Recommendations:

- Prediabetes lifestyle modifications include weight management, physical activity and eating a healthy diet low in fat, saturated fat and high in fibre.
- Healthy eating provides adequate nutrients, promotes optimal growth and health, and minimizes the risk of nutrient-related chronic diseases such as type 2 diabetes.
- Following Canada's Food Guide will help to reduce the risk of type 2 diabetes.

Canada's Food Guide Recommendations

	Adults			
Age in Years	19-50		51+	
Gender	Females	Males	Females	Males
Vegetables and Fruit	7-8	8-10	7	7
Grain Products	6-7	8	6	7
Milk and Alternatives	2	2	3	3
Meat and Alternatives	2	3	2	3

- Choose a variety of foods from all of the four food groups.
- Eat at least one dark green and one orange vegetable each day.
- Make at least half of your grain products whole grain each day.
- Drink skim or 1% milk, or fortified soy beverages each day.
- Select lower fat milk alternatives such as yogurt and cheese with lower milk fat (MF) percentage.
- Have meat alternatives such as beans, lentils, and tofu often.
- Eat at least two servings of fish each week.
- Include a small amount, 2-3 Tbsp (30-45 mL), of unsaturated fat each day such as olive oil, nuts, seeds, avocado and natural nut butters.
- Limit butter, hard margarine, lard, and shortening, as well as products prepared with these types of fat.
- Choose food products that are prepared with little or no added fat, sugar, or salt.
- Satisfy thirst with water.

Additional recommendations:

- Eat regular meals throughout the day and adding snacks when needed to avoid fasting.
- Choose healthy low-fat cooking techniques such as steaming, baking, boiling, grilling, broiling, poaching, and slow cooking rather than high-heat and high-fat cooking like frying.
- Choose carbohydrates high in fibre and/or with a low-glycemic index more often as they may aid in weight management and glycemic control.
- Limit saturated fat found in animal meats, butter, cheese, and tropical plant oils.
- Limit trans-fat and hydrogenated fats/oils such as shortening and hard margarine used frequently in baked goods, snacks, and frozen foods.
- Limit processed meats and remove all visible fat and skin from animal meats including poultry, red meat, and pork.
- Supplement recommendations are the same for prediabetes and the healthy population.

Health Benefits

Following the recommendations in these guidelines may help to:

- Minimize the risk of nutrient-related chronic diseases such as cardiovascular disease (CVD), type 2 diabetes mellitus, obesity, and hypertension.[1]
- Promote and maintain a healthy weight when combined with active living.[1]
- Reduce the risk of developing diabetes by incorporating a program of lifestyle changes including weight management, increasing exercise, reducing total fat and saturated fat intake and increasing fibre intake.[2,3]

Key Questions

What is prediabetes?

Prediabetes is a term that describes blood glucose levels that are higher than normal, but are not high enough to diagnose diabetes. Prediabetes includes impaired fasting glucose (IFG) and/or impaired glucose tolerance (IGT).[4] Having prediabetes does increase an individuals' risk of developing type 2 diabetes and its complications, specifically cardiovascular disease (CVD).[4] Not all individuals with prediabetes will progress to diabetes. Lifestyle intervention demonstrates to be very effective in delaying the onset of type 2 diabetes in people with prediabetes.

Who should be screened for prediabetes and/or diabetes and how often?

Adults who are at low or moderate risk for diabetes, based on a validated risk assessment tool, are not recommended to have routine screening for type 2 diabetes.[5] Health care professionals can perform the CANRISK screening assessment tool every three to five years in all adults.[5] Laboratory screening is suggested every three to five years for adults that are at "high risk" and annually for adults at "very high risk" for developing diabetes.

The CANRISK assessment tool is available at www.publichealth.gc.ca/CANRISK and Canadian Task Force on Preventive Health Care at www.canadiantaskforce.ca. To complete the online questionnaire, an individual's waist circumference is required. Refer to the Nutrition Guideline: *Body Measurements* to follow the correct method for measuring waist circumferences.

Some of the common risk factors for diabetes include:

- age,
- family history of diabetes,
- ethnic background (Aboriginal, Hispanic, Asian or African origin),
- history of gestational diabetes and/or having given birth to an infant over 9 pounds (4 kg),
- being physically inactive,
- having schizophrenia,
- having a metabolic syndrome (a condition that includes insulin resistance, abdominal obesity, hypertension, dyslipidemia, prediabetes, polycystic ovarian syndrome, vascular disease and acanthosis nigrans).[4] Refer to *What is metabolic syndrome?* below for the criteria to identify metabolic syndrome.

How is prediabetes diagnosed?

The preferred screening tests for diabetes include hemoglobin A1c, fasting serum glucose (FPG) and/or a two hour 75 gram oral glucose tolerance test (OGTT).[4,5] If the initial test is elevated, a repeat laboratory analysis is required on a subsequent day for final confirmation of diabetes.[4] Individuals with a FPG of 5.6 to 6.0 mmol/L and ≥1 risk factor, stated above, should be given a OGTT.[4]

Table 1: Diagnostic criteria for prediabetes and diabetes[4]

		Fasting Serum Glucose* (mmol/L)		2 hr OGTT** (mmol/L)	Hemoglobin A1c
Normal		<6.1	and	<7.8	N/A
Prediabetes	Isolated IFG	6.1-6.9		N/A	N/A
	Isolated IGT	<6.1	and	7.8-11.0	N/A
	IFG and IGT	6.1-6.9	and	7.8-11.0	N/A
Diabetes		≥7.0		≥11.1	≥6.5%

*Fasting serum glucose=no food or liquid (apart from water) for at least 8 hours
**OGTT=measured 2 hours after the ingestion of 75 grams of glucose

How do impaired fasting glucose (IFG) and impaired glucose tolerance (IGT) differ?

Isolated IFG and isolated IGT are characterized by insulin resistance and/or reduced insulin secretion. However, the site of insulin resistance and pattern of insulin secretion are different.[6] IFG is predominantly hepatic insulin resistance and normal muscle insulin sensitivity. IGT is normal to slightly reduced hepatic insulin sensitivity and moderate to severe muscle insulin resistance. When both IFG and IGT are present, there is hepatic and muscle insulin resistance. IGT is more strongly associated with CVD outcomes when compared to IFG. Individuals who have both IFG and IGT are at higher risk for diabetes as well as CVD.[4]

How and why does insulin resistance occur?

Insulin resistance occurs when the body does not use insulin properly or as efficiently. This may increase the requirements from the pancreas to produce more insulin to help transport the glucose into the muscle, liver, and fat cells. The pancreas struggles to meet insulin production demands, eventually failing to maintain these higher levels. As a result, glucose levels increase in the bloodstream, resulting in hyperglycemia and setting the stage for diabetes. Chronic hyperglycemia is associated with damage and failure of various organs. Hyperglycemia and type 2 diabetes are often manifestations of metabolic syndrome *(see What is metabolic syndrome?* for more information on metabolic syndrome*).* Individuals with prediabetes and/or metabolic syndrome are at risk of developing type 2 diabetes and CVD and would benefit from both diabetes and vascular risk reduction.[4,7]

How can type 2 diabetes be prevented or delayed?

Individuals with prediabetes are at a high risk of developing diabetes. A 20-year follow-up study showed that in the absence of any lifestyle intervention, 93% of individuals with prediabetes developed type 2 diabetes.[8] Short-term (up to four years) lifestyle intervention in individuals with prediabetes can reduce

diabetes risk by approximately 58 to 89%.[2,5,9] Long-term observation (ranging between seven and 20 years follow-up) of the lifestyle intervention, have demonstrated a 34 to 43% reduction in the risk of developing type 2 diabetes.[5,8,10]

Lifestyle intervention includes eating a healthy diet that is high in fibre, low in total fat and saturated fat, engaging in moderate intensity physical activity, and achieving weight loss of 5 to 10% initial body weight and/or maintenance of a healthy body weight.[4,2,11] Each of these lifestyle modifications contributes to reduced risk for diabetes; however, achieving more of the lifestyle modifications listed above can lead to greater protection against diabetes.[12] Pharmacologic therapy may be considered in some individuals in combination with lifestyle intervention if lifestyle goals and/or glycemic targets are not achieved. Physician consultation is required.

What is metabolic syndrome?

Metabolic syndrome is a highly prevalent, multifaceted condition characterized by a number of abnormalities that include abdominal obesity, hypertension, dyslipidemia, insulin resistance and dysglycemia.[4] An individual diagnosed with metabolic syndrome is at increased risk for developing diabetes and CVD.[4]

Table 2: Criteria for clinical diagnosis of the metabolic syndrome[13,14]

Measurement	Categorical cut-off points		
	Country or Ethnic Group	Men	Women
Waist circumference	NCEP-ATP III values	> 102 cm	> 88 cm
	Europid[a]	≥ 94 cm	≥ 80 cm
	South Asians, Chinese, Malay, Asian Indian	≥ 90 cm	≥ 80 cm
	Japanese[b]	≥ 85 cm	≥ 90 cm
	South and Central American	Use South Asian cut-off points until more specific data are available	
	Sub-Saharan African and Eastern Mediterranean and Middle East (Arab)	Use European cut-off points until more specific data are available	
Triglycerides	≥ 1.7 mmol/L or treatment for this lipid abnormality		
HDL	Considered a cut-off point if treatment for this lipid abnormality	<1.0 mmol/L	<1.3 mmol/L
Blood Pressure	≥130-85 mm Hg or treatment for hypertension		
Fasting Glucose	≥5.6 mmol/L or previous diagnosis of diabetes		

[a] In future epidemiological studies of populations of European origin, prevalence should be given using both European and North American cut-off points to allow better comparisons. In the United States, the NCEP-ATP III values are likely to continue for clinical purposes. However, strong recommendations for epidemiologic studies to use ethnic specific cut-off points for people of the same ethnic group. Thus, recommendations for the same criteria for Japan and expatriate Japanese communities, as would those for South Asian men and women regardless of place and country of residences.

[b] Subsequent data analyses suggest use of Asian values for Japanese populations until more data is available.

Why is physical activity an important factor in the prevention of diabetes?

Being physically active can help to reduce the risk for premature death, heart disease, stroke, hypertension, some cancers, type 2 diabetes, osteoporosis and obesity.[1,15] Mental health, overall well-being and self-esteem can also improve with physical activity.[15] Meeting physical activity guidelines in the absence of weight loss (over 1 year), has been independently associated with a 44% reduction in the risk of developing type 2 diabetes.[10] All adults should aim for a minimum of 150 minutes of aerobic exercise at a moderate- to vigorous-intensity each week.[9,10,12,15] The more physically active an individual is, the more health benefits they can achieve.

Physical activity helps to:

- Promote weight loss, weight maintenance and improve metabolism
- Lower blood sugars and decrease insulin resistance
- Improve blood cholesterol and fat levels
- Lower blood pressure
- Maintain healthy muscles, bones and joints
- Promote relaxation and reduced stress

What type of physical activity is recommended?

Aerobic activities are most associated with the prevention of diabetes.[16] However, a combination of aerobic and resistance exercises along with stretching and flexibility are an important part of maintaining a healthy body.

- Endurance (aerobic) activities are activities that increase and maintain an elevated heart rate, which 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. Moderate-intensity exercises include brisk walking and bike riding.[15] Someone may feel slightly out of breath and produce a small amount of sweat. Vigorous-intensity exercise includes jogging and cross-country skiing.[15] An individual will feel out of breath and will not be able to carry a conversation.
- Strength (resistance) activities are activities that use muscles to move a weight, lift, or push something heavy such as weight lifting or using weight machines. Resistance exercises are beneficial to do at least 2 days per week. They help to add muscle and strengthen bones when using the major muscle groups. Initial instructions and supervision by an exercise specialist is recommended for this type of activity.[15]
- Flexibility and Balance activities are activities that enhance mobility and balance, decrease muscle stiffness and help prevent of falls. These can be included daily.

Below are some examples of endurance activities to increase daily physical activity:

- Join a community running or walking group.
- Go for a brisk walk around the block after dinner.
- Take a dance class
- Bike or walk to work everyday
- Take up a favourite sport or try a new sport
- Be active with the family

What is a healthy body weight for adults?

Achieving and maintaining a healthy body weight is very important in reducing the risk of developing diabetes. Weight loss in overweight or obese individuals with prediabetes is the primary factor in reducing risk of diabetes.[2]

Lifestyle modification that result in a loss of 5 to 10% (over an average of 3 years) of initial body weight in individuals who are overweight or obese can reduce the risk of progression from prediabetes to type 2 diabetes by 58%.[1,2,3] This modest weight loss can substantially improve insulin sensitivity, glycemic control, high blood pressure and dyslipidemia. The optimal rate of weight loss is 1 to 2 lbs (0.5 to 1 kg) per week.[4]

Body mass index (BMI) and waist circumference (WC) are useful to identify an individual at increased risk of developing health problems because of body weight or shape. BMI correlates with morbidity and mortality.[17] BMI is a calculated value of the weight (kg) divided by the height (m^2). Evidence for minimizing mortality rates in adults suggests a BMI of 18.5 to 24.9 kg/m^2 and slightly higher (22 to 29.9 kg/m^2) in adult's ≥65 years of age.

An elevated WC puts an individual at an increased risk of developing health concerns such as type 2 diabetes, CVD and high blood pressure.[18] WC is an indirect measure for both visceral and subcutaneous fat. Excess abdominal fat is an independent predictor of disease and mortality.[17,19] Cut-off points for WC are located in Table 2 above.

Refer to Guidelines: Body Measurements; Adult Weight Management

Is there a special diet or special dietary foods for prediabetes?

Guidelines for healthy eating are the same for people with prediabetes and for healthy individuals.[1,4] Recommendations include following Health Canada's *Eating Well with Canada's Food Guide* as described below. In moderation, all foods can fit in a healthy diet. Foods that are nutritionally rich and low in energy (calorie) density will help to optimize satiety and ensure adequate intake of carbohydrate, fibre, protein, essential fatty acids, vitamins, and minerals. Healthcare providers should individualize dietary recommendations to accommodate preferences according to clients' age, culture, lifestyle, economic status, activity level, and any other health condition.

Special "diabetic" foods are not necessary. Foods labeled as "diabetic" are not necessarily the optimal choice when compared to healthy unprocessed food options. Individuals with prediabetes should choose foods higher in fibre, and lower in fat, saturated fat, and calories. Individuals should use the information on food labels to choose healthier foods.

Nutrition supplement products targeted at people with diabetes, such as Glucerna® or Boost Diabetic® meal replacement beverages or bars, are not necessary as part of a healthy diet for persons with prediabetes. However, if a liquid meal replacement is required the formulations specific to diabetes may be beneficial in managing postprandial blood glucose.[20,21]

What are Health Canada's guidelines to reduce risk for chronic disease?

Canada's Food Guide (CFG) recommends choosing a variety of foods from the four food groups everyday.[1] Following this pattern of eating can help minimize the risk of nutrient-related chronic diseases such as CVD, type 2 diabetes mellitus, osteoporosis, obesity and certain cancers.[1,22]

Table 3: Canada's Food Guide food groups and selected serving recommendations for adults[1]

Age in Years	19 to 50		51+	
Gender	Females	Males	Females	Males
Vegetables and Fruit	7-8	8-10	7	7
Grain Products	6-7	8	6	7
Milk and Alternatives	2	2	3	3
Meat and Alternatives	2	3	2	3

In addition to including the appropriate number of servings from each food group, additional recommendations are:

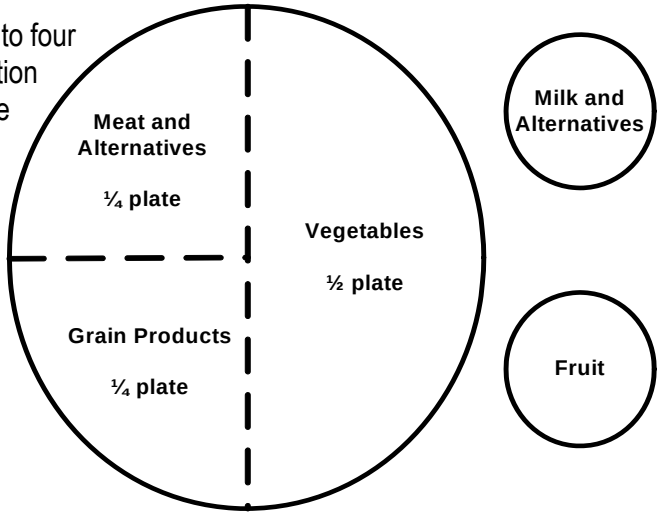
- Choose a variety of foods from all of the four food groups
- Eat at least one dark green and one orange vegetable each day
- Make at least half of your grain products whole grain each day
- Drink skim, 1% milk each day
- Select lower fat milk alternatives such as yogurt and cheese with less milk fat percentage
- Have meat alternatives such as beans, lentils, and tofu often
- Eat at least two servings of fish each week
- Include a small amount, 2-3 Tbsp (30-45 mL), of unsaturated fat each day such as olive oil, nuts, seeds, avocado and natural nut butters
- Limit butter, hard margarine, lard, and shortening, and products prepared with these types of fat
- Choose food products that are prepared with little or no added fat, sugar, or salt
- Satisfy thirst with water

What does a healthy meal for prediabetes look like?

Individuals can meet their recommended number of servings by eating three regular meals per day and one to three snacks each day. Individualize the frequency and consistency of meals and snacks based on an individual's lifestyle, mealtime preferences, and their weight loss goals. Healthy snacks can help meet nutrient needs, increase energy levels, and manage hunger by preventing overconsumption at meal times.

A healthy meal for prediabetes should include three to four of the food groups. A healthy meal will help with portion control and meeting recommended servings from the four food groups. Larger portions can lead to increased calorie intake, carbohydrate intake, and increased glycemic response and weight gain. Consistency in meal patterns may help control blood glucose.[1]

The picture shown here is an example of how a healthy meal including all food groups.[23]



Refer to guidelines: General Healthy Eating for Children and Adults; Planning Healthy Meals and Snacks; Portion Sizes; Label Reading

Can eating out in restaurants be part of a healthy diet?

Restaurants, including fast food and cafes, often serve foods higher in fat, starch, and sodium, and lower in fibre. Portions are generally much larger than what an individual would consume at home.[24] The increased portion size and caloric density of these foods can lead to weight gain.[25,26] Individuals with prediabetes should minimize foods eaten away from home; however, the convenience of eating out is part of the typical North American lifestyle. Healthcare providers should educate patients to make informed healthy decisions about restaurant foods for weight management success.

Refer to guideline: Eating Out

What are carbohydrates, and how do they affect prediabetes?

Canada's Food Guide recommends eating a variety of foods in moderation. Carbohydrates include sugar, starch, and fibre found in starchy vegetables, fruit, grain products, milk, yogurt, and legumes. Starchy vegetables include squash, corn, potatoes, sweet potatoes, and yams. Advise individuals to make at least half of their daily grain products whole grains.[1] Whole grains are typically higher in fibre and more nutritionally dense than processed white grain products.

Sugar can be found naturally in food, or can be added during processing. Natural sugars are in a variety of healthy foods such as fruit and milk products. As these foods have important nutrients, Canada's Food Guide recommends moderate amounts daily.[1] Added sugars (both natural and processed) are in foods such as desserts, granola bars, breakfast cereals, and pastries. These added sugars and food products should be limited. Intake of sugar-sweetened foods has increased markedly over the past 30 years,[27] some of which may be displacing more nutritious foods in the diet.

The World Health Organization advises that people should have no more than 10% of their caloric intake from added sugar to reduce the risk of chronic disease such as cardiovascular disease, obesity, and diabetes.[28]

Added sugar can be limited by:
- Limiting added sugars in coffee and tea.
- Limiting sugar-sweetened beverages. Drink water to quench thirst.
- Limiting high sugar desserts, baked goods like muffins and donuts, granola bars, cakes, cookies, candy, cereals, jam, syrup, sweet sauces, and honey.

Healthy desserts that may be incorporated into a healthy diet include:
- Fresh fruits, or canned or frozen, unsweetened, or no sugar added fruits.
- Homemade milk pudding, made with low fat milk and alternatives and low in sugar
- Low fat yogurt, plain or sugar-free

Refer to guideline: Food and Drinks High in Calories, Fat, Sugar or Salt

Is there a specific amount of carbohydrate that should be consumed each day?

Carbohydrate requirements are specific to individuals' needs (age, weight, height, activity level). The recommendation is that 45 to 65% of daily calories should come from carbohydrates, with a minimum of 130 grams of carbohydrates each day.[29] For example; a 2000 calorie diet should include 225 to 325 grams of carbohydrates spread across the day in three meals and one to three snacks. A person who lives a very active life may need to aim for the higher end of the recommended carbohydrate range, whereas a smaller individual that is less active may aim for the lower end.

Carbohydrates include starch, sugar, and fibre. Foods containing carbohydrates include starchy vegetables, fruits, grain products, milk, yogurt, and legumes. These foods with carbohydrates should be spread out in the meals and snacks eaten throughout the day.[4]

Individuals with prediabetes should avoid low carbohydrate diets such as Atkins, Paleolithic, and Ketogenic diets, which provide less than recommended daily carbohydrates. These diets can lead to nutrient deficiencies by excluding carbohydrate-containing foods such as whole grains, starches, yogurt, milk and alternatives, fruits and some starchy vegetables.

Can eating lower glycemic index carbohydrates improve glycemic control?

The glycemic index (GI) is a ranking of a standard amount of carbohydrate on a scale of 0 to 100 based on blood glucose response to that standard amount of carbohydrate.[30] 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 the glycemic index, please see www.glycemicindex.com.

Replacing high-GI foods (GI score of ≥ 70) with low-GI foods (GI score ≤55) may improve glycemic control in people with insulin resistance.[4] Inconsistent findings from observational studies continue to make the

recommendation for low-GI foods controversial.[32] Nevertheless, carbohydrates with a low-GI are rich in fibre and other important nutrients, and are therefore encouraged as part of a healthy diet according to Canada's Food Guide.[1,32]

Foods high in fibre and with a low-GI include beans, barley, oats, pears, yams and eggplant.[4,30]

Foods with a higher GI that should be limited include sugar, sweets, white bread, white rice, baking potatoes, soda crackers, corn flakes and other products made with white flour or added sugar.[30]

How much fibre is necessary in the diet?

Total dietary fibre recommendations are the same for prediabetes as they are for the rest of the healthy population. Recommendations are to aim for 14 grams per 1000 calories per day.[33]

- Goal for men is to aim for 30 to 38 grams of dietary fibre each day.
- Goal for women is to aim for 21 to 25 grams of dietary fibre each day.

There are different types of fibre. How do they help to lower the risk for diabetes?

There are two different types of dietary fibre; soluble and insoluble.[34] Insoluble fibre is not water-soluble and is known as a bulking fibre that promotes regular bowel movements. Soluble fibre dissolves in water. This fibre readily ferments in the large intestine by microflora. Most fibre-containing foods include about one-third soluble and two-thirds insoluble fibre.

High sources of fibre include:

- Insoluble fibre: cereal grains like wheat bran, whole grains and vegetables, fruits and legumes
- Soluble fibre: oat bran, oatmeal, psyllium, fruit, dried beans, peas, lentils, and barley.

The dietary fibre from cereal grains has been shown to decrease the risk for cardiovascular risk.[35] Research shows that fibre, especially soluble fibre, reduces gastric emptying and delays the absorption of dietary glucose.[4,36] Slowing glucose absorption improves blood sugars following a meal.[35]

Why is it important to get the recommended amounts of fibre each day?

Getting the recommended amount of dietary fibre is important for individuals with prediabetes as it is linked to improvements in BMI and insulin sensitivity.[36] Along with lowering the risk for diabetes, adequate fibre intake reduces cardiac risk by lowering total and LDL cholesterol serum levels.[4,36] Both soluble and insoluble fibres can slow gastric emptying and slow the movement of nutrients through the digestive track.[35] This helps to improve serum glycemic load by slowing carbohydrate absorption. Most of the studies on dietary fibre have dealt with management rather than prevention of diabetes. Hypothesized mechanisms for reducing diabetes risk involve the effect of fibre on reduction of postprandial blood glucose and insulin response, which may delay pancreatic exhaustion. [35,36]

Refer to guidelines: Fibre; Label Reading

What sweeteners are safe to use, to lower intake of sugar?

There are many sweeteners, other than sugar, that Health Canada has approved safe for use. Sweeteners go through a vigorous process including safety testing before being deemed safe by Health Canada.[37] There are two categories of sweeteners; non-nutritive and nutritive sweeteners.[38]

Non-nutritive sweeteners[39] provide no significant caloric value. Canada approves the use of acesulfame-potassium (ace-K), aspartame, neotame, and sucralose in food products. Table-top sweeteners include ace-K, aspartame, saccharine, steviol glycosides, sucralose.[38] Ingredient lists on food packages must indicate that these sweeteners are in the product.[40]

- Caution: Cyclamate and saccharin are not permitted in food products but can be sold as table-top sweeteners. Packaging for table-top cyclamate and saccharin must state that they are not approved during pregnancy and use is only permitted with advice of a physician. Steviol glycosides are not approved by Health Canada during pregnancy.

Table 4: Non-nutritive sweeteners

	Common name and brand name	ADI[39] (mg/kg/day)	Quantity required to reach daily limit*[41]
Acesulfame Potassium	Sunett	0 – 15**	24 cans of diet soda
Aspartame	Equal, NutraSweet	0 – 40**	14 cans of diet soda
Cyclamates	SugarTwin	0 – 11**	3 packets of Sugar Twin
Saccharin	Sugar Twin, Hermesetas	0 – 5**	28 packets
Steviol glycosides	Stevia	1 (stevioside)	150 mg
Sucralose	Splenda	0 – 9	51 packets
Thaumatin	Talin	Not specified	

*Quantity based on 68.2 kg (150 lb) person.

** According to the Joint Expert Committee of Food Additives, United Nations and World Health Organization[39]

Nutritive sweeteners provide a sweet taste and a source of energy from carbohydrates.[42] Nutritive sweeteners include sugars such as table sugar, agave nectar, molasses, honey and corn syrup which provide 4 calories/gram. Polyols (sugar alcohols) provide an average of 2 calories per gram. Polyols include sorbitol, mannitol, zylitol, erythritol, D-tagatose, Isomalt, lactitol, maltitol, Doses of 10 to 15 grams per day of polyols are tolerated. Higher doses can result in intestinal discomfort including diarrhea, gas and bloating.

Many foods that state “sugar free” or “no sugar added” on the label are higher in fat, calories, and may be low in fibre. Individuals with prediabetes and diabetes may eat large quantities of these sweetened foods, believing them to be healthier choices.

Moderation is encouraged when consuming or recommending products sweetened with nutritive or non-nutritive sweeteners.

Refer to Guideline: Label Reading

What is the recommended amount of dietary fat to consume each day?

Health Canada recommends adults consume a total fat intake of 20 to 35% of total daily calories.[29] Individuals consuming a diet with moderate amounts of healthy fat and low in saturated fat and trans-fat, have a decreased risk for CVD and other diet-related chronic diseases such as type 2 diabetes and obesity.[27,43,44] High-fat diets may promote weight gain which may lead to insulin resistance.[45] Observational studies suggest insulin resistance is associated with relatively high intakes of saturated fat and low intakes of polyunsaturated fat.[46] The table below provides recommendations for maximum dietary fat intakes at three different calorie levels.[29]

Table 5: Health Canada recommended range of fat, based on caloric intake[29]

Calorie level per day	Recommended fat intake range
2000 calories	44 to 78 grams/day
1800 calories	40 to 70 grams/day
1500 calories	33 to 58 grams/day

To lower fat intake, here are some tips:

- Choose lower fat milk products like skim or 1% milk and low-fat yogurt
- Choose cheese with less than 20% M.F.
- Limit intake of higher fat dairy products, creams, and ice cream
- Avoid using lard, shortening and hard margarines
- Replace hard fats such as butter with non-hydrogenated margarine
- Limit fats that you add to food or use in cooking
- Choose lean meats, remove visible fat and skin
- Limit bacon, processed meat and ground beef
- Replace meat choices with legumes including beans, peas, lentils, nuts or tofu
- Reduce high fat baked goods such as cakes, donuts, cookies and snack foods such as chocolate bars, and chips
- Choose lighter methods of cooking such as boiling, baking and steaming.

Refer to guideline: Heart Healthy

What is saturated fat and trans fat?

Saturated fat is solid at room temperature. It is generally found in foods that come from animals such as fats such as beef, lamb, pork, chicken, dairy products, and lard.[47] It can also be found in some plant oils such as palm oil, cocoa butter and coconut oils.[47] These are used in packaged foods like crackers, muffins and cookies. Saturated fats help to maintain the texture, taste and stability of food products. Look for ingredients and ready-made foods that are low in saturated fat. Consider a product low in saturated fat if it contains less than two grams of saturated fat per serving.[47]

Trans fat is made when liquid vegetable oils are processed and changed into a solid fat.[48] Shortening and hydrogenated or partially-hydrogenated fat and oil, listed on the ingredient list, mean the food product contains trans fat. Trans fat is found in hard margarines, some tub margarines, vegetable shortenings, packaged foods like crackers, cookies, muffins, and many deep fried foods like French fries and donuts.

Refer to guidelines: Heart Healthy; Label Reading

How much saturated and trans fat should an individual consume?

The Dietary Reference Intakes recommend limiting saturated fat and trans fat.[43] The American Heart Association (AHA) and National Cholesterol Education Program recommend the general population consume less than 7% of total calories from saturated fat each day to reduce the risk for CVD.[47,48] For example, a person consuming 1800 calories per day would aim for no more than 14 grams of saturated fat each day.

Individuals should consume as little trans fat as possible. The WHO recommends consuming less than 1% of total calories from trans fat each day.[49] The Nutrition Facts section of the food label indicates the amount of trans fat per serving. The table below provides examples of total and saturated fat in common foods. Detailed nutrition analysis by a Registered Dietitian is recommended, however, the table below may help to identify common foods a patient consumes regularly, and how to make healthier options.

Table 6: Examples of common foods with total and saturated fat content per serving[50]

Food item	Portion amount	Total Fat (grams)	Saturated fat (grams)
Butter	1 tsp (5 mL)	3.80	2.40
Lard or shortening	1 tsp (5 mL)	5.00	2.01
Non-hydrogenated margarine	1 tsp (5 mL)	4.01	0.83
Coconut Oil	1 tsp (5 mL)	5.00	4.31
Olive Oil	1 tsp (5 mL)	5.00	0.69
Cheddar cheese, regular	1.5 oz (50 g)	16.57	10.5
Ground beef, extra lean cooked	2.5 oz (75 g)	5.69	2.58
Ground beef, regular cooked	2.5 oz (75 g)	13.40	5.39
Chicken wing, fried	2.5 oz (75 g)	16.36	4.37
Chicken breast, grilled	2.5 oz (75 g)	2.68	0.65
Salmon, sockeye, cooked	2.5 oz (75 g)	5.02	0.68

Refer to guideline: Heart Healthy; Label Reading

What are dietary sources of healthy fats?

Monounsaturated fats and polyunsaturated fats are associated with a lower risk of cardiovascular disease. Choose moderate amounts of these fats more often, and choose saturated fat and trans-fat less often.[27,43] Canada's Food Guide recommends including 2 to 3 Tbsp. (30 to 45 mL) of healthier fats per day, including the fat used in food preparation.[1] By eating a variety of the oils and foods listed in the table below as replacements for trans fat and saturated fat, individuals will increase their intake of healthy fats and lower their risk for CVD and diabetes.

Table 7: Mono and Polyunsaturated fatty acid food sources

Monounsaturated fats:	Polyunsaturated fats:	
• canola and olive oil • some soft non-hydrogenated margarines • avocados • almonds, cashews and pine nuts	Omega-6 fats: • sunflower and safflower oil • almonds, Brazil nuts, sunflower, sesame, pecan, and hemp seeds	Omega-3 fats: • fatty fish: salmon, Atlantic mackerel, rainbow trout, herring and sardines • walnuts, chia and ground flax seeds • canola, flaxseed and soybean oils • non-hydrogenated margarine made from these sources

Refer to guideline: Heart Healthy; Label Reading

Does alcohol have any effect on the risk for diabetes?

Alcohol consumption greater than three to four drinks a day is likely associated with an increase in risk of developing type 2 diabetes,[51] compared with moderate alcohol consumption. Moderate alcohol intake, as advised by Health Canada[52] and the Canadian Diabetes Association,[4] appears to be safe for individuals with prediabetes, and may reduce the risk of cardiovascular disease. The research is unclear if moderate intakes will help prevent type 2 diabetes in those with prediabetes, although there does not appear to be any increased risk at intakes advised by Health Canada and there may be some small cardiovascular prevention benefit. The Canadian Diabetes Association 2008 Clinical Practice Guidelines recommend the alcohol intake limits below:[4]

- 9 drinks a week for women, with no more than 1 drink a day
- 14 drinks a week for men, with no more than 2 a day

One standard drink is:[53]

- 12 ounces (341 mL) of beer
- 5 ounces (142 mL) of wine
- 1.5 ounces (43 mL) of distilled spirits)

Alcohol contains between 100 and 150 calories per standard drink, which can increase total daily calories significantly. The additional calories can lead to weight gain, and may displace other nutritious foods in the diet.

Does coffee or caffeine have an effect on diabetes risk?

Several studies have indicated a protective effect from habitual coffee consumption on the risk of developing type 2 diabetes.[54,55,56] There is an inverse relationship between the amount of coffee consumed and the risk for diabetes.[56] However, these effects may be a result of constituents in coffee other than caffeine as other studies have shown that decaffeinated coffee also contributes to the reduced risk.[57] More research is warranted before a definitive recommendation can be made. Health Canada recommends that healthy adults (excluding women who are pregnant, breastfeeding or planning to become pregnant) limit their caffeine intake to no more than 400 mg/day of caffeine.[58] Caffeine content in products can vary greatly in tea, coffee and caffeinated beverages. In general, 400 mg caffeine is approximately equivalent to three cups (1 cup = 8 oz or 237 mL) of coffee per day.

What are the recommendations for daily sodium and/or salt?

As prediabetes increases the risk for cardiovascular disease,[4] it is best practice to recommend a reduction in sodium intake to help prevent and manage hypertension,[59] and to reduce the risk of cardiovascular disease and kidney disease.[60] Adults should aim to eat less than 2300 mg of sodium per day. The closer an individual can get to a daily intake of 1500 mg, the better.[33,59,60]

Most Canadians' intake of sodium greatly exceeds the recommended intake.[59] To decrease sodium or salt in the diet watch for words on the food label such as "salt", "sodium", or "soda". Read the Nutrition Facts section of the label to choose foods with <5% Daily Value per serving.[1] Other ways to lower sodium in your diet include:

- Limit intake of processed and packaged foods.
- Avoid salty snack foods.
- 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."
- Avoid using salt in cooking and at the table.

Refer to guidelines: Sodium; Hypertension

Are there certain vitamins and minerals recommended to reduce diabetes risk?

There is no indication for routine supplementation of vitamins and minerals for the prevention of type 2 diabetes. Supplementation to support dietary deficiencies is determined on an individual basis. A balanced diet should include the vitamins, minerals, and antioxidants needed for health in this population.

There is no evidence to support routine supplementation for glycemic control, specifically Vitamin A, C, and E, beta-carotene, chromium, vanadium and CoQ10.[1,61]

Vitamin D

There is no indication for additional supplementation of vitamin D to improve glycemic control.[4,61] Vitamin D is found naturally in foods like fish and egg yolks.[50,62] Foods such as margarine, milk, yogurt, and some soy, rice, and almond beverages have been fortified with Vitamin D and other nutrients.[50,62] In view of the fact that in Alberta the likelihood is small of receiving adequate vitamin D from food sources and synthesis from sun exposure, supplementation is necessary for most people. Recommended supplementation:

- All healthy individuals, including pregnant and lactating women, 0-70 years old should consume 400 IU of supplemental vitamin D per day.
- Adults over the age of 70 should consume 800 to 1000 IU of supplemental vitamin D each day, all year round.

Refer to guideline: Calcium and Vitamin D

Magnesium

It is thought that hypomagnesemia is associated with insulin resistance.[63] There is some evidence that higher dietary magnesium intake is associated with reduced risk of developing diabetes but more research is needed to determine the efficacy of magnesium supplementation for this purpose. Eating a healthy diet, including foods rich in magnesium such as whole grains, beans, nuts, vegetables, and fruits is recommended.

Fish oil and/or omega-3 fatty acids

Research reports inconsistent and inconclusive results in the benefit of long chain omega-3 fatty acid supplementation for the prevention of type 2 diabetes and cardiovascular disease.[31] Canada's Food Guide recommends consuming at least two servings of fish each week.[1] Fish oil supplementation can lower elevated triglycerides;[31] supplements should only be taken on the advice of a Registered Dietitian or physician.

Chromium

Although there has been some reported beneficial effects from supplementation of chromium on glycemic control, a conclusive association of chromium with improved insulin sensitivity has not been demonstrated.[31]

Cinnamon

There is insufficient evidence to support the use of cinnamon to lower blood glucose levels.[64] There was no significant difference in hemoglobin A1c, postprandial glucose or serum insulin levels when compared to controls. However, the use of dietary cinnamon is safe.

Alternative natural therapies

There is currently insufficient evidence to recommend individual herbs and supplements for the prevention of diabetes; however, they appear to be generally safe. Several supplements may warrant further research to encourage use in prediabetes population.[31]

Refer to guideline: Natural Health Products

Medication for the prevention of diabetes may be used in combination with lifestyle intervention. Are there any nutritional implications to the medications used?

For individuals with prediabetes who are unable or unsuccessful in modifying lifestyle goals as listed in this guideline, some physicians may initiate pharmacological therapy to assist in glycemic control and weight loss.[4,61] The decision to use pharmacologic therapy requires individual judgment with regards to risks and benefits for each medication and should be initiated in consultation with their physician. Pharmacological therapy should always be in conjunction with lifestyle intervention to achieve optimal and lasting results compared with medication alone.[3,65]

Metformin

Metformin Glucophage® can improve glycemic control through lowering hepatic glucose production and peripheral cellular glucose uptake (insulin sensitivity). Studies showed a reduced progression to diabetes by 31% in under 3 years.[2] Metformin has been shown to be safe and well tolerated over the long-term (10 years).[66] Long-term use (over four-years) of Metformin can decrease the intestinal absorption of vitamin B_{12} by 19%.[67] Metformin may also reduce folate by 5%.[66,67] If deficiency in these B-Vitamins occur, elevated levels of homocysteine concentrations can result and increase the risk for CVD. Prevention of vitamin B_{12} and folate deficiency is possible with supplementation. Serum measurements of serum vitamin B_{12} are available to identify deficiencies. Consider supplemental vitamin B_{12} treatment of deficiency for long-term use of Metformin.

- Nutrition implication: intestinal symptoms such as nausea, diarrhea and gas are common when initiating the medication.[2,66] Recommended dosing for Metformin is gradual with low doses initially to minimize side effects.[2,66]

Is blood sugar monitoring required with prediabetes?

Blood glucose monitoring is generally not required for someone with prediabetes.[4] Certain individuals, however, may wish to obtain information about their own glycemic control to determine if they are in the normal, IFG and/or IGT range. They may wish to know about how their body responds to different food choices in order to modify behaviours or to reinforce appropriate food choices.

When should a Registered Dietitian be consulted for the management of prediabetes?

Many community programs exist that can support individuals with prediabetes in achieving weight loss targets, healthy lifestyle interventions and reducing risks of developing diabetes; when possible and applicable clients should be encouraged to participate in these programs.

Children:

All children diagnosed with prediabetes should be referred to a Registered Dietitian to provide individualized nutrition counselling for healthy growth and development.

Adults:

Consider consulting a Registered Dietitian for all adult clients with prediabetes who meet the criteria outlined in the *Nutrition Guideline: Referral to Registered Dietitian 2.1.1* for individual or group nutrition intervention. In addition to this list, consider a consult to a Registered Dietitian for the following conditions with prediabetes specifically:

- Pregnancy or pre-conception planning
- Weight management help: inability to achieve weight loss goals of 5 to 10% of body weight at a rate of 0.5 to 1 kg (1 to 2 lbs) per week with implementing current healthy lifestyle practices

Refer to guideline: Referral to Registered Dietitian

Resources

- CANRISK Screening Assessment Tool: www.publichealth.gc.ca/CANRISK
- CTFPHC Screening Assessment Tool for professionals and the public:www.canadiantaskforce.ca
- Dietitians of Canada: www.dietitians.ca
- Eating Well with Canada's Food Guide: www.healthcanada.gc.ca/foodguide
- Glycemic Index: www.glycemicindex.com
- Canadian Diabetes Association: www.diabetes.ca
- Canadian Physical Activity Guidelines: www.csep.ca/guidelines

Handouts

Refer to approved provincial Alberta Health Services diabetes nutrition handouts to support patient education. For more information, contact Nutrition.Resources@albertahealthservices.ca

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