

Alcohol

Information for Health Professionals

Introduction

In our society, alcohol is a large part of social events and is usually not thought of as a drug, particularly since it is self-prescribed; however, alcohol is, by far, our most used and abused drug. Alcohol is a depressant drug and is often included, along with sleeping pills, in the sedative/hypnotic class of drugs. All depressant drugs, such as benzodiazepines, narcotics, and barbiturates, slow down the nervous system and can cause drowsiness, induce sleep, or relieve pain. In addition to acting on the nervous system, excess use of alcohol can have adverse effects on almost every other system of the body.

The word alcohol, as commonly used, refers to beverage alcohol. The active ingredient is the chemical ethanol, also known as ethyl alcohol. It is produced by fermenting or distilling various fruits, vegetables, or grains. Pure ethanol is a clear, colourless liquid.

Methyl alcohol (i.e., methanol), another clear, colourless liquid, is very poisonous and should not be consumed. As little as 15 ml (½ oz.) can cause blindness and 59 to 89 ml (2 to 3 oz.) can be fatal. Methyl alcohol is a solvent used in paint removers, antifreeze, liquid fuel, lacquer thinner, and some industrial cleaning solutions.

So-called “non-beverage” alcohol is ethyl alcohol in a form that is not meant to be consumed. Products such as rubbing alcohol, Lysol® cleaner, vanilla extract, some mouthwashes, aftershave lotions, and cooking wines all contain high concentrations of ethyl alcohol. Despite the danger of overdose and toxic effects, people who are alcohol dependent but cannot afford beverage alcohol, may drink these products because they are potent, inexpensive, and often readily available. Numerous toxic effects can also result from other chemicals present in non-beverage alcoholic products.

In beverages, pure ethyl alcohol is diluted with various ingredients that affect the colour and consistency. Alcohol content can vary between brands, even if the type of beverage is similar. Spirits such as whisky, gin or rum can contain 40-50% ethanol, table wine contains approximately 12%, regular beer contains approximately 5%, and spirit and wine-based coolers are approximately 5% alcohol.

The usual serving (standard drink) contains 17 ml or 13.5 grams (0.6 oz.) of pure alcohol. A standard serving is equivalent to 45 ml (1.5 oz.) of spirits, 150 ml (5 oz.) of table wine, or 355 ml (12 oz.) of regular Canadian beer. The effect of alcohol does not depend on the type of alcoholic beverage but on the amount of alcohol consumed. Canadian low-risk drinking guidelines have recently been released to help reduce immediate and long-term health risks of alcohol. It is recommended that women consume no more than 10 drinks per week, with no more than two drinks per day. For men, it is recommended to consume no more than 15 drinks per week, with no more than three drinks per day. The guidelines also suggest times when drinking should be avoided (e.g., before operating machinery or tools, if you are pregnant or nursing, etc.).

How alcohol works

After consumption, alcohol is rapidly absorbed into the bloodstream from the stomach and small intestine. The effects of alcohol depends on how much is in the bloodstream, which is called the blood alcohol concentration (BAC). The drinker’s BAC depends on many factors, such as the amount of alcohol

consumed in a given time, the drinker's size and gender, the presence of food in the stomach, and metabolism. Food in the stomach delays the feeling of intoxication because it slows the absorption of alcohol in the stomach (which absorbs up to 20% of alcohol ingested) and delays passage of alcohol into the small intestine (where most absorption takes place). Because absorption is slowed, peak alcohol levels are also reduced, and the feeling of intoxication is not as great.

Ethanol dissolves in water, but not in fat or oil. Because of this and its ability to easily cross cell membranes and barriers, ethanol will distribute across the body in proportion to the water content of body tissues. This results in interesting differences between individuals. For example, women generally have lower amounts of body water and higher proportions of body fat than men, and therefore will have a higher BAC after consuming the same amount of alcohol as a man with the same body weight.

Alcohol is broken down in the body (i.e., metabolized) by enzymes that are present in the stomach and liver. Factors such as gender, race, and genetics impact how fast an individual will metabolize alcohol. In the stomach, small amounts of ethanol are metabolized into acetaldehyde by the alcohol dehydrogenase (ADH) enzyme. ADH metabolizes the majority of ethanol in the liver, where the liver can process 30 ml (1 oz) of alcohol per hour. The acetaldehyde, which is a carcinogen, is quickly metabolized by the aldehyde dehydrogenase enzyme into acetate, a harmless substance.

Because alcohol is dissolved throughout the water in the body, it affects almost all organs and systems. In the brain, alcohol affects a variety of neurotransmitters in the nervous system, including gamma-aminobutyric acid (GABA), dopamine, acetylcholine, serotonin, and norepinephrine. The depressant effect on the nervous system may in part result from an increase in the inhibitory effects of GABA in a way that is similar to sedative drugs. Pleasurable feelings associated with alcohol are caused when alcohol activates the reward system of the brain through opioid and dopaminergic systems. The activation of serotonin and endorphins may also contribute to the feeling of well-being and mood elevation seen within alcohol intoxication.

The effect of any drug, including alcohol, depends on the amount and how it was ingested. The user's expectations of the effect of alcohol, their mental state while drinking, and previous exposure to alcohol can alter the effects of alcohol. The setting, location, and the use of other drugs or substances while drinking can also influence the effects of alcohol.

Short-term effects

Short-term effects of alcohol include an increase in stomach secretions, dilation of blood vessels in the skin (causing loss of body heat despite a feeling of warmth), increased urine production, and even in small amounts, accumulations of fat in liver cells.

The most obvious, immediate effects of alcohol result from the depression of the nervous system. Even the initial apparent stimulant effect (e.g., increased self-confidence and becoming more socially outgoing) actually results from depression of centers in the brain that inhibit our actions and restrain our behaviour.

After one drink, at a BAC of about 0.02% (0.02 grams of alcohol per 100 ml of blood), most people will feel more relaxed. Drinking more can make some people feel outgoing and possibly more self-confident, while others may become hostile, depressed and withdrawn. At higher doses, even below a BAC of 0.08 (the legal BAC limit for those in Alberta with a Graduated Driver's license [GDL]), thinking, judgment, and

ability to estimate distances can be impaired and reaction times decreased. People may also experience trouble with fine motor movements, like writing, and have a decrease in their attention span.

At BAC levels greater than 0.10, which will occur when a 72 kg (160 lb) man consumes four or five drinks in an hour, significant impairment occurs. Studies have shown that drivers with a BAC of 0.10 are seven times more likely to cause a motor vehicle accident because both performance and judgment are impaired. At BACs over 0.20, the non-tolerant person is very intoxicated with pronounced motor incoordination (e.g., staggering gait, slurred speech). Their vision may become blurry, and they may feel dizzy. People with BACs over 0.20 may also be highly emotional; they may be extremely aggressive, become withdrawn, or exaggerate affection. People with BACs from 0.3 to 0.4 may be unresponsive to their environment. They may be unable to walk or move, drift in and out of consciousness, and also vomit. BACs above the range of 0.40 to 0.60 are usually fatal; the heart rate may slow down and body temperature may drop. People with BACs in this range may die, typically from respiratory depression, unless urgent medical help is sought.

A “hangover” occurs eight to 12 hours after heavy drinking ends. Symptoms of a hangover include fatigue, feeling thirsty, having a dry mouth, headache and nausea. Some people may also vomit or feel shaky. The hangover is partially caused by mild alcohol withdrawal, and is partly suppressed by additional alcohol; however, this will not prevent the hangover from happening, it will just delay the hangover’s occurrence. A hangover may be more severe if larger amounts of alcohol are consumed. Despite numerous “home remedies”, there is currently no effective cure for hangovers. Sipping water will help ease symptoms of dehydration and snacking on bland foods (e.g., crackers) may help settle an uneasy stomach. The symptoms usually disappear within 24 hours as body systems return to normal.

Blackouts are periods of memory loss that occur while a person is drinking heavily. Although conscious and functioning, the person is later unable to recall what they did or said. This happens because alcohol impairs the ability to form new memories when intoxicated; people can typically remember what happened up to a certain point in time. Frequent blackouts and morning drinking to treat hangovers are possible indicators of a drinking problem.

Death from alcohol overdose is often associated with binge drinking (i.e., heavy consumption over a short period of time) at events where such consumption is encouraged (e.g., grad parties, bush parties, college initiations, drinking contests). Unconsciousness or unresponsiveness are signs of possible alcohol overdose. Any unconscious person, whether intoxicated or not, should be watched closely and receive medical attention if they cannot be aroused.

Death could occur when moderate amounts of alcohol are combined with other depressant drugs, such as sleeping pills and narcotics. Anti-anxiety medications should also not be taken with alcohol, as both substances act on similar bodily systems and alcohol intensifies the drug’s sedative effects. Some illicit drugs (e.g., heroin) combined with alcohol can also cause death. Even small amounts of alcohol taken together with these or other drugs, such as cannabis or antihistamines (in cold, cough, and allergy remedies), can seriously impair a person’s ability to drive a car; the combination can make a person feel drowsy or dizzy.

Long-term effects

Nervous system

In addition to causing tolerance and withdrawal as discussed below, harmful or hazardous drinking patterns may affect the nervous system in other ways. It is a major cause of preventable brain injury resulting in severe dysfunction in up to 10% of excessive drinkers. Wernicke-Korsakoff syndrome (WKS) can result in loss of brain function similar to what occurs in Alzheimer's disease. Those diagnosed with WKS suffer from impaired memory and confusion, vision changes and loss of muscle control. Heavy use of alcohol can also seriously disrupt sleep and cause movement disorders, damage peripheral nerves, and lead to an increased risk of serious complications following head injury.

Gastrointestinal tract and digestive system

Chronic use of alcohol can cause damage to the stomach and intestines, as well as cause serious disease of the gall bladder, liver, and pancreas. When excessive alcohol intake is combined with poor eating habits, severe nutritional deficiencies can develop.

The liver

Chronic alcohol abuse is the single most frequent cause of illness and death from liver disease. The early accumulation of fat in the liver, called fatty liver, is generally reversible and requires no treatment except abstinence from alcohol and a good diet. Alcoholic hepatitis occurs when the liver becomes inflamed and cells die as a result of excessive alcohol consumption. This disorder can be treated with medications in conjunction with abstinence from drinking, and a good a diet with adequate levels of protein. The late stage liver disease, alcoholic cirrhosis, is irreversible. In serious cases, a liver transplant may be required.

The pancreas

Prolonged alcohol abuse can also cause chronic pancreatitis, which is inflammation of the pancreas. Symptoms of pancreatitis include severe upper abdominal pain, nausea and vomiting that worsens after eating. Diabetes can also result from pancreatitis, possibly requiring treatment with insulin. Bleeding from the stomach and enlarged veins around the esophagus (esophageal varices), ulcers in the stomach and intestines, or diarrhea and malabsorption of nutrients can all occur in heavy drinkers, as well as stomach cancer.

Cardiovascular system

Abstinence from alcohol is critical in the treatment of the wide range of serious effects of alcohol abuse on the heart and blood vessels. In alcoholic cardiomyopathy, excessive consumption of alcohol leads to deterioration of the heart muscle, which may increase the risk of heart failure. Cardiac arrhythmia (i.e., irregular heartbeat) has been linked to sudden death in people who abuse alcohol, although this is not a common occurrence. Cardiomyopathy and atrial fibrillation and flutter have also been linked to alcohol use.

Research focusing on the effects of moderate alcohol consumption (one to two drinks per day) on heart failure has been mixed; some studies indicate a protective influence while others have found alcohol consumption led to an increased risk of heart failure. Conflicting results have also been observed in the effect of moderate alcohol consumption on risk of stroke, diabetes, and coronary artery disease. Any protective effect of alcohol may be impacted by population or patterns of drinking.

Reproductive system and other hormonal effects

In men, chronic ingestion of excess alcohol may lead to impotence and decreasing sexual desire, sterility, atrophy of the testes, and enlargement of the breasts. Premenopausal women who drink excessive alcohol may experience rises in estrogen levels, which may lead to menstrual irregularities. Although moderate drinking is associated with higher bone mineral density, abuse of alcohol is associated with bone loss (i.e., osteoporosis), due to excess output of hormones from the adrenal gland and low levels of sex hormones.

Metabolic effects

Acute alcohol abuse can cause low blood sugar, which is of particular concern for diabetic patients. Ketoacidosis, a condition involving excess acidity of the blood, can also be caused by excess alcohol use. This condition is more commonly seen in people with diabetes.

Immune system and cancer-producing effects

Depression of the immune system caused by chronic alcohol abuse results in an increased risk for developing infections such as pneumonia, tuberculosis, or hepatitis C, as well as cancer. In addition, increased risk of infections, like HIV, could occur if loss of judgment and inhibitions during intoxication resulted in unsafe sexual practices, or if injection drug users share needles.

Liver and oral cancers (i.e., the throat, larynx, mouth, esophagus and pharynx) are the most frequently associated with excessive use of alcohol. Chronic alcohol consumption may lead to an increased risk of breast cancer in women, and colorectal cancer in men. Preliminary research shows alcohol may slightly increase the risk of developing stomach, pancreas, lung, urinary tract, or skin cancer.

For women, any benefits of moderate consumption may be offset by a greater risk of breast cancer.

Blood and muscle

Anemia is common in people who abuse alcohol, due to low levels of iron and vitamin B. Chronic alcohol consumption can cause the development of thrombocytopenia, which is a decrease in the number of platelets in the blood. The level of platelets, which are important in the normal clotting of blood, is often low, but usually causes no clinical signs of a bleeding problem.

Alcohol also affects bone marrow, where red blood cells are produced. Fewer new blood cells are produced; cells may have atypical structures, and may be abnormally large.

The profound weakness seen in chronic alcoholics may in part be caused by peripheral nerve damage, but also results from direct damage to muscles.

Alcohol and pregnancy

Mothers who consume alcohol during pregnancy are at an increased risk of having children with birth defects. Fetal Alcohol Spectrum Disorder (FASD) covers the full range of birth defects associated with maternal alcohol consumption during pregnancy, including fetal alcohol syndrome (FAS) and fetal alcohol effects (FAE).

Fetal alcohol syndrome is a well-defined pattern of abnormalities. The diagnosis of FAS includes confirmation of drinking during pregnancy, and abnormalities in each of three categories:

- i) growth retardation (birth height or weight below the tenth percentile)

- ii) central nervous system damage, such as hearing disorders, mental retardation, or brain malformations
- iii) characteristic facial features, including narrow eye width, elongated, flattened midface, and thin upper lip

Babies born with FASD may experience a variety of lifelong problems including low intelligence, behaviour problems, and difficulties with impulse control and social perception. Children with FASD may have difficulties at school (e.g., learning disorders or disruptive behaviour) and may later have higher rates of criminal activity as they become adults. A 2016 systematic review and meta-analysis completed by CAMH found that more than 400 conditions affecting nearly every bodily system can co-occur with FASD.

The term fetal alcohol effects has come to mean a birth defect caused by alcohol consumption during pregnancy in which some, but not all, of the symptoms related to FAS are present. FAE is not a milder form of fetal alcohol syndrome. Even though a child or adult with FAE has only some of the symptoms of fetal alcohol syndrome, those symptoms may have a severe impact on their life.

Tolerance and dependence

When continued consumption of excess alcohol occurs, the nervous system adapts to the presence of a chronic depressant and physical dependence develops. Indicators include tolerance (the need to consume increasing amounts of alcohol to obtain a desired effect) and the development of withdrawal symptoms if the user stops drinking. Because tolerance develops, many drinkers don't appear intoxicated even with increased consumption and their deteriorating physical condition may go unrecognized. If alcohol intake stops abruptly for any reason (e.g., they are hospitalized), they experience withdrawal.

People with psychological dependence experience strong emotional needs for alcohol. When they experience withdrawal symptoms, they may feel very uneasy or more anxious than normal. In this case, the reaction results not from physical withdrawal, but because the user has become psychologically accustomed to regular alcohol intake. Like physical dependence, this response can contribute to continued use of alcohol.

Withdrawal and treatment

Withdrawal symptoms often develop in three stages. The initial phase begins within six to 12 hours after the last drink, and symptoms may include tremulousness ("the shakes"), irritability, headache, nausea and vomiting, and difficulty sleeping. Seizures may occur in severe withdrawal cases. The severity of symptoms depends on a variety of factors including the length of time a person has been drinking and the amount they had to drink before abstaining. Withdrawal symptoms reach peak intensity within 24 to 48 hours, and subside in two or three days. Alcoholic hallucinosis (e.g., visual or auditory hallucinations) can occur during this phase.

In the second phase, convulsions can develop within 24 to 48 hours after stopping even heavier drinking. Convulsions have been reported to occur for as long as five and up to 20 days later. People suffering seizures during withdrawal should be carefully monitored, as there is a risk of death from the seizures. Except in persons with epilepsy, the standard treatment of moderate to severe withdrawal symptoms described below is usually adequate.

Delirium tremens (DTs) are the third and most serious stage of alcohol withdrawal, and occur in 5-20% of those going through withdrawal. They occur four or five days after prolonged, heavy drinking stops, at which time the person becomes severely agitated, extremely confused and disoriented, and has dilated pupils, fever, high blood pressure, and a very rapid heart rate.

Reassurance and supportive nursing care in subdued surroundings are the basis for treating the alcohol withdrawal states, especially for those experiencing hallucinations or delusions. Chlordiazepoxide (Librium®), diazepam (Valium®), and other benzodiazepines are the drugs most commonly used in the treatment of alcohol withdrawal. Particularly with DTs, electrolyte imbalances should be corrected and adequate fluids administered. Hallucinations should be treated cautiously. Thiamine (vitamin B1) is usually given orally or intramuscularly to most patients treated for significant alcohol withdrawal.

Who uses alcohol?

A 2015 nationwide survey found that 76.9% of Albertans over the age of 15 were current drinkers (had consumed at least one drink in the previous year). This was similar to Canada's national rate of 78.4%. An estimated 19.0% of Albertans and Canadians aged 12 and older are classified as heavy drinkers and 16.6% of Canadians were consuming alcohol at high risk levels. Heavy drinking refers to males who reported having 5 or more drinks, or women who reported having 4 or more drinks, on one occasion, at least once a month in the past year. The World Health Organization has determined that Canadians aged 15 and older drink 3.6 times more than the world average.

Among grade 7 to 12 Canadian students in 2016-2017, 44% reported alcohol use in the previous 12 months. The average age of drinking onset has been measured to be 13.4 years old, with prevalence of alcohol use increasing with age.

Alcohol misuse also has a broad impact in society and can undermine individual health, family and personal relationships, economic productivity, and community safety. In 2002-2003, the cost of alcohol abuse in Alberta was estimated at \$1.6 billion—\$527 for every citizen of the province. In a separate study conducted in 2014, alcohol was found to cost Canadians \$14.6 billion.

Additionally, motor vehicle collisions, alcoholic liver disease, and alcohol-related suicides are the leading causes of alcohol-related mortality. Alcohol is a major contributor to injuries and fatalities resulting from falls, drowning and fires, increased rates of work-related accidents, absenteeism, and illness. Alcohol attributes 34.4% of hospitalizations in Canada and lost productivity costs have risen 8.4% from 2007 to 2014. Crimes of violence, including spousal abuse and physical assault, also frequently involve people under the influence of alcohol.

Alcohol and the law

There are many laws that regulate the manufacture, distribution, advertising, possession and consumption of alcohol. Alcohol legislation is a joint responsibility of the federal and provincial governments. In Alberta, it is an offence for anyone under 18 years of age to possess, consume, or purchase alcohol. It is illegal to sell or supply alcohol to anyone known to be, or appearing to be, under the age of 18 (unless the person has proof otherwise); however, it is not illegal for parents or guardians to give an underage child a drink at home. Selling or supplying alcohol to any person who appears to be intoxicated is illegal.

Under the Criminal Code of Canada, it is an offence to drive with a blood alcohol concentration (BAC) of 0.08% or greater, and to drive while impaired even if one's BAC is less than 0.08%. In Alberta, new tougher penalties for driving while under the influence of alcohol were implemented in 2012 by Bill 26. Drivers testing over 0.08 BAC now face immediate license suspension until the charges are resolved and have their vehicle impounded for three to seven days. They must also participate in the ignition interlock program, which requires them to have an alcohol sensing device installed in their vehicle, as well as complete an educational course. Drivers who test between 0.05 and 0.08 BAC face a three-day license suspension, will have their vehicles impounded for three days, and must complete an educational course. Repeat offenders face increasing penalties. New drivers who only possess a graduated driver's license face automatic vehicle seizure for seven days and a 30-day driving ban if caught with any amount of alcohol in their system.

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