IFALPA
The Global Voice of Pilots

Human Performance
Briefing Leaflet

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Alcohol Information for Pilots

This paper supersedes 10MEDBL02 – Alcohol; how much is too much?

INTRODUCTION

The importance of not drinking alcohol in proximity to duty is well known by pilots. There is also a broader issue around alcohol use in terms of overall health, including long-term health risks with an impact on flight safety. Contrary to popular belief, most people with severe alcohol-induced liver disease are not alcoholics but rather habitual heavy social drinkers.

The pattern of drinking may be as important as the overall amount consumed. The increasing prevalence of "binge drinking," if a regular occurrence, is especially hazardous. Globally, 3 million deaths every year result from harmful use of alcohol, this represents 5.3 % of all deaths.

The World Health Organization's Global Burden on Disease Study found that alcohol is the third most important risk factor, after smoking and raised blood pressure, for European ill health and premature death[1]. This puts alcohol as a factor ahead of cholesterol levels and obesity. Most people underestimate their alcohol intake and are not aware of the possible consequences of habitual drinking significantly above the recommended safe levels.

WHY IS ALCOHOL HARMFUL?

Alcohol is a global cellular toxin; however certain tissues are particularly vulnerable to the effects of alcohol both acutely and in the long term. Alcohol is a neurotoxin, it affects the brain, spinal cord, and peripheral nerves.

The alcohol found in alcoholic drinks is ethyl alcohol (ethanol) C2H5OH diag. Alcoholic drinks do not contain pure alcohol as this would be rapidly toxic. Ethanol concentrations are usually given as % weight / volume. Recommended daily alcohol limits are given in terms of **UNITS** of alcohol. A UNIT of alcohol is 10mls. 10mls of ethanol contains 8g pure ethyl alcohol.

To calculate the number of UNITS of alcohol in a drink simply multiply the % w/v x volume (in liters)

- one pint (0.54L) average beer (3.5%) = 0.54 x 3.5 = 1.89 units
- a large glass (250mls 0.25L) of wine (12%) contains 0.25 x 12 = 3 units
- a standard pub measure gin 35mls (0.035L) at 40% contains 0.035x40 = 1.4 units

1 World Health Organization 2019. https://www.who.int/news-room/fact-sheets/detail/alcohol. Retrieved 24 September 2019.

It is important to note that today, the alcohol content of drinks varies widely. The often quoted, "pint beer = 2 units, glass of wine = 1 unit, shot of spirits = 1 unit," may be misleading. Beers may vary in strength between 2% and 9%, wine from 8% - 18%, spirits from 24%- 90%.

Results of studies on alcohol consumption and limitation recommendations vary widely, however a recent study[1] shows that no level of alcohol consumption can improve health.

GENDER DIFFERENCES

Women have a lower tolerance for excess alcohol than men. This is reflected in the recommended daily alcohol limits for men and women. There are a number of reasons for this, for example, women have a greater proportion of body fat than men. As alcohol is distributed in the non-fatty tissue, the cellular concentration of alcohol for a given dose will be greater for a woman than for a man even if they are of the same body weight. The toxic potential, both acutely and in the longer term, is therefore greater in women. Women also have reduced levels of the key liver enzymes necessary to metabolize alcohol (see below – alcohol metabolism).

ALCOHOL METABOLISM – WHAT HAPPENS WHEN WE DRINK?

Alcohol enters the stomach where 10-20% of the alcohol is absorbed. The rest enters the small intestine where the remaining 80-90% is rapidly absorbed into the blood. Blood from the intestines and stomach passes directly to the liver for processing. As alcohol is a toxin, removing it from the blood is a priority for the liver over a number of its other functions such as maintaining blood sugar levels, protein manufacture and reduction of blood lipids. 90% of alcohol metabolism takes place in the liver; the rest is excreted unchanged by urine, breath, sweat, and saliva.

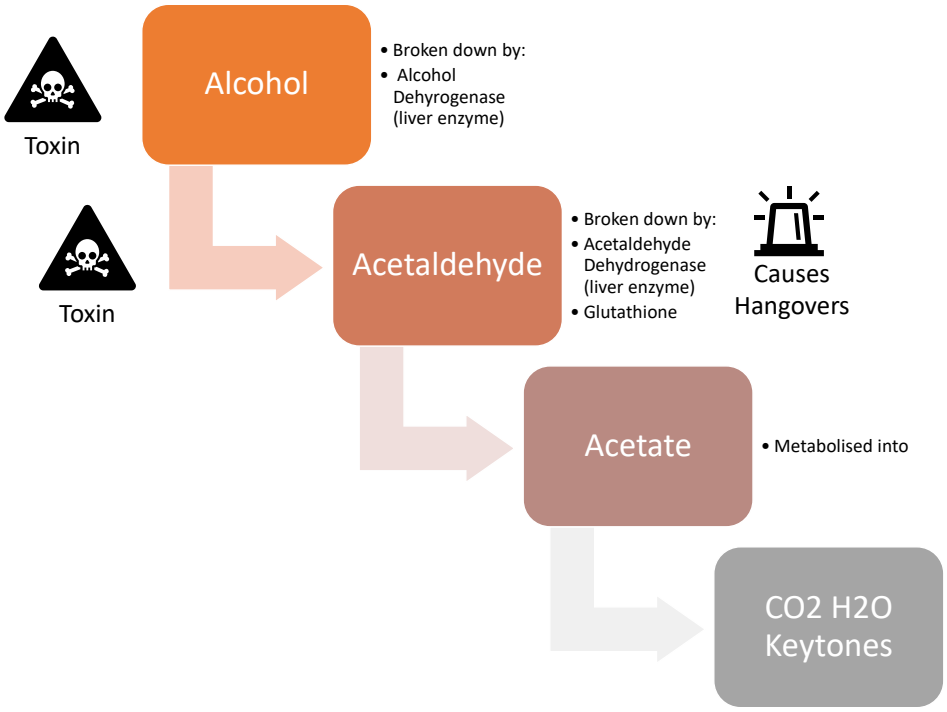
Alcohol is first broken down to **acetaldehyde** by the liver enzyme alcohol dehydrogenase. **Acetaldehyde** is a relatively toxic substance and is the intermediate metabolic product of alcohol break down. It needs to be broken down further. However, the next step is rate limiting, as it requires both another enzyme – **acetaldehyde dehydrogenase**, and another substance called **glutathione**. The liver's stores of **glutathione** are limited. When larger amounts of alcohol enter the system, the toxic Acetaldehyde levels build up in the blood while the liver makes more glutathione.

Enzymes are proteins that act as catalysts for chemical reactions in the body.

Acetaldehyde is the chemical largely responsible for the symptoms of a hangover. In fact, the drug Antabuse (disulfiram) which is used to stop alcoholics from drinking, blocks the action of acetaldehyde dehydrogenase allowing acetaldehyde to build up rapidly. This causes severe headaches and vomiting.

Acetaldehyde is then broken down to **acetate** which is nontoxic. This is then metabolized to carbon dioxide and water or used to form ketones. Ketones are used for energy when glucose levels are low. They give a characteristic "sweet smell" to the breath often noted during a hangover.

1 The Lancet, Volume 392, ISSUE 10152, P1015-1035, September 22, 2018. Alcohol use and burden for 195 countries and territories, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016.



Effects of excess alcohol metabolism on the liver

As stated above, the liver prioritizes alcohol break down. The necessary enzymes increase in their levels over time, giving a degree of tolerance to alcohol, but this alters the balance of other liver functions. As a consequence of enzyme induction, other processes also increase. Formation of cholesterol is increased as is formation of harmful lipoproteins. Levels of triglycerides increase. All these are well known risk factors for heart disease. Acetaldehyde (the hangover toxin) also has a major role in directly damaging liver cells leading to scarring which can ultimately cause liver cirrhosis.

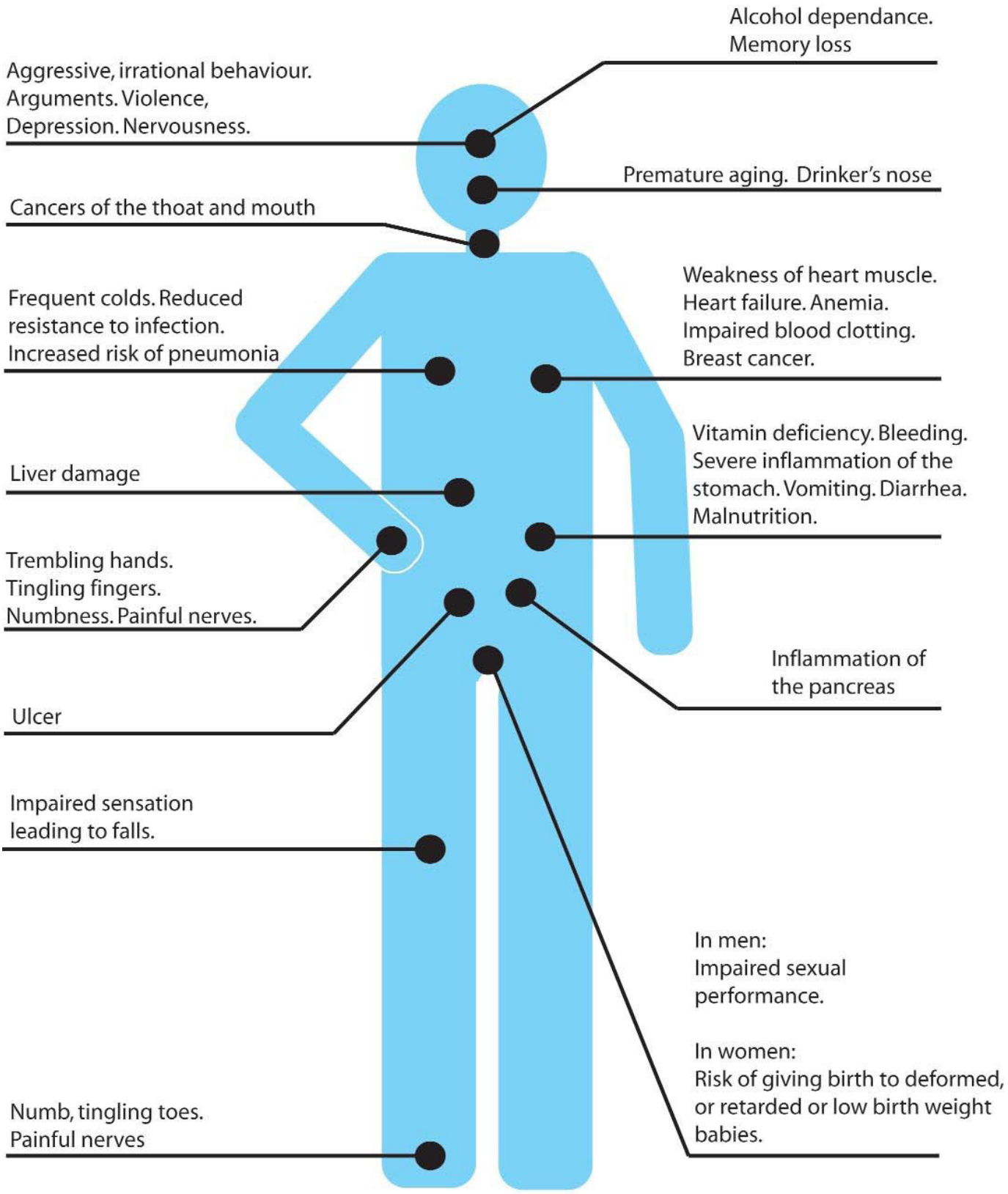
There are 3 forms of alcoholic liver disease:

- Fatty liver
- Alcoholic hepatitis
- Alcoholic cirrhosis

The important point is that the first two may be reversible. Fatty liver can be caused by a single heavy drinking session. Alcoholic hepatitis occurs in heavy drinkers and can result in widespread destruction of the liver. It may be fatal, but it may also be reversible if drinking is reduced or ceases. Cirrhosis is not reversible. This is permanent scarring leading to loss of function and ultimately liver failure.

EFFECTS OF ALCOHOL ON OTHER SYSTEMS OF THE BODY

The acute effects of alcohol are well known, but an awareness of the potential damage to the systems in the long term, even from moderate habitual drinking, are less widely understood. Alcohol and its metabolic products may cause widespread cellular damage even at relatively low levels. The most vulnerable systems are the nervous system and the gastrointestinal system (including the liver and pancreas).



High risk drinking may lead to social, legal, medical, domestic, job and financial problems. It may also reduce your lifespan and lead to injury or death through alcohol related accidents

Source: World Health Organization, The Alcohol Use Disorders Identification Test, 2001.

Nervous system

- The brain, spinal cord, and peripheral nervous system.
- Long term excessive alcohol can impair memory and intellectual functions.
- Reduced quality of sleep.
- Encephalopathy and psychosis - major cerebral conditions in chronic alcoholism.
- Increased risk of stroke and head injury.
- Cerebellar degeneration leading to poor coordination and loss of balance.
- Tingling and loss of sensation in hands and feet.

Gastro-intestinal system

- Liver damage, increased acid reflux/heartburn, gastritis, gastric ulcers.
- Oesophageal (gullet) varices (abnormal blood vessels) with rupture and bleeding.
- Pancreatitis – inflammation of the pancreas causing severe pain and internal fluid loss. Chronic inflammation of the pancreas leading to diabetes and malabsorption of food.

Change in body shape

- Wasting of peripheral muscles and redistribution of body fat to the abdomen and trunk (“Beer Gut”)
- Alcohol is fattening. White wine has approximately the same calorific value of milk.
- One unit of alcohol is approximately 70 KCalories.

Hormonal changes

- Gynecomastia - men may develop female breasts.
- Reduced sexual function.
- Abnormal sperm count.

Heart Disease

- Increased risk as described above due to lipid/cholesterol increases. Direct cellular damage to the heart.
- Increased risk of high blood pressure. Abnormal heart rhythms.

Alcoholic bone disease

- Chronic alcohol excess is an important cause of osteoporosis.

Cancer

- Associated with increased risks of cancer of the mouth and throat.
- Increases the risk of breast cancer.
- Liver cancer.

Kidneys

- Increased risk of kidney stones.
- Gout due to impaired secretion of uric acid.

Skin

- Facial flushing.
- Premature aging, changes in skin’s appearance (“drinker’s nose”).

SUMMARY AND RECOMMENDATIONS

Sustained drinking at levels over the recommended limit is hazardous to the long-term health. This has implications for both personal wellbeing and flight safety. Many people are unaware of the hazards of sustained heavy "social drinking". Many people underestimate the amount of alcohol they regularly drink. Blood tests of alcohol consumption (Phosphatidyl ethanol (Peth) or CDT), liver function (GGT), and cholesterol and triglycerides, as well as simple questioning, can help to identify problem drinking.

Peth is specific marker for chronic alcohol use. Intake of less than 48 g ethanol/day for three weeks gives a whole blood a PEth concentration of <0.7 µmol/l. Repeated ethanol intake of 48–102 g per day for three weeks gives a blood PEth of 1.0–2.1 µmol/l.[5] After cessation of alcohol intake, the half-life of PEth is between 4.5 and 10 days in the first week and between 5 and 12 days in the second week.

However, the main aim of this leaflet is to highlight the problems associated with moderate alcohol use. There is a lack of understanding of the dangers of moderate habitual drinking. Statistics show a very worrying trend of ill health and deaths from alcohol related illness.

Education and self-awareness of these issues will contribute to both health and flight safety.

If you feel that you may have a problematic relationship to alcohol, please contact your home Member Association for local resources and help. If you are unable to access support through your home Member Association, please contact IFALPA, https://www.ifalpa.org/contact-us/, for a broader range of resources in your region.