canada's [Balanced Food Plate](#) is a plate model that can be used for people with diabetes to provide an example of a balanced meal.⁸ This resource is an adapted version of [Canada's food guide](#) and provides modified recommendations about fruit and starchy vegetables (Table 1).

Table 1. Comparison of Canada's Food Guide and Diabetes Canada's [Balanced Food Plate](#)

	Canada's Food Guide	Diabetes Canada's Balanced Food Plate
Recommendations	<ul style="list-style-type: none">• $\frac{1}{2}$ plate vegetables and fruit	<ul style="list-style-type: none">• $\frac{1}{2}$ plate non-starchy vegetables and small portion of fruit.• Fruit may be included with a meal or as a snack
	<ul style="list-style-type: none">• $\frac{1}{4}$ plate whole grains	<ul style="list-style-type: none">• $\frac{1}{4}$ plate whole grains and starchy vegetables
	<ul style="list-style-type: none">• $\frac{1}{4}$ plate protein foods• Choose protein foods that come from plants more often	<ul style="list-style-type: none">• Same as Canada's food guide

Breakfast does not include vegetables for some people. When addressing breakfast recommendations with patients, encourage protein foods along with carbohydrate foods (e.g. fruit, whole grains). When appropriate, discuss choosing high fibre and/or lower glycemic index carbohydrate foods at breakfast to assist with managing the blood glucose response to the meal. See [Fibre](#) and [Glycemic Index](#) sections of this NG for more information.

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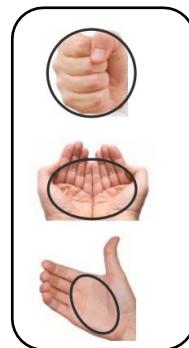
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How can individuals with diabetes estimate recommended portion sizes?

Nutrition education about portion sizes can help to improve patients' glycemic management and achieve their best weight. (See the [Weight](#) section.)

Using the patient's hands is a strategy for guiding portion sizes:⁹

- Using a fist to guide portions of grain/starches or fruit serving size.
- Using two handfuls to guide the serving size of vegetables at a meal.
- Using the palm and thickness of the little finger to guide serving size for meat, fish, or poultry.
- Using the tip of the thumb to guide the serving of added fat.



Are snacks recommended to manage diabetes?

Not all individuals with diabetes need to eat snacks, but consuming a snack can help improve blood glucose management when:

- meals are more than 4–6 hours apart
- hypoglycemia (low blood glucose) occurs when a person does not have a snack
- an individual is more active than usual and is at risk of hypoglycemia as a result
- an individual has improved fasting (morning) blood sugars when they include an evening snack
- an individual experiences better portion control at meal times if they have a snack mid-day

A **bedtime snack** may or may not be needed and is dependent on the above-mentioned factors. For individuals with insulin-treated diabetes, a bedtime snack including some carbohydrate and protein can help prevent hypoglycemia when bedtime glucose is <7.0 mmol/L.^{10,11}

To prevent undesired weight gain, instead of adding more calories by the addition of snacks, consider spreading current intake into meals and snacks.

What types of snacks are recommended for people with diabetes?

Snacks that include one or two different types of foods that are high in fibre, include some protein and contain limited or no added sugars or fats are recommended choices for snacks. Table 2 provides snack examples.

Table 2. Snack Examples for People with Diabetes

Food	One Serving
Vegetables and Fruit	
Vegetables, raw	not specified
Fruit, fresh	1 piece or 1 cup (250 mL)
Fruit, canned unsweetened	½ cup (125 mL)
Grain Products	
Crackers, whole grain (e.g. Ryvita® or Wasa®)	2–3
Bread, whole grain	1 slice
Popcorn, plain	3 cups (750 mL)
Cookies, low-fat (e.g. digestive or arrowroot)	3
Cereal, high-fibre (≥4 g fibre/serving)	½ cup (125 mL)

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Food	One Serving
Protein Foods	
Milk, skim, 1%, or 2% M.F.	1 cup (250 mL)
Yogurt, plain or sugar-free	¾ cup (175 mL)
Cottage cheese, 1% or 2% M.F.	¼ cup (60 mL)
Eggs, hardboiled	1
Peanut butter	2 Tbsp (30 mL)
Nuts or seeds, unsalted, shelled	¼ cup (60 g)
Tuna, canned	1 small can (85 g)
Hummus	¼ cup (60 mL)

% M.F. = % Milk Fat

What is the evidence to support intermittent fasting for type 2 diabetes treatment?

There are various approaches to intermittent fasting: alternative-day fasting, time-restricted feeding (e.g. restricting food intake for 18–20 hours), and severe energy restriction for eight days or longer. Intermittent fasting studies including people with type 2 diabetes are small and short in duration.² A meta-analysis of studies in individuals with obesity and type 2 diabetes demonstrated that intermittent fasting results in a modest decrease in body weight (-1.9 kg) with no significant improvement in A1c compared to standard reduced energy diets.¹² Therefore, intermittent fasting results in similar health benefits compared to standard reduced-calorie diets and may be considered an alternative, but safety and medication adjustments need to be considered.¹³ The long-term sustainability of the positive health effects (e.g. weight, blood glucose, and blood pressure reduction) requires further investigation.¹³

If a patient is interested in intermittent fasting, discuss the potential risks (e.g. hypoglycemia, dehydration) associated with fasting and the need to create a plan for adjusting diabetes medications, blood glucose monitoring, and sick day management.¹³

Considerations

- Poorly planned intermittent fasting increases the risk of nutrient deficiencies, dehydration, and hypo- or hyperglycemia.¹³
- Intermittent fasting is contraindicated for in individuals with the following conditions:^{13,14}
 - Pregnancy
 - High variability in daily blood glucose levels.
 - Recent history of frequent or severe hypo- or hyperglycemia
 - Eating disorder
 - Advanced macrovascular complications or renal disease
 - Immunosuppressed

A referral to an RD is recommended for people with diabetes interested in intermittent fasting to reduce the risk of nutrient deficiencies.

Refer to:

- [Additional Considerations](#) section for more information about fasting for religious or spiritual reasons.
- Nutrition Guideline: [Adult Obesity Care](#) for more information about intermittent fasting as a lifestyle approach to treating obesity.

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Carbohydrates

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What are carbohydrates?

Carbohydrates include sugar, starch, and fibre. Major food sources of carbohydrate include starchy vegetables, fruits, grains and grain products, milk, yogurt, legumes (beans, lentils, and peas), and sugar (e.g. molasses, honey, and table sugar).

Both sugar and starch are carbohydrates digested by the body and absorbed into the blood as glucose, which provides energy to the brain, muscles, and cells. Fibre is also a carbohydrate but is not broken down into glucose in the body.¹⁵ Choosing high-fibre foods supports good blood glucose management. Refer to the [Fibre](#) section of this NG for more information.

Consideration

For individuals taking meal-time insulin, the amount of fibre in the food or meal is an important consideration. See the carbohydrate counting question (below) for information on calculating “available carbohydrate”.

Why is it important to spread carbohydrates over the day?

A variety of carbohydrate foods need to be eaten daily to get enough energy, fibre, vitamins, and minerals from the diet. Carbohydrate foods have the greatest effect on raising blood glucose. Since these foods elevate blood glucose levels, it is important to distribute carbohydrate foods evenly throughout the day. Consistent carbohydrate intake and regular spacing of meals may help manage blood glucose and weight. [Grade D, Level 4 Evidence for type 2 diabetes]¹

People taking mealtime insulin, such as those with type 1 diabetes and some individuals with type 2 diabetes, may benefit from matching insulin dose to their carbohydrate intake. [Grade C, Level 2 Evidence for type 1 diabetes]¹ Alternatively, maintaining consistency in carbohydrate intake to match a fixed mealtime insulin dose can be used. [Grade D, Level 4 Evidence for type 1 diabetes]¹

What is carbohydrate counting?

Counting carbohydrates is a method used by some people with diabetes to help manage or anticipate their glucose levels after eating. It can support better distribution of carbohydrate intake over the day, as well as individualized eating patterns that match carbohydrate intake with the patient’s lifestyle, diabetes medications, and/or insulin. Carbohydrate counting requires an increased level of literacy and numerical skill, therefore, it may not be appropriate for everyone with diabetes.

Education following the Diabetes Canada “carbohydrate choice” system is often used to introduce the concept of carbohydrate counting.¹⁶ This system portions carbohydrate-rich foods into amounts that provide 15 g of “available” carbohydrate (Table 3).

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Table 3. Examples of Food Portions that Contain Approximately 15 g Available Carbohydrate

Food	One Carbohydrate Choice (approximately 15 grams available carbohydrate)
Fruit	
Fruit, fresh	1 small to medium piece
Fruit, fresh, cut up	1 cup (250 mL)
Fruit, canned unsweetened	½ cup (125 mL)
Grain Products & Starchy Vegetables	
Pasta, potatoes, yams, couscous, quinoa, barley, cooked	½ cup (125 mL)
Rice, cooked	1/3 cup (75 mL)
Bread	1 slice
Bun, hot dog or hamburger	½ bun
Bagel	¼ large or ½ small
Beans, peas, lentils, cooked	½ cup (125 mL)
Milk, Yogurt & Soy-based beverages	
Milk, skim, 1%, or 2% M.F.	1 cup (250 mL)
Yogurt, plain or sugar-free	¾ cup (175 mL)
Soy-based beverages, unsweetened	1 cup (250 mL)
Sweets	
Sugar, jam, honey or syrup	1 Tbsp (15 mL)

Available carbohydrate is calculated by subtracting the fibre and sugar alcohol content of a food portion from the total carbohydrate amount in the food portion.

$$\text{total carbohydrate} - [\text{fibre} + \text{sugar alcohol}] = \text{available carbohydrate}$$

Fibre and sugar alcohols do not contribute to a rapid rise in blood glucose. The rationale for calculating available carbohydrate is to reduce the risk of hypoglycemia for individuals matching their meal-time insulin dose to the carbohydrates they consume at that meal.¹

RDs, in coordination with the diabetes interdisciplinary team, can help determine individualized insulin to carbohydrate ratios (ICR). The ICR can help match patients' meal insulin dose to the amount of carbohydrate they consumed, resulting in better glycemic management after meals.

What is the recommended carbohydrate intake for an individual with diabetes?

For the majority of adults with diabetes, it is recommended that 45–60% total energy intake comes from carbohydrate in order to achieve a nutritionally balanced diet.¹ The quality of carbohydrate (e.g. amount of fibre, added sugars, food processing) is an important factor when considering dietary carbohydrate effect on health.¹⁷ For a 2000 calorie diet, the 45–60% recommendation translates to between 225–300 g carbohydrate/day, of which the majority should be derived from high-fibre and low glycemic index foods.

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For adults, the recommended daily allowance (RDA) for carbohydrate intake is no less than 130 g/day.¹⁵ The RDA is based on a scientific literature review and intended as a guideline to assess and plan nutritionally adequate diets for the majority of the adult population.¹⁵ However, there is insufficient evidence to provide specific minimum carbohydrate recommendations for people living with diabetes. The amount of carbohydrate an individual needs depends on individual lifestyle, metabolic response, and treatment goals.

See [Fibre](#), [Glycemic Index](#), and [Sugar and Sugar Substitutes](#) sections for more information about different types of carbohydrate.

What are restricted carbohydrate and ketogenic diets?

There is increasing interest in restricted carbohydrate and ketogenic diets for diabetes management. The definition of these diets varies. Table 4 provides definitions and descriptions most commonly used in the literature.

Table 4. Restricted Carbohydrate Diet Descriptions^{15,18,19}

Diet	Carbohydrate Amount*
Moderate carbohydrate	≥130 g carbohydrate daily and between 26–45% total energy from carbohydrate
Low carbohydrate	<130 g carbohydrate daily or <26% total energy from carbohydrate
Ketogenic (Very-Low Carbohydrate High Fat [‡])	20–50 g carbohydrate daily or <10% total energy from carbohydrate

*Note: Carbohydrate refers to available or net carbohydrate, which is the total carbohydrate minus dietary fibre.

[‡]High fat typically refers to an intake of 65–80% total energy from dietary fat.

Some dietary strategies restrict the total amount of carbohydrate per day, others restrict certain foods (e.g. groups of foods) or types of carbohydrate (e.g. refined grain products, added sugars). Generally, as the proportion of carbohydrate decreases, energy intake from dietary fat increases. Protein intake can vary as well but tends to remain within the recommended range (10–35% of daily energy).¹⁵ As the carbohydrate amount decreases in the diet, the risk of nutrient deficiency increases.^{20–22}

Dietary carbohydrates provide the body with glucose, which is typically the body's primary source of fuel. When the body's availability of glucose is low, ketones (acetooacetate, beta-hydroxybutyrate, acetone) are produced from fatty acids in the liver and can be used as an alternative fuel source.²³ A **ketogenic diet** includes a very-low carbohydrate and high fat intake to promote the body to use a higher proportion of fatty acids for energy and put the body in a state of ketosis.^{15,24}

Nutritional or metabolic ketosis often refers to the physiological state created due to a ketogenic diet.^{23,24} Nutritional ketosis can occur after a period of time (typically 3–4 days) of following a very-low (<50 g) carbohydrate intake.²⁴ The amount of time needed before the body enters into the state of metabolic ketosis will depend on the dietary strategy and individual factors (e.g. activity level, body size). Fasting is sometimes used to expedite the time required to enter into the ketosis state.

Diabetic ketoacidosis (DKA) differs from metabolic or nutritional ketosis. DKA is a life-threatening condition that occurs due to severe insulin deficiency and causes an acute rise in blood ketone concentrations, electrolyte imbalances, and acidosis.^{24,25}

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Are restricted carbohydrate (including ketogenic) diets effective and safe for adults with diabetes?

Well-planned restricted carbohydrate diets are one of many dietary approaches that may achieve desirable metabolic and health outcomes in adults with diabetes.²⁶ It's important to recognize these diets can be difficult to follow and the benefits, challenges, and risks are factors for patients to explore prior to initiating the diet. Individuals choosing a very-low carbohydrate or ketogenic diet should be followed by an interdisciplinary team including an RD.

Type 2 diabetes: Studies in adults with type 2 diabetes have demonstrated restricted carbohydrate diets produce greater reductions in A1c compared to higher carbohydrate diets in the short term, but no difference was observed in the longer term (12–24 months).^{26,27} Restricted carbohydrate diets often require a reduction or change in diabetes medications, so despite no difference in A1c in the long-term, a reduction in the need for medications may be an important outcome to consider.^{26,27}

Type 1 diabetes: Research evaluating restricted carbohydrate diets in adults with type 1 diabetes is limited.²⁸ A review of the evidence suggests restricted carbohydrate diets may have a lowering effect on A1c and reduction in total daily insulin doses in people with type 1 diabetes.²⁹ Little is known about the effect of restricted carbohydrate diets on other important outcomes such as the risk of severe hypoglycemia, weight, and glycemic variability.^{28,29}

Considerations

- Poorly planned restricted carbohydrate diets increase the risk of nutrient deficiencies.
- Patients consuming a restricted carbohydrate diet while taking SGLT-2 inhibitors (e.g. canagliflozin, empagliflozin, dapagliflozin) are at increased risk of (euglycemic) diabetic ketoacidosis.³⁰
- Very-low carbohydrate and high fat (ketogenic) diets are contraindicated for individuals with the following conditions:²³
 - Pregnancy³¹
 - Inborn errors of fat metabolism
 - Renal stones
 - Severe dyslipidemia
 - Liver failure
 - Failure to thrive or poor oral intake
 - History of pancreatitis
 - Severe gastroesophageal reflux
 - Gastroparesis
 - Cardiomyopathy
 - Chronic metabolic acidosis

There are many gaps in the evidence to make conclusions about the long-term effects of restricted carbohydrate diets on other markers of health and chronic diseases, such as inflammation and gut health.

For more information on restricted carbohydrate diets, refer to Nutrition Guideline: [Restricted Carbohydrate Diet](#).

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Fibre

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How does a high fibre diet benefit people with diabetes?

The benefit of high fibre diets includes regularity of bowel movements, reduced blood cholesterol levels, management of blood glucose and/or insulin levels, and a healthy colon.³² Fibre intake recommendations for people with diabetes are higher than for the general population due to the health benefits described below.¹

Soluble Fibre

- Helps manage blood glucose after meals by delaying gastric emptying and the absorption of glucose in the small intestine.¹
- Helps lower low-density lipoprotein (LDL) levels.
- Found in foods such as oat bran and oatmeal, psyllium, some fruits (e.g. avocados, pears, apples, nectarines, plums, oranges), legumes (beans, lentils, and peas), and barley.

Insoluble Fibre

- Associated with decreased risk of cardiovascular disease.¹
- Found in wheat bran, whole grain foods such as whole wheat bread, vegetables, fruits, and legumes (beans, lentils, and peas).

How much daily fibre is recommended for people with diabetes?

The recommended intake for an adult with diabetes is 30–50 g/day from a variety of sources, including soluble and insoluble fibres.¹ Fibre requirements can be met by eating high fibre foods such as whole grain breads and cereals, legumes, vegetables, and fruit.

Refer to Nutrition Guideline: [Fibre](#) for further information and examples of high fibre foods.

Glycemic Index

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What is the glycemic index?

Glycemic index (GI) is a scale from 1 to 100 that ranks carbohydrate-rich foods by how much they raise blood glucose levels after meals when compared to a standard food (glucose or white bread).³³ GI is a reflection of the rate carbohydrates are digested and absorbed as glucose following consumption. High GI foods (≥ 70 out of 100) convert quickly into glucose causing a rapid rise in blood glucose, while low GI foods (≤ 55 out of 100) are converted more slowly and produce a lower blood glucose response.³³

Many factors can affect the GI of a food, including the amount of fibre, protein and/or fat in the food, the type of carbohydrate, the acid content, food processing, and cooking methods. For more information regarding GI refer to www.glycemicindex.com.

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How can people with diabetes use the glycemic index to make food choices?

Exchanging high GI carbohydrate foods with low GI carbohydrate foods can decrease blood glucose response to food and therefore can be a helpful strategy for people with diabetes. [Grade B, Level 2 Evidence for type 1 and type 2 diabetes]¹

Education on GI can be provided based on the patient's interest and ability.¹ Glycemic index is an advanced concept, as many factors affect the GI of a food and individuals will require additional education to use it successfully.³³ The GI is a tool to help guide food choices but serving sizes are also an important consideration when choosing low GI foods. In addition, nutrition guidelines for overall health remain an essential factor.

Tips to use the GI as a tool to improve blood glucose management:³⁴

- Enjoy vegetables, fruits, and milk products with meals. These generally have a low GI.
- Plan meals using medium and low GI grains or starches. See examples in Table 5.
- Limit intake of foods with a high GI and aim to find acceptable lower GI replacements (see Table 5).

Table 5. Glycemic Index Food Example List³⁴

Low GI (≤ 55) Foods	Medium GI (56–69) Foods	High GI (≥ 70) Foods
<ul style="list-style-type: none">• Breads: 100% stone-ground whole wheat, heavy mixed grain, sourdough• Cereals: All-Bran®, psyllium, oat bran• Grains: barley, bulgur• Pasta: al dente cooked pasta/noodles• Rice: parboiled, converted• Starchy vegetables: sweet potato, yam, legumes (beans, lentils, and peas)	<ul style="list-style-type: none">• Breads: whole wheat, rye, pita bread• Cereals: puffed wheat, oatmeal• Crackers: Stoned Wheat Thins™, rye crisps• Pasta: couscous• Rice: basmati, brown, wild rice• Starchy vegetables: new/white potatoes, sweet corn, popcorn	<ul style="list-style-type: none">• Breads: white, bagels• Cereals: All-Bran® Flakes, Corn Flakes®, Rice Krispies®• Crackers: soda crackers• Rice: short-grain, Jasmine• Rice cakes• Pretzels• Starchy vegetables: Russet potatoes, French fries

Patient education resources about GI are available from Diabetes Canada. Refer to the [Resource](#) section.

Sugar and Sugar Substitutes

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Can individuals with diabetes consume sugar and sugar-sweetened foods and beverages?

Dietary sugars include total sugars, free sugars, and added sugars (see Figure 1).^{35,36} It is recommended for people with diabetes to follow a diet that contains <5% or up to 10% of total energy from free sugar.^{1,37} Table 6 summarizes the recommended **maximum** daily amount of free sugar and teaspoons of sugar equivalents based on daily caloric intake.

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Figure 1: Types of Dietary Sugars³⁵

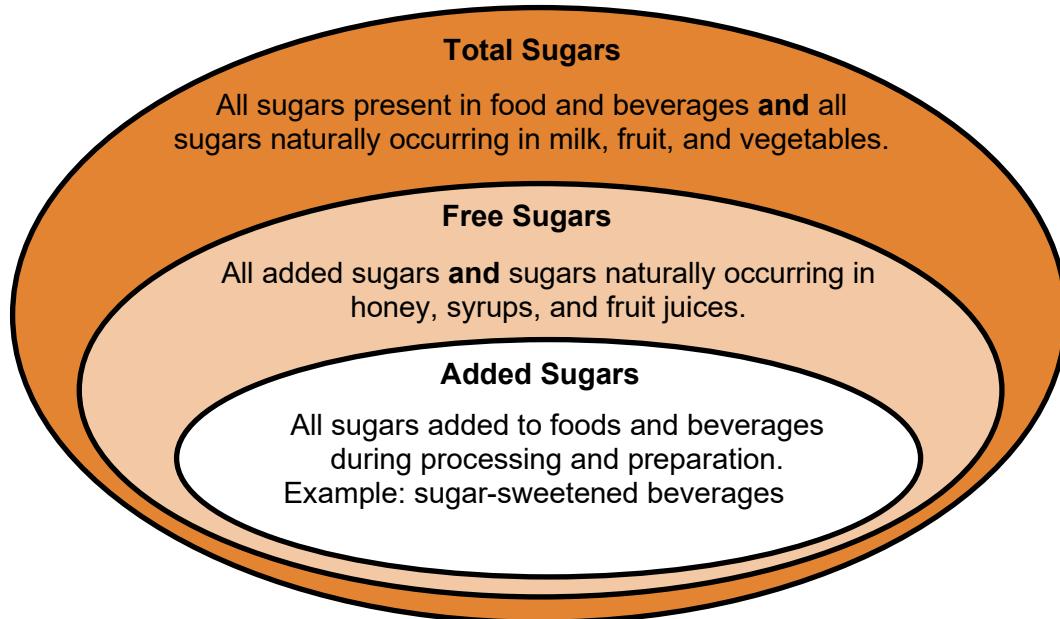


Table 6. Recommended Maximum Daily Free Sugar Allowance Based on Daily Calorie Intake

Daily Calorie Intake	Maximum Total Daily Free Sugar*	Teaspoons of Sugar (4g/tsp)**
1200–1500 kcal	30–38 g	7.5–9 tsp
1600–1800 kcal	40–45 g	10–11 tsp
1900–2100 kcal	48–53 g	12–13 tsp

*Equation: 10% total daily energy ÷ 4 kcal/g carbohydrate

**Note: 1 can (355 mL) of sugar-sweetened carbonated beverage (e.g. cola) provides approximately 40 g added sugars or the equivalent of 10 tsp sugar.

The dietary source of sugar is a more important consideration than the type of sugar.¹ For example, a high sugar-sweetened beverage intake providing more than 10% total daily calories is strongly associated with the risk of hypertension and coronary heart disease in people with diabetes.¹ This relationship has not been shown for naturally occurring sugars obtained from fruit, whole grains with added sugar, or yogurt with added sugar.¹

Are sugar substitutes safe for individuals with diabetes?

Sugar substitutes include artificial sweeteners, high-intensity sweeteners, and sugar alcohols.^{38,39} When consumed below the acceptable daily intake (ADI), sugar substitutes are safe for people with diabetes (Table 7).^{1,40}

Sugar substitutes:

- can be used in moderation and should not replace nutrient-dense food choices.⁴¹
- can reduce calorie intake when substituted for added sugars and/or other carbohydrates.²
- have little effect on blood glucose and can assist to lower the glycemic response to a food/meal when substituted for added sugars and/or other carbohydrates.^{2,40}

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Foods may state “sugar-free” or “no sugar added” on the label but can be high in fat, calories, low in fibre, and still contain carbohydrate. Some individuals with diabetes may eat large quantities of these foods, believing them to be healthier choices. Consuming products sweetened with sugar substitutes in moderation is encouraged to ensure these products are not replacing more nourishing foods.

Table 7. Sugar Substitutes Approved for Use in Canada^{41,42}

Sweetener	Common name and brand name*	ADI (mg/kg/day)	Quantity required to reach daily limit**
Acesulfame-potassium	Sunett®	0–15	25 cans diet soda
Aspartame	Nutra-Sweet®, Equal®, Sweet ‘N Low®, private labels	0–40	14 cans diet soda
Cyclamates***	Sucaryl®, SugarTwin® and Sweet ‘N Low®	0–11	3 packets SugarTwin®
Neotame	Not common	0–2	n/a
Saccharin	Hermesetas® (only purchased at pharmacies)	0–5	29 packets
Steviol glycosides	Truvia®, SugarTwin® Stevia, Krisda®, Pure Via™	0–4	10 packets of Truvia®
Sucratose	Splenda®, Sugar Twin Sucratose®	0–8.8	51 packets
Thaumatin	Not common	0–0.9	Information not available
Monk Fruit extract (Luo Han Guo Extract)	Lakanto®, Splenda®, Whole Earth® (products often include erythritol or stevia)	Not established†	No upper limit set

*Brand names are provided as examples only and are not an endorsement.

**Quantity based on 70 kg (154 lb) person.

***Caution patients about the use of cyclamates. Consumers can easily exceed the ADI compared to other sugar substitutes.

† Monk Fruit is generally recognized as safe (GRAS) by the Food & Drug Administration (FDA) but does not have an established ADI.⁴³ It is approved as a tabletop sweetener by Health Canada.⁴⁴

Sugar alcohols (polyols) provide an average of 2 kcal/g but have little to no effect on blood glucose.^{1,38,45} Sugar alcohols include sorbitol, mannitol, xylitol, erythritol, D-tagatose, Isomalt, lactitol, and maltitol. It is recommended to limit intake of sugar alcohols to ≤10 g/day to reduce the risk of gastrointestinal side effects.¹

Considerations

- **For individuals who are pregnant or are planning pregnancy**, refer to the Nutrition Guideline: [Pregnancy](#) for additional statements about the use of cyclamates and stevia leaves.
- **For individuals with insulin-treated diabetes**, matching rapid insulin dose to the sugar-alcohol content of food is not recommended. To reduce the risk of hypoglycemia after meals, sugar alcohols should be subtracted from the total carbohydrate amount when counting carbohydrates.¹

Refer to Nutrition Guideline: [Sugar Substitutes](#) for more information on this topic.

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Fat and Protein

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How do fat and protein affect blood glucose levels?

Although carbohydrate has the greatest effect on blood glucose levels, fat and protein can have some direct and indirect effects.

High-fat diets may impair insulin sensitivity in some individuals, thereby increasing blood glucose levels.^{46,47} For individuals who take insulin with meals, more insulin may be required for high-fat meals (e.g. 60 g fat or more).⁴⁸ In addition, fats slow gastric emptying causing a delay in the peak glycemic response to the meal.^{47,48}

Protein has minimal effect on blood glucose when consumed in recommended amounts, such as those discussed in the [Meals and Snacks](#) section of this document.^{47,49} For individuals with type 1 diabetes, high protein meals (e.g. more than 30 g) may require additional insulin.^{48,50} For individuals with type 2 diabetes, protein can stimulate insulin secretion to varying degrees and does not contribute to a rise in blood glucose.^{2,49}

What is the recommended intake of protein for an individual with diabetes?

Recommended dietary protein intake for people with diabetes is no different than for those without diabetes. The majority of individuals (with and without diabetes) typically consume between 1–1.5 g protein/kg body weight/day.¹ This often represents 15–20% total daily calories consumed coming from protein.

What is the recommended intake of fat for an individual with diabetes?

Recommended total fat intake in people with diabetes is similar to those for people without diabetes. Eating patterns should encourage a total fat intake of 20–35% total daily energy intake. [Grade D, Consensus]¹

People living with diabetes are at a high risk of cardiovascular disease, therefore, the type of fat (e.g. unsaturated fat versus saturated fat) consumed is more important than the total amount consumed.^{1,2} To reduce the risk of cardiovascular disease, it is recommended to consume a diet that is lower in saturated fat (<9% of total calories/day) and to avoid trans fatty acids.¹ This can be achieved by replacing foods high in saturated fatty acids with foods rich in polyunsaturated and monounsaturated fatty acids.

Refer to Nutrition Guideline: [Heart Health](#) for information about dietary fat and eating to reduce cardiovascular disease risk.

Do individuals with diabetes need to worry about LDL blood cholesterol?

Cardiovascular disease (CVD) is the primary cause of death in people with both type 1 and type 2 diabetes.⁵¹ The blood lipid goal for most individuals with diabetes is achieving an LDL-C of ≤ 2.0 mmol/L.⁵¹

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- To improve blood lipid levels it is recommended to limit intake of saturated fat to <9% of total calories and to restrict trans-fat intake to a minimum.¹ Refer to Nutrition Guideline: [Heart Health](#) for more information.
- Soluble fibre helps to lower LDL-C by binding to fatty acids in the gastrointestinal tract. It also decreases the amount of cholesterol produced by the liver.⁵² See [Fibre](#) section.
- Many individuals with diabetes will need a combination of lifestyle modification and medications to achieve recommended lipid targets.⁵¹

Effective cardiovascular protection requires a multifaceted approach targeting all risk factors including weight management, hypertension, hyperglycemia, dyslipidemia, microalbuminuria, smoking, sedentary lifestyle, and diet.⁵¹

Refer to Nutrition Guideline: [Heart Health](#)

Dietary Patterns

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What dietary patterns are recommended for people with diabetes?

Several dietary patterns can support glycemic management and reduce cardiovascular risk in people with diabetes.¹ These dietary patterns have similarities to Canada's food guide: promoting the intake of whole grains, vegetables and fruit, and limited saturated fats, sugar and sodium. Most research has focused on Mediterranean and vegetarian dietary patterns in people with type 2 diabetes. Although the evidence is less robust, the Dietary Approaches to Stop Hypertension (DASH) diet has shown to decrease blood pressure and incidence of CVD in people with type 2 diabetes.^{1,53}

What is a Mediterranean diet and its benefits for people with diabetes?

The Mediterranean diet is primarily a plant-based diet:¹

- rich in vegetables, fruits, legumes, nuts, seeds, cereals, and whole grains.
- moderate to high in (extra-virgin) olive oil.
- low to moderate in dairy, fish, poultry, and red wine with meals.
- low in red meats, added sugars, and highly processed foods.

Water intake and regular physical activity are also important parts of this lifestyle and eating pattern.

A Mediterranean diet has been identified as one of the most effective dietary approaches to reduce major cardiovascular events [Grade A, Level 1A Evidence]¹ and improve glycemic management [Grade B, Level 2 Evidence]¹ in individuals with type 2 diabetes.^{1,2} A small observational study suggested a Mediterranean diet also has cardiovascular protective effects in people with type 1 diabetes.⁵⁴

If a patient is interested in following a Mediterranean meal pattern, consider referring them to an RD.

Refer to Nutrition Guidelines: [Hypertension or Heart Health](#) for more information about a Mediterranean diet.

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What are the benefits of following a vegetarian diet for people with diabetes?

A vegetarian dietary pattern does not include meat, fish, or poultry. This dietary pattern emphasizes a high consumption of plant-based foods such as vegetables, fruits, nuts, legumes, and whole grains. Well-planned vegetarian diets typically have a lower glycemic index, are lower in saturated fat, and higher in fibre compared to standard American diets, therefore, can assist with glucose management, weight management, and reducing cardiovascular risk.^{55,56} [Grade B, Level 2 Evidence]¹

Refer patients who are interested in adopting a vegetarian diet to an RD.

Refer to Nutrition Guidelines: [Heart Health](#) or [Hypertension](#) for more information about a vegetarian diet.

What diet helps manage blood pressure in people with diabetes?

Many individuals with diabetes will develop hypertension, which is a major determinant of both microvascular and cardiovascular complications associated with having diabetes.⁵⁷ Lifestyle interventions to lower blood pressure may include following a DASH (Dietary Approaches to Stop Hypertension) dietary pattern.⁵⁸ [Grade C, Level 2 Evidence]¹ The DASH diet has been shown to improve glycemic management (A1c) and reduce cardiovascular risk (reduce weight, blood pressure, LDL, and increased high-density lipoprotein [HDL]).¹ This dietary pattern emphasizes vegetables, fruits, lower-fat dairy products, whole grains, poultry, fish, and nuts. The DASH diet is most effective in lowering blood pressure when combined with a lower sodium intake.^{1,2}

It is recommended to limit sodium intake to less than 2300 mg of sodium a day for the general population.⁵⁹ This sodium recommendation also applies to individuals with diabetes.² In individuals with diabetes and hypertension, a sodium restriction of closer to 2000 mg should be considered⁵⁸ and implemented on an individual basis.²

Reading food labels can help decrease sodium in the diet. Watch for words such as “salt”, “sodium”, or “soda” in the ingredient list. Read the Nutrition Facts table to choose foods with <15 % daily value (DV) per serving.⁵⁹

Other ways to lower sodium in the diet include:

- Limit intake of processed and packaged foods.
- Avoid salty snack foods.
- Prepare lower-sodium foods at home and eat less restaurant and fast food.
- Eat smaller portion sizes of foods that contain salt.
- Choose a variety of foods that are “low in salt,” “reduced-sodium”, or have “no salt added”.
- Limit or avoid using salt in cooking and at the table.

Consideration

For individuals who need to limit the amount of potassium in their diet or are taking potassium-sparing medications, salt substitutes, or low-sodium foods containing added potassium (e.g. potassium chloride, No-Salt®, or Half-Salt®) are not recommended. Encourage patients to check with their healthcare provider before using salt substitutes. For more information, refer to Nutrition Guideline: [Renal](#).

Refer to Nutrition Guidelines: [Sodium](#) or [Hypertension](#)

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Eating Out

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How can restaurant meals fit into a healthy eating pattern for someone with diabetes?

Food served at restaurants is often higher in fat and sodium and lower in fibre. Portion sizes are also often larger than what an individual would eat at home.^{60,61} Tips for eating out when living with diabetes:

- To manage portion sizes, share meals with someone or ask for half of the meal to be packed up ahead of time.
- To reduce extra fat, sodium, and sugars, avoid fried appetizers, side dishes, entrees, and desserts.
- Aim to order a meal that represents a balanced plate including ½ plate of vegetables.
- Ask for leftovers to be packed up.
- If really hungry before going out to eat, consume a small snack.
- Consider a tossed salad with dressing on the side as a starter course.
- Limit eating out to 2 times/week or less.
- Limit or avoid intake of beverages with added sugars or alcohol.
- Check nutrition information online and look for food and drink choices that best fit the individual's eating plan, such as lower calorie, fat, or carbohydrate choices.

Consider referring an individual with diabetes who eats out regularly to an RD.

Vitamin, Minerals, and Natural Health Products

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Do people with diabetes require vitamin and mineral supplements?

Most individuals with diabetes can meet their nutrition needs by eating a balanced diet as recommended by Canada's food guide.⁷ Routine vitamin and mineral supplementation is not necessary, except for:

- **Folic Acid:** Individuals with diabetes who are of childbearing age, and may become pregnant, are recommended to supplement daily with 1.0 mg folic acid to ensure supplementation at least three months before conception. Starting in the second trimester, they may choose to decrease to 0.4 mg daily.³¹ A daily multivitamin before and during pregnancy, and while lactating, is also recommended to provide adequate vitamin B₁₂, iron, and vitamin D.
 - Refer to Nutrition Guidelines: [Pregnancy](#); [Diabetes in Pregnancy](#); [Nutrition for Lactation](#); [Adult Obesity Care](#).
- **Vitamin D:** The evidence that vitamin D supplementation improves glycemic management in people with diabetes is conflicting.² In Alberta, it is unlikely the majority of people will obtain adequate vitamin D through sun exposure and food sources; therefore, supplementation is necessary for most people. The following recommendations apply to all Albertans, including those with diabetes:¹
 - 400 IU vitamin D daily for adults 19–50 years of age
 - 1000 IU vitamin D daily for adults 51 years of age and older
 - Refer to Nutrition Guideline: [Calcium and Vitamin D for Prevention and Treatment of Osteoporosis](#) for more information.

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- **Vitamin B₁₂:** Individuals taking metformin long-term (e.g. >4 years), at a dose of more than 1 gram daily, are at increased risk of vitamin B₁₂ deficiency. Serum measurements of vitamin B₁₂ can identify deficiencies and periodic testing in those with anemia or peripheral neuropathy is suggested.^{2,62} Prevention and treatment of vitamin B₁₂ deficiency may be required through supplementation in these individuals.

Other vitamin and/or mineral supplementation may be recommended in cases where a deficiency, limited dietary intake, or a special need is identified.^{1,2} Supplements such as meal replacements, specialty bars, or products designed for diabetes are not required for glycemic management.

Are there Natural Health Products (NHPs) recommended for the management of diabetes?

Natural Health Products (NHPs) include all herbal medications and dietary supplements, including minerals, vitamins, and other micronutrients. NHPs are not recommended as a strategy for managing diabetes due to a lack of evidence regarding safety and efficacy. Some NHPs have shown to lower A1c in trials lasting three months or greater in adults with type 2 diabetes;⁶³ however, most of these trials are small single studies.

Up to half of the individuals with diabetes use NHPs for various indications.⁶³ Due to the potential for side effects and drug interaction associated with NHPs, always ask individuals with diabetes if they are using these products.⁶³

Refer to Nutrition Guideline: [Natural Health Products](#).

Alcohol

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Can an individual with diabetes drink alcohol?

Excessive alcohol consumption is a leading cause of chronic disease. The general recommendation for adults is to follow [Canada's Low Risk Alcohol Drinking Guidelines](#) to minimize an individual's overall health risk. For individuals with diabetes, recommendations are the same as those for the general population.^{1,64}

- 10 standard drinks/week for females, with no more than 2 standard drinks/day
- 15 standard drinks/week for males, with no more than 3 standard drinks/day

Additional considerations regarding alcohol consumption for people with diabetes include:

- Hypoglycemia can occur up to 24 hours after drinking alcohol in individuals using insulin or insulin secretagogues.¹
- Individuals with type 1 diabetes should be aware of the risk of morning hypoglycemia if alcohol is consumed two to three hours after the previous evening meal. [Grade C, Level 3]¹
- Higher intake than recommended may increase blood pressure and triglycerides, as well as an increase in total caloric intake.
- For people with hypertension, it is recommended to limit their intake of alcohol to 2 drinks or less daily.⁶⁵ Refer to Nutrition Guideline: [Hypertension and Heart Health](#) for more information.

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Adult Diabetes

Strategies for individuals using insulin or insulin secretagogues to prevent hypoglycemia and manage glucose levels when consuming alcohol:⁶⁶

Before drinking alcohol:

- Eat regular meals, take medication, and monitor glucose levels frequently.
- Always have fast-acting sugar available to treat hypoglycemia if needed.
- Wear diabetes identification, such as a Medic Alert® bracelet.
- Ensure someone with the individual knows their signs of hypoglycemia (e.g. light-headedness, shakiness, sweating, and drowsiness) as well as how to appropriately treat hypoglycemia.
- Glucagon (a treatment for low blood glucose) does not work properly when alcohol is in the body. For this reason, make sure someone knows to call an ambulance if the individual has an altered level of consciousness.

While drinking alcohol:

- Eat carbohydrate-rich foods and take insulin accordingly.
- Do not take insulin for carbohydrates found in an alcoholic beverage.
- Eat extra carbohydrate-rich foods if dancing, playing sports, or doing other physical activity.
- Mix drinks with sugar-free mixes and use less alcohol.
- Drink slowly. If drinking more than one drink, make every other drink alcohol-free.

After drinking alcohol:

- Inform a responsible individual about alcohol consumption. This individual should look for any signs of hypoglycemia. Delayed hypoglycemia can occur anytime up to 24 hours after drinking alcohol.
- Check glucose levels more frequently and before going to bed. Eat a carbohydrate snack if blood glucose is lower than usual.
- Set an alarm to wake up on time the next day for any food, medication, or insulin normally taken.
- Do not miss medication or insulin as it can lead to high blood glucose, ketones, and DKA.

How much carbohydrate and calories are in alcohol?

Alcohol contains varying amounts of carbohydrate and can increase total daily caloric intake. The additional carbohydrate and calories from the alcohol, and potential coinciding drink mixes, can displace other nutritious foods and add extra sugar to the diet (Table 8). This can lead to unpredictable glycemic responses and reduce diet quality.

Table 8. Calories and Carbohydrates in a Standard Serving of Alcoholic Beverages⁶⁷

Alcohol Type	Standard Drink Size	Calories (kcal)	Carbohydrates (g)
Beer	341 mL (12 fl. oz)	147	12
Beer, light	341 mL (12 fl. oz)	99	6
Wine	142 mL (5 fl. oz)	124	4
Wine, sweet dessert	142 mL (5 fl. oz)	230	20
Wine, cooler	355 mL (12 fl. oz)	178	21
Hard liquor	43 mL (1.5 fl. oz)	98–111	0
Hard liquor, fruit cooler	355 mL (12 fl. oz)	212	32
Liqueur, coffee/cream	43 mL (1.5 fl. oz)	155	10

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Weight

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How does body weight affect diabetes management and health risks?

The majority of individuals with type 2 diabetes have obesity and the prevalence of obesity in people with type 1 diabetes is increasing.⁶⁸ Body Mass Index (BMI) and waist circumference (WC) are among several factors used when assessing an individual's risk of developing health problems.⁶⁹ For patients living with excess body weight that is affecting their overall health, modest weight loss (5–10% of initial weight) may be considered to improve metabolic health (e.g. blood glucose, lipid profile, and/or blood pressure management) and risk for associated comorbid conditions.

Body Mass Index

BMI is a calculated value of the weight (kg) divided by the height (m^2).

- A BMI $\geq 30 \text{ kg/m}^2$ (or having obesity) is a risk factor for developing chronic diseases such as type 2 diabetes.⁷⁰
- There are several limitations to using BMI to assess individual health risk and therefore its use is not recommended when calculating a “target” or “healthy” weight.

Waist Circumference

WC is an indirect measure of both subcutaneous and visceral abdominal fat, which can contribute to the level of health risk.

- An elevated WC puts an individual at an increased risk of developing health concerns such as CVD and high blood pressure and is an independent predictor of disease and mortality.^{69,70}
- WC cutoff points established by Health Canada and associated with increased health risk are:⁶⁹
 - $\geq 102 \text{ cm}$ (40 inches) for males*
 - $\geq 88 \text{ cm}$ (35 inches) for females*

* Ethnic-specific measurements are available as research has indicated the level of disease risk varies between ethnicity.

Edmonton Obesity Staging System

The Edmonton Obesity Staging System (EOSS) is a tool that, in addition to BMI, considers the presence of other health risk factors and functional limitations to classify the severity of obesity, thereby providing a more accurate assessment of health risks associated with excess weight. The tool can be found at <http://www.drsharma.ca/wp-content/uploads/edmonton-obesity-staging-system-staging-tool.pdf>

It is not recommended to use BMI or WC to determine a weight loss goal or to determine what a healthy weight is for an individual. See the next question about ‘best’ weight.

For assessing health risks associated with obesity, and treatment options, refer to Nutrition Guideline: [Adult Obesity Care](#).

For more information about BMI and WC values and classifications, refer to Nutrition Guideline: [Body Measurements](#).

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How can an individual with diabetes achieve their ‘best’ weight?

For patients with excess body weight and diabetes, a modest weight loss of 5–10% of initial body weight can significantly improve insulin sensitivity, glycemic management, blood pressure, and dyslipidemia.⁶⁸ It’s important to recognize achieving and maintaining weight loss is complex. People with diabetes and obesity have a more difficult time losing and sustaining weight loss,⁶⁸ and weight outcomes are not in the direct control of the patient. Rather than a weight-based goal for patients, focusing on positive behaviour changes that are in the direct control of the patient is recommended.

Weight loss is not sustainable if it is achieved by consuming the smallest amount of calories and doing the largest amount of exercise a person can tolerate.⁷¹ The term “best weight” may be helpful when discussing a patient’s desire to lose weight.⁷¹ Best weight is the weight a person achieves while living a life they truly enjoy.⁷¹ Enjoyment includes consumption of the foods they love and doing the amount of exercise they enjoy.

Refer to Nutrition Guideline: [Adult Obesity Care](#).

Physical Activity

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What benefits do people with diabetes get from physical activity?

Studies have shown decreased mortality in individuals with type 1 and type 2 diabetes who participate in regular physical activity. Being sedentary usually has far greater adverse health consequences than exercise-associated risks for most individuals.⁷² Regular physical activity has been shown to improve glycemic management in people with type 2 diabetes. In people with type 1 diabetes, an improvement in glycemic management may not occur, but other important health benefits are recognized.⁷³

Physical activity helps to:^{72–74}

- Increase cardiovascular fitness.
- Decrease insulin resistance and improve glycemic management in people with Type 2 diabetes.
- Improve lipid profile.
- Control blood pressure.
- Maintain weight loss.
- Maintain healthy muscles, bones, and joints.
- Promote relaxation and reduce stress.

Considerations

- Before starting a prescribed exercise program, people with diabetes should be evaluated for the presence of diabetes complications, cardiovascular concerns, and musculoskeletal issues.⁷²
- Individuals treated with insulin and insulin secretagogues are at risk of hypoglycemia. Medication adjustments or additional carbohydrate (e.g. small snacks) before, during, or after activity may be required to prevent hypoglycemia.^{72,75} Consider the patient’s self-management knowledge and skills and weight management goals when making recommendations to prevent hypoglycemia. See [Hypoglycemia \(Low Blood Glucose\)](#) section.

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What type of physical activity is recommended?

Both endurance (aerobic) and strength (resistance) exercises are encouraged for people with diabetes.

Endurance (aerobic) activities are activities that increase heart rate and may make an individual breathe a little heavier, such as brisk walking, swimming, dancing, raking leaves, and biking. This type of activity needs to last at least 10 minutes in duration for a total of 30–60 minutes/day, with a minimum of 150 minutes/week. It is recommended to spread endurance activities over at least three non-consecutive days of the week, with no more than 2 consecutive days without exercise.^{72,73}

Strength (resistance) activities are activities that use muscles to move a weight or lift or push something heavy, such as weight-lifting or using weight machines. These should be done at least two to three times per week.⁷² Initial instruction and periodic supervision by an exercise specialist is recommended for this type of activity.^{72,76}

Supervised exercise programs involving both aerobic or resistance exercise tend to have better outcomes in individuals with type 2 diabetes compared to unsupervised programs.⁷²

Reducing sedentary time by interrupting time that involves very little movement (e.g. sitting), every 20–30 minutes, with brief (\leq 5 minutes) bouts of standing or light movement.^{72,73}

For more information about physical activity refer to Canadian Physical Activity Guidelines: www.csep.ca/guidelines or Diabetes Canada www.diabetes.ca.

Hypoglycemia (Low Blood Glucose)

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What is hypoglycemia (low blood glucose)?

Hypoglycemia, or low blood glucose, is defined by:⁷⁷

- blood glucose less than 4.0 mmol/L (for those treated with insulin or insulin secretagogues), and
- the presence of neurogenic (or autonomic) or neuroglycopenic symptoms (Table 9), and
- symptoms responding to the administration of carbohydrate

People who can self-treat while experiencing only neurogenic, or a combination of neurogenic and neuroglycopenic symptoms (Table 9), are considered to have mild or moderate hypoglycemia respectively.⁷⁷ If the individual requires the assistance of another person to treat the low blood glucose (typically <2.8 mmol/L), they are considered to be experiencing severe hypoglycemia and likely to exhibit neuroglycopenic symptoms.

Table 9. Signs and Symptoms of Hypoglycemia⁷⁷

Neurogenic (autonomic) (effects on the nervous system)	Neuroglycopenic (effects on the brain)
Trembling	Hunger
Palpitations	Nausea
Sweating	Tingling
Anxiety	
	Difficulty concentrating
	Confusion
	Weakness
	Drowsiness
	Vision changes
	Difficulty speaking
	Headache
	Dizziness

Individuals taking insulin or antihyperglycemic agents (insulin secretagogues) that have a risk of hypoglycemia should be taught the symptoms, risks, prevention measures, and appropriate treatment.⁷⁷

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How does a person with diabetes prevent hypoglycemia?

In individuals at risk, self-management education to prevent hypoglycemia is important. A mismatch between available blood glucose and circulating insulin levels caused by missed meals or snacks, increased physical activity, excess insulin administration, or alcohol consumption are the primary causes of hypoglycemia and are therefore the target of prevention strategies.⁷⁸

Steps that can be taken to reduce the risk of having hypoglycemia include:⁷⁸

- Following a meal plan that promotes matching carbohydrate intake to insulin or medication dose. (See [Carbohydrate](#) section.)
- Consuming carbohydrate foods when consuming alcohol.
- Increasing glucose monitoring frequency during and after engaging in activities that increase the risk of hypoglycemia, such as physical activity or consuming alcohol.
- Adjusting insulin or medication dosing as needed to prevent hypoglycemia, such as when consuming less food or carbohydrate than usual, or before and/or after increased physical activity.

How should a person with diabetes treat hypoglycemia?

Treatment of **mild to moderate hypoglycemia** should consist of 15 g rapidly absorbed carbohydrate.⁷⁷ Examples of 15 g rapidly absorbed carbohydrate include:

- | | |
|--|--------------------------|
| • 15 g glucose (glucose or dextrose tablets) | • 15 mL (1 Tbsp) honey |
| • 15 mL (1 Tbsp) sugar dissolved in water | • 6 Lifesavers® (chewed) |
| • 150 mL (2/3 cup) regular pop or juice | |

Overtreatment should be avoided due to the risk of rebound hyperglycemia.⁷⁷ It is recommended that individuals check blood glucose before the treatment of hypoglycemia and re-check blood glucose 15 minutes after the initial treatment. If blood glucose remains below 4.0 mmol/L, re-treating with another 15 g carbohydrate dose is recommended.⁷⁷ Once blood glucose levels are within target, the individual should have the next routine meal or snack if that meal/snack is planned within the next hour. If the next meal/snack is not within one hour, a snack consisting of 15 g carbohydrate and protein should be consumed to prevent recurrent hypoglycemia.⁷⁷

Snack examples consisting of approximately 15 g carbohydrate and protein:

- ½ meat sandwich
- 1 slice of toast and peanut butter
- 1 medium apple and ¼ cup (60 mL) nuts
- 7 soda crackers or 3–6 (30 g weight) crackers and 1-oz lower-fat cheese

Treatment of severe hypoglycemia in a conscious individual will require a higher dose of carbohydrate (e.g. 20 g), preferably as glucose (e.g. glucose tablets). Blood glucose should be checked every 15 minutes and re-treated with 15 g carbohydrate for as long as the blood glucose remains below 4.0 mmol/L. Providing education about the use of glucagon to support people or caregivers of individuals at risk of having severe hypoglycemia is recommended.⁷⁷

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Sick Day Management

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How can individuals manage their diabetes during illness?

Illnesses, such as a cold, flu, or infection, put stress on the body. A common stress reaction is a rise in blood glucose levels due to a release of hormones that help the body fight disease. If high blood glucose levels are not properly managed during illness, DKA or hyperosmolar hyperglycemic state can result.²⁵

Sick day guidelines:⁷⁹

- Patients who are experiencing vomiting or diarrhea and are at risk of dehydration should consult with their doctor regarding their medications.⁸⁰ It is recommended to hold or reduce the dose of some medications in these situations.⁸⁰
- Monitor and record glucose levels every two to four hours, or more if they are rising quickly.⁸⁰
- For individuals with type 1 diabetes, check for ketones if blood glucose is above 14 mmol/L.⁸¹ If ketones are present patients should consult with their doctor or diabetes educator.
- Check body temperature throughout the day (e.g. four times a day).
- Continue following the usual meal plan, if able. If unable, follow the guidelines below.

When an individual is sick and not able to follow usual eating patterns:

- Drink plenty of calorie-free fluids to prevent dehydration.⁸⁰
- Eat food or drink liquids containing carbohydrates (see Table 10) as needed to prevent hypoglycemia.⁸⁰
- Avoid caffeinated liquids.

When an individual needs to follow a clear fluid diet:

- Drink calorie-free clear fluids throughout the day.
- Replace carbohydrate choices in meals and snacks with clear fluid choices that contain carbohydrate.

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Table 10. Sick Day Food and Drink List

Examples of carbohydrate choices with about 15 g carbohydrate:		Calorie-Free Fluids
Foods	Fluids	
<ul style="list-style-type: none">• 1 Tbsp (15 mL) sugar or honey• 3 graham wafers• 7 soda crackers or multigrain melba toasts• 1 slice of dry toast	<ul style="list-style-type: none">• 1 cup (250 mL) soup• $\frac{3}{4}$ cup (175 mL) cooked cereal• $\frac{1}{2}$ cup (125 mL) ice cream• $\frac{1}{2}$ cup (125 mL) regular gelatin dessert* (e.g. Jell-O®)• 1 Popsicle®*• $\frac{1}{2}$ cup (125 mL) pudding• $\frac{1}{3}$ cup (75 mL) sherbet• $\frac{3}{4}$ cup (175 mL) sugar-free fruit-flavoured yogurt• 1 cup (250 mL) milk• $\frac{2}{3}$ cup (150 mL) unsweetened fruit juice (apple, cranberry, grape)*• $\frac{2}{3}$ cup (150 mL) regular soda pop*• 1 cup (250 mL) sports drink* (Gatorade® or PowerAde®)• $\frac{1}{2}$ cup (125 mL) nutrition supplement drinks like Boost® or Ensure®• $\frac{3}{4}$ cup (175 mL) Glucerna® or Resource Diabetic®• 1 bottle (237 mL) Boost Diabetic®	<ul style="list-style-type: none">• Water*• Broth or bouillon*• Sugar-free Popsicles®*• Sugar-free pop or club soda*• Sugar-free gelatin dessert* (e.g. sugar-free Jell-O®)• Clear tea or coffee*

* Indicates clear fluids.

Additional Considerations

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How can I support people with diabetes wanting to fast for spiritual or religious reasons?

Some people may choose to fast for spiritual or religious reasons. National and international organizations acknowledge the importance of fasting to people of various faiths.⁸²

Ideally, education and support from a healthcare provider about fasting is provided one to two months prior to fasting.⁸³ However, some people choose to fast every week or month, so it is important to confirm with the patient how often they might fast and discuss a plan accordingly. Understanding the type of fasting, the timing of meals and snacks, and what can and cannot be consumed during this period are key considerations. For example, some cultures allow fruits to be consumed during a fast, but not grains. After understanding the type of fasting, the potential risks (e.g. hypoglycemia, hyperglycemia, dehydration) associated with fasting can be discussed, and a plan for adjusting diabetes medications, glucose monitoring frequency and sick day management can be created.

Table 11 provides an example of the dietary changes that can occur during fasting.

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Table 11. Dietary Changes that Occur During Fasting⁸²

Usual Diet	During Fasting
<ul style="list-style-type: none">Three meals per daySnacks as needed during the dayFasting occurs overnight: about 8 to 10 hoursFluid intake not restricted	<ul style="list-style-type: none">One to two meals per dayRestricting or avoiding some foods (e.g. meats and grains, etc.)Meals can be >16 hours apartLimited fluid intakeSnacks may or may not be consumedEnergy-dense foods may be consumed more frequently

Consideration

Fasting is not recommended for individuals who:⁸³

- are pregnant
- have highly variable or unpredictable blood glucose
- had a recent history of severe hypo- or hyperglycemia
- have advanced macrovascular complications or renal disease
- have a history of an eating disorder

For information about managing diabetes during Ramadan, health care providers are encouraged to refer to the Diabetes Canada guidelines⁸³ ([Diabetes Canada | Clinical Practice Guidelines - Ramadan and Diabetes](#)).

A referral to an RD is recommended for people with diabetes interested in fasting.

How can I support a person with diabetes facing financial strain and household food insecurity?

Household food insecurity (HFI) is defined as “an inadequate or insecure access to food because of financial constraints”,⁸⁴ it impacts physical, mental and social well-being. HFI is higher among individuals living with diabetes compared to those without diabetes.⁸⁵ Providers will encounter patients living in food-insecure households due to the high prevalence of HFI among those accessing health care.⁸⁶

HFI is best addressed through income-based interventions.^{84,87,88} Those experiencing HFI have food preparation, budgeting, and cooking skills similar to the general population.⁸⁹ Interventions focused on food skills do not protect people from, nor improve HFI.⁸⁹ Emergency food programs (e.g. food banks) may provide temporary relief;⁹⁰ however, these programs do not solve HFI and are inappropriate and/or inaccessible for many patients.⁹⁰

Healthcare providers can offer better support if they are aware when patients are worried about having enough money for food and are experiencing other challenges because of financial strain.^{91,92} Providers are encouraged to work with patients to develop interventions that are sensitive to financial strain.

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Key steps for healthcare providers include:

- Learn about financial strain, how to screen patients for poverty, and the link between poverty and poorer health through the **Identifying Financial Strain and Addressing Financial Barriers to Health Care Modules**; available on MyLearningLink for AHS staff and on CLiC for Covenant Health staff.
- Review the [Nutrition Guideline: Household Food Insecurity](#) for additional information on how to support patients experiencing HFI.
- Assist patients in accessing available income supports. 211 Alberta (ab.211.ca) is a provincial directory that can be used to identify financial benefits, programs, and services.

Resources

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What resources are available for patients?

- Nutrition handouts are available for patients on a variety of topics to help support their learning needs and nutrition goals. Visit [Nutrition Education Handouts](#) for more information.
- Additional patient resources can be found at
 - Diabetes Canada: www.diabetes.ca
 - MyHealthAlberta: www.myhealth.alberta.ca
 - Glycemic Index: www.glycemicindex.com

What resources are available for health professionals caring for patients with diabetes?

- Nutrition Guidelines are available on a variety of topics to help support health professionals provide consistent, evidence-based messaging. Visit [Nutrition Education Handouts](#) for more information.
- Additional resources for health professionals:
 - Diabetes Canada's Clinical Practice Guidelines provides diabetes practice support tools for Health Care Providers: [Diabetes Canada | Clinical Practice Guidelines](#)
 - Canadian Physical Activity Guidelines: www.csep.ca/guidelines

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