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DIABETES
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2018 Clinical Practice Guidelines

Weight Management in Diabetes

Diabetes Canada Clinical Practice Guidelines Expert Committee

Sean Wharton MD, FRCPC, PharmD, Sue D. Pedersen MD, FRCPC, David C.W. Lau MD, PhD, FRCPC,
Arya M. Sharma MD, PhD, FRCPC



KEY MESSAGES

- Sustained weight loss of $\geq 5\%$ of initial body weight can improve glycemic control and cardiovascular risk factors.
- In people with diabetes and obesity, weight loss and A1C lowering can be achieved with healthy behaviour interventions as the cornerstone of treatment. Weight management medications can improve glycemic and metabolic control in people with diabetes and obesity.
- Bariatric surgery may be considered appropriate for people with diabetes and obesity.
- When selecting the most appropriate antihyperglycemic agent(s) for a person with diabetes, the effect on body weight should be considered.

KEY MESSAGES FOR PEOPLE WITH DIABETES

- When you have diabetes, having overweight or obesity increases your risk for complications.
- Healthy behaviour modifications, including regular physical activity and eating well can help with your blood glucose control and reduce your risk for other health problems associated with diabetes.
- Your diabetes health-care team can help you with weight management. For some people with diabetes, weight management medications and bariatric surgery may be helpful.

Introduction

Obesity is a chronic health problem that is often progressive and difficult to treat. An estimated 80% to 90% of people with type 2 diabetes have overweight or obesity (1). Obesity is also becoming more prevalent in people with type 1 diabetes; one study reported a sevenfold increase in the last 20 years (2). In addition, intensive insulin therapy and some antihyperglycemic medications are associated with weight gain which, in turn, leads to obesity-related comorbid conditions (3,4). The relationship between increasing body fat accumulation and adverse health outcomes exists throughout the range of overweight and obesity in men and women of all age groups (5). Weight loss has been shown to improve glycemic control by increasing insulin sensitivity and glucose uptake and diminishing hepatic glucose output (6).

Conflict of interest statements can be found on page S127.

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Assessment of Overweight and Obesity

Health Canada guidelines recommend that the initial assessment of people with diabetes should include the following measurements: height, weight, calculation of body mass index (BMI) (kg/m^2) and waist circumference (WC) (7) (Table 1). Metabolic comorbidities are highly correlated with increasing BMI and WC (8,9). Excessive abdominal adiposity is a strong independent predictor of metabolic comorbidities (10,11). Cut-off values for healthy WC vary among expert guidelines (12,13). Table 2 lists National Cholesterol and Education Program Adult Treatment Panel III (NCEP-ATP III) WC values. The International Diabetes Federation (IDF) has proposed population specific WC cut-off values; however, these guidelines have not been fully validated against the development of clinical events (14) (Table 3).

In people with diabetes and overweight or obesity, the reasons for the previous or current positive energy balance can often be identified. People with diabetes often take medications that are associated with weight gain; these include antihyperglycemic, antihypertensive, pain relief and antidepressant agents (15). Assessing psychological aspects of eating behaviours, such as emotional eating, binge eating, attention deficit and hyperactivity disorder (ADHD), and depression, is also relevant in determining reasons for weight gain (16). Physical parameters that impede activity, such as osteoarthritis or dyspnea, can contribute to obesity (17). Comorbid conditions, such as osteoarthritis and obstructive sleep apnea (OSA), can also impact the ability to lose weight (18).

Treatment of Overweight and Obesity

The goals of therapy for people with diabetes and overweight or obesity are to achieve optimal glycemic and metabolic control and, ultimately, improve quality of life, morbidity and mortality. Attaining and maintaining a healthy body weight, and preventing weight regain, are key components of optimizing glycemic control in people with diabetes. Often people with obesity and diabetes have greater difficulty with achieving weight loss compared to people with obesity but without diabetes (19). Health-care providers should attempt to minimize use of weight-inducing agents without compromising glycemic control, or switch the person with diabetes to agents not associated with weight gain (15).

For many people with diabetes, prevention of further weight gain is a realistic and sustainable target. A modest weight loss of 5% to

Table 1

Canadian guidelines for body weight classification in adults using BMI

Classification	BMI* category (kg/m ²)	Risk of developing health problems
Underweight	<18.5	Increased
Healthy weight	18.5–24.9	Least
Overweight	25.0–29.9	Increased
Obesity	≥30.0	
Class I	30.0–34.9	High
Class II	35.0–39.9	Very high
Class III	≥40.0	Extremely high

BMI, body mass index. Adapted from reference 74.

* BMI values are age and gender independent, and may not be correct for all ethnic populations.

Table 2

Waist circumference (WC) and risk of developing health problems

WC cut-off points†	Risk of developing health problems
Men ≥102 cm	Increased
Women ≥88 cm	Increased

WC, waist circumference. Adapted from reference 74.

* WC cut-offs may be lower in some populations (e.g. older individuals, Asian population [see Table 3]), especially in the presence of the metabolic syndrome (such as hypertriglyceridemia).

† Increased WC can also be a marker for increased risk, even in persons with healthy weight.

10% of initial body weight can improve insulin sensitivity, glycemic control and blood pressure. Greater amounts of weight loss may be needed to improve OSA and dyslipidemia (20–24). The 2006 Canadian Obesity Guidelines have suggested a weight loss of 2 to 4 kg/month (25). A negative energy balance of approximately 500 kcal/day is needed to achieve this weight loss. Metabolic and physiologic adaptations following weight loss can promote weight regain and make sustained weight loss challenging (26). Adjustment of the caloric deficit may be required as weight loss progresses. In addition, as individuals lose weight, adjustment in antihyperglycemic medications may be required to avoid hypoglycemia (27).

The National Institutes of Health (NIH)-sponsored multicentre Look AHEAD (Action for Health in Diabetes) trial, investigated the effects of lifestyle intervention on changes in weight, fitness and cardiovascular (CV) risk factors and events in people with type 2 diabetes (28). The 8-year data revealed a 4.7% decrease in weight in the intensive lifestyle arm (29). This provided evidence that lifestyle changes can have a positive impact on weight change, fitness level and a decrease in medications, along with a small decrease in glycated hemoglobin (A1C) and other health benefits (29).

Table 3

Ethnic-specific values for waist circumference (WC)

Country or ethnic group	Central obesity as defined by WC	
	Men	Women
Europid*	≥94 cm	≥80 cm
South Asian, Chinese, Japanese	≥90 cm	≥80 cm
South and Central American	Use South Asian cutoff points until more specific data are available	
Sub-Saharan African	Use Europid cutoff points until more specific data are available	
Eastern Mediterranean and Middle East (Arab)	Use Europid cutoff points until more specific data are available	

Adapted from reference 11.

* NCEP-ATP III guidelines (9,78) and Health Canada (79) define central obesity as WC values ≥102 cm in men and ≥88 cm in women.

Table 4

Checklist for weight management programs

1. The program assesses and treats comorbid conditions.
2. The program recommends healthy behaviour modifications, and pharmacotherapy or surgery for those who qualify.
3. The program provides individualized nutritional, physical activity and behavioural programs and counselling.
4. Reasonable weight loss goals are set at 1–2 kg/month.
5. Cost is not prohibitive.
6. There is no requirement to buy products, supplements, vitamins or injections.
7. The program does not make unsubstantiated claims.
8. The program provides access to a weight maintenance program.

Adapted from reference 38.

Healthy Behaviour Interventions

Healthy behaviour interventions are essential components of successful weight management. (30,31). Interventions that combine dietary modification, increased and regular physical activity and behaviour therapy are the most effective at improving health outcomes (32–35). Structured interprofessional programs and group programs have demonstrated better results (34) compared to solo health-care professional-based interventions (36).

Dietary plans for people with diabetes should be evidence based and nutritionally adequate to ensure optimal health. Specific dietary recommendations for weight loss can be found in the Nutrition Therapy chapter, p. S64. Moderate carbohydrate reduction has been beneficial in people with diabetes, demonstrating improvements in high density lipoprotein (HDL) and triglycerides, blood glucose stability, and reductions in diabetes medication requirements (37).

People with obesity and diabetes benefit from advice by qualified professionals on appropriate serving sizes, caloric and carbohydrate intake and how to select nutrient-rich meals, as demonstrated by the Look AHEAD Study (28). Programs and clinics dedicated to weight management may be beneficial, particularly those that adhere to the checklist in Table 4 (38).

Pharmacotherapy

The effect of antihyperglycemic medication on body weight varies by class of medication. Some antihyperglycemic medications are associated with weight gain (insulin, insulin secretagogues, thiazolidinediones), and the magnitude of weight gain can vary from 4 to 9 kg or more (15,39,40) (see Pharmacologic Glycemic Management of Type 2 Diabetes in Adults chapter, p. S88). Insulin is associated with the most weight gain (41). Metformin, acarbose and DPP-4 inhibitors are typically weight neutral (15). Glucagon-like peptide-1 (GLP-1) receptor agonists are associated with a weight loss of about 3 kg in people with diabetes (42). Sodium-glucose co-transporter 2 (SGLT2) inhibitors are associated with a typical weight loss of 2 to 3 kg (43). People with type 1 diabetes may have a tendency toward slightly higher body weight with use of neutral protamine Hagedorn (NPH) insulin compared to long-acting basal insulin analogues (44).

Orlistat and liraglutide are the only approved medications for chronic weight management in Canada (42,45) (Table 5). When used to treat people with overweight or obesity and type 2 diabetes, both have been demonstrated to improve glycemic control and to reduce the doses of antihyperglycemic agents that promote weight gain (45). For people with type 2 diabetes or prediabetes, pharmacotherapy is indicated for chronic weight management with a BMI ≥27.0 kg/m², in whom healthy behaviour interventions have been unsuccessful or insufficient for improvement in health. Clinical trials with weight loss agents have confirmed a smaller degree of weight loss in people with diabetes compared to people with obesity without diabetes (42,46,47).

Table 5

Medications approved for the treatment of obesity in type 2 diabetes

Class	Relative weight loss	Side effects	Therapeutic considerations	Cost
Gastrointestinal lipase inhibitor (orlistat) (45)	↓	Loose stools, GI upset, rare liver failure	Oral medication, decreases fat absorption, may require vitamin supplementation	\$\$\$
GLP-1 receptor agonist (liraglutide 3.0 mg) (42)	↓↓	Nausea, GI upset, rare gallstones and pancreatitis	Subcutaneous injectable, increases satiety	\$\$\$\$

GLP-1, Glucagon-like peptide-1.

Orlistat leads to greater weight loss when coupled with healthy behaviour interventions (45). It has been shown to be effective at improving glycemic and metabolic control in people with obesity and type 2 diabetes (45,48–50). In people with obesity and IGT, orlistat also improves glucose tolerance and reduces the progression to type 2 diabetes (19,51,52). Potential adverse effects include loose stools and other gastrointestinal side effects that may affect long-term compliance (53). Rare cases of fulminant liver failure have also been reported (54).

Liraglutide is a GLP-1 receptor agonist, which acts to increase satiety and decrease hunger in the brain. While most of the blood glucose lowering benefits of liraglutide are seen at 1.8 mg per day, there is an additional dose dependent weight loss effect up to 3.0 mg per day (42). Liraglutide is indicated at 1.2 or 1.8 mg per day for the treatment of type 2 diabetes, and at 3.0 mg per day for weight management in people with (42) or without type 2 diabetes (46). In people with type 2 diabetes, liraglutide 3.0 mg is effective to facilitate weight loss in addition to improving glycemic control and metabolic parameters, in combination with a lifestyle modification program (42,55,56). In people with prediabetes, liraglutide 3.0 mg is effective to delay progression to type 2 diabetes (46) (see Reducing the Risk of Developing Diabetes chapter, p. S20). Gastrointestinal side effects, including nausea, are generally transient in nature. Gallbladder disease and acute pancreatitis are rare potential complications of treatment (46).

Pharmacotherapy directed at weight management has not been adequately studied in people with type 1 diabetes.

Bariatric Surgery

Bariatric surgery is a therapeutic option in the management of people with type 2 diabetes and obesity. “Bariatric surgery” is the preferred term over “metabolic surgery”, as the benefits encompass metabolic, mechanical and psychological improvements. These procedures can result in sustained weight loss and significant improvements in obesity-related comorbidities, including control or remission of type 2 diabetes. Surgery is a treatment option for people with $\text{BMI} \geq 40.0 \text{ kg/m}^2$ or with $\text{BMI} 35.0 \text{ to } 39.9 \text{ kg/m}^2$ in the presence of comorbidities, such as type 2 diabetes, who have demonstrated an inability to achieve weight loss maintenance following an adequate trial of healthy behaviour interventions and/or pharmacotherapy. Evaluation for candidacy and appropriateness for surgical procedures includes assessment by an interdisciplinary team with medical, surgical, psychiatric and nutritional expertise (57). The benefits and risks of bariatric surgery must be carefully considered for each individual, and candidates must be prepared to comply with lifelong medical surveillance.

Commonly performed bariatric surgeries include Roux-en-Y gastric bypass (RYGB) (Figure 2), sleeve gastrectomy (Figure 1),

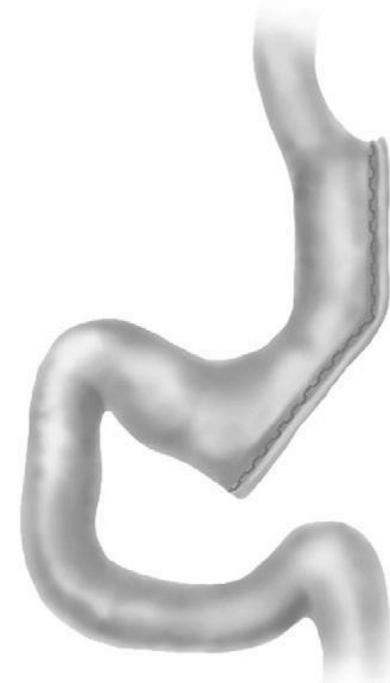


Figure 1. Gastric sleeve. A longitudinal (sleeve) resection of the stomach reduces the functional capacity of the stomach and eliminates the ghrelin-rich gastric fundus (80).

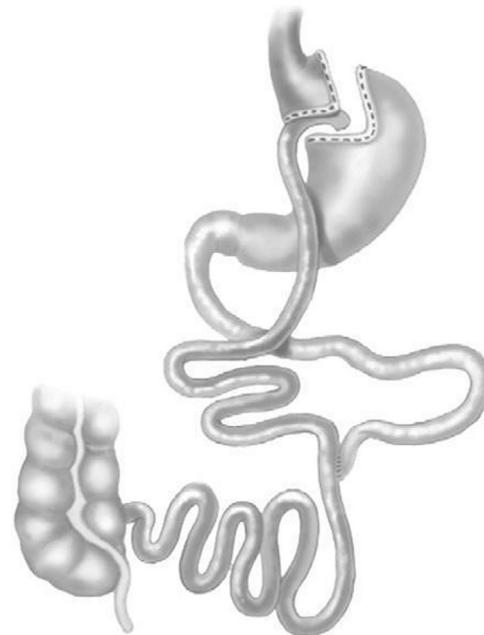


Figure 2. Roux-en-Y gastric bypass. A surgical stapler is used to create a small gastric pouch. Ingested food bypasses ~95% of the stomach, the entire duodenum and a portion of the jejunum (80).

and biliopancreatic diversion with or without duodenal switch (BPD/BPD-DS) (Figure 3). These procedures lead to sustained weight loss and improvements in or remission of type 2 diabetes (58–61). The likelihood of improvement in control or remission of type 2 diabetes is higher with Roux-en-Y gastric bypass surgery, sleeve gastrectomy or BPD compared to gastric banding (62–65). The gastric band has largely been abandoned in North America due to less

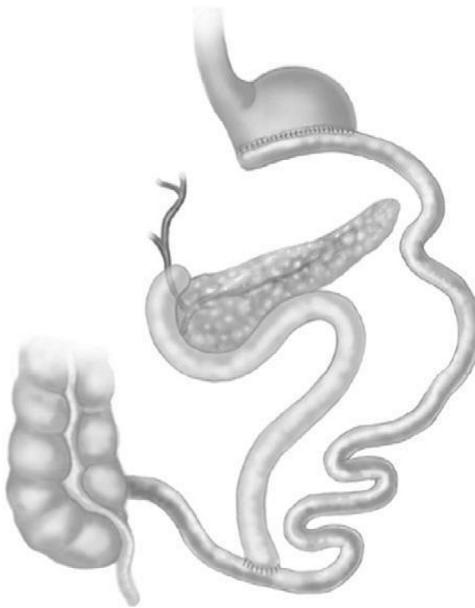


Figure 3. Biliopancreatic diversion with duodenal switch. The stomach and small intestine are surgically reduced so that nutrients are absorbed only in a 50-cm "common limb" (80).

sustained weight loss and metabolic benefits, and high surgical complication rates necessitating band removal (66).

Predictors of likelihood of remission of type 2 diabetes after bariatric surgery include higher preoperative serum C-peptide, younger age, shorter duration of diabetes and lack of need for insulin therapy preoperatively (67,68). People who experience remission of type 2 diabetes with bariatric surgery may experience recurrence of diabetes years later; thus, life-long monitoring and screening for recurrence is important (69). Evidence of the risks and outcomes of bariatric metabolic surgery in people with type 2 diabetes and BMI between 30 to 35 kg/m² is very limited and cannot be recommended at this time.

Bariatric surgery can prevent the development and progression of albuminuria (70). Studies have shown variable effects of bariatric surgery on diabetic retinopathy (71). One study has shown that bariatric surgery may reduce the risk of myocardial infarction in people with type 2 diabetes (72). Bariatric surgery has not been adequately studied in people with type 1 diabetes (73–76).

RECOMMENDATIONS

- For people with overweight or obesity who have or are at risk for diabetes, an interprofessional weight management program is recommended to prevent weight gain and improve CV risk factors [Grade A, Level 1A (24,28)].
- Weight management medication may be considered in people with diabetes and overweight or obesity to promote weight loss and improved glycemic control [Grade A, Level 1A (42) for liraglutide; Grade A, Level 1A (45) for orlistat].
- In adults with type 2 diabetes and overweight or obesity, the effect of antihyperglycemic agents on body weight should be considered when selecting pharmacotherapy [Grade D, Consensus].
- Bariatric surgery may be considered for selected adults with type 2 diabetes and obesity with BMI ≥35.0 when healthy behaviour interventions with or without weight management medication(s) are inadequate in achieving target glycemic control or healthy weight goals [Grade A, Level 1A (58,59,61)].

Abbreviations:

A1C, glycated hemoglobin; BPD/BPD-DS, biliopancreatic diversion with or without duodenal switch; BMI, body mass index; CV, cardiovascular; CVD, cardiovascular disease; IGT, impaired glucose tolerance; LAGB, laparoscopic adjustable gastric banding; MI, myocardial infarction; RYGB, Roux-en-Y gastric bypass; WC, waist circumference.

Other Relevant Guidelines

Reducing the Risk of Developing Diabetes, p. S20

Physical Activity and Diabetes, p. S54

Nutrition Therapy, p. S64

Pharmacologic Glycemic Management of Type 2 Diabetes in Adults, p. S88

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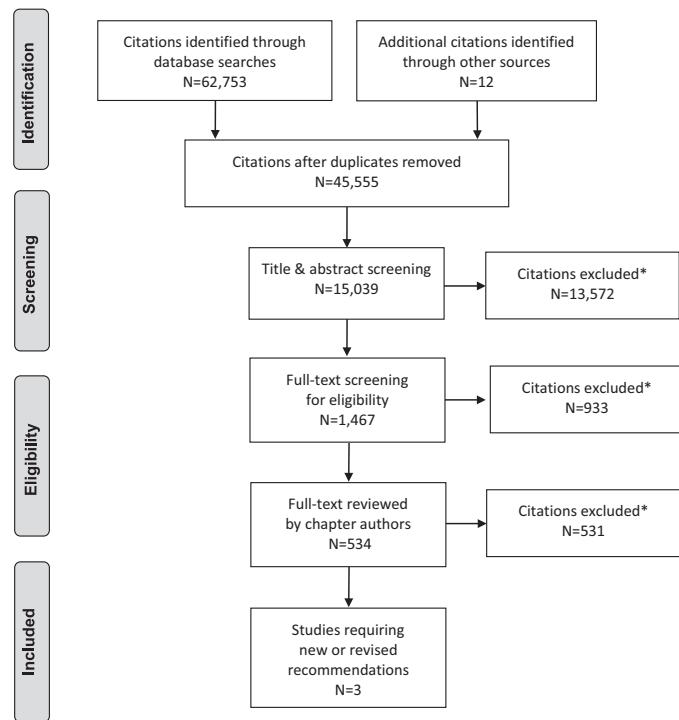
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Literature Review Flow Diagram for Chapter 17: Weight Management in Diabetes



*Excluded based on: population, intervention/exposure, comparator/control or study design.

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