



ALCOHOL AND HEALTH  
**ALCOHOL AND DIABETES**



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## PREAMBLE

Sugar. Our relationship with it is both simple and very complicated.

The simple part is, well, simple. Sweet things taste good and we are drawn to them from the earliest age. Even our language has a host of expressions associating sweetness with love and other good things, from sweetheart to sweetie-pie to sweet pea. We say a nice person is as sweet as sugar, we negotiate a sweet deal, and we enjoy the sweet smell of success.

But the complicated part comes from what we now know about how bad too much sugar can be, for our teeth, nutrition and overall health. Some of the dangers are valid, some are often overstated.

When it comes to diabetes, people commonly associate the disease with “sugar in the blood.” And they’re right.

It is not a minor concern. Close to 900,000 people in Quebec are diabetic. And Diabetes Quebec estimates that about a quarter-million of them are not even aware of it.

When Éduc’alcool presented people with a list of subjects and asked which one interested them the most, about 75% of Quebecers said “alcohol and health.” And since alcohol contains sugar, it made perfect sense for Éduc’alcool to focus its attention on the relationship between alcohol and diabetes.

So, is sugar a good thing, or a bad thing?

As with alcohol, it’s all a question of how much you consume.

In other words, moderation is always in good taste.

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# INTRODUCTION

Carbohydrates are our primary source of energy. They can be found in most of the foods people eat in Quebec. When carbohydrates are metabolized in the human body, they are transformed primarily into **glucose**. Under normal conditions, the amount of glucose in the blood (your **blood sugar** level) is regulated by the **pancreas**. This vital organ secretes **insulin**, a hormone that allows the cells in the body to use glucose molecules to produce energy immediately, or, in some cases, to store the glucose—in the liver, for example—for later use.

When a person is diabetic, two things may be happening: the body may not be producing enough insulin to maintain the right blood sugar level, and/or the body is unable to use the insulin properly even when it is available (this condition is known as **insulin resistance**). As a result, the person may end up with a blood sugar level that is

too high (hyperglycemia), which can cause serious health problems, such as cardiovascular and kidney diseases, and vision problems. In some severe cases, it can even require amputation of the lower limbs.

In recent decades, the percentage of the Quebec population affected by diabetes has grown, rising from 5.3% in 2000 to 7.4% in 2019.<sup>1</sup> The risk of diabetes increases notably with age.

People who suffer from diabetes must make changes to their lifestyle, particularly how and what they eat. And since alcohol is part of the diet of more than 80% of Quebecers, it's important for people to be well informed about the potential impact of alcohol on the risk of developing diabetes, as well as on the health of those who are already diabetic.



<sup>1</sup> Pigeon and Larocque, 2011; Statistics Canada, 2019.

# THE DIFFERENT TYPES OF DIABETES

There are three main types of diabetes: **type 1 diabetes**, **type 2 diabetes**, and **gestational diabetes**.

**Type 1 diabetes** is an autoimmune disease that is also known as “insulin-dependent diabetes.” According to the Institut national de santé publique,<sup>2</sup> about 10% of all diabetics are type 1. In people with type 1 diabetes, the pancreatic cells responsible for producing insulin are attacked by the body’s own immune system, resulting in the inability to produce the hormone. Type 1 diabetes generally appears in childhood (which is why it used to be called “juvenile diabetes”) but it can also occur in adults.

**Type 2 diabetes** is far more common, accounting for about 90% of all cases. This type of diabetes used to be called “adult-onset” or “non-insulin-dependent” diabetes. Although it occurs primarily during adulthood, it is also observed in children and teens. Aside from genetic predisposition (i.e. other family members have it), the main risk factors for type 2 diabetes are age, excess weight and a sedentary lifestyle. Regular physical activity, a healthy diet and moderate consumption of coffee and alcohol are associated with lower risk.<sup>3</sup>

While both type 1 and type 2 diabetes are chronic diseases, **gestational diabetes** is a temporary condition that affects about 4% of pregnant women: it occurs during pregnancy and most often disappears as soon as the baby is born. However, women who have had gestational diabetes are at higher risk for developing type 2 diabetes.

<sup>2</sup> Pigeon and Larocque, 2011.

<sup>3</sup> Bellou et al., 2018.



# DIABETES AND ALCOHOL

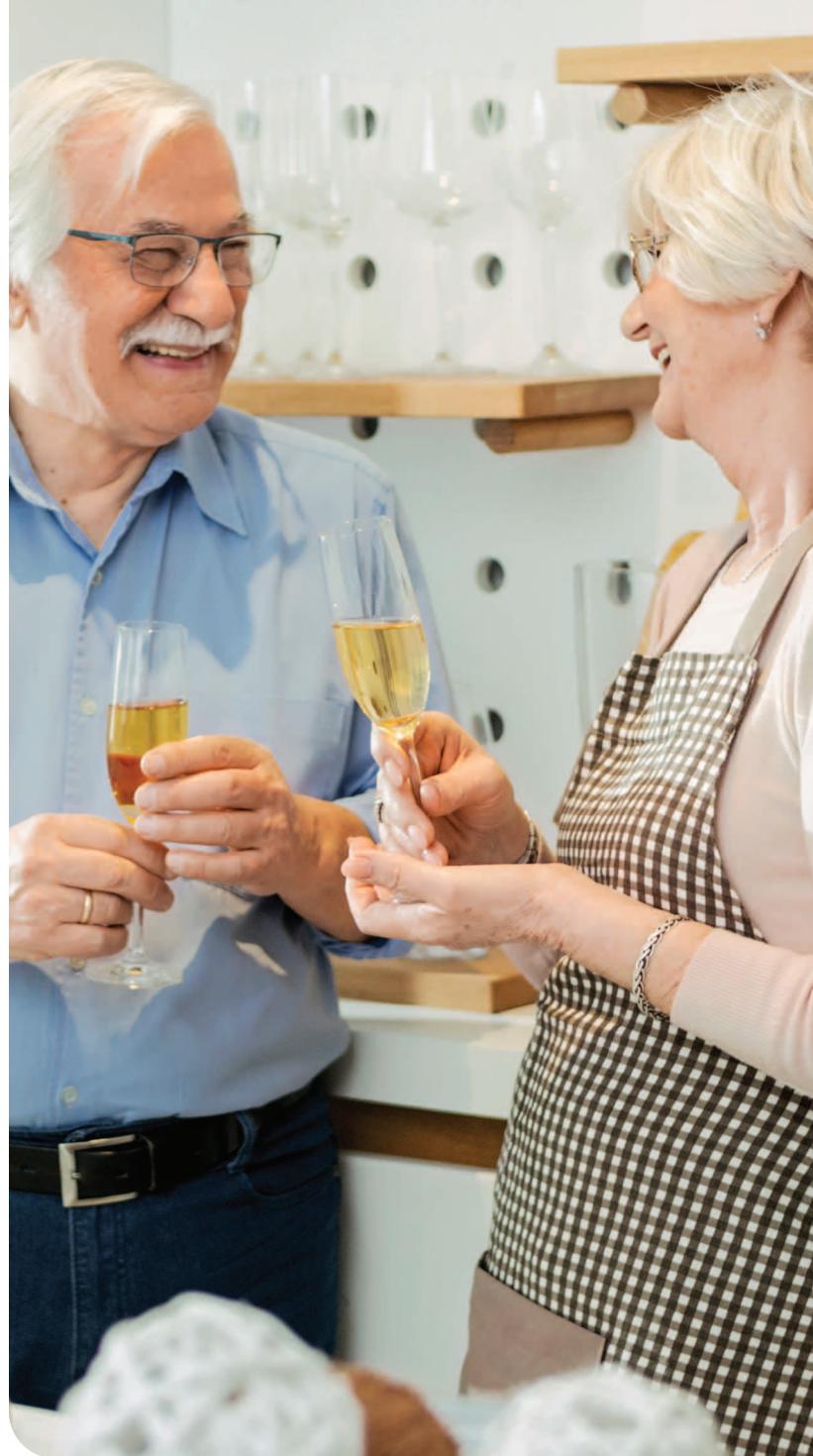
Alcohol affects a number of factors involved in the onset of diabetes, but the connection between drinking and the different risk factors varies according to the amount of alcohol consumed and drinking frequency.

## Moderate drinking

When researchers seek to determine how drinking affects the risk of a certain disease, different groups of drinkers, including moderate drinkers, are compared to people who never drink at all. Only in the early years of this century did studies begin to separate non-drinkers into two groups: life-time abstainers (those who had never drunk alcohol) and former drinkers (those who had chosen to stop drinking). Given that former drinkers might well include people who had decided to stop drinking for health reasons, research studies conducted before the distinction was made tended to overestimate the benefits of moderate drinking, since moderate drinkers were being compared to people who were already sick. In this section, we discuss the results of research in which the problem was corrected, i.e. where moderate drinkers were compared to life-time abstainers.

Epidemiological studies, which help estimate the prevalence of a disease among a given population, cannot show a definitive cause-and-effect link between a given characteristic and the risk of developing a disease such as diabetes. These studies tend to speak in terms of "association." Thus, the results presented below should be understood as demonstrating an association—not a causal relationship—between drinking and the risk of diabetes.

An initial review of 20 studies (known as a meta-analysis, in scientific language) has found that moderate drinking—two standard drinks a day—is associated with the lowest risk of developing diabetes, among both women and men.<sup>4</sup> Specifically, the risk is 40% lower for women and 13% lower for men.



More recently, another meta-analysis of 38 studies was conducted, using 17 studies previously analyzed plus another 20 or so published later.<sup>5</sup> Unlike the first meta-analysis, this one found no reduction in risk for men. However, a closer examination shows that, among the later studies, a significant percentage of new participants—48% of 1.9 million people—were Asian men. When the results of this research were separated by Asian and Western populations, the beneficial effect of moderate drinking was obvious among Westerners but not among Asians. The absence of a beneficial effect among men in the overall results can therefore be explained by the grouping together of all participants and the significant proportion of Asian men.

<sup>4</sup> Baliunas et al., 2009.

<sup>5</sup> Knott et al., 2015.



## Heavy drinking

A third meta-analysis,<sup>6</sup> this one targeting Asian men only, reached the same conclusion: no observable reduction in the risk of diabetes in this population. This can be explained primarily by the fact that certain Asian populations have a genetic particularity that affects the way alcohol is metabolized in their bodies, causing a kind of allergic reaction to alcohol. In fact, given the same amount of alcohol, Asian men with this genetic code displayed more pronounced harmful effects than Western men.<sup>7</sup>

When it comes to drinking frequency, meaning the number of days a week someone drinks, the research shows that the lowest risk for developing diabetes occurs when drinking is spread over three or four days.<sup>8</sup> Therefore, drinkers who do not want to exceed an average of two standard drinks a day, calculated weekly, should not have all their drinks on one or two days and then abstain from drinking the rest of the week; rather, they should spread their drinking over several days, sticking to moderate amounts.

Heavy drinking can lead to an inflammation of the pancreas called pancreatitis. The problem can occur suddenly and dramatically (acute pancreatitis) or more mildly but over a longer time (chronic pancreatitis). Both types of pancreatitis affect the ability of the pancreas to produce insulin.

Because of this damage to the pancreas, the risk of developing type 2 diabetes begins to exceed that of life-time abstainers at 3.7 standard drinks per day for women, and 4.5 standard drinks per day for men.<sup>9,10</sup> Even though a more recent meta-analysis<sup>11</sup> shows that the risk for men increases as of the first drink, it is important to note that this study analyzed primarily Asian men presenting a genetic predisposition making them particularly vulnerable to alcohol.

But beware! This does not mean that the amounts noted above should be considered the limits. Drinking at that level can increase the risk of other diseases, such as certain cancers and cardiovascular diseases (see other Éduc'alcool publications on this subject).



<sup>6</sup> Han, 2020.

<sup>7</sup> Beulens et al., 2007a; Kim et al., 2020.

<sup>8</sup> Holst et al., 2017.

<sup>9</sup> The study established thresholds of 50 and 60 grams of alcohol for women and men, respectively.

In Canada, a standard drink contains 13.45 grams of pure alcohol.

<sup>10</sup> Baliunas et al., 2009.

<sup>11</sup> Knott et al., 2015.

## Metabolic syndrome

Metabolic syndrome includes a cluster of medical conditions, which, when they occur together, significantly increase the risk of type 2 diabetes and cardiovascular disease. This syndrome is diagnosed when at least three of the following five conditions are present: excess body fat around the waist, elevated triglycerides (a type of fat found in the blood), elevated fasting blood sugar, low HDL (high-density lipoproteins, or the “good cholesterol”), and high blood pressure. One in five Canadians has metabolic syndrome, and the risk of developing it increases with age.<sup>12</sup>

Alcohol affects each of the indicators of metabolic syndrome. In fact, about one in five people who are alcohol dependent also suffer from metabolic syndrome, the most common indicators being high blood pressure and elevated triglycerides.<sup>13</sup>

When we look at drinking more generally, the risk of metabolic syndrome doubles the moment alcohol consumption exceeds three standard drinks a day.<sup>14</sup> The data is not yet conclusive with regard to moderate drinking, because the beneficial effects have thus far been observed primarily in studies where drinkers were compared to former drinkers, who, as noted above, may have chosen to stop drinking for health reasons.

Still, if there is any benefit, it would be as a result of having no more than two standard drinks a day, and only among those who drink mainly with meals.<sup>15</sup>



## What about red wine?

Several studies have shown the beneficial impact of red wine on various indicators linked to a reduced risk of diabetes, such as insulin sensitivity (allowing the body to use insulin more effectively),<sup>16</sup> higher HDL, and even lower fasting blood sugar.<sup>17</sup>

To separate the role of red wine from that of other types of alcohol, researchers<sup>18</sup> compared a spirit (gin) with red wine, both regular and alcohol-free. Their results showed that blood sugar was higher after drinking gin than after drinking both kinds of red wine. We can assume that lower blood sugar, due among other things to higher insulin sensitivity, may be associated with the characteristics of red wine, with or without alcohol.

Such results, however, do not justify more rounds every time you're drinking red wine. For one thing, studies to date have been done on men only and we don't know whether the benefits apply also to women.

Furthermore, the benefits mentioned above are explained generally by resveratrol, a beneficial antioxidant present in red wine. While it is true that resveratrol increases insulin sensitivity in humans,<sup>19</sup> the amounts used in such studies were about ten times higher than that usually found in one bottle of wine.<sup>20</sup>

Without a clear explanatory process, we cannot yet conclude that red wine is different from other types of alcohol when it comes to the beneficial impact on diabetes. Any benefit would probably be due to overall nutrients present in red wine, not just resveratrol, or to the fact that, compared to other types of alcohol, red wine is the alcohol most commonly drunk with meals.<sup>21</sup>



<sup>12</sup> Statistics Canada, 2019.  
<sup>13</sup> Vancampfort et al., 2016.  
<sup>14</sup> Sun et al., 2014.  
<sup>15</sup> Vieira et al., 2016.

<sup>16</sup> Chiva-Blanch et al., 2013.  
<sup>17</sup> Da Luz et al., 2014.  
<sup>18</sup> Chiva-Blanch et al., 2013.  
<sup>19</sup> Brasnyó et al., 2016.  
<sup>20</sup> Weiskirchen et al., 2016.  
<sup>21</sup> Vieira et al., 2016.



## HOW IT WORKS

After observing these connections between drinking and the risk of diabetes, researchers have suggested various mechanisms that may explain how alcohol might act on the different processes that regulate blood sugar. Some of these mechanisms are more controversial than others.

### Insulin sensitivity (or resistance)

Some studies maintain that moderate drinking has a positive impact on insulin sensitivity, but those conclusions do not stand up when data from multiple studies are examined in a meta-analysis.<sup>22</sup> Data available to date are not conclusive when it comes to the general population, but the positive impact may be seen among post-menopausal women.<sup>23</sup>

### Triglycerides

The research is contradictory when it comes to the potential benefits of moderate drinking on the level of triglycerides in the blood.<sup>24</sup> However, it has been shown conclusively that people with high triglyceride levels are susceptible to pancreatitis, which can have an impact on insulin production and thus negatively affect blood sugar. In people with elevated triglycerides, drinking alcohol can further raise triglyceride levels in a significant and prolonged way.

### Adiponectin

Adiponectin is a hormone involved in regulating blood sugar and certain lipids (fats). To date, the research associating moderate drinking and adiponectin remain contradictory. Some studies have found higher levels of adiponectin among moderate drinkers, which is a good thing when it comes to the risk of diabetes.<sup>25</sup>

Bell and Briton,<sup>26</sup> however, are the only ones to have analyzed the impact of drinking on changes in adiponectin levels over the long term. While drinking alcohol during the week before blood samples were taken was associated with the presence of the hormone, there was no connection between drinking habits and adiponectin levels two years later. The beneficial impact of moderate drinking on adiponectin would not explain the reduced risk of diabetes, which occurs over the long term, but it might well explain other positive effects observed in the short term, such as lower fasting blood sugar.

### Acetaldehyde

Studies have shown that people who do not eliminate acetaldehyde because of a genetic vulnerability are at higher risk for diabetes.<sup>27</sup> This suggests that acetaldehyde could be a toxic agent in developing the disease.

Acetaldehyde is produced when alcohol is metabolized in the body. It has a harmful effect on the pancreas and can cause acute or chronic inflammation of the organ.<sup>28</sup> A sick pancreas will have trouble producing insulin, and that could result in diabetes.

<sup>22</sup> Schrieks et al., 2015.

<sup>23</sup> Davies et al., 2002; Joosten et al., 2008.

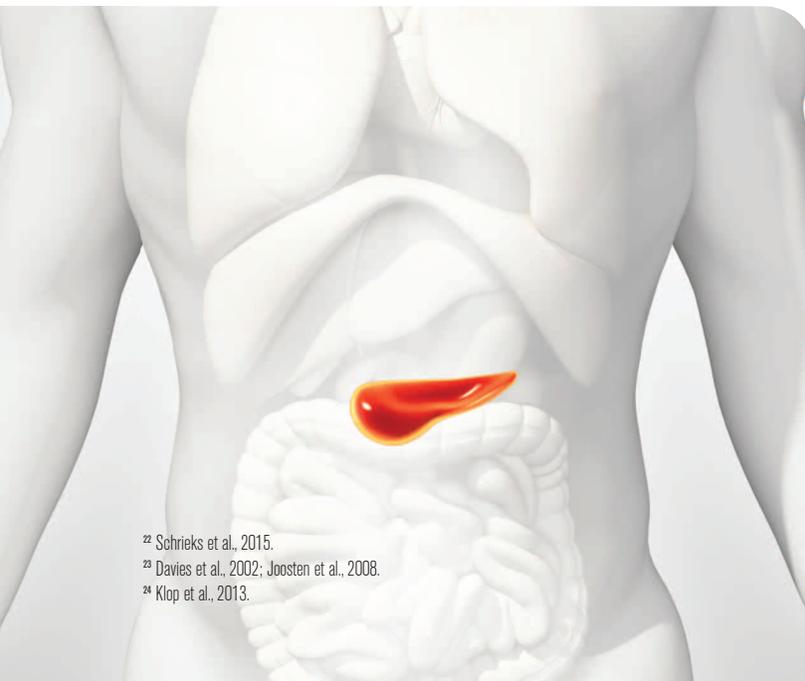
<sup>24</sup> Klop et al., 2013.

<sup>25</sup> Beulens et al., 2007b; Sierksma et al., 2004.

<sup>26</sup> Bell and Briton, 2015.

<sup>27</sup> Beulens et al., 2007a; Kim et al., 2020.

<sup>28</sup> Vonlaufen et al., 2007.



# IF YOU HAVE DIABETES

The 2018 guidelines published by Diabetes Canada recommend that diabetics make sure they meet the following criteria before drinking alcohol:

- 1 Have their diabetes under control, i.e. able to maintain blood sugar at recommended levels;
- 2 Have no health problems for which drinking would be contraindicated, such as pancreatic disease or uncontrolled high blood pressure;
- 3 Know how to prevent and treat hypoglycemia (below-normal blood sugar).

## CARBOHYDRATE CONTENT OF VARIOUS ALCOHOLIC AND NON-ALCOHOLIC BEVERAGES.

Amounts are given for illustration purposes and should not be used to establish a dietary program.

BEVERAGE	Volume (ml)	Carbohydrates (g)	Calories (kCal)
<i>WITH ALCOHOL*</i>			
Beer, light (4%)	435	7	124
Beer, regular (5%)	341	12	147
Liqueur, coffee-and-cream (17%)	93	20	319
Spirits (40%)	43	0	93
Dessert wine, dry (19%)	87	10	134
Dessert wine, sweet (19%)	87	12	140
Red table wine (12%)	142	4	121
White table wine (12%)	142	2	116
<i>WITHOUT ALCOHOL</i>			
Alcohol-free beer	341	27	126
Alcohol-free wine	142	2	9
Cola	355	39	152
Diet cola (with aspartame)	355	1	7
Orange juice, fresh	355	39	168
Orange juice, supermarket, refrigerated	355	43	182

\*Amounts for alcoholic beverages correspond to standard drinks, as defined by Canadian standards. Percentage markings indicate alcohol content.

Content adapted from Health Canada, 2018  
<https://food-nutrition.canada.ca/cnf-fce/>

Drinking, even in moderation, and hypoglycemia can both have a negative impact on certain cognitive functions, such as reaction time.<sup>29</sup> Alcohol plus hypoglycemia can have even more serious consequences. Anyone who is at risk for hypoglycemia (people who take insulin or oral medications such as sulfonylureas) and who chooses to drink should be aware a) of the risk of confusing a symptom of hypoglycemia with an effect of alcohol, and b) that the effects of hypoglycemia can be exacerbated by alcohol, impairing certain faculties significantly, even when blood alcohol content is below the legal limit for driving.

Drinking habits can also affect blood sugar levels in diabetics. No matter whether they are compared to people who have never drunk alcohol or to former drinkers, moderate drinkers who have no more than three standard drinks a day generally have lower blood sugar levels over the long term, which itself could reduce the risk of certain diabetes-related complications.<sup>30</sup> For people with type 1 diabetes (i.e. insulin dependent), alcohol can also lower blood sugar in the short term, up to 24 hours following the last drink,<sup>31</sup> which makes it important to eat a meal containing carbohydrates while drinking. If drinking, it may also be necessary to eat or carry additional snacks to prevent or treat hypoglycemia.

But remember: not all alcoholic beverages are created equal when it comes to carbohydrates! Short-term blood sugar can be affected differently, depending on the type of alcohol you drink. A standard glass of regular beer contains three times more carbohydrates than red table wine, and six times more than white table wine. That means hyperglycemia (high blood sugar) could be a problem before hypoglycemia (low blood sugar). You have to be very careful to correct this hyperglycemia, which is most often temporary. For example, it is generally recommended that you do not account for the carbohydrates in alcohol when calculating your insulin dose. Pure spirits have no carbohydrates, but mixers do, so you have to consider everything that goes into a cocktail.

Aside from carbohydrates, alcohol also has quite a few calories. Given how important weight management is in treating type 2 diabetes, the calorie count of the alcoholic beverages you drink is another important factor to consider.

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<sup>29</sup> Cheyne et al., 2004.

<sup>30</sup> Ahmed et al., 2008.

<sup>31</sup> Richardson et al., 2005.



## Diabetes medication and alcohol

A major study<sup>32</sup> explains why people who take medication that can cause hypoglycemia must always eat before or while drinking alcohol. When glucose levels are low, the pancreas secretes a hormone called glucagon, which works on the liver to increase blood sugar. This process is inhibited by the presence of a naturally occurring chemical in the body called NADH. When the liver metabolizes alcohol, a large amount of NADH is produced, meaning the glucagon cannot do its job as well, if at all.

Also, some diabetes medications, such as the sulfonylureas used to manage type 2 diabetes, can interact with alcohol and cause adverse reactions, such as extreme facial flushing or nausea (the same type of allergic reaction to alcohol seen in some Asian populations).

## Blood sugar monitoring and alcohol

Alcohol can affect blood sugar in both directions causing either hyperglycemia (too much) or hypoglycemia (too little). Diabetics therefore need to monitor their blood sugar levels regularly when drinking. It is also important to have sweet foods or glucose tablets handy to prevent or treat hypoglycemia.

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<sup>32</sup> Weathermon et al. 1999.



## CONCLUSION

The risk of developing diabetes varies according to drinking habits. Among Western populations, regular, moderate drinking—about two standard drinks a day, three to four days a week—is associated with a lower risk. When women have more than 3.7 drinks a day, and men more than 4.5 drinks a day, the risk rises much higher than among people who have never drunk alcohol.

This does not mean that anyone should aim for those upper limits, since drinking that much significantly increases the risk of other diseases, particularly cardiovascular disease and certain cancers. For people who are already diabetic, heavy drinking can also lead to short-term complications, such as an increased risk of hypoglycemia, and long-term problems, such as cardiovascular, kidney and vision problems.

For these reasons, it is better to drink only while eating carbohydrate-rich meals.

It's also a good idea to be aware of how many carbohydrates there are in the alcoholic beverages you drink, to help control your blood sugar. Even when it comes to diabetes, it's clear that moderation is always in good taste.

# DEFINITIONS

## Type 1 diabetes

A chronic autoimmune disease in which the body attacks the pancreatic cells that are supposed to produce insulin, resulting in insulin deficiency. Also called “insulin-dependent diabetes,” it appears most frequently in young people. People with this type of diabetes must take insulin.

## Type 2 diabetes

A chronic disease in which the pancreas does not produce sufficient insulin, or the body does not respond well to the insulin secreted. Also called “adult-onset diabetes” or “non-insulin-dependent diabetes,” it generally appears in adulthood. Treatment involves lifestyle changes (nutrition, physical activity, etc.), as well as oral or injectable medications that may include insulin.

## Gestational diabetes

A type of diabetes that occurs only in pregnant women and disappears after childbirth. Gestational diabetes increases the risk of developing type 2 diabetes later on.

## Glucose

A simple sugar that is an important energy source in humans.

## Blood sugar

The level of glucose in the blood.

## Insulin

A hormone secreted by the pancreas that regulates blood sugar.

## Pancreas

The organ responsible for producing insulin.

## Insulin resistance or sensitivity

The body’s capacity to use available insulin effectively. In someone who is insulin resistant, the insulin has a harder time lowering blood sugar.

## Metabolic syndrome

A cluster of medical conditions that significantly increase the risk of type 2 diabetes and cardiovascular disease. A diagnosis of metabolic syndrome requires the presence of three of the following five indicators: excess body fat around the waist, elevated triglycerides, elevated fasting blood sugar, low high-density lipoproteins (HDL) and high blood pressure.



Éduc'alcool would like to thank Dr. Rémi Rabasa-Lhoret, MD, PhD, for his invaluable contribution in revising this publication. Dr. Rabasa-Lhoret is a Full Research Professor and Vice President, Clinic and Clinical Research of the Montreal Clinical Research Institute (IRCM), where he also directs the Diabetes Clinic, the Metabolic Diseases research unit and the research platform on obesity, metabolism and diabetes. In addition, he is a full professor in the Department of Nutrition, Faculty of Medicine, Université de Montréal; a physician in the Endocrinology Division, Medicine Department, CHUM; and holder of the J.A. DeSève and Lamarre Gosselin Chair in diabetes research.

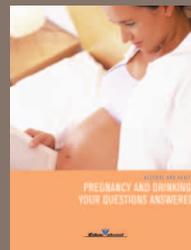
# IN THE SAME COLLECTION

The reports in Éduc'alcool's *Alcohol and Health* series are well researched and easy to read. Each one gets straight to the point and is a valuable health, education and information resource. All of them may be downloaded from [educalcoool.qc.ca](http://educalcoool.qc.ca) or ordered by calling 1-888-ALCOOL1.



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A review of the research on how moderate, regular alcohol consumption affects human health.



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Straightforward answers to frequently asked questions about drinking during pregnancy and breast-feeding, for pregnant women and those who might become pregnant.



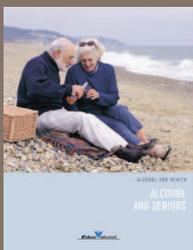
## ALCOHOL AND THE HUMAN BODY

An explanation of what happens to alcohol as it passes through the body and the effects it produces.



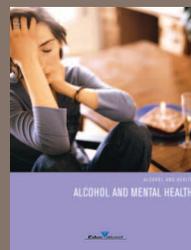
## THE EFFECTS OF EARLY ALCOHOL USE

Examines the harmful effects of early alcohol use and explains the basic reasons why young people should not have unrestricted access to alcohol.



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A description of the effects of alcohol on people 65 and older. Includes valuable advice for seniors, their families, friends and caregivers.



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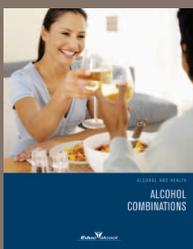
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A review of the physiological and psychological effects of abusive drinking. The consequences of both chronic and occasional excessive drinking are highlighted.



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Abusive drinking has long-lasting effects even when blood alcohol content is back to zero.



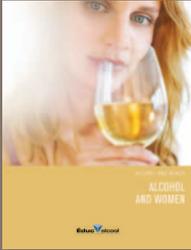
## ALCOHOL COMBINATIONS

Explains the beneficial, harmful and downright dangerous effects of combining alcohol with various other substances or activities.



## ALCOHOL AND SLEEP

Alcohol is a fickle friend of sleep. That's one of the most important conclusions of this report on the impact of drinking on sleep. There are many more.



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A report on women and drinking that explains why women are more vulnerable than men—both physiologically and socially—to the effects of alcohol.



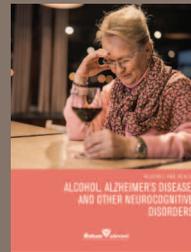
## ALCOHOL AND HEART HEALTH

A report on the effects of moderate drinking on cardiovascular health. Benefits are explained and myths are debunked.



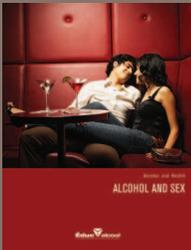
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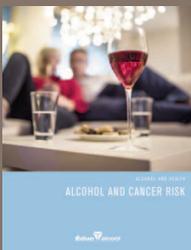
## ALCOHOL AND SEX

Alcohol can sometimes help smooth the way in intimate relationships, but abusive drinking can lead to disaster. This report examines some of the well-known and lesser-known issues.



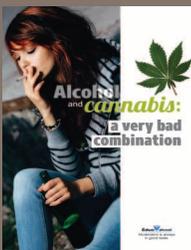
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Moderation is always in good taste.

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