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## The new markers of alcohol consumption

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In all parts of the world, the consumption of alcoholic beverages is current practice at many social gatherings. Excessive alcohol consumption however, brings more of a risk to producing health and social problems and to be harmful to the economy for it generates drunkenness, intoxication and familiarization. Alcohol consumption can be equally responsible indirectly in violent deaths, homicides or suicides.

Alcohol dependence affects 4% of the population in England aged 16-65 years old; approximately 1.1 million people. The World Health Organisation (WHO) defines alcohol dependent individuals as those exhibiting a range of behaviours including the strong desire to drink alcohol to the point that it takes precedence over all other behaviours, persistence to drink despite negative consequences and physical withdrawal symptoms.

Alcohol dependence was once considered a problem associated with middle age. However, figures from the Department of Health show that alcohol dependence is now more common among younger people. For women, alcohol dependence is highest between ages 16-24, while for men it is highest between ages 25-34.

Source: <http://www.drinkaware.co.uk/facts/factsheets/alcohol-dependence>

In 2006, the Directorate-General for health and consumer protection reported that there were 55 million adults estimated to drink alcohol at harmful levels in the EU (this was classed at more than 40g of alcohol, i.e. 4 drinks a day, for men and over 20g, i.e. 2 drinks a day, by women). Harmful alcohol consumption was estimated to be responsible for approximately 195 000 deaths a year in the EU due to, for example, accidents, liver disease, cancers, etc. More than 1 in 4 traffic accident deaths on EU roads was caused by drink-driving (approximately 10 000 per year). More than 1 out of every 4 deaths among young men (aged 15-29 years) in the EU was due to alcohol (often caused by road traffic accidents, homicide, violence, etc) and 1 in every 10 deaths among young women.

Source:

[http://ec.europa.eu/health/archive/ph\\_determinants/life\\_style/alcohol/documents/alcohol\\_factsheet\\_en.pdf](http://ec.europa.eu/health/archive/ph_determinants/life_style/alcohol/documents/alcohol_factsheet_en.pdf)

The Institute for alcohol studies in the UK reported that in 2007, 460 deaths were caused by drivers over the legal alcohol limit (80mg% in the UK). There are in addition a number of fatal accidents each year caused by drivers with a raised blood alcohol level but still below the legal limit. If under-the-influence pedestrians are also taken into account, then alcohol is a factor in around one in five of all road deaths.

Source: <http://www.ias.org.uk/resources/factsheets/accidents.pdf>



In times when alcohol dependence is so common, it is important to have access to biological, sensitive and specific tests, allowing us to confirm excessive consumption of ethanol. In this, we focus on the new markers available for analysis.

### ➤ The markers of alcohol consumption

Ethanol can be measured in the blood and the concentration detected will reflect the blood alcohol concentration in the body at the time of the provision of the sample. This is extremely useful in driving under the influence, road traffic incidents and in forensic cases (violence, poisoning, causes of death, etc.). The recognised method for determining blood alcohol concentrations used in this laboratory is Head Space Gas Chromatography.

In addition to measuring ethanol itself, there are indirect markers such as Mean Corpuscular Volume (MCV), Gamma Glutamyl Transpeptidase (GGT), Aminotransferases (ASAT, ALAT) and Carbohydrate Deficient Transferrin (CDT) which can provide evidence for chronic alcohol consumption. These indirect markers are unfortunately likely to be altered in certain conditions without previous exposure to ethanol. However, CDT's remain the more reliable parameter in this category. Our laboratory does not currently analyse for these indirect markers in blood.

### ➤ The new alcohol markers

The new markers of alcohol consumption have been introduced in the last decade or so and have been added to our list of routine toxicology analyses. Ethylglucuronide (EtG) and Fatty Acid Ethyl Esters (FAEE) have been scientifically validated and have become the more favorable parameters to complement the markers already analysed in body fluids. They are commonly used in child custody cases, to complete clinical examinations in reinstating drivers licenses or in the framework of forensic investigations.

### ➤ Presentation, validation and interest of the new markers

#### ***Detection of ethylglucuronide in blood and urine***

After consumption, ethanol is essentially metabolised by the liver (90-95%), the kidneys (0,5-2%), the lungs (0,5-6%) and the skin (0,5%) to give water and carbon dioxide. A very weak quantity of ethanol (less than 0.5%) can be eliminated in the form of EtG, a phase II metabolite. In contrast to the classical markers (MCV, GGT, etc), EtG is specific to ethanol. It is not altered by medications (that can increase for example GGT) and is not related to the function of the pathological state of the subject (hepatitis, diabetes, cancer, etc).

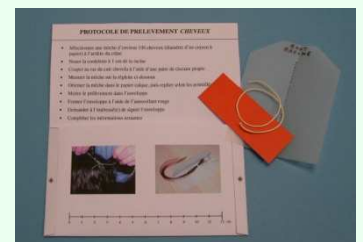
The quantity of EtG in the blood allows us to discriminate between post-mortem alcohol production and actual consumption of ethanol since in the case of putrefaction, the concentration of EtG is not influenced. Another major interest of EtG is to increase the detection time. If ethanol is eliminated at a rate of approximately 18mg%/hour, EtG is eliminated much slower. In fact, one can detect EtG in blood for 6 to 18 hours after ethanol was already eliminated. In urine, it is detectable from 48 to 60 hours after exposure. It is therefore possible to establish an eventual consumption of alcohol in the hours preceding an incident, even in the absence of a measurable blood alcohol level and/or of a positive breathalyser test.



## Hair collection Kit

**ChemTox** laboratory can provide Hair Collection Kits free of charge. It contains all the necessary components required and advice to take a hair sample correctly. Please do not hesitate to contact us with any requests.

Phone: 0800 970 8400 - email: [labochemtox@labochemtox.com](mailto:labochemtox@labochemtox.com)



### *Detection of ethylglucuronide in hair:*

EtG incorporates into the keratinized matrix of head hair and nails. At this time, the identification and quantification of EtG in head hair is more pertinent for the characterization of excessive and repeated consumption of alcohol. The cut-off level for positive samples (30 picograms per milligrammes or pg/mg in head hair) has been recommended by the Society of Hair Testing and proposed through a European consensus (<http://www.soht.org>) which distinguishes between "social" drinkers and excessive alcohol consumers (WHO definition: An excessive consumer of alcohol consumes an average of more than 60 grams of pure alcohol per day over several months). A hair sample allows us to establish the profile of an individual addicted to alcohol. These analyses are carried out by ChemTox with COFRAC accreditation according to the standard ISO 17025.

### *Detection of FAEs in hair:*

Fatty acid ethyl esters are a group of more than 20 substances and are alcohol biomarkers which are produced in response to the consumption of ethanol (alcohol). They are not specific to ethanol and are incorporated into the hair mainly through sebum steadily produced by the sebaceous glands attached to every hair root. Whilst levels of individual markers are variable and are dependent on several factors, the total of the four markers analysed are believed to be a good estimate of an individual's drinking habits. The four markers chosen are ethyl myristate, ethyl palmitate, ethyl oleate and ethyl stearate. According to the consensus of the Society of Hair Testing (SoHT), the cut-off in head hair for the sum of the four esters (total FAEs) to strongly suggest chronic excessive alcohol consumption is proposed at 0.5 nanograms per milligram (ng/mg) in head hair based on the 0-3cm proximal segment or 1.0ng/mg in head hair based on the 0-6cm proximal segment.

It is important to note that when assessing an individual's alcohol consumption, all factors are taken into consideration and the final decision is based on more than one analytical result.



Accreditation  
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Details available on  
[www.cofrac.fr](http://www.cofrac.fr)

**Dr Vincent Cirimele**  
Scientific Director

**Kirsten Turner**  
Forensic Toxicologist



STRATÉGIE ET INNOVATIONS EN TOXICOLOGIE

3 rue Grüniger – CS 60191  
67405 ILLKIRCH Cedex - FRANCE

Phone: 0800 970 8400 - Fax: 0208 711 6700  
[labochemtox@labochemtox.com](mailto:labochemtox@labochemtox.com)  
[www.labochemtox.com](http://www.labochemtox.com)