The Australian Wine Research Institute

Fact Sheet
WINE AND HEALTH

How the alcohol contained in wine is absorbed, broken down and removed by the body

Background

Wine is made up of many components including approximately 27 different alcohols. The major alcohol is ethyl alcohol or ethanol, where the concentration ranges from approximately 8 to 15% v/v in 'table' wine. Other compounds include acids, sugars, esters, carbonyls, aldehydes, polyols, anions, cations, vitamins, nitrogenous compounds and phenolic compounds. The following information refers to the ethanol concentration of wine.

Introduction

All alcohol from wine consumed is absorbed into the blood stream. It is rapidly absorbed from the stomach, small intestine (duodenum) and large intestine (colon) into the blood. Vaporised alcohol can also be absorbed through the lungs into the blood stream.

The rate of absorption of alcohol from the stomach can vary, depending on a number of factors. For example, food in the stomach delays emptying of alcohol into the small intestine, especially foods high in fat or protein. The subsequent absorption of alcohol from the small intestine into the liver will also be delayed.

Hence, when you drink a glass of wine on an empty stomach your blood alcohol concentration (BAC) – which is the amount of alcohol in your blood stream – increases more rapidly and you feel the effects more rapidly.

Did you know?

- Your BAC is measured in mg of alcohol per 100 mL of blood.

- Your blood alcohol level will continue to rise after you have consumed your last drink. You generally won't reach your maximum BAC until 45-90 minutes after consuming it.
- Alcohol is broken down (or metabolised) in the body more slowly than it is absorbed. Consequently, the more and faster the alcohol is consumed, the higher the BAC will become.
- In an adult, the average rate of metabolism of alcohol is about one standard drink per hour. However, there is significant variation in this rate among individuals.
- About 10% of the alcohol you absorb is not metabolised. Most of this unchanged alcohol is excreted in your urine, but a proportion is excreted via your lungs in breath and via your skin as sweat.
- Alcohol is detected in the systemic circulation, including the brain, within about five minutes of ingestion.
- The brain and central nervous system are permeable to alcohol, and alcohol readily crosses the blood brain barrier into the cerebro-spinal fluid.
- Alcohol belongs to the class of drugs called depressants. These do not necessarily make you feel depressed, but slow down the central nervous system including the transmission of messages to and from the brain.
- In pregnant women, the placenta is permeable to alcohol and it will readily cross the placental barrier into the foetal blood.
- Alcohol will enter the breast milk of women who are breastfeeding.
- Breast milk contains a higher concentration of water than the mother's blood, hence the alcohol concentration in breast milk is about 10% higher than the BAC in the mother.

The distribution of alcohol in blood and tissues

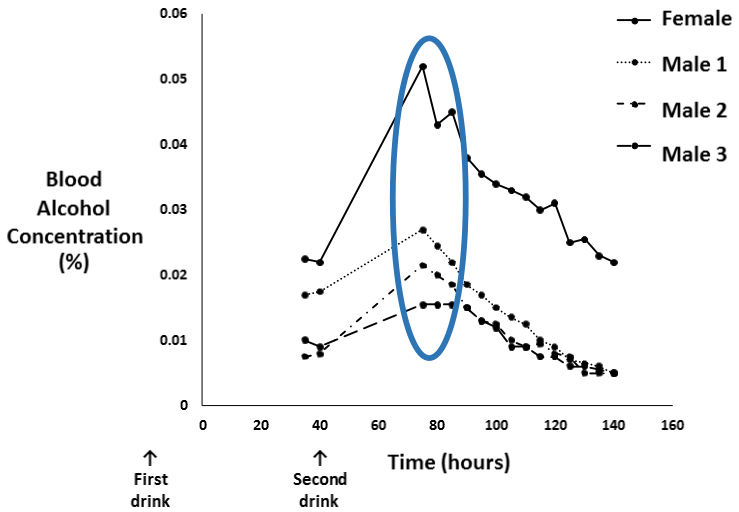
Once absorbed, alcohol continues to circulate in the blood until it is distributed into the tissues and fluids. A person's gender and body shape will affect this distribution.

Alcohol is water-soluble and will distribute more rapidly from the blood of a person who has higher body water content. In contrast, it is relatively fat-insoluble and will distribute slower into and out of fat. This slower distribution is exacerbated by a limited blood supply in fat.

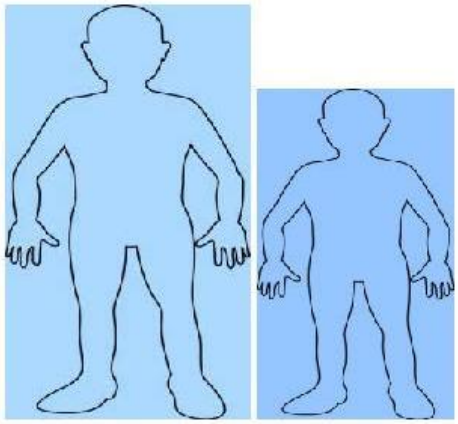
Men and women process alcohol differently due to differences in their body make-ups. Men have a higher content of body water (55-65%) into which the water-soluble alcohol distributes rapidly and they also have lower body fat (about 12%). Women have lower body water (about 45-55%) and also have higher body fat (about 33%) into which the relatively fat-insoluble alcohol distributes slowly.

The result is that women record a significantly higher maximum BAC than men when a comparable concentration of alcohol is consumed. It also takes longer for women's blood alcohol to fall than it does for men.

In addition, larger individuals will have a higher content of body water and fat into which alcohol can distribute. As a result, they record a significantly lower maximum BAC when consuming a comparable concentration of alcohol to a smaller person.



Gender differences in maximum blood alcohol concentration



Larger/less concentrated – smaller/more concentrated

The breakdown of alcohol in the body

Oxidation pathways break down (metabolise) about 90% of the alcohol that is absorbed into the blood. The metabolism of alcohol is different to that of most foods because a constant amount is broken down at all times.

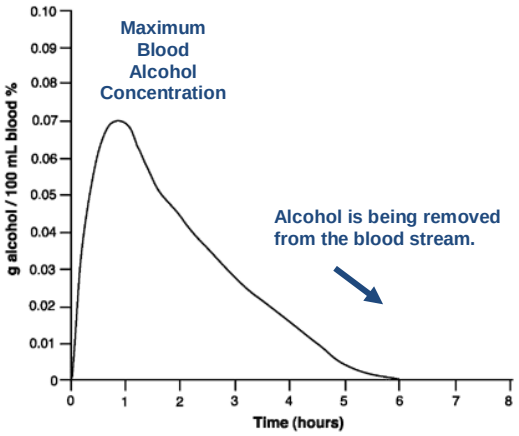
The amount of alcohol metabolised per unit time is approximately proportional to body weight and hence, liver weight. In an adult, the average rate of metabolism is 15-20 mg of alcohol per 100 mL blood per hour. This works out at about one standard drink per hour.

Oxidative metabolism occurs primarily in the liver, but also in the stomach. Alcohol can be metabolised by three enzymes and pathways, each located in a different sub-cellular compartment of the liver. The first is always switched on; the second is only switched on when there is a sufficiently high concentration of alcohol in the liver. This helps lower the BAC, and switches off when not required.

A person with a BAC of 0.05 has 0.05 g of alcohol in their body for every 100 mL of blood. One standard drink is equivalent to 10 g alcohol. The amount of blood in a person's body is proportional to their weight. For example, on average, a 60 kg person will have approximately five litres of blood. A person's BAC will generally increase by between 0.01 (for men) and 0.03 (for women) for each standard drink. A person's BAC will generally decrease by between 0.7% (for women) and 1.0% (for men) per 10 g standard drink per hour.

Removal of alcohol from the body

Up to 10% of the alcohol absorbed from the gastro-intestinal tract escapes oxidative metabolism. Most of the unchanged alcohol is excreted via the kidneys in urine, but a proportion is excreted via the lungs in breath and via the skin as sweat.



A typical blood alcohol curve

Contact

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