INTRODUCTION

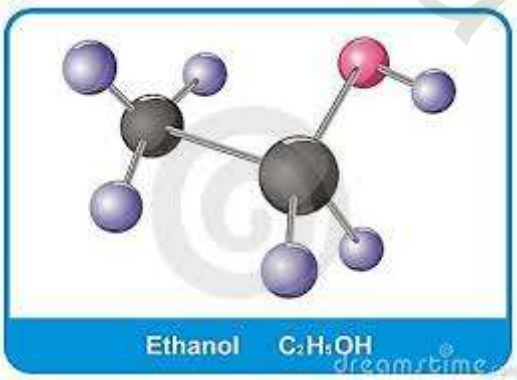
History and epidemiology:

The fermentation of sugar into ethanol is one of the earliest biotechnologies employed by humans, the intoxicating effect of ethanol consumption have been known since ancient times, ethanol has been used by humans since prehistory as the intoxicating ingredient of alcoholic beverages. Dried residue on 9.000 year old pottery found in china suggests that Neolithic people consumed alcoholic beverages.[1]

The earliest known scientific identification of ethanol was from the Persian polymath, razes, in the 9th century. Although distillation was well known by the early Greeks Arabs, the first recorded production of alcohol from distilled wine was by the school of Salerno alchemists in the 12th century. [2]

The first who mention absolute alcohol, in contrast with alcohol-water mixtures, was Raymond lull. And the French chemist Antoine Lavoisier described ethanol as a compound of carbon, hydrogen, and in 1807 Nicolas-Theodore de Saussure determined ethanol's chemical formula. [3]

Physical and chemical properties of Ethanol:



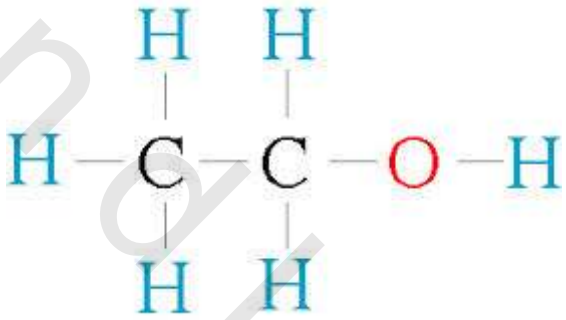


Table (I) physical and chemical properties of ethanol: [4, 5]

Molecular formula	C_2H_6O
Molar mass	46.07 g mol^{-1}
Density	0.789 g/cm^3 (at 25°C)
Melting point	−114 °C (−173 °F; 159 K)
Boiling point	78.37 °C (173.07 °F; 351.52 K)

Ethanol is a clear, colorless, odorless, volatile, liquid hydrocarbon with burning taste. It is fully miscible in water and is lipid soluble. It readily diffuses across lipid membranes. Rapidly absorbs water from the air, it mixes readily with most organic liquids. [6]

Ethanol is rapidly absorbed from the gastrointestinal (GI) tract, with approximately

20% absorbed from the stomach and the remainder from the small intestine. [7]

Under optimal conditions for absorption, 80-90% of an ingested dose is fully absorbed within 60 minutes. Factors that delay or decrease ethanol absorption include high concentrations of ethanol (by causing pylorospasm), presence of food, coexistence of GI disease, coingestion of drugs (eg, aspirin and N-butyl scopolamine), time taken to ingest the drink, and individual variation. Any of these factors and individual variation may delay absorption for 2-6 hours. [7, 8]

Physical and chemical properties of Methanol:

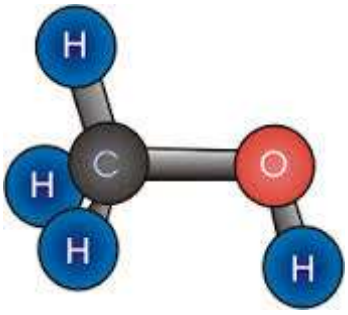


Table (II): Physical and chemical properties of methanol :[4]

molecular formula	CH4O
molar mass	32.04gmol-1
Appearance	colourless liquid
Density	0.7918g cm-3 / 0.7925g cm-3(ref 1)
melting point	-143.7 f; 175.6 k
boiling point	148.5 f; 337.8 k

Methanol as a wood alcohol, was one of the first organic chemicals to find extensive laboratory and industrial use. The development of synthetic methanol has made the compound one of the most widely used solvents and chemicals. [9]

Alcohol beverages:

An alcoholic beverage is a drink that typically contains 3%-40% alcohol (ethanol). Alcoholic beverages are divided into 3 classes; beers, wines, and spirits (distilled beverages).They are legally consumed in most countries around the world. More than 100 countries have laws regulating their production, sale, and consumption. [10]

Wine:

Wine is a fermented beverage produced from grapes. Wine involves a longer fermentation process than beer and also a long aging process (months or years), resulting in an alcohol content of 9-16% alcohol blood volume (ABV). Sparkling wine can be made by means of a secondary fermentation. Beverage called (fruit wines) is made from fruits such as plums, cherries, or apples. The kind of fruit must be specified on the label. [11]

Beer:

Beer is a beverage fermented from grain mash. It is made from barley or a blend of several grains. If the fermented mash is distilled, the beverage is spirit. Beer is the most consumed alcoholic beverage in the world. (11)

Cider:

Cider or cyder is a fermented alcoholic beverage made from any fruit juice (traditional and most common), peaches, pears or other fruit. Cider alcohol content varies from 1.2% ABV to 8.5% or more in traditional English cider. In some regions, cider may be called (apple).(12)

Alcoholic concentration:

The concentration of alcohol in beverage is usually stated as the percentage of alcohol by volume (ABV, the number of ml of pure ethanol in 100 ml of beverage) or as a proof. In the United States, proof is twice the percentage of alcohol by volume at 60 degree faherenhite. (13)

Most yeast cannot reproduce when the concentration of alcohol is higher than 18%, so that is the practical limit for the strength of fermentated beverages such as wine, beer, and sake. However, some strains of yeast have been developed that can reproduce in solutions of up to 25%ABV. (13)

Pharmacokinetics of alcohol:

Absorption and distribution:

The alcohol molecule is a small polar molecule with both lipophilic and hydrophilic characteristic. The amphibiotic qualities of alcohol help to explain its pharmacokinetics within the body. The lipophilic qualities explain how alcohol is absorbed by passive diffusion across the cell membranes without the need for modification. (14)

Blood alcohol concentration (BAC):

It is determined by the various factors that affect the rate of alcohol absorption, distribution, metabolization and excretion from the body. (15)

As alcohol is a small water soluble molecule that can cross cell membrane, it is absorbed from both the stomach (20%) and the upper small intestine (80%). (15)

The rate of absorption varies significantly in both intra-individual inter-individual comparisons even after standardized conditions. (15)

This suggests that intra-individual variability is due to variation in gastrointestinal function (gastric emptying, intestinal transit time, and portal blood flow) the rate of gastric emptying has significant impact on the speed at which alcohol is absorbed, because alcohol is absorbed much faster from the small intestine, than it is from the stomach. (15)

The bioavailability of alcohol is reduced by first pass metabolism (FPM). Oxidation of alcohol by gastric alcohol dehydrogenase (ADH) in the gastric mucosa account for a

small proportion of FPM, but the majority occurs via oxidation by ADH in the liver hepatocytes. [16]

The proportion of alcohol that is absorbed, and escape FPM enters the systemic circulation and it is rapidly distributed throughout the body tissues via the alcohol plasma until an equilibrium between the BAC and tissue concentrations reached. [17]

Females generally have a proportionality smaller lean body mass and a smaller blood volume. The result is a lower volume of distribution an higher BAC when females ingest the same amount of alcohol as men. It has been also suggested that higher BAC may be due to lower FPM by gastric ADH in the gastric mucosa of females.[18]

This would increase the bioavailability of alcohol resulting in increased BAC. However, the ability of gastric ADH to metabolize significant amounts of alcohol has been questioned because its activity is 100 times lower than hepatic ADH25 and more recent studies have failed to support this finding.[19]

Metabolism and excretion:

The metabolism and elimination parameters of alcohol are more consistent than the absorption and distribution. A small proportion (2-5%) of the absorbed alcohol is excreted unchanged in the urine, sweats or breath. [20]

The metabolism of alcohol occurred through:

1- Oxidative pathway of alcohol:

The majority is removed via primary oxidation (by ADH). This can occur in various organs such as the stomach and small intestine but it is primarily carried out by hepatic ADH. Oxidation process by ADH converts alcohol to acetaldehyde, a reactive and toxic molecule that is rapidly oxidized by aldehyde dehydrogenase to harmless acetate. Under normal conditions acetate is then oxidized in the liver and peripheral tissues to carbon dioxide and water. The rate limiting step in the ADH pathway is the limited availability of NAD+ thus alcohol metabolized is restricted to approximately 15gm/hour. [14]

A secondary oxidation pathway for alcohol metabolism is the microsomal alcohol oxidizing system. [15]

Third oxidative pathway via the enzyme heme catalase, which converts a small proportion of alcohol (0-2%) to acetaldehyde and water. [15]

1- Non-oxidative pathways of alcohol metabolism:

Although the metabolism of alcohol by these pathways is minimal, the products may have pathological relevance because their products persist after alcohol elimination and have been demonstrated to interfere with cell signaling. The rate of alcohol metabolism is influenced by BAC and genetics via the particular ADH isoenzymes present in the individual.[15]

Mechanism of action of alcohol:

Ethanol is a central nervous system depressant and has significant psychoactive effects in sublethal doses. Based on its ability to change the human consciousness, ethanol is considered as psychoactive drug. (21)

Death from ethanol consumption is possible when blood alcohol level reaches 0.4%. A blood alcohol level of 0.5% or more is commonly fatal. Levels of even less than 0.1% can cause intoxication, with unconsciousness often occurring at 0.3-0.4%.(22)

The amount of ethanol in the body is typically quantified by blood alcohol content (BAC), which is here taken as weight of ethanol per unit volume of blood.(23)

In general ethanol with small doses, produce euphoria and relaxation; people suffering from these symptoms tend to become talkative and less inhibited and may exhibit poor judgment. At higher dosage(BAC more than 1g/L), ethanol acts as a central nervous system depressant, impaired sensory and motor functions, slower cognition, unconsciousness, and possible death with higher doses Ethanol acts on CNS primarily by binding to the GABA receptor increasing the effects of the inhibitory neurotransmitter GABA. (23)

A person is said to suffer from alcohol intoxication when the quantity of alcohol consumed produces behavioral or physical abnormalities. (24)

Ethanol is also found in a variety of common household products, including mouthwash, perfume, cologne, cooking extracts and some medications.(25)

Alcoholism:

It is a broad term for problems with alcohol, and is generally used to describe compulsive and uncontrolled consumption of alcoholic beverages, usually affect the drinker's health, personal relationships, and social standing. It is medically considered a disease, especially an addictive illness. In psychiatry several other terms have been used. Especially, **alcohol abuse**; is a psychiatric diagnosis describing the recurring use of alcohol despite its negative consequences. Or **alcohol dependence**; is a substance-related disorder in which an individual is physically or psychologically dependent upon drinking alcohol. And **alcohol use disorde**; problem drinking becomes severe (by national institute on alcohol abuse and alcoholism). (26)

Alcohol misuse has the potential to damage almost every organ in the body, including the brain, liver and spleen. The cumulative toxic effects of chronic alcohol abuse can cause both medical and psychiatric problems. (27)

The biological mechanisms that cause alcoholism are not well understood. Social environment, stress, mental health, family history, age, ethnic group, and gender all influence the risk for the conditions.(28,29)

Significant alcohol intake produces changes in the brain's structure and chemistry, though some alterations occur with minimal use of alcohol over a short term period. This changes maintains the person with alcoholism's compulsive inability to stop drinking and result in alcohol withdrawal syndrome if the person stops. (30)

In general, drinking is considered alcoholism when the person continue to drink despite experiencing social or health problems.[31]

Clinical manifestations:

A. Alcoholism and nervous system:

1- Immediate effects of alcohol use:

Being drunk impairs judgment, inhibitions, concentration, and increasing amounts leads to drowsiness and coma. The loss of memory for a period of drunkenness (alcoholic blackout) can occur in occasion as well as with regular heavy drink and it is due to interference of alcohol with the laying down of memories. [32, 33]

2- Long-term effects of alcohol use:

Chronic alcohol use can damage the brain and nerves in a variety of ways. This may be due to thiamine (vitamin B 1) deficiency (secondary to alcohol use, either because of poor diet or because alcohol reduces the absorption of thiamine from the gut and interferes with how thiamine is used in the body).[34, 35]

Thiamine deficiency can cause an acute, severe, life-threatening disorder called:

1. **Wernicke's encephalopathy**: which usually presents with symptoms of abnormal or paralyzed eye movements, difficulty walking and confusion, pain, weakness, numbness, and inability to feel touch.

2. And in rare cases it can damage specific centers in the brain leading to:

   - Loss of mental function.
   - Inability to walk and death.[33]
   - development of epilepsy chronic fits.[36]
   - Sleep disturbances.

3. **Korsakoffs syndrome, psychosis or dementia**: a chronic condition where loss of old memories occurs and difficulties in laying down new memories may be profound. Both of these disorders are ultimately fatal without treatment with thiamine.[32]

4. A Chronic heavy alcohol use can also damage the part of the brain responsible for balance and co-ordination (the cerebellum), leading to instability and problems with walking.[35]

5. **Sleep disturbances:** Although individuals suffering from insomnia sometimes use alcohol to treat insomnia, tolerance to the sedating effect of alcohol is likely to occur, increasing the risk of excessive use. sleep can be disrupted, increasing the chances of a person waking in the night and finding it hard to fall back asleep.[33]

6. **Alcohol increases the risk of hemorrhagic stroke**: where the stroke is caused by bleeding in the brain. However, low to moderate alcohol use (one to two drinks a day) reduces the risk of ischemic stroke, where the stroke is caused by blockage of the blood vessels in the brain, but higher levels of alcohol use increase the risk of ischemic stroke. [37]

3- Hepatic encephalopathy:

Mechanisms leading to HE:

Researchers have gained a better understanding of the mechanisms that leads to Hepatic encephalopathy (HE) in patients with alcoholic liver disease by using neuroimaging and spectroscopic techniques that permit them to study the metabolism and functions of specific brain regions in living patients. These studies have confirmed the contributions of at least two neurotoxic substances, ammonia and manganese, to the development of HE.[38]

Investigations employed positron emission tomography (PET), a technique used to examine the metabolic activity of various body regions, including the brain, by monitoring the transport and breakdown of radioactively labeled molecules using sophisticated detection devices have been used for alcoholic patients to assess ammonia uptake and metabolism in the brain. In cirrhotic patients with mild HE, PET analyses using radioactive ammonia have revealed significant increases in the amount of ammonia taken up and metabolized in the brain. In particularly, a variable called the permeability - surface area product (PS), measure it how much ammonia can enter the brain from the general circulation, increases when cirrhotic patients start to develop HE. When the PS increases, a greater proportion of the ammonia in the general circulation can enter the brain. The brain has only a limited capacity to remove any ammonia coming in because of the increased PS. The only way to eliminate any ammonia that has reached the brain cells is through a reaction mediated by an enzyme called glutamine synthetase, which is found in the astrocytes. This enzyme combines a molecule of the amino acid glutamate with a molecule of ammonia to form the amino acid glutamine. In patients with HE, the amounts of glutamine formed in the brain are correlated with the severity of the disease, indicating that the brain is exposed to increasing levels of ammonia as the disease progresses.[38]

1- Cerebellar degeneration:

Alcoholism is an extremely prevalent and well-recognized cause of morbidity and mortality nationally and worldwide. It is responsible for 100,000 deaths per year, and costs attributable to alcohol abuse approach $100 billion per year. Alcohol permeates every organ and tissue of the body, and causes numerous distinct disease entities. Alcoholic cerebellar degeneration (ACD) is caused by irreversible toxic degeneration of Purkinje cells, and is clinically characterized by impaired gait, tremor and predominantly truncal ataxia. Midline cerebellar lesions with predominant involvement of the lower extremities, a chronic course and irreversibility after alcohol cessation are the hallmarks of the disease.[39]

Acute alcohol intoxication can be ruled out by history and toxicological analysis. Certain medications can cause neurological manifestations similar to ACD. For example, moderate lithium toxicity, seen with plasma concentration between 2.5 and 3.5 mEq/L, can cause coarse tremor, ataxia and muscle weakness. The group of genetic neurological conditions known as adult onset primary cerebellar degeneration also needs to be considered in the differential diagnosis.[40]

The treatment of ACD is proper nutrition, including thiamine, and cessation of drinking.[40]

B- Psychiatric problem with alcoholism:

Independent Major Depression:

Mood disturbances (which frequently are not severe enough to qualify as "disorders") are the most common psychiatric complaint among treatment- seeking alcoholic patients, affecting up to 80 % of alcoholics at some point in their drinking careers. (41)

Some controversy exists as to the precise cause – and - effect relationship between depression and alcoholism, with some authors pointing out that depressive episodes frequently predate the onset of alcoholism, especially in women.(42)

Several studies found that approximately 60 percent of alcoholics who experience a major depressive episode, especially men, meet the criteria for an alcohol—induced mood disorder with depressive features. (43)

The remaining approximately 40 percent of alcoholic women and men who suffer a depressive episode likely have an independent major depressive disorder—that is, they experienced a major depressive episode before the onset of alcoholism or continue to exhibit depressive symptoms and signs even during lengthy periods of abstinence.(44)

Bipolar Disorder:

Bipolar disorder (i.e., mania or manic—depressive illness) is the second—most common disorder associated with alcohol dependence. Among manic patients, 50—60 percent abuse or become dependent on alcohol or other drugs (AODs) at some point in their illness. (45)

Diagnosing bipolar disorder in alcoholic patients can be particularly challenging. Several factors, such as the underreporting of symptoms (particularly symptoms of mania), the complex effects of alcohol on mood states, and common features shared by both illnesses (e.g., excessive involvement in pleasurable activities with high potential for painful consequences) reduce diagnostic accuracy. Bipolar patients are also likely to abuse drugs other than alcohol (e.g., stimulant drus such as cocaine or methamphetamine) which further complicating the diagnosis.(41)

Anxiety Disorders:

Overall, anxiety disorders do not seem to occur at much higher rates among alcoholics than among the general population. (46)

Specific anxiety disorders, such as panic disorder, social phobia, however, appear to have an increased co-occurrence with alcoholism.(47)

As with alcohol—induced depression, it is important to differentiate alcohol - induced anxiety from an independent anxiety disorder. This can be achieved by examining the onset and course of the anxiety disorder. Thus, symptoms and signs of alcohol - induced anxiety disorders typically last for days to several weeks, tend to occur secondary to alcohol withdrawal, and typically resolve relatively quickly with abstinence and supportive treatments.(48)

In contrast, independent anxiety disorders are characterized by symptoms that predate the onset of heavy drinking.[49]

C- Alcoholism and alimentary tract:

Pharynx and oral cavity:

Increased risk of oro-pharyngeal cancer has been observed in most of the studies across different geographic regions and populations.[50]

Stomach and duodenum:

Ethyl alcohol can directly damage the mucosa of the alimentary tract. Atrophic gastritis was observed only in patients addicted to alcohol. The appearance of atrophic changes pointed to a close relation with the period of addiction. The studies did not show any relation existing between the percentage of cases with atrophic inflammation and the kind of drinks or the content of ethanol in them. Examinations concerning the secretory function of the stomach showed lower values of hydrochloric acid secretion, in patients addicted to alcohol as compared to the control. The results prove that continuous abuse of alcohol predisposes to atrophic inflammation of the gastric mucosa, and the appearance of this type of inflammatory changes is related to the duration of addiction. The longer the addiction, the lower the secretion of hydrochloric acid.[51]

Small intestine:

Research presented at the American College of Gastroenterology's Annual Scientific Meeting conference, in Washington, suggests that drinking even moderate amounts of alcohol on a regular basis may negatively influence the balance of naturally occurring bacterial flora in the small intestines. [52]

Large intestine:

Alcohol consumption greatly reduces the frequency and strength of muscle contractions in the rectum. This, as in the small intestine, can speed movement of food through the intestines thus reducing absorption of nutrients and fluids and also cause diarrhea.[53]

Epidemiological human data and biochemical animal experimental data both show that chronic alcohol consumption poses a great risk factor for polyps and cancer of the colorectum. This can occur as alcohol may act as a carcinogen by enhancing the carcinogen effects of other - chemicals and also interacting with enzymes that normally help to detoxify substances in the body. This interaction can also increase the toxicity of some carcinogens, which results in cancer.[54]

Pancreas:

Alcoholic pancreatitis:

Two major clinical observations have driven research into the pathogenesis of alcoholic pancreatitis.[55]

- The first is that the risk of developing the disease increases with the amount of' alcohol consumed, which suggests a direct toxic effect of alcohol on the gland. Alcohol is metabolized by the pancreas and causes oxidative stress in the gland; it also promotes the synthesis of pancreatic digestive enzymes and destabilizes intracellular membranes, which predisposes the gland to autodigestion. (55)
- The second observation is that only a minority (around 5%) of alcoholics develop pancreatitis.(56)

The role of smoking in the etiology of alcoholic pancreatitis is controversial, although researchers agree that this factor is a major cause of mortality for patients with this disease through the development of cancers of the gastrointestinal tract and cardiovascular disease. (57)

Evidence also suggests that smoking may accelerate the progression of established alcoholic pancreatitis However, evidence that abstinence decreases the frequency and severity of attacks also exists. Yet little is done in routine clinical practice to prevent subsequent attacks of pancreatitis in alcoholics by reducing their consumption of (and dependence on) alcohol.(57,58)

Alcoholism and the liver:

The liver is our largest organ and it has different functions. One of the liver's most important function is to break down food and convert it into energy when you need it. Your liver also helps the body to get rid of waste products and plays a vital role in fighting infections, particularly in the bowel.(59)

Regularly drinking over the government's lower risk guidelines can increase your risk of developing liver disease and cause irreversible damage to this very important part of your body. In fact, this level of drinking is a major cause of the 25% increase in deaths from liver disease in England over the last decade (from 9,231 in 2001 to 11,575 in 2009). (59)

Overall, alcoholic liver disease accounts for over a third (37%) of liver disease deaths. And figures show victims of liver disease are getting younger — more than 1 in 10 of deaths of people in their 40s are from liver disease, most of them from alcoholic liver disease.(59)

Evidence suggests that other factors that increase your risk of developing liver disease include:

1. Being dependent on alcohol - around seven in 10 people with alcoholic liver disease have an alcohol dependency problem.(59)
2. Being female - this could be because women develop higher levels of alcohol in the blood than men even if they've drunk the same amount of alcohol.(59)
3. Being overweight - excess weight can exacerbate many of the mechanisms of liver damage caused by excessive drinking.(60)
4. Genetics - certain genetic factors, including those affecting the liver's handling of fat, influence the risk of a heavy drinker, developing liver disease.(60)

Excessive drinking can make your liver get fat — reducing your consumption can help it return to its normal size.(60)

Drink more than eight units a day (four pints of 4% larger) if you're a man and over five units a day (a couple of 175m1 glasses of wine) if you're a woman, for two or three weeks and you're likely to develop something called 'fatty liver [(60)]

Later stage liver damage symptoms are more serious and they can include:

1. Jaundice (yellow skin)
2. Vomiting blood
3. Fatigue
4. Weakness, loss of appetite
5. Itching
6. Easy bruising
7. Swelling of the legs, ankles, or abdomen
8. Liver cancer
9. Bleeding in the gut
10. Increased sensitivity to alcohol and drugs, both medical and recreational (because the liver cannot process them).[(60)]

D-Alcoholism and cardiovascular system:

Alcohol, in striking contrast to tobacco and illicit drugs, is linked to an extensively documented J-shaped dose-effect curve, with regular moderate consumption reducing cardiovascular and overall mortality, whereas excessive or binge drinking has the opposite effect.[(60, 61)]

In particular, cardiovascular disorder about alcohol consumption in patients with previous VD reflect experts' consensus rather than circumstantial evidence. The US Food and Drug Administration warns that heart disease patients should stop drinking, and people who take aspirin regularly should not drink alcoho1. However, in the American Heart Association/American College of Cardiology guidelines for secondary prevention CVD patients are encouraged to maintain a lifestyle that includes drinking alcohol in moderation.[(62,63)]

Alcoholic cardiomyopathy:

Long-term heavy alcohol consumption in both sexes and all races is the leading cause of a No ischemic dilated cardiomyopathy, referred to as alcoholic cardiomyopathy (ACM). ACM is a specific heart muscle disease of a known cause that occurs in two stages: an asymptomatic stage and a symptomatic stage. In general, alcoholic patients consuming > 90 g of alcohol /day (approximately seven to eight standard drinks per day) for> 5 years are at risk for the development of asymptomatic ACM. Those who continue to drink may become symptomatic and develop signs and symptoms of heart failure. ACM is characterized by an increase in myocardial mass, dilatation of the ventricles, and wall thinning. Changes in ventricular function may depend on the stage, in that asymptomatic ACM is associated with diastolic dysfunction, whereas systolic dysfunction is a common finding in symptomatic ACM patients. The pathophysiology of ACM is complex and may involve cell death (possibly due to apoptosis) and changes in many aspects of myocyte function. ACM remains an important cause of a dilated cardiomyopathy, and in latter stages can lead to heart failure. Alcohol abstinence, as well as the use of specific heart failure pharmacotherapies, is critical in improving ventricular function and outcomes in these patients.[(64)]

Alcoholic arrhythmia:

They defined as 'acute changes in cardiac conduction or rhythm, associated with the ingestion of high amounts of alcohol in individuals with no other evidence of cardiac diseases, and which disappear without squeal under abstinence. Those patients may presented with a syndrome called (Holiday heart syndrome) on holiday season (between December 24 and January 1). The major electrocardiographic change found in that syndrome was the onset of atrial fibrillation. The patients showed premature beats or tachyarrhythmia, especially atrial fibrillation.(65)

Other reports described cases of acute atrial fibrillation and alcohol, considered alcohol as the cause for atrial fibrillation in 30-60% of patients with no cardiac diseases , especially in those under 60 year o1d. Cohen et al. (1988) showed relative risk to be two-fold among those consuming high doses of ethanol (> 6 doses/day) as compared to those consuming little ethanol (<1 dose/day). While assessing drinkers through a questionnaire observed that 42% of all cases of isolated atrial fibrillation among middle aged men consuming over 150 g of ethanol/week were due to alcohol. (66)

E-Alcohol and hypertension:

In the general population, the prevalence of hypertension rises linearly with alcohol consumption. Guidelines for the management of hypertension recommend avoiding binge drinking and suggest regular alcohol consumption, limited to no more than 2 to 3 drinks per day for men and 1 to 2 drinks per day for women, if not stop drinking.(67)

A recent analysis investigated whether reducing alcohol consumption lowered blood pressure without losing the cardiovascular benefits of drinking in moderation. Moderate drinking was associated with a lower risk of heart failure, AMI, and cardiovascular and all-cause mortality in hypertensive subjects. (64)

Hypertension appears to be similar regardless of the level of alcohol consumption. The Physicians' Health Study reported a protective effect of moderate alcohol consumption on secondary congestive heart disease (CHD) outcomes in men who had hypertension at baseline. (58)

F-Diabetes mellitus:

Diabetic patients have a CHD risk 2 to 4 times than that of nondiabetic individuals. A meta-analysis of 15 prospective cohort studies showed a J-shaped relation between alcohol consumption and risk of developing diabetes, with a 30% lower risk in moderate alcohol consumers (1 to 2 drinks per day). Two quantitative reviews concluded that moderate alcohol consumption was associated with a lower incidence of heart disease or total mortality in patients with type 2 diabetes mellitus. Obviously, the decrease in CVD risk associated with moderate alcohol consumption in hypertensive or diabetic subjects does not reduce the importance of controlling blood pressure or blood glucose, regardless of drinking habits.(7,68, 69)

There are three main ways drinking alcohol to excess can be a factor in causing diabetes:

- Heavy drinking can reduce the body's sensitivity to insulin, which can trigger type 2 diabetes.(68)
- Diabetes is a common side effect of chronic pancreatitis, which is overwhelmingly caused by heavy drinking.(68)
- Alcohol contains a huge amount of calories – one pint of lager can be equivalent to a slice of pizza. So drinking can also increase your chance of becoming overweight and your risk of developing type 2 diabetes.(70)

Non alcoholic and heavy drinkers have an equally high risk of developing diabetes Low levels of alcohol could potentially provide some level of protection against developing diabetes. According to several studies search diabetes and alcohol, 'moderate drinkers' (who drank between one and six units per day) were a third less likely to develop type 2 diabetes than either people who didn't drink alcohol or those who drank heavily. This is thought to be because low to moderate levels of alcohol actually make the body more sensitive to insulin. (71)

Hypoglycemia can be particularly dangerous when you're drinking because people can mistakenly think that you're drunk and may not realize you need urgent medical help. Drinking heavily can also increase the chances of developing hypoglycaemia because it prevents the liver from making glucose when you drink on an empty stomach.(72)

G- Alcohol and pregnancy:

Among pregnant women, the following characteristics were associated with the highest prevalence of prenatal alcohol use:(73)

1. Age between 35 and 44 years (14.3 percent)
2. College graduate (10.0 percent)
3. Employed (9.6 percent)
4. White (8.3 percent)

Employed and unmarried pregnant women were two- to three-fold more likely to report binge drinking than unemployed and married pregnant women.(73)

Data from the National Birth Defects Prevention Study of 4088 women who delivered live born infants without birth defects between 1997 and 2002 indicate that 30.3% consumed alcohol at some time during pregnancy, of whom 8.3% reported binge drinking (at least four drinks on one occasion).(74)

Many of these women are also at risk for an alcohol-exposed pregnancy if they are sexually active and not using effective measures to prevent pregnancy. These data were supported by the Pregnancy Risk Assessment Monitoring System (PRAMS) survey conducted by the CDC in 2004, in which 50 percent of women stated they consumed alcohol in the three months prior to their most recent pregnancy.(75)

Foetal alcohol syndrome(FAS)

Is a pattern of mental and physical defects that can develop in a fetus in association with high levels of alcohol consumption during pregnancy. Alcohol crosses the placental barrier and can stunt fetal growth or weight, create distinctive facial stigmata, damage

neurons and brain structures, which can result in intellectual disability and other psychological or behavioral problems, and also cause other physical damage. (76)

The main effect of FAS is permanent central nervous system damage, especially to the brain. Developing brain cells and structures can be malformed or have development interrupted by prenatal alcohol exposure; this can create an array of primary cognitive and functional disabilities (including poor memory, attention deficits, impulsive behavior, and poor cause-effect reasoning) as well as secondary disabilities (for example, predispositions to mental health problems and drug addiction). Alcohol exposure presents a risk of fetal brain damage at any point during a pregnancy, since brain development is ongoing throughout pregnancy. (77,78)

H- Alcoholism and hematological effect:

Alcohol abuse is generally defined as chronic consumption of more than 80 grams of alcohol per day. (79)

This translates into a daily intake of one of the following: approximately 250 mL of hard liquor, more than 500 mL of fortified wine, one bottle (750 mL) of table wine, or 1.5 liters of beer (four 12 ounce cans or bottles).(79)

Alcohol abuse can have a variety of effects on the hematologic system, including:

- Macrocytosis with or without anemia,
- Leukopenia.
- And/or thrombocytopenia.

How this occurs is not completely understood. A direct toxic effect on hematopoietic cells, abnormalities in membrane phospholipids, and interference with folate utilization all may be involved. (80,81)

The adverse effects of alcohol on hematopoiesis may be mediated in part by metabolites of alcohol (ethanol). Ingested ethanol is metabolized in the liver in part by alcohol dehydrogenase, which oxidizes alcohol to acetaldehyde, while reducing NAD to NADH. It has been suggested that acetaldehyde accounts for some of the hematologic toxicity of alcohol. Acetaldehyde can produce RBC protein-acetaldehyde adducts, which may generate immune responses against these modified proteins. (82)

I- Alcoholism and endocrine system:

Chronic consumption of a large amount of alcohol disrupts the communication between nervous, endocrine, and immune system and causes hormonal disturbances that lead to profound and serious consequences at physiologic and behavioral levels. These alcohol-induced hormonal dysregulations affect the entire body and can result in various disorders such as stress abnormalities, reproductive deficits, body growth defect, thyroid problems, immune dysfunction, cancers, bone disease, and psychological and behavioral disorders. This review summarizes the findings from human and animal studies that provide consistent evidence on the various effects of alcohol abuse on the endocrine system. (83)

J- Alcoholism and renal effect:

Excessive alcohol consumption can have profound negative effects on the kidneys and their function in maintaining the body's fluid, electrolyte, and acid-base balance. Hepatorenal failure refers to the most frequent and gravest condition in which the kidneys are damaged. It occurs in a person who has cirrhosis of the liver from long-term heavy alcohol consumption. It can appear after severe gastrointestinal bleeding, or occasionally, for no identifiable reason. The kidneys gradually fail to produce urine and, within a short time, the patient expires. (84)

K- Alcoholism and cancer:

Cancer of the mouth, throat, larynx, and esophagus:

Alcohol use clearly raises the risk. Drinking and smoking together raises the risk of these cancers far more than the effects of either drinking or smoking alone. This might be because alcohol can act as a solvent, helping harmful chemicals in tobacco to get inside the cells that line the digestive tract. Alcohol may also slow down these cells' ability to repair damage to their DNA caused by chemicals in tobacco.(85)

Liver cancer: Long-term alcohol use has been linked to an increased risk of liver cancer. Regular, heavy alcohol use can damage the liver, leading to inflammation. This, in turn, might raise the risk of liver cancer.(85)

Colon and rectal cancer: Alcohol use has been linked with a higher risk of cancers of the colon and rectum. The evidence for such a link is generally stronger in men than in women, although studies have found the link in both sexes.(85)

Breast cancer: Even a few drinks/week is linked with an increased risk of breast cancer in women. This risk may be especially high in women who do not get enough folate (a B vitamin) in their diet or through supplements. Alcohol can affect estrogen levels in the body, which may explain some of the increased risk. Drinking less alcohol may be an important way for many women to lower their risk of breast cancer. (85)

Type of drink matter:

Ethanol is the type of alcohol found in alcoholic drinks, whether they are beers, wines, or liquors (distilled spirits). These drinks contain different percentages of ethanol, but in general a standard size drink of any type 12 ounces of beer, 5 ounces of wine, or 1.5 ounces of 80-proof liquor contains about the same amount of ethanol (about half an ounce). Of course, larger or 'stronger' drinks can contain more ethanol than this. Overall, the amount of alcohol consumed over time, not the type of alcoholic beverage, seems to be the most important factor in raising cancer risk. Most evidence suggests that it is the ethanol that increases the risk, not other additives in the drink. (86)

How does alcohol raise cancer risk:

The exact way alcohol affects cancer risk isn't completely understood.

1- **Damage to body tissues:** Alcohol can act as an irritant, especially in the mouth and throat. Cells that are damaged may try to repair themselves, which could lead to DNA changes in the cells that can be a step toward cancer.(87)

In the colon and rectum, bacteria can convert alcohol into large amounts of acetaldehyde, a chemical that has been shown to cause cancer in laboratory animals. Alcohol and its byproducts can also **damage the liver**, leading to inflammation and scarring. As liver cells try to repair the damage, they can end up with mistakes in their DNA, which could lead to cancer.(87)

2- Effects on other harmful chemicals:

Alcohol can act as a solvent, helping other harmful chemicals, such as those in tobacco smoke; enter the cells lining the upper digestive tract more easily. This might explain why the combination of smoking and drinking is much more likely to cause cancers in the mouth or throat than either smoking or drinking alone. In other cases, alcohol may slow the body's ability to break down and get rid of some harmful chemicals. Lower levels of folate or other nutrients: Folate is a vitamin that cells in the body need to stay healthy. Alcohol use can lower the body's ability to absorb folate from foods. This problem can be worse in heavy drinkers, who often do not get enough nutrients such as folate in their diet. Low folate levels may play a role in the risk of breast and colorectal cancers.(87)

3- Effects on important hormones: Alcohol can raise body levels of estrogen, an important hormone in the growth and development of breast tissue. This could affect a woman's risk of breast cancer.(87)

4- Effects on body weight: Too much alcohol can add extra calories to the diet, which can contribute to weight gain in some people. Being overweight or obese is known to increase the risks of many types of cancer. Along with these mechanisms, alcohol may contribute to cancer in other, as of yet unknown, ways. (87)

Alcohol drug interaction:

The interaction between many medications and alcohol can lead to a significant increase in one's risk of illness, injury, or even death. When certain medications and alcohol compete in the body for absorption, the potency of the medication and/or alcohol is often increased. There is no set formula for what will happen when an individual consumes both alcohol and a medication. Each person is different, and the results of this type of potentially fatal cocktail vary based on the type and quantity of medication and alcohol ingested, the time frame involved, the individual's tolerance to both the medication and to alcohol, as well as a series of unpredictable, unique factors. To be safe, never mix alcohol with any type of medication, whether prescription or over-the-counter, before first checking with a licensed health care professional. (88)

Reference Chart:

Use the following chart to get a better understanding of the potentially fatal effects of mixing alcohol and medications. DO NOT use this chart as the sole basis for determining whether or not it is safe to consume alcohol while taking a certain medication. Be sure to check with a health care provider before mixing alcohol and a certain medication. (88)

Table (III): Alcohol-Drug Interactions

Drug	Prescribed Purpose	Interaction
Anesthetics (ex: Diprivan, Ethrane, Fluothane)	Administered prior to surgery to render a patient unconscious and insensitive to pain	- increased amount of drug required to induce loss of consciousness - increased risk of liver damage
Antibiotics	Used to treat infectious diseases	- reduced drug effectiveness - nausea/vomiting - headache - convulsions
Antidepressants (ex: Elavil)	Used to treat depression and other forms of mental illness	- increased sedative effects - may decrease effectiveness of anti-depressant - potential for dangerous rise in blood pressure
Antidiabetic medications	Used to help lower blood sugar levels in diabetic individuals	- reduced drug effectiveness - nausea - headache
Antihistamines (ex: Benadryl)	Used to treat allergic symptoms and insomnia	- intensified sedation - excessive dizziness
Antipsychotic medications (ex: Thorazine)	Used to diminish psychotic symptoms such as delusions and hallucinations	- intensified sedation - impaired coordination - potentially fatal breathing difficulties
Antiseizure medications (ex: Dilantin)	Used to treat epilepsy	- decreased protection against seizures - increased risk of drug-related side effects
Antiulcer medications (ex: Tagamet, Zantac)	Used to treat ulcers and other gastrointestinal problems	- increased presence of drug ⇒ increased risk of side affects
Cardiovascular medications (ex: nitroglycerin, Apresoline, Ismelin, Inderal)	Wide variety of medications used to treat ailments of the heart and circulatory system	- extreme dizziness or fainting - reduced drug effectiveness
Narcotic pain relievers (morphine, codeine, Darvon, Demerol)	Used to alleviate moderate to severe pain	- intensified sedation - increased possibility of a fatal overdose
Nonnarcotic pain relievers (aspirin, ibuprofen, acetaminophen	Used to alleviate mild to moderate pain	- increased risk of stomach bleeding - increased risk of the inhibition of blood clotting - increased effects of consumed alcohol *acetaminophen (Tylenol) taken during or after drinking may significantly increase one's risk of liver damage
Sedatives and hypnotics (Valium, Dalmane, Ativan, sleeping pills)	Used to alleviate anxiety and insomnia	- severe drowsiness - depressed cardiac and respiratory functions - increased risk of coma or fatality

Medicolegal aspect of alcoholic intoxication:

After recalling the risks from alcohol abuse at work, there are papers discusses the complex problems (medical, social, juridical) related to drinking and driving. Acute intoxication may be adequately identified (also in the medico-legal setting) through direct or indirect measurement of blood ethanol concentration, whereas the diagnosis of alcohol abuse and binge drinking (useful to assess fitness to work and/or driving) is complicated by the scarce efficiency of the currently available biomarkers.(89)

Alcohol and traffic problem:

Alcohol is responsible for different traffic accidents

Without vehicle impoundment, some drivers will continue to drive despite license suspension. Suspended drivers are overrepresented in fatal crashes. Vehicle impoundment dramatically reduces the numbers of suspended drivers on the road and therefore ef-fectively addresses this problem.(90)

مادة ١	قانون حظر شرب الخمر رقم ٦٣ لسنة ١٩٧٦ باسم الأمة رئيس الجمهورية مادة (١) : تعتبر خمورا فى تطبيق أحكام هذا القانون المشروبات الروحية والكحولية والخمور ا لمبينة بالجدول الملحق بهذا القانون ، ويجوز بقرار من وزير الداخلية إضافة أنواع أخرى للجدول المذكور .	**1**
مادة ٢	مادة (٢) : يحظر تقديم أو تناول ا لمشروبات الروحية أو الكحولية أو المخمرة فى الأماكن العامة أو المحال العامة ، وستثنى من هذا الحكم . (أ) الفنادق والمنشآت السياحية المحددة طبقا لأحكام القانون رقم ١ لسنة ١٩٧٣ فى شأن المنشآت الفندقية والسياحية . (ب) الأندية ذات الطابق السياحى التى يصدر بتحديدها قرار من وزير السياحة طبقا لأحكام القانون رقم ٧٧ لسنة١٩٧٥ بإصدار قانون ا لهيئا ت الأهلية لرعاية الشباب والرياضة .	**2**
مادة ٣	مادة (٣) : يحظر النشر أو الإعلان عن المشروبات المنصوص عليها فى المادة السابقة بأية وسيلة .	**3**
مادة ٤	مادة (٤) : تلغى التراخيص بتقديم الخمور الصادرة للمحال العامة المشار إليها فى المادة (٢) من هذا القانون قبل العمل بأحكامه .	**4**
مادة ٥	مادة (٥) : يعاقب كل من يخالف أحكام المادة (٢) من هذا القانون بالحبس مدة لا تزيد على ستة أشهر وبغرامة لا تجاوز مائتى جنبه أو بإحدى هاتين العقوبتين . ويعاقب بذات العقوبة فى حالة العود فى أى من الحالتين ا لسابقتين . ويجب على الحكم فى جميع الأحوال بالمصادرة . وبإغلاق المحل لمدة لا تقل عن أسبوع ولا تزيد على ستة أشهر .	**5**
مادة ٦	مادة (٦) : يعاقب كل من يخالف أحكام المادة (٣) بالحبس مدة لا تزيد على ستة أشهر وبغرامة لا تجاوز مائتى جنيه أو لإحدى هاتين العقوبتين . ويعاتب بذات العقوبة المسئول عن نشر الإعلان أو إذاعته بأية وسيلة .	**6**
مادة ٧	مادة (٧) : يعاقب كل من يضبط فى مكان عام أو فى محل عام فى حالة سكر بين بالحبس الذى لا تقل مدته عن أسبوعين ولا تزيد على ستة أشهر أو بغرامة لا تقل عن عشرين جنيها ولا تجاوز مائة جنيه ، ويجب الحكم بعقوبة الحبس فى حالة ا لعود .	**7**
مادة ٨	مادة (٨) : لا تخل العقوبة المقررة بهذا القانون بأية عقوبة أشد ينص عليها قانون العقوبات أو أى قانون آخر .	**8**
مادة ٩	مادة (٩) : يلغى كل حكم يخالف أحكام هذا القانون .	**9**
مادة ١٠	مادة (١٠) : على الوزراء كل فيما يخصه إصدار القرارات اللازمة لتنفيذ أحكام هذا القانون .	**10**
مادة ١١	مادة (١١) : ينشر هذا القانون فى الجريدة الرسمية ، ويعمل به بعد ستين يوما من تاريخ نشره . يبصم هذا القانون بخاتم الدولة ، وينفذ كقانون من قوانينها. صدر برياسة الجمهورية فى٥ شعبان سنة ١٣٩٦ (أول أغسطس سنة ١٩٧٦) .	**11**

وقد نص قانون العقوبات على معاقبه كل من قاد مركبه وهو تحت تاثير مخدر او مسكر بالحبس مده لا تقل عن تلاته اشهرولا تزيد عن سنه وبغرامه لا تقل عن الف جنيه ولا تزيد على ثلاثه الاف جنيه او باحدى هاتين العقوبتين وتضاعف العقوبه عند العوده الى الفعل ذاته خلال سنه من تاريخ الحكم النهائى.

Homicide and suicide with alcoholics:

Total alcohol consumption and consumption of each of beer, distilled spirits, and wine were significantly and positively related to total suicide mortality rates. A membership rates were negatively related to total and female suicide rates. Although data for males did not reach significance (except for the relationship between wine consumption and suicide rate), the direction of effects was consistent with that observed for female and total suicide rates. Unemployment rates were positively related to male and total suicide rates in some models. [91]

Laboratory investigations in alcohol abuse:

Ethanol level can be measured from: [92,93]

- Blood
- Urine
- Saliva
- Or breathe tests.

Toxic concentration is depend on individual tolerance and usage although levels greater than 300-400 mg/dL can be fatal due to respiratory depression. [92]

Conversion unit: one millimole of ethanol per liter of blood is equal to 4.61 milligrams of ethanol per 100 milliliters of blood. [92]

Lower limit of detection (in the blood) [93] = 10 mg/dL ->80 mg/dL (>17.4 mmol/L) is considered positive for driving under the influence in most states ->300-400 mg/dL (65.1-86.8 mmol/L) potentially fatal

Urine ethanol level:

Urine ethanol levels vary widely and do not correlate well with blood alcohol level.[93]

Electrolyte disturbance:

Prevalence of electrolyte disturbances and biochemical changes were determined in patients admitted to the emergency room.

The most frequent electrolyte disturbances noticed were:

- Hypernatremia (41%)
- Hyperchloremia (21%)
- Hypermagnesemia (17%) and
- Hypocalcemia (15%)
- Hypokalemia and hypophosphatemia were observed quite rarely (5% and 3.4%, respectively).

The most frequent biochemical changes observed were consistent with signs of cellular toxicity i.e. increased liver enzymes (elevated gamma-glutamyltransferase GGT, aspartate aminotransferase, alanine aminotransferase and lactic dehydrogenase) as well as signs of pancreatitis (elevated serum lipase and amylase) and muscle damage (elevated creatine kinase).[94]

The most frequent changes in blood counts were:

- Leucocytosis (23%)
- Thrombocytopenia (14%),
- And anemia (12%).
- C-reactive protein showed only minimal elevation.

Male sex and level of blood alcohol were detected as major risk factors for the diagnosis of chronic alcohol abuse in the patient sample investigated. When testing the value of routinely measured parameters for predicting the presence of chronic alcohol abuse, GGT and mean corpuscular volume of red blood cells (MCV) appeared to be of equal value. A combination of elevated blood alcohol with an increase in either of these markers may be interpreted as high risk for chronic alcohol abuse in this particular group of patients. [94]

Anion gap with alcohol abuse:

Definition: The anion gap is the defference between primary measured cations (sodium NA^+ and potassium K^+) and the primary measured anions (chloride Cl^- and bicarbonate $HCO3^-$) in serum. This test is most commonly performed in patients who present with altered mental status, unknown exposures, acute renal failure, and acute illness. The reference range of anion gap is 3-11mEq/L. [95]

Alcoholic ketoacidosis: is a metabolic complication of alcohol use and starvation characterized by hyoerketonemia and anion gap metabolic acidosis without significant hyperglycemia.

Alcoholic ketoacidosis causes nausea, vomiting, and abdominal pain. Diagnosis is by history and finding of ketoacidosis without hyperglycemia.[96]

Most specific investigations for ethanol:

- The single most important laboratory test in a patient who appears intoxicated with ethanol is a serum glucose level.
- Hypoxia, head injury, seizures, and other metabolic disturbances must be excluded by either history or physical examination or with the appropriate tests.
- The routine use of a serum blood alcohol level is controversial, largely because it is unlikely to affect management in a patient who is awake and alert. Many clinicians consider the patient safe for discharge once they are clinically free.[97]
- In patients who are chronic users, anemia, thrombocytopenia, elevation of hepatic transaminase levels, and a prolongation of the prothrombin time can be observed. These need not be routinely checked in a patient who presents simply for alcohol intoxication but may be useful if changes from baseline are suspected. [97]

Specific investigations for methanol:

Serum methanol levels should be obtained when this diagnosis is suspected. As previously stated, both the osmolar and anion gap should be obtained. [97]

Alcohol withdrawal:

Alcohol withdrawal refers to symptoms that may occur when a person who has been drinking too much alcohol every day suddenly stops drinking alcohol. Alcohol withdrawal occurs most often in adults, but it may occur in teenagers or children .The more you drink every day, the more likely you are to develop alcohol withdrawal symptoms when you stop drinking. You may have more severe withdrawal symptoms if you have certain other medical problems. Alcohol withdrawal symptoms usually occur within 8 hours after the last drink, but can occur days later. Symptoms usually peak by 24 - 72 hours, but may persist for weeks. [98]

Common symptoms include: -Anxiety or nervousness–Depression–Fatigue-Irritability-Jumpiness or shakiness-Mood swings–Nightmares-Not thinking clearly.[98]

Other symptoms may include:

- Clammy skin.
- Enlarged (dilated) pupils.
- Headache.
- Insomnia (sleeping difficulty).
- Loss of appetite.
- Nausea and vomiting.
- Pallor.
- Rapid heart rate.
- Sweating.
- Tremor of the hands or other body parts.[99,100]

A severe form of alcohol withdrawal called delirium tremens can cause:

- Agitation
- Fever
- Seeing or feeling things that aren't there (hallucinations)
- Seizures
- Severe confusion.[99,100]

Table (IV): Physical and behavioral changes in relation to alcohol level: Blood Alcohol Level Chart:

Progressive effects of alcohol[101]		
BAC (% by vol.)	**Behavior**	**Impairment**
0.010–0.029	• Average individual appears normal	• Subtle effects that can be detected with special tests
0.030–0.059	• Mild euphoria • Relaxation • Joyousness • Talkativeness • Decreased inhibition	• Concentration
0.06–0.09	• Blunted feelings • Disinhibition • Extroversion	• Reasoning • Depth perception • Peripheral vision • Glare recovery
0.10–0.19	• Over-expression • Emotional swings • Anger or sadness • Boisterousness • Decreased libido	• Reflexes • Reaction time • Gross motor control • Staggering • Slurred speech • Temporary erectile dysfunction • Possibility of temporary alcohol poisoning
0.20–0.29	• Stupor • Loss of understanding • Impaired sensations • Possibility of falling unconscious	• Severe motor impairment • Loss of consciousness • Memory blackout
0.30–0.39	• Severe central nervous system depression • Unconsciousness • Possibility of death	• Bladder function • Breathing • Dysequilibrium • Heart rate
0.40–0.50	• General lack of behavior • Unconsciousness • Possibility of death	• Breathing • Heart rate • Positional Alcohol Nystagmus
>0.50	• High risk of poisoning • Possibility of death	

Standard drink chart (U.S.)[102]					
Alcohol	**Amount (ml)**	**Amount (fl oz)**	**Serving size**	**Alcohol (% by vol.)**	**Alcohol**
80 proof liquor	44	1.5	One shot	40	0.6 US fl oz (18 ml)
Table wine	148	5	One glass	12	0.6 US fl oz (18 ml)
Beer	355	12	One can/bottle	5	0.6 US fl oz (18 ml)

Table (V): Ability of drinking alcohol in relation to sex:

Male Female	**Approximate blood alcohol percentage (by vol.)**[102] **One drink has 0.5 US fl oz (15 ml) alcohol by volume**								
Drinks	**Body weight**								
	40 kg	**45 kg**	**55 kg**	**64 kg**	**73 kg**	**82 kg**	**91 kg**	**100 kg**	**109 kg**
	90 lb	**100 lb**	**120 lb**	**140 lb**	**160 lb**	**180 lb**	**200 lb**	**220 lb**	**240 lb**
1	– 0.05	0.04 0.05	0.03 0.04	0.03 0.03	0.02 0.03	0.02 0.03	0.02 0.02	0.02 0.02	0.02 0.02
2	– 0.10	0.08 0.09	0.06 0.08	0.05 0.07	0.05 0.06	0.04 0.05	0.04 0.05	0.03 0.04	0.03 0.04
3	– 0.15	0.11 0.14	0.09 0.11	0.08 0.10	0.07 0.09	0.06 0.08	0.06 0.07	0.05 0.06	0.05 0.06
4	– 0.20	0.15 0.18	0.12 0.15	0.11 0.13	0.09 0.11	0.08 0.10	0.08 0.09	0.07 0.08	0.06 0.08
5	– 0.25	0.19 0.23	0.16 0.19	0.13 0.16	0.12 0.14	0.11 0.13	0.09 0.11	0.09 0.10	0.08 0.09
6	– 0.30	0.23 0.27	0.19 0.23	0.16 0.19	0.14 0.17	0.13 0.15	0.11 0.14	0.10 0.12	0.09 0.11
7	– 0.35	0.26 0.32	0.22 0.27	0.19 0.23	0.16 0.20	0.15 0.18	0.13 0.16	0.12 0.14	0.11 0.13
8	– 0.40	0.30 0.36	0.25 0.30	0.21 0.26	0.19 0.23	0.17 0.20	0.15 0.18	0.14 0.17	0.13 0.15
9	– 0.45	0.34 0.41	0.28 0.34	0.24 0.29	0.21 0.26	0.19 0.23	0.17 0.20	0.15 0.19	0.14 0.17
10	– 0.51	0.38 0.45	0.31 0.38	0.27 0.32	0.23 0.28	0.21 0.25	0.19 0.23	0.17 0.21	0.16 0.19
Subtract approximately 0.01 every 40 minutes after drinking.									

Estimated blood ethanol concentration (EBAC):

To calculate estimated peak blood alcohol concentration (EBAC), a variation, including drinking period in hours, of the Widmark formula was used.[103]

The formula is: [103]

EBAC = \frac {0.806 \cdot SD \cdot 1.2}{BW \cdotWt} - (MR \cdot DP) where 0.806 is a constant for body water in the blood (mean 80.6%), SD is the number of standard drinks containing 10 grams of ethanol, 1.2 is a factor to convert the amount in grams to Swedish standards set by The Swedish National Institute of Public Health, BW is a body water constant (0.58 for men and 0.49 for women), Wt is body weight (kilogram), MR is the metabolism constant (0.017) and DP is the drinking period in hours. Regarding metabolism (MR) in the formula; Females demonstrated a higher average rate of

elimination (mean, 0.017; range, 0.014-0.021 g/210 L) than males (mean, 0.015; range, 0.013-0.017 g/210 L). Female subjects on average had a higher percentage of body fat (mean, 26.0; range, 16.7-36.8%) than males (mean, 18.0; range, 10.2-25.3%).[103,104]

Additionally, men are, on average, heavier than women but it is not strictly accurate to say that the water content of a person alone is responsible for the dissolution of alcohol within the body, because alcohol does dissolve in fatty tissue as well. When it does, a certain amount of alcohol is temporarily taken out of the blood and briefly stored in the fat. For this reason, most calculations of alcohol to body mass simply use the weight of the individual, and not specifically his water content. Finally, it is speculated that the bubbles in sparkling wine may speed up alcohol intoxication by helping the alcohol to reach the bloodstream faster.[104]

Units of measurement:

There are several different units in use around the world for defining blood alcohol concentration. Each is defined as either a mass of alcohol per volume of blood or a mass of alcohol per mass of blood (never a volume per volume). 1 milliliter of blood is approximately equivalent to 1.06 grams of blood. Because of this, units by volume are similar but not identical to units by mass. In the U.S. the concentration unit 1% w/v (percent mass/volume, equivalent to 10g/l or 1 g per 100 ml) is in use. [104]

Table (VI): Blood alcohol concentrations (BAC) in different countries:

Reference	Unit	Dimensions	Equivalent to	Used in
BAC by volume	1 percent (%)	1/100 g/mL = 1 g/dL	9.43 mg/g, 217.4 mmol/L	United States, Australia, Canada
	1 permille (%)	1/1000 g/mL = 1 g/L	0.943 mg/g, 21.7 mmol/L	Austria, Bulgaria, France, Latvia, Lithuania, Netherlands, Poland, Romania, Spain, Switzerland, Turkey
	1 basis point	1/10,000 g/mL =10 mg/100 mL	94.3 ppm, 2.17 mmol/L	Great Britain
BAC by mass	1 percent (%)	1/100 g/g = 1 cg/g	1.06 cg/mL, 230 mmol/L	
	1 permille (%)	1/1000 g/g = 1 mg/g	1.06 mg/mL, 23 mmol/L	Finland, Norway, Sweden, Denmark, Germany, Russian Federation
	1 part per million(ppm)	1/1,000,000 g/g = 1 µg/g	1.06 µg/mL, 23 µmol/L	

Management of acute alcohol toxicity:

The main stay of medical treatment of patients with ethanol toxicity is supportive care. Many modalities for treating ethanol intoxication and enhancing ethanol clearance have been attempted. In general, a conservative approach is recommended. Hypoglycemia and respiratory depression are the 2 most immediate life-threatening complications that result from ethanol intoxication in children. (105)

Initial care:

- Assess the airway. If necessary, secure the airway with an endotracheal (ET) tube if the patient is not maintaining good ventilation or if a significant risk of aspiration is observed. Provide respiratory support and mechanical ventilation if needed.
- Obtain intravenous (IV) access and replace any fluid deficit or use a maintenance fluid infusion. Use plasma expanders and vasopressors to treat hypotension, if present.
- Ensure that the patient maintains a normal body temperature.
- Quickly correct hypoglycemia. In children, 2-4 mL/kg of 25% dextrose solution is usually administered. A maintenance infusion of dextrose-containing IV fluids is often required. Correct any electrolyte abnormalities found with laboratory studies. Routine empiric electrolyte replacement is not helpful; only documented electrolytic abnormalities should be corrected.
- lavage: If the ingestion occurred within 1 hour of presentation, placing a nasogastric tube and evacuating the stomach contents can be helpful.
- In patients with chronic ethanol abuse, administer thiamine 100 mg IV/intramuscularly (IM) to prevent neurologic injury.(105)

Additional care:

If other substances have been co-ingested, initiate specific treatment for those substances, if available. For instance, naloxone can be used to reverse respiratory depression if opiate co-ingestion is suspected. (105)

Other treatments:

- The administration of medications to cause emesis is not recommended because of the rapid onset of CNS depression and risk of aspiration.
- The administration of activated charcoal is not recommended for isolated alcohol ingestions because it does not bind hydrocarbons or alcohols. If the clinician suspects a concomitant ingestion of other toxic products, activated charcoal may be effective in absorbing these toxins.
- Forced diuresis is not helpful because 90% of ethanol metabolism occurs in the liver, and only 10% of the ethanol load is secreted in the urine.
- GABA-receptor antagonists such as naloxone and flumazenil have little effect on the CNS or respiratory depression caused by ethanol; their use is not recommended in isolated ethanol intoxication.
- The effects of insulin, glucose, caffeine, and several other medications have been studied, but none consistently increases ethanol metabolism or alleviate CNS depression.(105)
- Glucose administration is important in patients who are hypoglycemic as a result of ethanol intoxication; however, this treatment does not clear ethanol from the blood.

- Fructose infusion can increase the ethanol clearance by 25%. However, the use of fructose is not recommended because significant adverse effects may occur. For instance, fructose infusion can cause lactic acidosis, severe osmotic diuresis, and GI symptoms; therefore, it is not routinely used in the treatment of ethanol intoxication.
- Hemodialysis efficiently clears ethanol from the blood but is an invasive procedure; thus, its use is not routinely recommended. Hemodialysis can be used in patients whose clinical condition is deteriorating or in patients whose CNS depression, respiratory depression, or hypotension is refractory to standard therapy.
- Patients who have impaired hepatic function may require dialysis to clear an ethanol load.(105)
- Thiamine:

  - For alcohol withdrawal (100mg iv or im)
  - For alcohol liver diseases (100mg iv or im)
  - For WE: Cook, Thomson and colleagues, all described both the prophylaxis and the treatment regimen of WKS in terms of thiamine dosage and duration of treatment. Specifically, the prophylactic treatment for at-risk patients consists of an intramuscular administration of 250 mg thiamine (plus other B vitamins and ascorbic acid), once daily for 3–5 consecutive days. Cases of established WE should be treated empirically with a minimum of 500 mg thiamine (plus other B vitamins and ascorbic acid), i.v. or i.m., three times daily, for at least 2 days. In patients with ataxia, polyneuritis, confusion or memory disturbance, the treatment should be continued until clinical improvement is registered.(106)

Management of alcohol withdrawal:

It is not entirely clear why some individuals suffer from more severe withdrawal symptoms than others, but genetic predisposition may play a role.(107)

Symptoms of alcohol withdrawal:

Occur because alcohol is a central nervous system depressant. Alcohol simultaneously enhances inhibitory tone (via modulation of gamma-aminobutyric acid activity) and inhibits excitatory tone (via modulation of excitatory amino acid activity). Only the constant presence of ethanol preserves homeostasis. Abrupt cessation unmasks the adaptive responses to chronic ethanol use resulting in overactivity of the central nervous system. Gamma-aminobutyric acid Gamma-aminobutyric acid (GABA) is the major inhibitory neurotransmitter in the brain. Highly specific binding sites for ethanol are found on the GABA receptor complex. (108)

Chronic ethanol use induces insensitivity to GABA such that more inhibitor is required to maintain a constant inhibitory tone. (109)

As alcohol tolerance develops, the individual retains arousal at concentrations which would normally produce lethargy or even coma. Excitatory amino acids — Glutamate is one of the major excitatory amino acids. When glutamate binds to the N-methyl-D-aspartate (NMDA) receptor, calcium influx leads to neuronal excitation. Ethanol inhibits glutamate induced excitation. Adaption occurs by increasing sensitivity to glutamate in an attempt to maintain a normal state of arousal.(110,111)

Minor withdrawal symptoms:

Minor withdrawal symptoms are due to central nervous system hyperactivity, and can include: [112]

- Insomnia
- Tremulousness
- Mild anxiety
- Gastrointestinal upset; anorexia
- Headache
- Diaphoresis
- Palpitations

Symptoms are usually present within six hours of the cessation of drinking and may develop while patients still have a significant blood alcohol concentration. If withdrawal does not progress, these findings resolve within 24 to 48 hours. The specific minor withdrawal symptoms in a given patient typically are consistent from one episode to the next.[112]

Withdrawal SEIZURES:

Withdrawal seizures are usually singular or occur as a brief flurry over a short period. Recurrent or prolonged seizures or status epilepticus should prompt an investigation into possible structural or infectious etiologies, generally guided by the findings of cranial computed tomography (CT) or lumbar puncture. Benzodiazepines (0.15mg/kg iv/dose) and Phenobarbital (15mg/kg iv/dose) can be used to treat status epilepticus while investigations proceed. [113,114]

Delirium TREMENS (DT)

Clinical manifestations of severe withdrawal and Delirium tremens (DT) is defined by hallucinations, disorientation, tachycardia, hypertension, fever, agitation, and diaphoresis in the setting of acute reduction or abstinence from alcohol. In the absence of complications, symptoms of DT can persist for up to seven days.

Patients with DT have significantly elevated cardiac indices, oxygen delivery, and oxygen consumption. [115]

Risk factors:

Approximately 5 percent of patients who undergo withdrawal from alcohol suffer from DT. DT typically begins between 48 and 96 hours after the last drink and lasts one to five days. DT and alcoholic hallucinosis are NOT synonymous and symptoms that occur a few hours after the cessation of drinking, even if severe, are not manifestations of DT.[115]

Alcoholic Hallucinosis:

Hallucinations are usually visual, although auditory and tactile phenomena may also occur. In contrast to delirium tremens, alcoholic hallucinosis is not associated with global clouding of the sensorium, but with specific hallucinations, and vital signs are usually normal.[114]

Risk factors for the development of DT include:[116,117]

- A history of sustained drinking
- A history of previous DT
- Age greater than 30
- The presence of a concurrent illness
- The presence of significant alcohol withdrawal in the presence of an elevated alcohol level

A longer period since the last drink (ie, patients who present with alcohol withdrawal more than two days after their last drink are more likely to experience DT than those who present within two days)[118]

Management:

Ruling out alternative diagnoses — Alcohol withdrawal remains a clinical diagnosis. It may be necessary to perform extensive testing, including lumbar puncture and cranial CT, to rule out other diagnostic considerations with confidence. This is particularly true when the presentation includes altered mental status and fever. Conditions, such as infection (eg, meningitis), trauma (eg, intracranial hemorrhage), metabolic derangements, drug overdose, hepatic failure, and gastrointestinal bleeding, can mimic or coexist with alcohol withdrawal. A premature diagnosis of alcohol withdrawal can lead to inappropriate use of sedatives, which can further delay accurate diagnosis. [119,120]

1- Symptom control and supportive care — Once comorbid illnesses have been excluded or adequately treated, the management of alcohol withdrawal is directed at alleviating symptoms and identifying and correcting metabolic derangements. Benzodiazepines are used to control psychomotor agitation and prevent progression to more severe withdrawal. Supportive care, including intravenous fluids, nutritional supplementation, and frequent clinical reassessment including vital signs, is important. Clinicians must avoid complacency when treating patients with alcohol withdrawal.[120]
2- Patients should be placed in a quiet, protective environment. Mechanical restraint may be necessary temporarily for patients suffering from delirium tremens (DT) in order to protect both the patient and caretakers. Clinicians should follow their facility's guidelines for documentation and implementation of physical restraints. Once adequate chemical sedation is achieved, physical restraints should be removed, as resistance against restraints can increase temperature, produce rhabdomyolysis, and cause physical injury.[121]
3- Volume deficits can be calculated and replaced accordingly, or, if there are no contraindications, isotonic intravenous fluid can be infused rapidly until patients are clinically euvolemic. Thiamine and glucose should be administered in order to prevent or treat Wernicke's encephalopathy.[121]
4- Multivitamins containing or supplemented with folate should be given routinely, and deficiencies of glucose, potassium, magnesium, and phosphate should be corrected as needed.[122]

During the early phases of withdrawal alcoholic patients are often given nothing by mouth (i.e, NPO) to prevent aspiration. However, nutritional support is essential as alcoholic patients are frequently malnourished and have high metabolic needs due to their excited autonomic state. Initially, glucose supplementation is sufficient, but additional

nutrition may be needed for patients who remain unable to eat for more than a day or two. Patients considered at high risk for complications should be monitored in an intensive care unit.[122]

5- Anticonvulsants – Sustained anticonvulsant therapy has no role in patients with isolated alcohol withdrawal seizures. The overwhelming majority of seizures from withdrawal are self-limited and do not require treatment with anticonvulsants. If status epilepticus ensues, phenobarbital may be used for short-term management in conjunction with benzodiazepines, while an underlying cause is investigated.[123]

While carbamazepine may have a role in the outpatient management of mild alcohol withdrawal, convincing evidence that the drug effectively treats patients with de1lirium tremens or other severe symptoms is lacking. [123]

Some clinicians report using centrally acting alpha-2 agonists (eg, dexmedetomidine) as adjunct therapy for alcohol withdrawal, and these agents may reduce some symptoms of withdrawal.

6- Beta blockers – Beta blockers may reduce minor symptoms of withdrawal, but they have not been shown to prevent the development of seizures or DT. We believe they should not be used for the treatment of acute severe alcohol withdrawal.
7- Baclofen: Baclofen, a selective agonist of the gamma-aminobutyric acid (GABA)-B receptor used to treat reversible spasticity. [124,125]

Management of alcoholism:

Alcoholism can be categorized into 2 types:

Early-onset (biological predisposition to the disease) or late-onset (brought on by environmental or psychosocial triggers). Understanding and studying the difference between early- and late-onset alcoholism facilitate the selection of the appropriate therapy.[126]

Treatment of alcoholism involves the following:

- **Complete abstinence:** is the only treatment for alcohol dependence. Emphasize that the most common error is underestimating the amount of help that will be needed to stop drinking. The differential diagnosis between alcohol abuse and dependence can be a difficult judgment call.[127]
- **Hospitalize patients:** if they have a history of delirium tremens or if they have significant comorbidity. Consider inpatient treatment if the patient has poor social support, significant psychiatric problems, or a history of relapse after treatment.[127]
- **Psychiatric support:** Encourage hospitalized patients to call AA from the hospital. AA will send someone to talk to them if the patient makes the contact. Patients need to attend meetings regularly (daily at first) and for a sufficient length of time (usually 2 y or more) because recovery is a difficult and lengthy process.

In the beginning of treatment, and perhaps ongoing, patients should remove alcohol from their homes and avoid bars and other establishments where strong pressures to drink may influence successful abstinence. [127]

If the patient has an antisocial personality (i.e, severe problems with family, peers, school, and police before age 15 y and before the onset of alcohol problems), recovery is less likely. If the patient has primary depression, anxiety disorder, or another potentially contributory disorder (the other disorder must antedate the problems with alcohol or it must be a significant problem during long periods of sobriety), treat this primary problem aggressively. [127]

Methanol:

1- Physical properties of methanol:

Methanol is the simplest alcohol, and is a light, volatile, colorless, flammable liquid with distinctive odor. Highly toxic and unfit for consumption, at room temperature it is polar liquid, and burns in oxygen, including open air forming carbon dioxide and water in the following formula:[128]

$$2\ CH_3OH + 3\ O_2 \rightarrow 2\ CO_2 + 4\ H_2O$$

2- Exposure to methanol:

General toxicity

Humans (and primates) are particularly sensitive to toxicity from methanol when compared to non-primates. The severity of toxicity following exposure has been correlated with the degree of exposure and time lapse since hospital attendance, and doses of toxic substances.

Inhalation of high concentrations of methanol vapor can cause acute toxicity. Toxicity has been associated with the inhalation of methanol concentrations greater than 400 mg m-3 (300 ppm). Deliberate inhalation of volatile preparations containing methanol may cause toxicity. [129,130]

Ingestion of methanol can cause severe acute toxicity, as described in the general toxicity section. There is significant variability within humans on the reported oral toxicity and lethality of methanol. The minimal lethal dose following ingestion is considered to be in the range of 300-1000 mg/kg. [129]

Dermal / ocular exposure:

Methanol may be absorbed across the skin and can result in systemic toxicity. Methanol is also irritating to skin and may cause dry skin and redness. [131]

In Egypt, a number of neonates died of severe metabolic acidosis following dermal exposure to methanol which was the main constituent of a compress used to relieve fever. The compresses were made using a local product termed “red-alcohol” which on analysis was found to have contained methanol (70-90% v/v). [129]

Contact of methanol with the eyes may result in irritation only. The ocular toxicity described previously is mediated by systemic and not local ocular exposure.[129]

3- Metabolism of methanol:

Methanol is readily absorbed by inhalation, ingestion and dermal exposure. Around 60-80% of inhaled methanol is absorbed in the lung of humans. Distribution is rapid and occurs throughout body water as indicated by a volume of distribution of approximately 0.6 L/kg. Individual tissue and organ concentrations are dependent on their water content. Following ingestion, peak serum concentrations are obtained within 30-90 min.[129]

There is no protein binding and methanol is poorly distributed to fatty tissues.[131]

In humans and primates, toxicity of methanol is mediated via metabolites and not the parent molecule. The liver is the primary site of metabolism for methanol. Through a series of oxidative steps methanol is oxidized to methanol (HCHO, formaldehyde), methanoic acid (H•COOH, formic acid) and finally detoxified to carbon dioxide (CO_2). The main enzyme groups involved in each step are alcohol dehydrogenase, aldehyde dehydrogenase, and folate dependent mechanisms, respectively. Methanoate (formate) or methanoic acid (formic acid) may be formed, dependent on pH.[129]

Un-dissociated formic acid readily crosses the blood brain barrier leading to CNS toxicity, aggressive alkaline therapy is required to maintain formic acid in the dissociated form; Elimination of methanol as formic acid occurs primarily via urinary excretion. At high concentrations, methanol elimination is saturated and is zero order with a rate of approximately 85 mg/L, about half the elimination rate of ethanol. Maximum excretion of formic acid may be as late as the second or third day following ingestion.[130]

Small quantities of methanol are excreted unchanged in the lung and the kidneys (2% of a dose of 50 mg kg-1). Concentration of methanol in the urine may be 20-30% higher than in the blood [131]

4- Clinical presentation of methanol toxicity:

A careful history should be taken in high-risk patients who report typical symptoms of methanol poisoning.

Time course:

Initial symptoms generally occur 12-24 hours after ingestion. The interval between ingestion and the appearance of symptoms correlates to the volume of methanol ingested and the amount of ethanol concomitantly ingested; competitive inhibition exists between the 2 compounds. [132]

Methanol blood levels peak at 30-90 minutes following ingestion and often do not correlate to the time to symptom appearance.[132]

Neurologic manifestations:

Initially, the symptoms of methanol intoxication are similar to those of ethanol intoxication, often with disinhibition and ataxia. Following a latent period, patients may develop headache, nausea, vomiting, or epigastric pain. In later stages, drowsiness may rapidly progress to obtundation and coma. Seizures may occur, generally as a complication

of the metabolic derangement or as a result of damage to the brain parenchyma. Cases of axonal polyneuropathy in association with chronic exposure have been reported. [133]

Further, motor neuron disease resembling amyotrophic lateral sclerosis has been documented in a case report. It is likely that neuropathies and spinal cord dysfunction are underestimated.[134]

Vision loss:

Blindness from methanol inhalation was described as early as 1910. Formic acid accumulates within the optic nerve, which results in the classic visual symptoms of flashes of light and blurring. Patients initially may present with diminished visual acuity, which can progress to scotomata and scintillations. The frank blindness that develops sometimes responds to immediate therapy; however, complete loss of vision is a common sequela. [135]

Delayed effects following an acute exposure:

The latent periods reported are of widely varying duration. The delayed onset of ocular toxicity and acidosis thereafter is also variable. Visual impairment or blindness arising may be permanent. Damage to the CNS is often in the form of lesions in basal ganglia especially the putamen, which may result in long term neurological deficits ranging from moderate polyneuropathy to tremors, rigidity, spasticity and hypokinesis as well as Parkinsonian-like extrapyramidal syndrome with mild dementia. [135]

Chronic and repeated exposure to methanol:

General toxicity:

In contrast to the widely reported toxicity of acute intoxication, reports of effect following chronic exposure are infrequently reported.[136]

Inhalation:

Chronic exposure to methanol may cause persistent or recurring headaches and impaired vision, nausea, dizziness, eye irritation.[132]

Dermal:

Long term or repeated dermal exposures to methanol may cause dermatitis. [131]

Carcinogenicity:

There is no data in the literature to indicate that methanol is carcinogenic in humans. Based on limited animal data, the lack of structural alerts and the lack of genotoxicity, methanol is not considered to be a carcinogen.[131]

5- Investigations for methanol toxicity:

Blood methanol level:

This test detects and measures methanol (wood alcohol) in blood. Methanol is a solvent and denaturing agent, and it is in antifreeze. It may be used in engines or cooking appliances. Methanol can be inhaled, absorbed through the skin, injected, or ingested.[130,137]This test is used when methanol poisoning is suspected.[130,138]

Related tests:

- Anion gap measurement
- Formate measurement
- Osmolality measurement, serum

Uses of this test:

- Laboratory tests may be done for many reasons.
- Tests are performed for routine health screenings
- Or if a disease or toxicity is suspected.
- To determine if a medical condition is improving or worsening.
- Lab tests may also be used to measure the success or failure of a medication or treatment plan.
- Lab tests may be ordered for professional or legal reasons. The following is a possible reason why this test may be done. (129)

Conclusion:

Normal methanol blood concentration from endogenous production and dietary sources is up to 1.5 mg/L. (130)

6- Management of methanol toxicity:

Prompt medical care is key to avoiding complications secondary to methanol intoxication.

Supportive therapy:

Is aimed at initiating airway management, correcting electrolyte disturbances, and providing adequate hydration.(131)

Metabolic acidosis in methanol poisoning:

May necessitate the administration of bicarbonate and assisted ventilation. Bicarbonate potentially may reverse visual deficits. In addition, bicarbonate may help to decrease the amount of active formic acid. (131)

Antidotal therapy:

Often using ethanol or fomepizole, is directed towards delaying methanol metabolism until the methanol is eliminated from the patient's system either naturally or via dialysis. Like methanol, ethanol is metabolized by ADH, but the enzyme's affinity for ethanol is 10-20 times higher than it is for methanol. Fomepizole is also metabolized by ADH; however, its use is limited because of high cost and lack of availability. (124, 132)

Hemodialysis:

Can easily remove methanol and formic acid. Indications for this procedure include greater than 30mL of methanol ingested, serum methanol level greater than 20 mg/dL, observation of visual complications, and no improvement in acidosis despite repeated sodium bicarbonate infusions.(133, 139)

Consultations:

Consultation with the following specialists can be beneficial:

Nephrologist: Consultation with a nephrologist is advisable to aid in the correction of the metabolic disturbance; the nephrologist can also help to arrange dialysis, respiratory care, or both.[135]

Ophthalmologist: is recommended for assessment of ocular damage.[135]

Neurologist: Consultation with a neurologist is arranged to assist with the management of seizures in the acute setting or with the treatment of any subsequent movement disorders that may develop.[135]