Fact sheet:
Ethanol is the problem toxin in drink

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What is the Margin of Exposure?

The Margin of Exposure (MOE) is the ratio of the dose of the consumed substance (for example ethanol or acetaldehyde) at the lower border of its toxic threshold divided by the estimated intake of the substance. Thus, for example a MOE of 1 means that the amount consumed is the same as the dose that is considered toxic. An MOE of 10 means that the amount consumed is only ten times lower than the dose that is considered toxic. An MOE of 1,000 means that the amount consumed is one thousand times lower than the dose that is considered toxic. For genotoxic carcinogens, (which ethanol, as well as acetaldehyde are), the European Food safety Authority indicates an MOE of 10,000 as the cut off point for public health safety. This means that the amount consumed should be at least 10,000 times lower than the level considered toxic. However, when based on human studies, and for a substance that is not considered an essential part of the diet as is the case for ethanol's cancer producing role, a cut-off point of 1,000 is acceptable. This does not mean that it is 100% safe to drink below this level – only that it is a reasonable guidance to ensure safety as much as possible. For health problems other than cancer, the European Food safety Authority indicates an MOE of 100 as the cut off point for public health safety. This means that the amount consumed should be at least 100 times lower than the level considered toxic. However, again, when based on human studies, and for a substance that is not considered an essential part of the diet as is the case for ethanol's disease producing role other than for cancer, a cut-off point of 10 is acceptable. This does not mean that it is 100% safe to drink below this level – only that it is a reasonable guidance to ensure safety as much as possible.

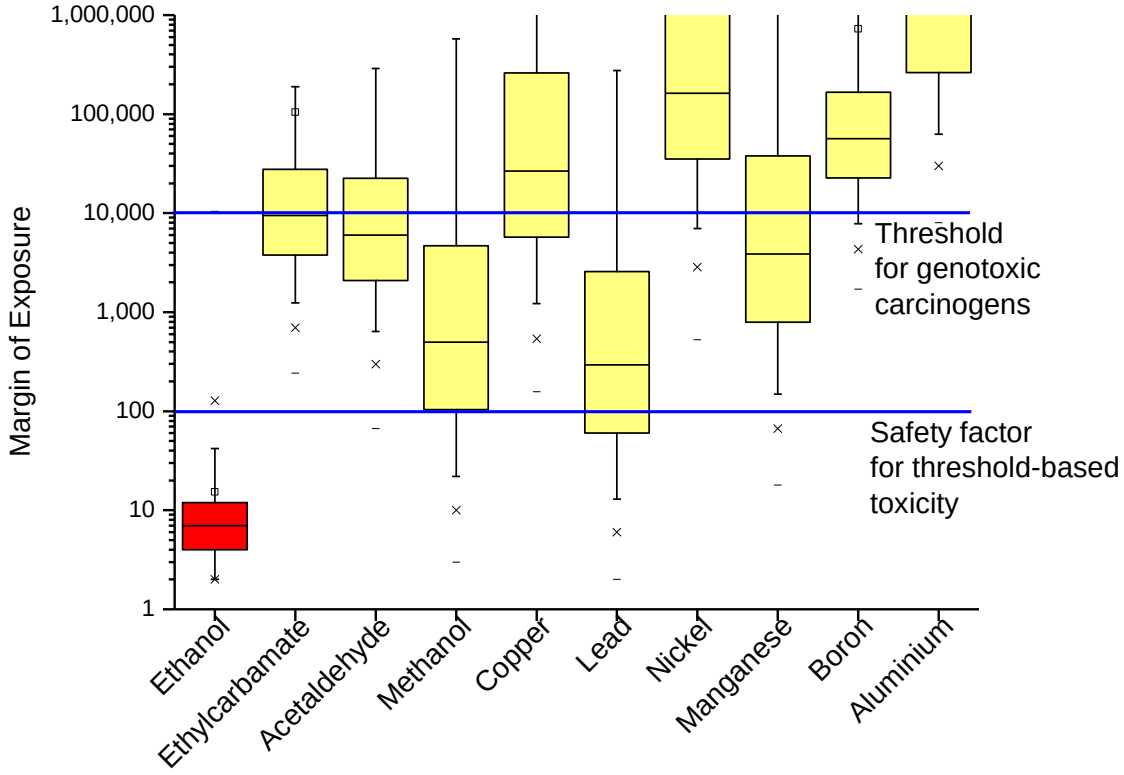
What are the margins of exposure in unrecorded alcohol?

One hundred and fifteen samples of unrecorded alcohol were collected from 16 European countries and margins of exposure were analysed for 10 potentially important substances, including alcohol, see figure.

Ethanol represents by far the highest risk in unrecorded alcohol. The MOE of ethanol reaches down to below 10, which is the lowest level of all compounds under study. Both genotoxic carcinogens ethyl carbamate and acetaldehyde may reach MOEs below 10,000 in some scenarios, which according to the European Food Standards Authority indicates a concern for public health. Nevertheless compared to ethanol, which is a genotoxic carcinogen, the risks of ethyl carbamate and acetaldehyde appear to be minor in the case of these unrecorded alcohol samples.

For non genotoxic substances, a 100-fold uncertainty factor is routinely applied. The factor is based on scientific judgement and allows for species differences (where animal data are used) and human variability. None of the average MOEs for the non-genotoxic substances would be below 100. For methanol and lead, where the MOE may be less than 100 in some cases below the 25th percentile, it must be considered that the toxicological assessment is based on human data, so that a safety factor of 10 should be sufficient. The MOE for these two compounds (methanol and lead) may fall below 10 only in extreme worst-case scenarios in the lowest 1st percentile of the distribution.

Margin of Exposure (MOE) for compounds occurring in unrecorded alcohol based on probabilistic exposure estimation (simulation with 10,000 iterations). The box is determined by the 25th and 75th percentiles. The whiskers are determined by the 5th and 95th percentiles. 1st and 99th percentiles are marked by x, while minimum and maximum are marked with dash. Values above 1,000,000 are not shown.



A further note about alcohol's toxicity

The International Agency for Research on Cancer (IARC), the world's reference body on cancer causing agents classifies alcohol as a carcinogen, causing cancers of the oral cavity, pharynx, larynx, oesophagus, liver, colorectum and female breast. Some 26,000 EU citizens die each year from alcohol-caused cancers before the age of 65 years, nearly 1 in 5 of all alcohol caused deaths, and about 1 in 14 of all cancer deaths. Using the European Food Standards Authority guidance on exposure for human consumption of carcinogens in food and drink products, with a margin of exposure set at 1,000, no one should drink more than about 50 milligrams of

alcohol a day, equivalent to 20g or two drinks a year. Currently, Europeans drink about 27 grams a day, some 540 times the exposure level. Ignoring alcohol's cancer causing role, and just considering other health outcomes, no one should drink more than about 0.3 grams of alcohol a day, equivalent to 9g or about one drink a month. Currently, Europeans drink about 90 times the exposure level.

Take home messages

1. Ethanol is the most dangerous toxic substance in unrecorded alcohol.
2. Ethanol is a genotoxic carcinogen, as well as being toxic to many other health conditions.
3. Adopting the European Food Stands Authority guidance for genotoxic carcinogens, no one should drink more than about 50 milligrams of alcohol a day, equivalent to 20g or two drinks a year.
4. Adopting the European Food Stands Authority guidance for non-genotoxic carcinogens, no one should drink more than about 0.3 grams of alcohol a day, equivalent to 9g or one drink per month.
5. Europeans on average consume alcohol at levels 540 times the exposure level for carcinogens and 90 times the level for non-carcinogenic toxins.
6. All alcohol beverage containers should carry consumer warnings that alcohol is a toxic substance, and in particular a carcinogen.
7. Low risk guidelines for drinking alcohol are, in general, too generous for health safety and should, in general, be reviewed downwards.

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